

PRINCETON STUDIES IN INTERNATIONAL FINANCE NO. 39

# Capital Mobility and Financial Integration: A Survey

Peter B. Kenen

INTERNATIONAL FINANCE SECTION  
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This is the thirty-ninth number in the series PRINCETON STUDIES IN INTERNATIONAL FINANCE, published from time to time by the International Finance Section of the Department of Economics at Princeton University.

The author, whose name customarily appears on this page as Director of the International Finance Section, is also Walker Professor of Economics and International Finance at Princeton University. This is the first time he has exercised his judgment as Director in favor of his own work as professor, but it is his second publication for the International Finance Section. The first appeared in 1963, when he was on the faculty of Columbia University.

It has been hard to decide whether to print the standard explanatory paragraph beneath the Director's introduction of the author. Continuity, if not credibility, favors its inclusion. It follows without modification.

This series is intended to be restricted to meritorious research studies in the general field of international financial problems that are too technical, too specialized, or too long to qualify as ESSAYS. The Section welcomes the submission of manuscripts for this series. While the Section sponsors the studies, the writers are free to develop their topics as they will. Their ideas and treatment may or may not be shared by the editorial committee of the Section or the members of the Department.

PETER B. KENEN  
*Director*

*Princeton University*

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## PREFACE

This monograph is the direct descendant of a paper I read at the Budapest Congress of the International Economic Association in August 1974. Like most offspring, however, it is bigger if not better than its parent. It develops several themes that could be played only once, without variations, in that short paper and adds thoughts provoked by the discussion in Budapest. I am particularly grateful to Alexander Swoboda, whose comments at Budapest have helped me to see what I was trying to accomplish and to avoid some traps I had set for myself.

Much of what is new in this monograph, however, results from a continuing dialogue with my colleague, Polly Allen, with whom I am collaborating on a larger study of the theory of international financial integration. She shares credit but no blame for the discussion of substitution, mobility, and integration in the first part of this monograph and for the specification of the algebraic model in the second part.

Finally, I am grateful to members and guests of the Research Seminar in International Economics at Princeton University for comments on earlier drafts and for their own presentations. I owe large debts to William Branson, Rudiger Dornbusch, Dwight Jaffee, Pentti Kouri, and Lars Nyberg. The research reflected in this monograph was supported by the International Finance Section, Princeton University, and the Ford Foundation's research program on International Economic Order.



## I. INTRODUCTION

Capital mobility and financial integration are subjects too large for close inspection, even for a rapid tour, in a single monograph. To examine all aspects of capital mobility would require a number of excursions. Economists have dealt with it in many ways, by building mathematical models, analyzing large amounts of data, and describing minutely the evolution of policies, markets, and financial institutions in major countries. The subject has several dimensions, real and monetary, positive and normative, short and long term. The international integration of financial markets, the ongoing process and the state of affairs, is another sprawling subject. It can be approached in just as many ways and has as many separate dimensions.

Here, then, I concentrate on two tasks. In Chapter II, I examine the relationships between mobility and integration, the obstacles to each, and some costs and benefits of integration. In Chapter III, I examine the implications of capital mobility for domestic monetary and fiscal policies and its effects on the process of balance-of-payments adjustment under fixed and flexible exchange rates.

Some readers may find Chapter II too casual and discursive. Others may complain that Chapter III is too abstract and terse. I am acutely aware of the difference in method and style, but I would not want to treat the subject one way without the other. It would be wrong to disregard the conceptual, political, and institutional problems considered in Chapter II. It would also be wrong to call a halt at the end of Chapter II without applying formal methods to the analysis of mobility and integration.

## II. ASPECTS OF MOBILITY AND INTEGRATION

Here, I propose to comment on five questions: What is the most useful way to define international financial integration? Are there ways to measure the degree of integration? What are the connections between financial integration and capital mobility? What are the principal barriers to integration? And what are the costs and benefits of integration?

My answers to these questions will be framed to reflect a view I have expressed elsewhere (Kenen and Lubitz, 1971, Chap. 1). The distinguishing feature of international trade, whether in goods, services, or claims, and of international migration is the fact of national sovereignty. International trade involves transactions between parties who reside in different jurisdictions. When the parties are corporations rather than natural persons, they are the creatures of those jurisdictions and may have different attributes. International migration likewise involves the movement of an economic actor from one jurisdiction to another.

Much can be accomplished analytically by treating nations as regions and the theory of international trade as the "chief application of the general theory of interregional trade" (Ohlin, 1933, p. 67). But this method can seduce us into the sin of neglecting the roles of power and policy in international economic transactions, a sin for which Galbraith (1973) has castigated our profession. Much can also be accomplished by adopting the Ricardian supposition that factors of production are perfectly mobile within countries and perfectly immobile between them, or the more general supposition that transport costs are higher internationally than intranationally. But these suppositions have a different flaw. They attach excessive importance to characteristics that are in truth differences of degree, not kind. Furthermore, they are contradicted by experience. The costs of moving goods, claims, and people are not always higher internationally than they are domestically.<sup>1</sup>

Ricardo's example is a better guide than his suppositions about mobility. He and his followers used the tools of economic analysis to

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<sup>1</sup> Some years ago, the U.S. Tariff Commission was asked to rule that West Coast producers of clay soil pipe constitute a separate industry and should be allowed to apply for relief from import competition. They were separate, it was claimed, because their output did not compete with that of other U.S. firms but was subject to intense competition from Canada. It was much more expensive to ship clay soil pipe across the Rocky Mountains than across the Canadian border.

study the implications of sovereignty—of governments' attempts to regulate foreign trade. It is also important, however, to catalogue the implications for international trade and migration of differences between *domestic* institutions and policies—of differences in laws and customs like those that define the rights and duties of employers and employees or of creditors and debtors and of differences in policies that express each society's choices between private and public ownership, between personal and collective consumption, and between such targets as full employment and price stability. Finally, it is important to catalogue the implications of ways in which governments have chosen to connect or separate their jurisdictions—of laws that levy taxes on incomes earned from foreigners and those paid to foreigners; of laws that collect or remit domestic taxes on goods, claims, and persons crossing the frontier; and of laws, regulations, and practices by which governments link or insulate their monetary systems.

### *On Capital and Claims*

It is churlish, if not wrong, to quarrel with definitions. It is worse, however, to use terms that can have many meanings without indicating which one you have in mind. Some definitions, moreover, are invitations to confusion. Consider a few of the definitions attached explicitly or implicitly to the terms "capital" and "capital movements" in writings on international trade and international investment.

In much of what is written on the pure theory of international trade, especially on the factor-endowment analysis of comparative advantage, capital is represented by a single, undifferentiated commodity, the capital good, that can be used in various combinations with labor and other factors to produce all outputs, including additional units of the capital good.<sup>2</sup> In the same context, the long-run consequences of international capital movements are analyzed by assuming that some part of the stock of capital goods has been shifted bodily from one country to another.

This view of capital is consonant with usage in the theory of production and national-income accounting. But it is also the source of serious misconceptions. Students who have mastered this notion of capital (and no longer make the freshman mistake of confusing the acquisition of financial assets with capital accumulation) find it difficult to understand

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<sup>2</sup> See, e.g., Samuelson (1965). In that same paper, Samuelson shows that one can derive many of the standard factor-endowment results in models containing several capital goods. See also Acheson (1970).

why paper claims on foreigners are included in a country's capital stock. What is worse, they continue to infer incorrectly that trade in the capital good is required if there are to be any capital movements.<sup>3</sup>

It is, of course, unnecessary to make this assumption. International capital movements can take place even when there is no trade in the capital good. It is sufficient for the good to depreciate, so that a capital-exporting country can run down its capital stock. By producing fewer new capital goods (failing to replace those that depreciate), it can produce additional consumer goods and sell them to the residents of another country in exchange for claims on that other country's future output. The capital-importing country can cut back its own output of consumer goods, increase its output of capital goods, and add to its capital stock.

Capital movements occur whenever there is an exchange of goods for claims, whether or not the capital good is traded. A transfer of capital goods from one country to another does not, by itself, denote a capital movement. Conversely, capital movements need not be accompanied by transfers of capital goods. They need not even be accompanied by real capital formation. A country can issue claims on its future output merely to consume more currently. It can mortgage some part of its future output to purchase consumer goods from other countries.

Balance-of-payments accounts are organized to identify and stress the exchange of goods for claims that is the fundamental characteristic of a net capital movement. The balance on current account is defined so that its mirror image measures net foreign investment, including any change in a nation's reserves (its holdings of international money). That balance, moreover, appears in the national-income accounts as one of the ways in which a nation uses its saving. Net foreign investment constitutes an addition to national wealth.

Much of what is written on the problem of accommodating capital movements, the so-called "transfer problem," uses the concept of capital I have just advocated. In this very different literature, capital movements involve the acquisition of claims on the outside world, and the process of accommodation is the manner in which the two countries involved jointly generate a change in the balance on current account that

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<sup>3</sup> For a history of this fallacy, see Caves (1960), pp. 134–136. Caves insists that "only one view of the factor 'capital' proves meaningful with respect to problems of adjustment and interregional capital movement in international trade. It is the view that capital consists of 'waiting' or purchasing power over goods and services; it does not consist of supplies of particular capital goods" (p. 134). I reach a similar conclusion below, but use different language (my "claims on future output" represent Caves's "waiting").

is sufficient to offset the capital movement. A transfer problem is said to exist when, at constant prices and fixed exchange rates, the change in the balance on current account induced by the changes in the two countries' spending is smaller than the desired transfer, and the actual transfer has therefore to be smaller than the desired transfer. Some part of the desired change in one country's claims on the other has to be made by exchanging claims for claims (reserves) rather than exchanging claims for goods.

Consider, next, the sense in which the term "capital" is used in much of what we read about multinational firms. Here, authors are not talking about capital in any of the senses encountered heretofore. Instead, they are talking about the activities of *capitalists*. They are concerned with the implications of foreign decision-making, of foreign control rather than ownership. It should be noted, in fact, that direct investment, the process of acquiring control over an enterprise in a foreign country, need not involve any transfer of capital in either of the two common meanings I have mentioned. It need not involve a shift in the geographic location of capital goods or an exchange of claims for goods. It can and often does involve a swapping of claims for claims.

A firm deciding to acquire a plant abroad has many ways to carry out that decision. It can rent a foreign plant rather than buy or build one. And even when it chooses to buy or build, it has several ways to finance its acquisition. It can use retained earnings; it can issue claims (debt instruments or stock) in its own country; it can issue claims in the country where the plant is to be located; it can issue claims in some third country. And if it issues claims in the country where the plant will be bought or built, the act of direct investment does not involve a net capital transfer.

Many firms have exercised this option. In 1969, the foreign affiliates of U.S. firms spent \$10.65 billion to acquire current and fixed assets. Half of the money came from or through the parent companies. Half came from other sources. Here are the figures (in billions):<sup>4</sup>

Total from parent companies . . . . .	\$5.30
Earnings reinvested by parent companies . . . . .	2.08
New equity investment by parent companies . . . . .	0.93
Lending by parent companies . . . . .	2.29

<sup>4</sup> Figures from U.S. Department of Commerce (1972), p. 19. Additional data for 1966-72, pertaining to a sample of foreign affiliates, are supplied by Mantel (1975). None of these data are strictly comparable to the corresponding balance-of-payments statistics; they come from a special survey of majority-owned foreign affiliates.

Total from others . . . . .	\$5.34
New equity investment by minority stockholders	0.10
Long-term borrowing from others . . . . .	1.30
Short-term borrowing from others . . . . .	3.94

This heavy reliance on borrowing outside the United States, some of it from foreign banks and other financial institutions, was due in part to the influence of U.S. controls on direct-investment outflows (Cairncross, 1973). But some was the more normal outcome of comparisons of costs (and risks) of borrowing in various capital markets.

The literature on direct investment raises important questions, and more work is needed to answer them. We are just beginning to study systematically why firms go abroad; how their decisions affect the levels and locus of production; how they affect employment, capital formation, and rates of economic growth in the host and source countries; and how they are apt to influence the volume, composition, and direction of international trade.<sup>5</sup> We need to know much more about the ways in which governments can use or modify the instruments of economic policy to influence firms whose own decision-making domains span many national jurisdictions.<sup>6</sup> It may now be time, for example, to consider bilateral or multilateral agreements that would allocate the firms' global incomes among tax jurisdictions, eliminating the need to police transfer-pricing practices.

These normative questions, however, lie outside my own domain, the relationship between capital mobility and financial integration. Furthermore, my comments on the financing of direct investment suggest that I can also set aside questions about the determinants of direct investment.

The process of direct investment can be deemed to have two parts. The first is concerned with acquisitions of facilities abroad. The second is concerned with the financing of those acquisitions. The first is the province of economists who deal with the microeconomic analysis of real capital formation and industrial organization. The second is the province of those who deal with international capital movements. Decisions concerning ways to finance a direct investment are no different

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<sup>5</sup> Theoretical work on firms' reasons for going abroad is surveyed by Ragazzi (1973); his survey, however, appeared too early to include the important contribution by Horst (1972). See also the studies cited by Caves (1974). Theoretical and empirical research on the causes and consequences of direct investment is reviewed comprehensively by Hufbauer (1975).

<sup>6</sup> The concept of domains was introduced by Cooper (1968). Unhappily, it has not been used extensively in formal economic analysis.

in principle from decisions concerning ways to finance a domestic investment. They should be studied just as one would study the old-fashioned choice between home and foreign borrowing by, say, a municipality or public utility, using the models one would employ to describe the optimization of any portfolio—models that focus on interest rates, tax rates, risk proxies, and the like.<sup>7</sup> It is wrong, indeed, to study them by any other method, and econometricians who try to explain the direct-investment flows appearing in balance-of-payments statistics err gravely when they use neoclassical models like those developed to explain real capital formation.<sup>8</sup>

All these introductory comments lead to one conclusion: The study of international capital movements should focus on reasons for acquiring claims on foreigners and for issuing claims to foreigners and on the markets in which these claims are issued and traded. And any catalogue of reasons for acquiring or issuing claims should include preferences concerning maturities as well as preferences concerning currencies.

It has been argued, for example, that the United States served for many years as an international financial intermediary. It accepted long-term claims on foreigners, making direct investments and long-term loans, and issued short-term claims to foreigners, including foreign central banks and governments (Kindleberger, 1965). On this view, the exchange of claims for claims, not of claims for goods, was the dominant and beneficial characteristic of U.S. payments experience, serving to reconcile the differing liquidity preferences of Americans and for-

<sup>7</sup> My own model of the U.S. balance of payments, in Kenen (1973b), uses this relationship for 1953–69:

$$\begin{aligned} \ln(EDI) = & -14.03 - 1.601\ln(SDI_{-1}) + 3.287\ln(ECS) - 2.858\ln(RUS_{-1}) \\ & (2.32) \qquad\qquad\qquad (3.89) \qquad\qquad\qquad (2.77) \\ & + 3.307\ln(RFN) + 2.244\ln(RCN) - 0.633DV - 0.751DM, \\ & (4.07) \qquad\qquad\qquad (2.65) \qquad\qquad\qquad (3.39) \qquad\qquad\qquad (3.19) \end{aligned}$$

where *EDI* is the quarterly direct-investment outflow, *SDI*<sub>-1</sub> is the stock of direct investments (parent-company claims) at the end of the previous quarter, *ECS* is gross corporate saving in the United States, *RUS* is the U.S. long-term interest rate, *RFN* is an average of European long-term interest rates, *RCN* is the Canadian long-term interest rate, and *DV* and *DM* are dummy variables denoting the “voluntary” and “mandatory” U.S. controls on direct-investment outflows. The coefficient of determination is 0.75; the Durbin-Watson statistic is 1.62. Numbers beneath the coefficients are *t* statistics.

<sup>8</sup> See, e.g., Kwack (1972). Stevens (1972) avoids this pitfall by treating direct-investment outflows as functions of concurrent capital formation by direct-investment affiliates. Severn (1972) and Ladenson (1972) avoid it by a more ambitious method; they explain capital formation and direct-investment outflows as the joint results of the firm’s decision-making processes.

eigners. On this view, moreover, the U.S. balance-of-payments deficit was not a symptom of overspending or any other malady. It was a statistical illusion, produced by dividing up the capital account—by drawing a line arbitrarily between the long-term claims acquired by the United States and the short-term claims it issued.

More recently, capital flows to and from the United States have probably been dominated by investors' preferences concerning currencies, not maturities. Individuals and firms have swapped claims with foreigners in order to translate their net worth from one currency into another. Some of these exchanges have involved forward foreign-exchange contracts, and these do not appear in the balance-of-payments statistics. But a forward foreign-exchange contract is a swap of claims for claims; it is a specialized financial instrument designed expressly for the purpose of altering the currency in which wealth is held. Recent work on the theory of forward exchange exploits this insight. It derives the demand for forward exchange by traders, arbitrageurs, and pure speculators from models of portfolio management (Kenen, 1965, and Feldstein, 1968).

### *Defining Integration*

The implications of capital movements for the functioning of financial markets and the conduct of financial policies are usually approached by asking to what extent capital movements have integrated various financial markets. Here again, however, terms are not always defined precisely, and carelessness can cause confusion.

The integration of two markets is usually defined and measured by applying the law of one price (see Kindleberger, 1974, and his references to Tinbergen, Balassa, and Myrdal). In many theoretical accounts, two markets are said to be perfectly integrated when prices are the same in both and the two behave as one. In much empirical work, the degree of integration is measured by averages of differences between market prices and other, more sophisticated indexes of convergence or dispersion.

This approach is not sufficiently elastic. It is quite appropriate to the study of two markets that deal in the same good, service, or claim in two countries or two regions of a single country. But it does not give guidance to reasoning or measurement when, as is typically the case, the goods, services, or claims traded in two markets are not identical in every respect. When they differ in any manner visible to those who use or hold them, there is no reason for their prices to be the same, the law of one price cannot furnish a standard for measuring integration,

and price differences cannot be used to identify departures from perfect integration.<sup>9</sup>

Integration, I believe, is more fruitfully defined by the extent to which markets are connected. More precisely, I employ it to describe the degree to which participants in any market are enabled and obliged to take notice of events occurring in other markets. They are *enabled* to do so when information about those events is supplied promptly and accurately in a form that permits its assimilation into the decision-making processes of recipients. They are *obliged* to do so when it is supplied in ways that invite them to use it in order to achieve their own objectives—to maximize income, wealth, or satisfaction.

This definition resembles Cooper's (1968) notion of interdependence. It *sounds* quite different from the definitions employed by Scitovsky and by Allen in their discussions of financial integration. According to Scitovsky (1969, p. 90), integration is measured by the transferability of assets from one market to another:

Indeed, the unresponsiveness of an asset's price to selling in one and buying in another region is the best index of the degree to which its market is integrated. The unresponsiveness of asset prices as a whole to asset transfers and attempted asset transfers of this sort indicates the extent of integration of asset markets in general.

According to Allen (1976, p. 19), integration is measured by substitutability:

The degree of integration between two or more securities markets reflects the degree of substitutability between those securities.

But Allen goes on to show that Scitovsky's definition is not significantly different from her own. It is impossible to transfer assets from one region to another without changing asset prices unless investors in that other region are willing to regard the assets in question as perfect sub-

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<sup>9</sup> It would be wrong, however, to neglect the information developed by those who have used *changes* in price differences to study *changes* in the degree of integration. I cite this information below. Furthermore, price differences at a point in time can be used to study a phenomenon that bears indirectly on the degree of integration. They can measure the heterogeneity of the goods, services, or claims traded in two or more markets. This was the suggestion made by Swoboda (1976) in response to my assertion, in Kenen (1976a) and later in this paper, that the heterogeneity of borrowers and instruments is larger internationally than domestically, making for a less perfect international integration of financial markets. "The crucial question," he replied, "is whether interest rates tend to differ more within one nation than among various nations."

stitutes for those they already hold.<sup>10</sup> And the two definitions resemble my own in that they identify the most important reason for participants in any single market to take account of developments elsewhere. The degree of interdependence among markets depends in large measure on the degree to which the goods, services, or claims traded in one market are deemed to be substitutes for those traded in others.<sup>11</sup>

My definition, however, has additional dimensions. It admits of other reasons for integration, and it lays down additional requirements.

Income and wealth effects can be important causes of interdependence between markets. The strength of these effects, in turn, depends on the number of economic actors who use or hold a good, service, or claim—what Allen (1976) describes as its “domain.” Petroleum is not a close substitute for wheat, yet we have come to know that events in the petroleum market can have powerful effects on the wheat market. Petroleum has an extensive domain—it is used in one form or another and in large amounts by the vast majority of economic actors—and an increase

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<sup>10</sup> Oddly enough, the context in which Scitovsky offers his definition is one where perfect substitutability (transferability) is not needed to stabilize asset prices. In his example, one region, the West, has a current-account deficit with another, the East, so that there is a net transfer of wealth from West to East. It is conceivable, albeit improbable, that this transfer of wealth will accomplish a transfer of securities from West to East at constant asset prices (yields) even though the securities are not perfect substitutes. This will happen if wealth holders in both regions hold Eastern and Western securities in identical proportions, if they have identical wealth elasticities of demand for Eastern and Western securities, and if they hold no other assets (not even money). In this instance, then, the relevant requirement is another one mentioned by Scitovsky (1969, p. 89), that portfolio preferences be regionally unbiased.

<sup>11</sup> Notice, however, that two markets can be integrated in my sense even when it is not possible to substitute directly one good, service, or claim for another: “Two markets can be integrated indirectly, if each of the two securities is regarded as a substitute for a third security (or for one of two other securities that are themselves substitutable and exchangeable)” (Allen, 1976, p. 21). Notice also that substitution can occur on both sides of the market. Two goods, services, or claims may be viewed as substitutes by those who use or hold them and by those who produce them. This point has been made repeatedly in discussions of balance-of-payments models containing two or more commodities. It has not been stressed enough in discussions of international capital mobility and financial integration. This is because we do not ordinarily emphasize the “production” of financial instruments; we emphasize adjustments in demand to exogenous changes in supply. Yet changes in supply can be endogenous. Debtors’ decisions concerning the “production” of short- and long-term bonds are influenced by the term structure of interest rates and by expectations about that term structure. Similarly, multinational firms can issue debt in any one of many national markets (and national currencies). This is, indeed, their chief contribution to international financial integration.

in the price of petroleum can have income effects big enough to influence the price of wheat. Similarly, a large change in the price of one asset can have effects on total wealth big enough to influence the level of saving and, therefore, to influence the prices of all other assets, even those that are not close substitutes for the one whose price set off the process.<sup>12</sup>

What may be more important, substitutability is not a sufficient condition for close integration. If the domain of a good, service, or claim is limited, the willingness of users or holders to swap it for another may not be matched by their ability to do so. A wealth holder may be willing to swap German for French bonds, but his willingness to do so will not stabilize their prices if he does not hold them in sufficient quantities to satisfy a shift in someone else's preferences. Furthermore, substitutability will not be invoked if prices changes originating in one market are not transmitted promptly and accurately to all other markets. Thus barriers to trade between regions or countries which block or distort the transmission of price changes are impediments to integration. The best examples are quotas and variable levies like the ones employed with pernicious success by the European Community to insulate its Common Agricultural Policy from changes in external prices of farm products.

But integration as defined here is not ruled out by other trade barriers, such as *ad valorem* tariffs, and it is not necessarily prevented or diminished by large departures from perfect competition. Two markets can be closely connected when each of them is oligopolistic. More generally, my definition of integration, unlike those that derive from the law of one price, has little to do with allocative efficiency. Admittedly, barriers to integration are almost certain to diminish efficiency (almost, not always, because we know that removing one trade barrier or one market imperfection does not always increase allocative efficiency when there are other barriers or imperfections). Those that interfere with the transmission of information diminish efficiency by depriving economic actors of opportunities to substitute one thing for another—to adjust their use or holdings of goods, services, or claims in response to news about changes in relative scarcities. Those that reduce the domain of any good, service, or claim diminish efficiency by depriving economic actors of opportunities to use or hold it. Yet even when all actors have unrestricted access to accurate information and to every good, service,

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<sup>12</sup> This point is developed formally in the Appendix. Notice, however, that income and wealth effects are apt to produce *inverse* relationships between price changes in two markets. As in so many other cases, the sign of the net change in the price of a good, service, or claim induced by a change in the price of something else depends on the relative sizes of opposite-signed income (wealth) and substitution effects.

and claim, we cannot be sure that factors of production, incomes, and wealth will be allocated as they would be under perfect competition.<sup>13</sup>

When economic information is conveyed as news about price changes, it satisfies the double test contained in my definition. News about price changes is easily assimilated, and economic actors ignore it at their peril. It is, indeed, the chief characteristic of a market economy, contrasted with a command economy, that the method it uses to instruct its economic actors is closely bound up with the method it uses to appraise and reward their compliance with instructions. The thorough use of economic information conveyed as news about price changes is required for the economic well-being of those who receive it. To study the strength of connections among markets, then, it makes sense to study the behavior of prices, but to look at their covariation over time rather than differences at a point in time.

This thought is not new, and much work has been done with measures of covariation, especially with correlations between interest rates in major financial centers (see, for example, Kwack, 1971; Herring, 1973; and Marston, 1974). But few authors seem to be aware that the choice between measures of covariation and dispersion implies a choice between notions of integration, and those who have paused to reflect on methodology have not always given good reasons for their choices. Furthermore, those who use covariation are not always careful to point out that most definitions of integration, including my own, imply covariation, but that covariation per se does not necessarily imply integration.

In one important paper, for example, Logue, Salant, and Sweeney (1976) take several pages to attack the use of differences between interest rates as indexes of financial integration. Their own case for covariation, however, is rather weak. They use it because they seek to apply the theory of portfolio optimization to the definition and measurement of integration, and the covariation of asset prices (rates of return) plays a strategic role in that theory. They argue, moreover, that the international integration of asset markets derives its importance from its implications for the conduct of autonomous monetary policies, taking monetary independence to mean that the central bank is able to influence the level of the domestic interest rate (Logue *et al.*, 1976, p. 92).

Neither of these reasons is especially cogent. The first, invoking portfolio theory, confuses a cause with an effect. In portfolio theory, close

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<sup>13</sup> The same point is made by Allen (1976). I revert to it below, when discussing the costs and benefits of integration.

covariation between two assets' prices is a *cause* of substitutability. When two assets are expected to yield the same rates of return on average and their prices are not expected to vary independently, the two will be regarded as perfect substitutes; investors will have no income-increasing or risk-reducing reason for holding both assets simultaneously. But this proposition, by itself, is not an argument for using covariation as a *measure* of market integration. The case for doing so, as I said before, derives from the more general proposition that substitutability, whatever its cause, is an attribute of integrated markets. If, indeed, one were to follow Logue, Salant, and Sweeney, one would not use covariation as an index of integration when looking at markets for goods, where covariation is not a cause of substitutability.

The second reason advanced by Logue, Salant, and Sweeney, invoking monetary independence, is unsatisfactory for a different reason. It is misleading or worse to measure monetary autonomy by a country's ability to alter its interest rates relative to rates in other countries. When autonomy is measured in this fashion, the concepts of financial integration and monetary autonomy become perfect antonyms, one of the two is redundant, and there is no point in trying to trace analytically the implications of one for the other.<sup>14</sup> It is for this reason, among others, that I shall define monetary autonomy in terms of a central bank's ability to control the stock of money (the supply of reserves available to commercial banks), not its ability to control the domestic interest rate.<sup>15</sup>

Logue, Salant, and Sweeney are on the right track, and they come to a number of challenging conclusions. But their work also shows how difficult it is to interpret evidence concerning covariation. Applying factor analysis to quarterly data on long-term interest rates in seven major countries, they come to these conclusions:

Our results show that most of the explainable variation in the observed interest-rate series can be related to a single factor, from which we draw the inference that there is a considerable degree of integration among the seven major international financial markets examined. Moreover, our quantitative results compare quite favorably to those obtained by researchers looking at yields in different financial markets in a single economy. When this single factor shifts for the world as a whole, interest rates in the seven countries shift also, whether or not capital flows occur. The shifts in interest

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<sup>14</sup> Others have used the interest-rate definition of autonomy, with somewhat confusing results. Thus, Kindleberger (1976) criticizes those who predicted that floating exchange rates would confer autonomy, pointing out that the advent of floating rates has not reduced capital mobility (i.e., has not weakened interest-rate linkages).

<sup>15</sup> This is the definition used by Kouri and Porter (1974) in their empirical work on monetary policy and international capital flows.

rates obviate the need for such flows, and responsiveness of interest rates in separate national markets to changing international conditions is essentially what we mean here by international integration of financial markets. . . .

While we found that a single international factor explained a substantial proportion of the variability of international interest rates, we also found traces of a "Germanic" factor which further linked interest rates in the Netherlands, Switzerland, and Germany and an "Atlantic" factor tying interest rates in France, the United Kingdom, and the United States together . . . (p. 98).

They also report (p. 129) that the advent of floating exchange rates did not loosen the connections among national interest rates (although their study did not cover sufficient experience with floating rates to give them great confidence in that conclusion).

As they define integration, their findings are indeed conclusive proof of international financial integration. When integration is *defined* by covariability, there can be no objection to measuring integration by looking at covariation—and looking no further. The evidence summarized above, however, does not prove close integration as Scitovsky (1969), Allen (1976), and I have defined the term. It does not demonstrate that markets are tightly connected—that events in one market influence events in others. It may merely show that prices (interest rates) in asset markets have responded to events that have impinged more or less simultaneously on all asset markets. Changes in expectations about rates of inflation and in concomitant expectations about changes in exchange rates come immediately to mind. These, in fact, may be the underlying cause for the "Germanic" and "Atlantic" factors mentioned above. Germany, Switzerland, and the Netherlands have had similar rates of inflation and similar exchange-rate histories; so, too, have France, the United Kingdom, and the United States. (The same set of common external causes may also explain why the introduction of floating exchange rates has had no discernible effect on the covariation of interest rates; it came when inflation was accelerating everywhere, and this common influence may have dominated temporarily any disintegrative influence of floating rates.)

Turning these last comments into a recommendation, an accurate empirical assessment of integration, as I define it, requires the measurement of covariation only after making every feasible allowance for the influence of common causes. It requires the use of partial correlations (or multiple regressions) rather than the simple correlations that have been used heretofore.<sup>16</sup>

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<sup>16</sup> It would, of course, be better to correlate price changes in one market with *nonprice* proxies for the disturbances originating elsewhere, but it is rarely possible

## *Financial Integration and Capital Mobility*

The most controversial point made by Logue, Salant, and Sweeney is their assertion that coordinated movements in interest rates can occur without capital movements and may serve to obviate the need for such movements. This assertion is not based on any systematic study of data on international capital flows. It is a deduction, supported only indirectly by the strength of the observed covariation of interest rates, from an *a priori* supposition that international financial markets are efficient in the finance-theory sense.<sup>17</sup> To use their own words once again (p. 95),

The interest-rate approach to integration is considerably more straightforward than the alternative approaches. Whereas alternative approaches focus on the flow of capital, this concept of integration ignores flows and concentrates on prices, specifically on interest rates. This concept involves, in essence, a notion of market efficiency which suggests that the prices of financial assets adjust instantaneously to new information, perhaps even in the absence of international capital flows.

If it is indeed true that capital markets can value assets appropriately even in the absence of capital movements, we would be compelled to revise our views about the efficacy of capital controls and about the conduct of monetary policy in an open economy. Let us ask, then, whether the assertion is accurate or needs to be amended.<sup>18</sup>

Notice, first, that the argument is a bit ambiguous. Read casually, it would seem to say that assets can be appropriately valued even in the

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to identify or quantify those disturbances. In this respect, much of our theoretical work, including work presented later in this paper, falls short of being fully operational. It is easy to posit an exogenous shift of demand or change of technology, but devilishly difficult to measure one. But I am not one to make a fetish of measurability. Indeed, I have made a ringing defense of nonoperational constructs:

I've never seen a purple cow,  
I know I'll never see one.  
But I can tell you anyhow  
I know damned well I'll need one.

To which a mathematical wag replied predictably: "Let there be a set  $S$  of purple cows defined upon a hyperpasture."

<sup>17</sup> Others have also invoked efficient-market theory, especially in work on expectations, speculation, and exchange rates; see, e.g., Aliber (1972) and Pippenger (1972).

<sup>18</sup> Some of what follows is drawn from my (1976b) comment on Logue, Salant, and Sweeney.

absence of opportunities for international capital movements. This cannot be true. When there can be no international trade in securities, the number of wealth holders willing and able to hold a particular asset will differ from what it would be if there were free trade in securities. The domain of each asset will be different, and the appropriate (equilibrium) price of each asset will also be different. Two of the examples offered below make this point clearly. The statement must therefore be read to say something less dramatic. It must mean that assets can be appropriately valued in the absence of actual capital flows—that capital-asset pricing can anticipate and obviate the need for actual transfers of claims between two markets.<sup>19</sup>

To examine this modified assertion, it is useful to distinguish between two classes of disturbances—those that affect exogenously the quality of an asset and those that affect exogenously the quantities supplied or demanded.<sup>20</sup> It is also useful to distinguish between disturbances that are anticipated and those that take wealth holders by surprise. Finally, it is useful to distinguish between events that affect all wealth holders' perceptions uniformly and those whose implications are different (or are thought to be different) for wealth holders residing in different jurisdictions.

This three-way classification threatens to spawn an elaborate taxonomy, but I will not traipse through every case. Instead, I will use it to formulate a pair of propositions and then illustrate them by a few examples.

My propositions depend on two assumptions: (1) All wealth holders are assumed to have identical preferences. When they confront the same rates of return, tax rates, and risks, they will want to hold identical portfolios. (2) All wealth holders have free access to all information and have the same ways of assimilating information. When they confront

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<sup>19</sup> The point at issue here resembles one made by Machlup (1972) in his introduction to the conference volume on *International Mobility and Movement of Capital*. Explaining the inclusion of "mobility" and "movement" in that title, he points out that there can be much mobility without much movement and vice versa. The term "mobility," he implies, should be used to denote the sensitivity, *ex ante*, of asset holdings to changes in yields and risks. The term "movement" should be used to denote the measurable consequence, *ex post*, of mobility. Thus, capital movements can be small when mobility is high if yields and risks are stable.

<sup>20</sup> Logue *et al.* (1976) acknowledge the importance of this distinction in their discussion of monetary policy and capital movements: If the disturbance affecting one country's interest rate is a change in the total supply of debt issued in that country (caused by new government borrowing or open-market sales by the central bank), some part of the additional supply will have to be exported. But they are inclined to regard this instance as a somewhat special exception to their general assertion.

new facts (or rumors), they will reach the same conclusions simultaneously.<sup>21</sup> Under these assumptions, the following assertions hold:

*Proposition I.* When an exogenous disturbance affects the quality of an asset and its implications are the same for all wealth holders, the disturbance will be reflected automatically in a change of asset prices. There will be no capital movements. In fact, under these conditions, there will be no transfers of assets whatsoever, not even between wealth holders in the same market or country. All wealth holders will alter their own bid and asked prices in the same way, precluding transactions between them. This proposition holds, moreover, whether the disturbance comes as a surprise or is fully anticipated, provided all wealth holders encounter it at the same moment.

*Proposition II.* When an exogenous disturbance affecting asset quality has different implications for wealth holders because they reside in different jurisdictions, or when the disturbance affects directly the quantities supplied or demanded, no new equilibrium can be achieved without international capital movements. If the disturbance comes as a surprise, the price changes are apt to occur concurrently with the international transfer of securities, since the transfer has to serve as the agent of change. If, instead, the disturbance is fully anticipated, the change in prices can precede the transfer of securities. But the transfer must take place eventually to validate the anticipations that produced the change in prices.

To illustrate these propositions, I shall use the example developed by Scitovsky (1969) in which there are two regions, East and West, and wealth holders in each region hold their own region's currency and bonds issued by both regions' governments. The wealth holders' preferences are identical (apart from the fact that they do not hold the other region's money). The exchange rate is fixed immutably, and no one has any doubt about it.<sup>22</sup>

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<sup>21</sup> These assumptions sound like those employed to prove factor-price equalization in the Heckscher-Ohlin trade model, and there is an analogy, not too far-fetched, between the efficient-market view of asset pricing and the factor-price-equalization theorem. One can develop a set of assumptions under which free international flows of "disembodied" knowledge relating to yields and risks would equalize interest rates on comparable assets, eliminating the need for capital movements. My assumption about the assimilation of information would play a role in that proof similar to the role played by assumptions concerning production functions in the proof of factor-price equalization.

<sup>22</sup> Recasting these assumptions in the language used above, Eastern securities held by Easterners are perfect substitutes for Eastern securities held by Westerners—no holder has cause to distinguish between them—and the same is true of Western securities. One would therefore expect the Eastern and Western markets for Eastern

To see how a disturbance affecting quality can affect interest rates everywhere without also causing capital movements, suppose that the Eastern government imposes a withholding tax on all its own interest payments and that Western wealth holders are not allowed to credit the withholding tax against income taxes owed to their own government.<sup>23</sup> Eastern bonds become less attractive to Eastern and Western wealth holders alike, but there is no way in which they can dispose of them because there has been no change in supply. In consequence, the prices of Eastern bonds must fall (the pre-tax return must rise) until the post-tax return is what it was before the tax was imposed.

There are, of course, two ways in which this price change can occur. According to traditional theory, wealth holders will *try* to sell Eastern bonds, driving down their prices. According to efficient-market theory, wealth holders will understand the implications of the tax, and their understanding will be translated into a price change without any sales or attempted sales. But this difference in explanations is not important for the point I want to make. I seek simply to demonstrate that the price changes required by the withholding tax do not call for any net transfer of bonds between Eastern and Western wealth holders and that the price changes will be the same in the two regions.<sup>24</sup>

Consider, next, an exogenous disturbance that also affects asset quality, not quantities supplied or demanded, but does so differently for Easterners and Westerners. Suppose that the Eastern government imposes an income tax on all the interest earned by its own citizens. Eastern and Western bonds both become less attractive to Eastern wealth holders; they want to hold more money and fewer bonds. Under fixed exchange rates, moreover, the East can acquire money from the West by running a balance-of-payments surplus, and this is what will happen. Easterners will sell Eastern and Western bonds, and Western-

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securities to behave as a single market (i.e., to be perfectly integrated under any definition of integration, including one derived from the law of one price). Furthermore, Easterners and Westerners do not differ in their willingness to substitute Eastern for Western securities. Thus, the intraregional markets for Eastern and Western securities need not be perfectly integrated, but the degree of integration is the same in both regions.

<sup>23</sup> Here and hereafter, I abstract from a number of indirect effects. In this particular instance, for example, I abstract from effects on Eastern revenues and, therefore, on the rate at which the Eastern government is issuing or redeeming bonds. In the next case, I abstract from the influence of an Eastern income tax on Eastern saving.

<sup>24</sup> These conclusions do not depend on the transferability of securities between East and West; they depend only on the assumptions with which I prefaced my propositions. In this instance, then, there is no need to distinguish between "mobility" and "movement" (i.e., transferability and transfers).

ers will buy them as bond prices fall. When the process of adjustment has come to an end, all bond prices will be lower than they were before the tax was imposed (pre-tax returns will be higher), and they will be the same in both countries. For Westerners, then, post-tax returns will be higher than they were to start with, and Westerners will be content to hold more bonds (less money). For Easterners, post-tax returns will be lower, and they will be content to hold fewer bonds (more money).<sup>25</sup> Bonds will have been transferred from East to West and money from West to East.

If wealth holders became aware of the government's intentions before the income tax came into force, bond prices would begin to change immediately, even before there was any net transfer of bonds; bond prices would be marked down in each and every market. But the capital flow from West to East would have to occur at some point in the process of adjustment in order to ratify wealth holders' expectations.<sup>26</sup>

Finally, consider an exogenous disturbance affecting the quantity of bonds supplied. Suppose that the Eastern government runs a budget deficit and issues additional Eastern bonds. Here, once again, there has to be a reduction in the prices of Eastern bonds, and if there is any substitutability between the two types of bonds, some reduction in the prices of Western bonds as well. Furthermore, the changes in bond prices must be the same in both regions. But there has also to be a net transfer of bonds. Some of the new bonds issued in the East have to be lodged with wealth holders in the West.

The lessons taught by these examples can be summarized succinctly. The theory of efficient markets can contribute to our understanding of the processes that integrate capital markets, calling our attention to the role of expectations as catalysts of changes in asset prices. It is nevertheless necessary to identify the characteristics of the disturbances that cause shifts in expectations; this is the only way to know whether shifts in expectations can cause permanent, parallel changes in asset prices without the aid of asset transfers from one market to another. If dis-

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<sup>25</sup> If the decline in bond prices were large enough to increase the Eastern post-tax return, wealth holders in both regions would want to hold more bonds (less money), and markets would not be in equilibrium.

<sup>26</sup> If Westerners were forbidden to buy more bonds from Easterners, the process of adjustment would be different; the East would still import money through its balance of payments but would do so by running a current-account surplus rather than a capital-account surplus. Furthermore, the final equilibrium configuration of asset prices would not be the same in the two regions. This is why I said before that it is impossible to define an "appropriate" valuation for an asset without first ascertaining the asset's domain.

turbances that call for asset transfers are large or frequent, relative to other disturbances, efficiency in the finance-theory sense will not guarantee covariant price changes. International capital mobility—the absence of barriers to trade in assets and a substantial substitutability between individual assets—is required for international financial integration.

### *Measuring Financial Integration*

The fifteen years that followed the restoration of currency convertibility in 1958 witnessed an enormous growth of international capital movements, rivaling and perhaps surpassing in significance the great growth of international trade. The facts are familiar. There was, first, the large increase of direct-investment outflows from the United States, followed by the internationalization of borrowing by multinational enterprises. At about the same time, U.S. banks began to make large short-term loans to foreigners; recall the big increase of lending to Japan and other countries that figured in the sharp deterioration of the U.S. balance of payments after 1958 and led to the revival of concern, academic and official, with the use of monetary policy to influence capital movements.<sup>27</sup> The last years of the 1950s also saw the revival of long-term foreign borrowing in the United States, led by a parade of new Canadian issues and private placements denominated in U.S. dollars and by the bond issues of the World Bank and other international financial institutions.

Restrictions imposed by the United States—the Interest Equalization Tax enacted in 1964, the Voluntary Credit Restraint Program applied in 1965, and a variety of controls on direct-investment outflows—combined to cause a slackening of international lending by U.S. institutions and of activity in U.S. markets.<sup>28</sup> But they did not halt the revival of international capital markets and movements. They led instead to the migration of activity—to the increase of offshore borrowing by foreign affili-

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<sup>27</sup> Mundell's papers on the optimum policy mix date from this era (Mundell, 1962, 1963). It also spawned the first attempts to measure econometrically the interest sensitivity of international capital flows (see the survey by Cohen, 1963). More recent work on this subject is reviewed by Spittaller (1971), Hodjera (1973), and Bryant (1975). Much of it has concentrated on short-term flows; the data are more readily available in the form required by portfolio-balance (stock-adjustment) models, and they *appear* to be more comprehensive. But some work has been done on long-term flows (see, e.g., Miller and Whitman, 1970, and Kenen, 1973a and 1973b) and on capital-account aggregates (see Branson and Hill, 1971, and Herring, 1973); the latter, however, include official flows and unrecorded transactions in goods and services (which lurk in errors and omissions).

<sup>28</sup> On the scope and effectiveness of these restrictions, see Cairncross (1973)

ates of U.S. firms, to the rapid increase of short- and medium-term lending by Eurocurrency banks, including the foreign branches of U.S. banks, and to the invention of the Eurobond market.

These newer practices and institutions appear likely to survive the repeal of U.S. capital controls. Foreign affiliates of U.S. firms would seem to be drawing more heavily on parent-company funds and repaying offshore indebtedness; direct-investment capital outflows rose to an all-time record of \$7.5 billion in 1974.<sup>29</sup> But they know that they have access to foreign capital and credit markets and will draw on them again when it is advantageous. The Eurocurrency market has by now developed into a worldwide counterpart of the federal funds market in the United States; banks everywhere, including U.S. banks, borrow and lend in that market to adjust their cash positions, and the network of relationships among Eurocurrency banks may be the most powerful agents of international financial integration.<sup>30</sup> In the first half of 1975, moreover, flotations of foreign and international bonds amounted to \$10.1 billion, an unprecedented figure, and all but \$2.7 billion of the total was issued outside the United States.<sup>31</sup>

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<sup>29</sup> U.S. Department of Commerce press release (Oct. 23, 1975).

<sup>30</sup> Most of those who write about this market invoke other analogies. Those who stress its monetary role (the Eurodollar multiplier) compare it to a fractional-reserve banking system; see, e.g., Machlup (1970) and Swoboda (1973). Others treat it as a pure intermediary; see, e.g., Marston (1974) and recent discussions of the role of the market in "recycling" surplus funds of the oil-exporting countries. Each of these analogies invites one to net out interbank transactions (which do not figure in most measurements of money supplies or discussions of intermediation between final borrowers and lenders), and this is the practice followed by the Bank for International Settlements (BIS) when it measures the "size" of the Eurocurrency market in its *Annual Report*. But the analogy with the federal funds market may be the most appropriate, stressing links between the Eurocurrency market and national money markets. This same analogy, however, suggests that what I say below, about capital controls and the thinness of secondary markets for long-term foreign bonds, may understate the degree to which long-term markets are integrated internationally. If each national capital market is integrated internally, with strong links between short- and long-term sectors, and the various short-term markets are also connected by common ties to the Eurocurrency market, the degree of integration between long-term markets may be quite high. Recall the point made above, in the quotation from Allen (1976), concerning indirect substitutability.

<sup>31</sup> *IMF Survey* (Feb. 17, May 12, and Aug. 11, 1975) and the sources cited there. In 1973, foreign and international bond issues totaled \$9.9 billion, and the U.S. share was only \$1.5 billion; in 1974, the year in which U.S. controls were rescinded, the global total was \$10.7 billion, and the U.S. share rose to \$3.5 billion. (In all these compilations and in the text below, foreign securities are those issued by non-residents in national capital markets; international securities are those issued in non-national markets, e.g., the Eurobond markets.)

This great growth of capital movements, however, does not suffice to prove a trend toward a more perfect international integration of national capital markets. To some significant degree, indeed, the growth that occurred in the 1960s was an adaptation to U.S. controls that sought with limited success to separate national capital markets. And though the United States rescinded its controls in 1974, many other countries have erected new ones, some have yet to open their capital markets to foreign borrowers (or to allow their own residents unrestricted access to foreign markets), and several governments continue to exercise very close control over their credit and capital markets to favor domestic borrowers, notably public and quasi-public entities.<sup>32</sup> Furthermore, the volume of new foreign issues outside the United States is as yet quite small compared to the volume of domestic issues (Krause, 1973, pp. 121–122), and secondary markets are still very thin, especially those for foreign and international bonds.

This last point deserves additional emphasis, as trade in seasoned securities—the migration of existing claims rather than shifts in the locus of new lending—is of paramount importance for the integration of capital markets, as I have defined it, and for the manner in which international capital mobility impinges on the process of balance-of-payments adjustment. Secondary markets are needed to facilitate the arbitrage that must occur (or be anticipated, as in capital-asset-pricing models) if asset prices are to move together in various countries. They are also needed to facilitate the changes in wealth holders' portfolios—in size and composition—that are emphasized so heavily by Ingram (1962, 1972), by Scitovsky (1969), and by the model I develop in Chapter III.

There is, of course, some international trade in seasoned securities. During the 1960s, for example, there was a fivefold increase in gross foreign purchases of U.S. corporate bonds and other nonfederal issues. In 1960–63, gross purchases averaged \$2.8 billion per year; in 1968–71, they averaged \$14.7 billion.<sup>33</sup> Firm price quotations are now readily available on many foreign and international issues traded outside the United States, and transactions appear to occur with greater regularity

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<sup>32</sup> See Segré *et al.* (1966), Monetary Committee (1970), and Hodgman (1974). In its most recent *Annual Report on Exchange Restrictions* (July 1975), the International Monetary Fund notes that the European countries and Japan have dismantled or liberalized controls on capital inflows, including controls on foreign borrowing by domestic institutions, thereby to finance current-account deficits resulting from the increase in oil prices. It notes some intensification, however, of controls over capital exports.

<sup>33</sup> Data from *Federal Reserve Bulletin*, various issues.

than they did a few years ago. Furthermore, econometric work by Miller and Whitman (1970) and by other students of long-term capital movements suggest that holders of long-term securities are not locked into the new issues they buy; they do switch in and out of foreign securities in response to changes in relative interest rates. Yet dealers and others who watch international markets continue to complain about the thinness of secondary markets. They argue, for example, that it is still an important impediment to the expansion of the new-issues market for foreign and international bonds. Because these securities are not readily salable after they are issued, they are deemed to be dangerously illiquid by many potential investors.

One more set of findings bears directly on the question I have raised—whether there has been a trend toward the closer integration of financial markets. Although differences between national interest rates should not be used to measure the degree of integration at a point in time—not without invoking the law of one price—they can be used cautiously to trace short-term *changes* in the degree of integration. Year-to-year changes in the dispersion of national interest rates can, of course, have many causes. They are bound to reflect international differences in the phasing of national business cycles and price expectations and in the phasing of monetary policies—in the ebb and flow of the centrifugal forces that integrative tendencies are called upon to overcome.<sup>34</sup> But they have also to reflect changes in wealth holders' ability and willingness to acquire claims on foreigners and to substitute foreign for domestic claims when there are changes in relative interest rates.

A number of economists have studied trends in the dispersion of interest rates, and most of them have come to the same conclusion: Despite the growth of capital movements and the development of large nonnational capital markets, the process of financial integration has slowed down in recent years.

Examining year by year the dispersion of short-term interest rates in ten industrial countries, Argy and Hodjera (1973) found that "there is a noticeable drop in dispersion between 1961-62 and 1964-66 but no evidence of any continuing decline in later years." Examining rates in the European Economic Community, Hawkins (1972) found that average differences between national interest rates widened in 1966 and again in 1969 to levels resembling those in the early 1960s. "In sum," he says, "while there is some observed tendency for differentials between

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<sup>34</sup> See Argy and Hodjera (1973), who tend to discount their own findings, mentioned below, because they believe these causes may dominate.

interest rates of EEC members to narrow, that tendency was not strong, irreversible, or even sustained over the period of integration." Similar conclusions can be drawn from the extension of Cooper's calculations in Logue *et al.* (1976, pp. 101–103). Minot (1974) found continuing convergence in a somewhat different sample of countries. But he goes on to argue persuasively that it reflects only the convergence of inflation rates and exchange-rate expectations. His proxies for *real* interest rates "show a pattern commensurate with what one would expect from a subjective evaluation of the intensity of capital controls."

### *Barriers to Mobility and Integration*

What barriers stand in the way of further integration? What are the chief limitations on a wealth holder's ability and willingness to acquire and deal in claims on foreigners?

A wealth holder's *ability* to do so can be limited directly by proscriptions and restrictions of the type found in any list of capital controls applied for balance-of-payments or monetary reasons. His government may not allow him to hold claims on foreigners, to hold certain types of claims, or to hold claims denominated in foreign currencies. It may allow him to hold them, but not to increase his holdings. Other governments, moreover, may not allow their residents to issue claims to him, to issue certain types of claims, or to issue claims in certain currencies. But there are other, more subtle restrictions that are not always listed in this context and tend to escape international opprobrium.

In many countries, for example, specialized financial institutions, like insurance companies and pension funds, are not allowed to hold claims on foreigners or claims denominated in foreign currencies, or may be permitted to invest only small fractions of their assets in these forms. Obversely, less blatantly, but no less importantly, many financial institutions are required or encouraged to invest in certain classes of domestic assets. Banks are sometimes subject to formal liquidity requirements that can be satisfied only by holding government paper. Banks and other institutions can be coerced or encouraged to participate in new loans to the treasury or to public enterprises. And preferential practices are followed frequently by public and quasi-public institutions, like the ones that manage the assets of the savings banks in several European countries (Hodgman, 1974, pp. 32–33, 88–91). All these arrangements discriminate implicitly against the acquisition of claims on foreigners.

A wealth holder's *willingness* to hold claims on foreigners can be affected by a number of circumstances. Some of these derive from the exercise of sovereignty—from the governments' powers to tax, to coin money, and to legislate the terms on which private individuals and

institutions enter and uphold contractual obligations. Some of them derive from the costs of buying knowledge and from the risks of acting with incomplete knowledge.

From time to time, governments use taxes deliberately to limit their citizens' purchases of foreign assets. I have already mentioned one such instance, the Interest Equalization Tax imposed by the United States to curb American purchases of foreign securities and, therefore, new foreign flotations in the U.S. market. But the influence of tax rates and tax codes is more pervasive and powerful. Tax laws can inhibit international transactions when they are not meant to do so. They can even have inhibiting effects when the governments involved are doing their best to prevent transnational discrimination.

Most major industrial countries try to avoid the double taxation of income arising from transnational activities, especially investment. They cannot always do so unilaterally, however, not even with the aid of bilateral tax treaties. The device employed most often for this purpose—the credit for taxes paid to foreign governments—cannot work perfectly when foreign tax rates are higher than domestic rates (or are made higher effectively by international differences in definitions of taxable income). Furthermore, tax policies designed to prevent discrimination *de jure* can sometimes introduce discrimination *de facto* or can alter the form in which it occurs.

Consider, again, my East-West example in which the Eastern government imposes an income tax on all interest incomes earned by its own residents. This tax, I said, will alter bond and money holdings in the two regions, but that is not the point I want now to emphasize. It is, instead, the fact that a tax of this type violates one canon of tax neutrality. Easterners and Westerners receiving the same incomes, interest on Eastern and Western bonds, will be treated differently.

There is no way in which the Eastern government can repair this violation, short of repealing the tax. There are two things it can do, but neither will suffice. First, it can limit the new tax to interest earned by Easterners from Eastern bonds. This will put Easterners and Westerners on the same footing insofar as they hold Western bonds. But it will not eliminate discrimination between Easterners and Westerners holding Eastern bonds, and it will discriminate anew between Eastern holders of Eastern and Western bonds. Second, the Eastern government can extend the tax to Westerners who hold Eastern bonds; it can impose a general withholding tax in lieu of an income tax on interest paid to Westerners. This tax will remove discrimination between Easterners and Westerners holding Eastern bonds, without also discriminating anew between Eastern holders of the two bonds. But it will introduce

another form of discrimination—between Westerners who hold Eastern bonds and those who hold Western bonds—and will most certainly reduce the domain of Eastern bonds.<sup>35</sup>

Withholding taxes of this type are used by many countries and are sometimes cited as major impediments to international capital mobility. But this assertion can be true only if withholding taxes are not credited in full against domestic income taxes, which leads me to advance an outrageous conjecture: Tax evasion may well be the strongest single motive for holding claims on foreigners. The ubiquitous desire to cheat the tax collector has probably widened wealth holders' horizons more than they are narrowed by any other fact of life, including the imperfect harmonization of national tax systems and the resulting residuum of double taxation. In different terms, the foreign domains of many assets are probably more extensive than they would be in a world without taxes, and their domestic domains are correspondingly smaller. Easterners hold Western bonds and Westerners hold Eastern bonds in amounts larger than they would if there were no taxes or they could not be evaded.

Finally, tax systems can discriminate *in favor* of transnational incomes. Many less developed countries offer tax holidays to foreign direct investors, and some of the advanced countries do so too, as part of an effort to foster investment in backward or depressed regions. And most of the major industrial countries, including the United States, encourage investment abroad by allowing corporations to postpone domestic taxes on incomes they earn but do not repatriate from foreign subsidiaries. This practice did not start as a deliberate encouragement to direct-investment outflows or to the reinvestment of foreign-source income; it started as an application of the simple principle that income should not be taxed until it is received. In the case of the United States, however, "tax deferral" has by now to be regarded as a conscious subsidy to direct investment. Congress has refused to rescind it twice, in 1961 when repeal was proposed by the Kennedy administration, and again in 1975.<sup>36</sup>

I turn now from fiscal to monetary aspects of sovereignty and their implications for financial integration. A nation that would exercise

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<sup>35</sup> For more on the issues raised in this example, see Musgrave (1960).

<sup>36</sup> There has been much debate about the role of tax deferral in companies' decisions to invest abroad. Its effects on these decisions, however, may be less important currently than its effects on pricing policies. Deferral furnishes an incentive for firms to shift their incomes from high-tax to low-tax countries and is responsible for much of the furor over the transfer-pricing practices of multinational companies. On these issues, see Musgrave (1969), Gilpin (1975), and Horst (1975).

monetary sovereignty must be free to alter its exchange rate. Fixed or pegged exchange rates interfere with monetary sovereignty in two ways—by limiting a nation's choice of monetary targets and by diluting its control over the supply of domestic money.

Interference in the first or normative sense is due to a simple fact. Stocks of owned reserves are finite, and the supply of reserve credit is not perfectly elastic, even to a reserve-currency country. No country can run an open-ended deficit in its international accounts. Sooner or later, it must modify its policies, including and especially its monetary policies, to achieve external balance. Otherwise, it will be obliged to abandon its support of the exchange rate.

Interference in the second or mechanical sense is due to another fact. A central bank committed to supporting the exchange rate cannot also control its total liabilities, and these are the source of high-powered money—of currency and the reserves of commercial banks. When a central bank enters the domestic securities market to buy government bonds in order to enlarge its total liabilities and the supply of money, it will be compelled to enter the foreign-exchange market and sell foreign currency in order to prevent the exchange rate from depreciating.

When capital flows are sensitive to changes in interest rates, the central bank will not even enjoy the luxury of lags. The balance of payments will start to deteriorate as soon as the central bank begins to buy bonds, as private wealth holders will try at once to reconstitute their holdings of government securities (or to replace them with foreign securities), and there will be an immediate capital outflow. The central bank will have to enter the foreign-exchange market almost as soon as it enters the bond market, and it will be unable to alter the supply of money for any appreciable length of time.<sup>37</sup> When, in addition, wealth holders come to understand that the attempt to conduct an independent monetary policy is bound to affect the exchange rate, the scenario I have just described can unfold with astonishing speed. Any indication that one central bank plans to step out of line, to pursue a more rapid expansion of the money supply or engineer a reduction in domestic interest rates, will induce speculative capital movements, and these can frustrate the attempt before it gets under way. If there are lessons to be learned from the central banks' experience in the late 1960s, this must surely be one.

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<sup>37</sup> These assertions also hold for attempts to alter the money supply by changing reserve requirements; for evidence regarding West Germany, see Kouri and Porter (1974).

Variations in exchange rates, however, are incompatible with the perfect international integration of national financial markets. When currency prices are alterable in any way whatsoever, the prices of assets denominated in different currencies cannot be expected to move together all the time. Investors will have a definite risk-reducing reason to diversify their asset holdings, and monetary autonomy, like fiscal autonomy, will extend the external domains of many financial assets at the expense of their domestic domains.<sup>38</sup> Furthermore and most important, investors will not regard assets denominated in different currencies as perfect substitutes for one another, and perfect substitutability is required for perfect integration.

This same point can be turned on end. In early articles on the theory of optimum currency areas, Mundell (1961) and McKinnon (1963) suggested that cost- and risk-minimization criteria argue for currency unification. To exploit most efficiently the unit-of-account and means-of-payment functions of money, the optimum currency area should be the world as a whole. It is the analogous implication of my argument that the store-of-value function is exploited most efficiently when all assets are denominated in a single currency.

But the optimum currency area is, for other reasons, very much smaller than the world as a whole. The case for monetary sovereignty—for national control of the money supply and variable exchange rates—derives from a number of compelling considerations. There is, first, the need to accommodate political imperatives. Governments may not be *willing* to harmonize their policies sufficiently to fix exchange rates forever. They may have to strive for different aims—for different positions, if you wish, on the so-called Phillips curve. There is, next, the need to accommodate structural variation. Governments may not be *able* to

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<sup>38</sup> The same point has been made by Grubel (1968). It is perhaps the best explanation for the diversification of currency holdings apparent in the data on the Eurodollar market. In December 1970, before the Smithsonian Agreement and the advent of floating exchange rates, 78.0 per cent of the external liabilities of European banks were denominated in U.S. dollars; by December 1974, after almost two years of floating rates, the figure had fallen to 70.9 per cent (BIS, *Annual Report*, June 1975, p. 131). Notice, however, that exchange-rate variability will have the opposite effect if wealth holders are both (1) risk averse and (2) concerned only to safeguard home-currency values. It will reduce holdings of foreign securities and external domains. Exchange-rate variability can have other effects that lie beyond the purview of this paper. Some say, for example, that it will shift real capital formation from traded-goods to nontraded-goods industries. This possibility may be important over the long run, and must be distinguished from the less plausible assertion that exchange-rate variability will shift capital formation from foreign to domestic locations.

harmonize their policies because they confront different constraints—they face different Phillips curves.<sup>39</sup> In other words, the transitional and permanent costs of achieving consistent objectives are not the same in all countries. Domestic outputs are not diversified to the same degree; traded-goods sectors differ in size; and domestic factor markets are not equally efficient.<sup>40</sup> Finally, there is a strong case for altering exchange rates when factors of production, especially labor, are not highly mobile between countries. This is the chief point made by Mundell (1961) in his discussion of currency areas,<sup>41</sup> and it takes on special meaning in the present context. When labor mobility is less than perfect, so that changes in exchange rates may be the least-cost way to deal with certain disturbances, financial assets will not be perfect substitutes, and capital markets cannot be perfectly integrated.

Comments like these are sometimes translated into arguments against freely flexible exchange rates.<sup>42</sup> But financial integration, as I have defined it, is far from being an end in itself. Furthermore, free-market flexibility is not the only form of variability, and it is variability that matters for substitutability. The financial risks that stem from variability cannot be removed by pegging rates temporarily. They cannot even be reduced by narrowing the bands within which exchange rates are free to fluctuate under a pegged-rate regime. The small probability of a large change in a pegged rate may, indeed, diminish substitutability more than the larger probability of a small change in a freely floating rate.

A wealth holder's willingness to hold any asset depends directly on the costs he must incur to obtain information concerning its quality. Borrowers and the instruments they issue are not homogeneous, and the differences between them are one major reason for limitations on the domain of any asset and on the substitutability of one asset for another.

There are many kinds of borrowers and instruments inside a single country or region. Within the United States, for example, debt instru-

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<sup>39</sup> These are the points stressed by Corden (1972) and others who have criticized European efforts at exchange-rate unification.

<sup>40</sup> For more on these issues, see Whitman (1967), Kenen (1969), and Tower and Willett (1976).

<sup>41</sup> See Kenen (1969), however, where I argue that the labor mobility required by Mundell is occupational as well as geographic, and that his criterion, carried to its limit, would call for a Balkanization of the international monetary system and a substantial sacrifice of economic efficiency.

<sup>42</sup> See, e.g., Kindleberger (1972b, 1976), who lays particular stress on the store-of-value function of money.

ments are issued by the federal government, the fifty state governments, hundreds of municipalities, and thousands of smaller public jurisdictions. They are issued by hundreds of large corporations, tens of thousands of small businesses, and millions of households. It is, of course, relatively easy to acquire information about large borrowers, the characteristics of the instruments they issue, and conditions in the markets for those instruments. To some appreciable extent, moreover, we have managed to reduce the individual investor's need for detailed information about small borrowers. Financial intermediaries lend to them exclusively and more or less expertly, and they issue their own obligations to the public. Thus, households can even lend to each other to finance purchases of homes and cars; they can acquire claims on commercial banks, savings banks, savings and loan associations, and acceptance corporations. But intermediation cannot banish completely differences among classes of borrowers and the instruments they issue, nor differences in the costs of learning about them. Hence large governmental units and large corporations—those that have the broadest non-financial domains—normally enjoy the easiest access to American capital markets. Because they are large, their names are well known. And because they are large borrowers, there are well-developed secondary markets for their obligations, enhancing the liquidity of those obligations.

When one turns from the domestic to the world scene, the heterogeneity of borrowers and instruments is amplified. The domains of non-financial activity are more remote, and lenders are not as familiar with borrowers, even with institutions whose size and financial situation compare favorably with those of domestic institutions. In addition, the relevant secondary markets may be less accessible and, as I said before, are not well developed in many major countries, notably those of Continental Europe, so that the obligations of the largest borrowers may not be as liquid as those of comparable U.S. borrowers.

Compounding these effects of distance and environment, there are large international differences in the amounts of information that borrowers are required to disclose. Most borrowers, including governments, are creatures of law, not natural persons, and laws differ significantly from country to country. There are, in fact, three distinct juridical dimensions to the distinction between domestic and foreign investment, bearing upon the costs of gathering information and of redeeming one's mistakes. First, there are differences in the rights and duties that laws confer upon artificial persons—governments, corporations, banks, and other borrowers. Second, debt instruments are defined, issued, and traded under the specific provisions of national statutes that regulate accounting practices, the disclosure of financial information, the rights

of claimants in instances of default, and the organization of securities markets. Third, the administration of the law is itself an attribute of national sovereignty, and one's standing before the law can depend precariously on one's nationality.<sup>43</sup>

### *Benefits and Costs of Integration*

Definitions of financial integration that derive from the law of one price have very strong normative implications. Perfect integration comes close to implying competitive efficiency in the allocation of financial resources and, by extension, the allocation of the world's real capital stock. The case for integration in these terms, then, is very similar to the case for cosmopolitan efficiency—for maximizing world output. It is hard to argue against integration without invoking arguments analogous to those that justify the use of optimal tariffs to manipulate the benefits from trade.<sup>44</sup>

My definition of integration does not have these implications, although it is not totally divorced from them. Measures that interfere with integration by inhibiting capital mobility do, of course, reduce allocative efficiency. Yet close integration can take place in an economic environment that produces significant departures from perfect efficiency. The benefits and costs of integration have therefore to be weighed with no strong presupposition in its favor.

There are several classes of real benefits. Some of them derive from the more efficient allocation of current saving and capital that occurs in the absence of barriers to integration—the benefits evoked by normative definitions of integration. Other real benefits derive from the substantial gains that accrue to individual wealth holders when they can diversify their portfolios. The larger the set of assets available to any investor, the more advantageous is his trade-off between risk and return, and improvements in private opportunity sets are beneficial socially. They can reduce discrepancies between private and social rates of return, removing disincentives to saving and fostering a better inter-temporal allocation of resources.

Kindleberger (1967) mentions some of these benefits but warns

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<sup>43</sup> Logue, Salant, and Sweeney paraphrase an earlier version of this paragraph; the appropriate reference was inadvertently omitted from their paper.

<sup>44</sup> On these points, see MacDougall (1960) and recent papers by Kemp (1966), Jones (1967), and Chipman (1972), who have extended the neoclassical argument, showing how controls on trade and factor flows must be used simultaneously to maximize the national advantage. For an "anticlassical" analysis of real costs and benefits, see Hymer (1970). For contrasting views on costs and benefits specific to the circumstances of less developed countries, see Ffrench-Davis and Arancibia (1972) and Kindleberger (1972a).

against the tendency to overstate them, especially when there are other impediments to allocative efficiency, so that there exists, at least in principle, some set of second-best controls on international capital movements that would increase efficiency. But Kindleberger also lists a number of reasons for expecting a net real gain from integration, especially from integrating capital markets in the developed world. The removal of barriers to integration would dilute the monopolistic powers exercised by banks and other institutions in small, isolated capital markets. It would broaden and deepen securities markets, enhancing the liquidity of seasoned securities and reducing the costs of new borrowing. Finally, it would facilitate a better matching of borrowers and lenders—a meshing of liquidity preferences—by offering to each of them a larger assortment of financial instruments.

There are, next, the benefits and costs that accrue to the conduct of national policies. I have already mentioned the principal cost. Financial markets cannot be integrated perfectly when exchange rates are variable, and exchange-rate unification calls for the abdication of monetary sovereignty (and may also call for some sacrifice of sovereignty in the use of other policy instruments). There are, however, two classes of benefits that must be weighed against this cost.

When capital is highly mobile between countries and financial markets are closely integrated, monetary policy can be used to regulate the balance of payments, freeing other instruments of economic policy for the pursuit of domestic objectives. This is, of course, the simplest statement of the more elaborate case made by Mundell (1962, 1963) for pairing individual policy instruments to individual policy targets (the principle of “effective market classification”).

Mundell’s prescription has been qualified many times over,<sup>45</sup> and the introduction of the portfolio-balance constraint into analyses of capital movements has caused some economists to reject it altogether. Under the assumptions commonly employed to analyze shifts in portfolios, capital flows induced by changes in interest rates cannot continue forever, and monetary policies geared to affecting the balance of payments by way of the capital account can have only temporary influence.<sup>46</sup> In my judgment, however, Mundell’s prescription has not lost much of its vitality. The once-for-all portfolio shifts found in current

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<sup>45</sup> The relevant literature is surveyed and synthesized by Whitman (1970); see also Swoboda (1972), Arndt (1973), and Myhrman (1976).

<sup>46</sup> Floyd (1972), Branson and Willett (1972), and Tower (1972a, 1972b). Furthermore, Tsiang (1975) and others have shown that the larger debt-service burdens produced by higher interest rates may in time exceed the capital inflows induced by those higher rates.

policy models, including the model developed later in this study, occur in the course of once-for-all movements between stationary states. The models rule out continuing capital flows by ruling out economic growth. True-to-life economies, by contrast, grow all the time; saving and investment take place continuously. Some of the saving, in turn, finds its way into claims on foreigners, and some of the investment is financed by borrowing from foreigners. There are *permanent* capital flows, and these are amenable to the influence of monetary policy. It can affect the sizes of the fraction of saving that goes abroad and of the fraction of investment that is financed abroad. Monetary policy has a significant comparative advantage in the quest for external balance.<sup>47</sup>

There is, in addition, a necessary and beneficial connection between the integration of financial markets and the unification of monetary policies. Most economists and practical people who have written about European monetary unification have stressed correctly the importance of financial integration for a happy marriage of monetary systems, even for a more limited harmonization of national monetary policies.<sup>48</sup> An integrated financial market is required for a unified central bank to have an appropriate stage on which to act. It must have access to a single, substantial securities market in order to conduct open-market operations. If the market is insufficiently large, the central bank's operations will have disruptive effects on asset prices, capital values, and financial institutions that typically function with large portfolios relative to net worth. If the market is insufficiently integrated, open-market operations will affect the internal distributions of economic activity, income, and wealth.<sup>49</sup> Concern about these side effects is bound to get in the way of the central bank's primary mission and to limit politically its freedom of action.

The first modern attempt to establish a central bank in the United States created a decentralized system—twelve Federal Reserve banks, each with much autonomy in respect of local credit markets. Soon after the First World War, however, with the creation of a large public debt, power came to be centralized in Washington. The more perfect integra-

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<sup>47</sup> For evidence in support of Mundell's assignment, see Kenen (1973b, 1974), where an econometric model of the U.S. balance of payments having portfolio-balance (stock-adjustment) specifications is used to simulate the consequences of alternative policy assignments. When monetary policy is assigned to external balance and fiscal policy to internal balance, the balance of payments and unemployment rate tend toward their target values; when the assignment is reversed, each of them diverges from its target (and the policies themselves are carried to extremes).

<sup>48</sup> See, e.g., Corden (1972), Krause (1973), and Magnifico (1973, Chap. 4).

<sup>49</sup> This is one of the chief issues explored by Allen (1976).

tion of regional capital markets, resulting from their common links to the much expanded market for government securities, led rapidly to the virtual unification of the Federal Reserve System and emergence of a national monetary policy.

The third and final set of benefits and costs arises in respect of the adjustment process—the manner in which a national or regional economy responds to exogenous disturbances or policy changes affecting its balance of payments. This subject has been studied by Ingram (1962, 1973), Scitovsky (1969), and other economists seeking to identify the differences between international and interregional adjustment and to explore their implications for international economic integration, especially for monetary unification.<sup>50</sup> They argue, *inter alia*, that financial integration reduces the cost of adjustment to exogenous disturbances by reducing the speed and size of the change in income induced (and required) by a disturbance and that it also reduces the size of the change in reserves occurring in the course of the return to equilibrium.

To study these issues more thoroughly, I shall develop a model that draws very heavily on a point made by Scitovsky (1969). A current-account deficit, he observes, reduces a country's wealth (a surplus enlarges it) and has therefore to disturb any equilibrium between desired and actual wealth. In consequence, a deficit sets in train changes in expenditure (saving out of income) aimed at establishing a new equilibrium. Furthermore, changes in actual wealth must alter the demands for each and every asset, not just the demand for money, and have therefore to cause capital movements or, in the absence of capital mobility, changes in interest rates. Using these same simple notions, I shall demonstrate that Ingram and Scitovsky have been imprecise in the claims they have made for mobility. It does not affect the size of the change in income required to restore external balance under fixed exchange rates. I shall also demonstrate, however, that capital mobility does reduce the speed of the change in income and the size of the change in reserves.

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<sup>50</sup> I have also written on these themes before, in Kenen (1967, 1973c); see also Whitman (1967). The same subjects can be approached by way of the theory of optimum currency areas; see especially the survey by Tower and Willett (1976).

### III. MOBILITY, MACROECONOMIC POLICY, AND INTERNAL ADJUSTMENT TO EXTERNAL DISTURBANCES

To study more thoroughly some of the costs and benefits of capital mobility and financial integration, I will develop an algebraic model of a small, open economy.<sup>1</sup> It is designed to identify the influence of capital mobility on the effectiveness of monetary and fiscal policies and on the manner in which an economy responds to an external disturbance.

#### *The Model*

The economy to be studied here is one that produces a single commodity. The commodity is consumed by households, the government, and foreigners, and it serves as the only capital good. The supply of the commodity is infinitely elastic at a price fixed (at unity) in domestic currency. The economy does not engage in capital formation; there is no change in the size of the stock of goods that is used in domestic production. By implication, domestic saving must be offset by a trade surplus or government deficit, and wealth can be accumulated only in the forms of money, claims on the government, and claims on the outside world.

Because production is so simple and there is no net investment, little is lost by ignoring the activities of firms. They have no incentive to save, and there is no other way for their net worth to change. I concentrate, then, on the activities of households, commercial banks, the central bank, and government.

Households are the ultimate owners of all privately held wealth and

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<sup>1</sup> The model developed here is similar to the flow version of the model in Allen and Kenen (1976), but the government securities are consols, not bills, and money is issued by commercial banks, not by the central bank. Another version is described in Kenen (1975). It allows for simple capital formation (investment in inventories financed by bank lending) and confirms Whitman's (1967) conjecture concerning the effects of income-induced investment on the process of balance-of-payments adjustment. Because an increase of exports leads to additional domestic investment, it causes a capital inflow (or smaller capital outflow) and a larger increase of reserves than the one which occurs without capital formation. [This effect is not noted explicitly in my paper. It can be identified, however, by comparing the flows of capital and reserves shown by equations (4.20) and (4.22) with those shown by equations (3.14) and (3.15).] But the specification of policy changes is imperfect in that paper. On the microeconomic foundations of models like the one used here, see Kouri (1975).

are the only holders of money. Neglecting their fixed claims on firms, the households' balance sheet takes this form:

$$W^h = L + (1/r)B^h + W^b, \quad (1)$$

where  $W^h$  is household wealth,  $L$  is the stock of money,  $B^h$  is the stock of government bonds (consols) held by households, measured in coupon payments,  $W^b$  is the banks' net worth, and  $r$  is the market interest rate on government bonds. All arguments are real (measured in domestic output).

Changes in household wealth come about on account of real household savings,  $S^h$ , and changes in capital values. Thus, the time derivative of the balance sheet is

$$\dot{W}^h = S^h - [(1/r^2)B^h]\dot{r} + \dot{W}^b. \quad (2)$$

Desired wealth,  ${}^*W^h$ , depends on the interest rate and real disposable income:

$${}^*W^h = W(r, Y^d), \quad W_r < 0, \quad W_y > 0, \quad (3)$$

where

$$Y^d = Y - T^h + (B^h + B^b). \quad (4)$$

Here,  $Y$  is real national income and  $T^h$  is the transfer (tax) payment from households to government. The terms  $B^h$  and  $B^b$  are the interest incomes of households and banks, respectively. The latter appears in this equation because banks do not save (they distribute all their income to households).<sup>2</sup> Desired saving,  $\hat{S}^h$ , depends on the difference between desired and actual wealth:

$$\hat{S}^h = \lambda^s({}^*W^h - W^h), \quad 0 < \lambda^s < (1/W_y), \quad (5)$$

so that the marginal propensity to save,  $\lambda^s W_y$ , is smaller than unity.

There are many ways to write the households' demand for money.<sup>3</sup> In this model, it is made to depend on the interest rate and real national income:

$${}^*L = L(r, Y), \quad L_r < 0, \quad L_y > 0. \quad (6)$$

Equation (6), however, is satisfied only in the long run. It defines the intended allocation of desired wealth between money and bonds, given  $W^b$  (over which households have no direct control). Formally,

<sup>2</sup> The entire national income appears in equation (4) for a similar reason. Because firms do not save, all profits are distributed to households.

<sup>3</sup> See Allen and Kenen (1976) and the papers cited there.

$$*W^h = *L + (1/r)*B^h + W^b. \quad (7)$$

The corresponding flow demands for money and bonds are defined by

$$\hat{L} = \lambda^h(*L - L), \quad 0 < \lambda^h < \infty, \quad (8)$$

$$\hat{S}^h = \hat{L} + (1/r)\hat{B}^h. \quad (9)$$

I impose two more restrictions on these short-run flow demands. (1) Saving caused by an increase of income will be divided between money and bonds. Neither is an income-inferior asset. Formally,  $\lambda^s W_y > \lambda^b L_y$ . (2) The speed of adjustment of money holdings exceeds the speed of adjustment of wealth.<sup>4</sup> Formally,  $\lambda^h > \lambda^s$ . Taken together, these two restrictions imply a third. Using the first,  $\lambda^s(W_y - L_y) > (\lambda^h - \lambda^s)L_y$ ; invoking the second, it follows that  $W_y > L_y$ . Neither asset is income inferior in the long run.

Notice, finally, that the stock and flow demands for money depend on real domestic output, not expenditure. They are not affected by the terms of trade or the exchange rate. The model, then, will not be able to replicate the real-balance effects of changes in exchange rates that play an important role in some of the recent work on portfolio adjustment in open economics (see, e.g., Dornbusch, 1973, 1975a).

The balance sheet of the commercial banks has four arguments:

$$W^b + L = L^c + (1/r)B^b, \quad (10)$$

where  $L^c$  is the stock of high-powered money (of commercial-bank deposits at the central bank).<sup>5</sup> As banks do not save, changes in  $W^b$  can be caused only by changes in capital values:

$$\dot{W}^b = -[(1/r^2)B^b]\dot{r}. \quad (11)$$

Banks hold only those reserves required to satisfy the fractional-reserve requirement,  $q$ , imposed by the central bank:

$$L^c = qL, \quad 0 < q < 1. \quad (12)$$

Furthermore, banks cannot borrow from the central bank. In consequence,  $L^c$  lies outside their control, and they behave quite mechanically. The flow supply of money obtained from equation (12) is

<sup>4</sup> This assumption is consistent with the assumptions above that  $\lambda^h$  is unbounded, while  $\lambda^s$  is bounded by  $(1/W_y)$ .

<sup>5</sup> The model set out in the Appendix adds a foreign bond to the banks' portfolios, allowing me to replicate some of the results obtained by Branson (1974) and Dornbusch (1975b) concerning the effects of open-market operations when one asset is traded and another is not.

$$\dot{L} = (1/q)\dot{L}^c. \quad (13)$$

Equations (10) and (12) together define the banks' desired holdings of government bonds. The corresponding flow demand derives from equations (10), (11), and (13):

$$(1/r)\dot{B}^b = \dot{L} - \dot{L}^c = [(1 - q)/q]\dot{L}^c. \quad (14)$$

The central bank holds government bonds and foreign-exchange reserves. Its balance sheet is

$$W^c + L^c = (1/r)B^c + \pi R, \quad (15)$$

where  $\pi$  is the exchange rate (the price of foreign currency in units of home currency),  $R$  is the stock of foreign-exchange reserves, and  $B^c$  is the stock of government bonds held by the central bank. The income of the central bank is  $B^c$ , and all of it goes to the government. In other words, the central bank does not save, and changes in its wealth can be written as

$$\dot{W}^c = -[(1/r^2)B^c]\dot{r} + R\dot{\pi}. \quad (16)$$

The central bank alters its bond holdings by open-market operations in the securities market, designed to influence the stock of money. It is important, however, to specify precisely the manner in which these operations are conducted. If the central bank bought or sold bonds in a way that was not consonant with the behavior of other bondholders, it would have a disruptive effect on the bond market and the entire economy. As households and commercial banks have flow demands for bonds, the central bank must regulate its purchases and sales according to a flow target,  $\hat{Z}^c$ , such that

$$(1/r)\dot{B}^c = \hat{Z}^c. \quad (17)$$

The number of bonds bought or sold,  $\dot{B}^c$ , depends on the size of the target (the amount by which the central bank seeks to alter bank reserves) and the current price of bonds,  $(1/r)$ . To obtain the long-run counterpart of this specification, define the change in the number of bonds bought or sold during an interval ending at time  $T'$ :

$$B^c = \int_0^{T'} \dot{B}^c dt = \int_0^{T'} r\hat{Z}^c dt, \quad (18)$$

where  $r$  and  $\hat{Z}^c$  are functions of time. If the central bank chooses  $\hat{Z}^c$  and  $T'$ , the end-point of the interval, it cannot also regulate  $B^c$ . But I shall assume that it chooses  $\hat{Z}^c$  and a long-term target,  $*B^c$ , such that

$$*B^c = \int_0^{T'} r\hat{Z}^c dt, \quad (18')$$

and ends its open-market operations as soon as they satisfy this equation.<sup>6</sup>

The central bank alters its holdings of reserves,  $R$ , by open-market operations (intervention) in the foreign-exchange market. But  $R$  is not exogenous. When the exchange rate is perfectly flexible, there is no intervention. When it is pegged, the volume of intervention depends on the evolution of the balance of payments:

$$\pi \dot{R} = (X - \pi M) + (T^f - B^f) + (1/r)\dot{B}^f, \quad (19)$$

where  $X$  is the volume of exports,  $M$  is the volume of imports (in units of foreign output priced at unity),  $T^f$  is a transfer from foreigners to government (in units of domestic output),  $B^f$  is the number of government bonds held by foreigners (an income payment to foreigners), and  $(1/r)\dot{B}^f$  is the capital inflow (+) or outflow (−) caused by foreign purchases or sales of government bonds.

The quantity of bonds outstanding,  $B$ , has always to be lodged with households, commercial banks, the central bank, and foreigners:

$$B = B^h + B^b + B^c + B^f, \quad (20)$$

and changes in the stock of bonds depend on the state of the government budget:

$$(1/r)\dot{B} = (G + B) - (T^h + T^f + B^c). \quad (21)$$

Government spending,  $G$ , is measured in domestic output and is policy determined:

$$G = \tilde{G}. \quad (22)$$

The transfer payments  $T^f$  and  $T^h$  are governed by special assumptions. First, I assume that transfers from foreigners are always adjusted to offset exactly payments of interest to foreigners,<sup>7</sup> so that

$$T^f = B^f. \quad (23)$$

<sup>6</sup> The target  ${}^*B^c$  is measured in bonds (coupons) but can be translated into a transactions value. The central bank can be deemed to aim at furnishing bank reserves in an amount  $(1/r_0){}^*B^c$ , where  $r_0$  is the interest rate prevailing just before the bank begins to buy or sell bonds. Subsequent changes in the interest rate do not require revisions in the target  ${}^*B^c$ . The bank has only to adjust the end-point  $T^f$  or the flow target  $\dot{Z}^c$ .

<sup>7</sup> This assumption rules out a problem raised by Tsiang (1975). Monetary policy cannot have perverse effects on the balance of payments because it cannot affect current-account flows.

Second, I assume that transfers from households (taxes) are always adjusted to achieve a policy-determined budget deficit,  $\hat{Z}^g$ ,<sup>8</sup> so that

$$(1/r)\dot{B} = \hat{Z}^g. \quad (24)$$

As in the case of open-market operations, moreover, I assume that the government regulates its deficit in accordance with a stock target,  $*B$ . It runs a deficit or surplus until a time  $T''$  at which

$$*B = B = \int_0^{T''} r\hat{Z}^g dt, \quad (25)$$

where  $r$  and  $\hat{Z}^g$  are functions of time.

The assumptions concerning  $T'$  and  $T''$  simplify the definitions of disposable income and the balance of payments:

$$Y^d = Y - \hat{G} + \hat{Z}^g, \quad (4')$$

$$\pi\dot{R} = X - \pi M + (1/r)\dot{B}^f. \quad (19')$$

Finally, the foreign demand for exports and domestic demand for imports are written as

$$\hat{X} = X(1/\pi), \quad X_{\frac{1}{\pi}} < 0 \quad (26)$$

and

$$\hat{M} = M(\pi, Y), \quad M_{\pi} < 0, \quad M_y > 0. \quad (27)$$

### *The Market-Clearing Equations*

All markets are assumed to clear at all times. In this small-country case, moreover, the demand for imports is always satisfied at a constant foreign-currency price. I have therefore to deal with only four markets—those for domestic output, money, government bonds, and foreign exchange.

The market-clearing equation for goods can be written as

$$(Y^d - \hat{S}^h) + \hat{G} + (\hat{X} - \pi\hat{M}) - Y = -\hat{S}^h + \hat{Z}^g \\ + (\hat{X} - \pi\hat{M}) = 0. \quad (28)$$

The market-clearing equation for money can be written as

$$\hat{L} - \dot{L} = \hat{L} - (1/q)\dot{L}^c = 0. \quad (29)$$

The market-clearing equation for bonds can be written as<sup>9</sup>

<sup>8</sup> This assumption resembles one used by Foley and Sidrauski (1971).

<sup>9</sup> I write it as an excess-supply equation because I am working with the interest rate rather than the price of bonds.

$$\hat{Z}^o - (1/r)\hat{B}^h - (1/r)\hat{B}^b - (1/r)\hat{B}^f - \hat{Z}^c \\ = \hat{Z}^o - \hat{S}^h + \hat{L}^c - (1/r)\hat{B}^f - \hat{Z}^c = 0. \quad (30)$$

But  $\hat{S}^h$ ,  $\hat{L}$ ,  $\hat{X}$ , and  $\hat{M}$  can be replaced by the arguments of equations (5), (8), (26), and (27), while  $\hat{L}^c$  can be replaced by the total time derivative of equation (15):

$$\hat{L}^c = \pi\dot{R} + (1/r)\dot{B}^c = \pi\dot{R} + \hat{Z}^c. \quad (31)$$

Hence the market-clearing equations for goods, money, and bonds can be rewritten as

$$-\lambda^s[W(r, Y - \hat{G} + \hat{Z}^o) - W^h] + \hat{Z}^o \\ + \left[ X(1/\pi) - \pi M(\pi, Y) \right] = 0, \quad (28')$$

$$\lambda^h[L(r, Y) - L] - (1/q)(\pi\dot{R} + \hat{Z}^c) = 0, \quad (29')$$

$$\hat{Z}^o - \lambda^s[W(r, Y - \hat{G} + \hat{Z}^o) - W^h] + \pi\dot{R} - (1/r)\hat{B}^f = 0. \quad (30')$$

The market-clearing equation for foreign exchange could be written by substituting desired for actual flows in the definition of the balance of payments, equation (19') above, but can also be derived from the other market-clearing equations. [Subtract equation (28') from equation (30').] The market for foreign exchange will clear when all other markets clear.

Before solving the market-clearing equations for goods, money, and government bonds, I specify more formally the situations that obtain in two of the relevant markets:

The foreign demand for government bonds defines the degree of capital mobility. When there is no mobility,

$$\hat{B}^f = 0, \quad (32)$$

and the interest rate adjusts to clear the bond market. When, instead, there is perfect mobility, the foreign demand is infinitely elastic, pegging the interest rate:

$$r = \bar{r}, \quad (33)$$

and foreign holdings of government bonds adjust to clear the market:

$$\hat{B}^f = \dot{B}^f. \quad (32')$$

When the exchange rate is fully flexible,

$$R = \dot{R} = 0, \quad (34)$$

and the exchange rate adjusts to clear the money (or foreign-exchange) market. When, instead, the rate is pegged,

$$\pi = \bar{\pi} = 1, \quad (35)$$

and reserves adjust to clear the market.

The market-clearing equations (28'), (29'), and (30') contain three market-clearing variables ( $Y$ ,  $r$  or  $B'$ , and  $\pi$  or  $R$ ) and two endogenous stocks,  $L$  and  $W^h$ . The latter, however, can be written in terms of two other endogenous stocks,  $B'$  and  $R$ , and two exogenous stocks,  $B$  and  $B^c$ :

$$L = (1/q)[R + (1/r)B^c - W^c], \quad (10')$$

$$W^h = (1/r)(B - B') + \pi R - W^c. \quad (1')$$

Because these stocks change slowly, each is deemed to be fixed in the short run.

Using the operator  $\delta$  to denote short-run changes, the total derivatives of the market-clearing equations can be written as:<sup>10</sup>

$$\begin{aligned} & \begin{bmatrix} -E_y & -\lambda^s E_r & 0 & -1 & 0 \\ -\lambda^s W_y & -\lambda^s E_r & -1 & 0 & 1 \\ q\lambda^h L_y & q\lambda^h L_r & 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} \delta Y \\ \delta r \\ (1/r)\delta B' \\ -e_\pi \delta \pi \\ \delta R \end{bmatrix} \\ & = \begin{bmatrix} -(1 - \lambda^s W_y) & -\lambda^s W_y & 0 & -1 \\ -(1 - \lambda^s W_y) & -\lambda^s W_y & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \delta \hat{Z}^g \\ \delta \hat{G} \\ \delta \hat{Z}^c \\ \delta X^a \end{bmatrix} \\ & \quad + \begin{bmatrix} -\lambda^s & 0 & -\lambda^s \\ -\lambda^s & 0 & -\lambda^s \\ 0 & \lambda^h & \lambda^h \end{bmatrix} \begin{bmatrix} (1/r)(\delta B - \delta B') \\ (1/r)\delta B^c \\ \delta R \end{bmatrix}, \quad (36) \end{aligned}$$

where

$$E_y = \lambda^s W_y + M_y,$$

$$E_r = W_r + (1/r^2)(B - B^c),$$

$$e_\pi = (X/\pi)[-(1/\pi)(X_{1/\pi}/X) - (\pi M/X)\pi(M_\pi/M) - (\pi M/X)].$$

Thus,  $E_y$  is the sum of the marginal propensities to save and import;  $E_r$  is the effect of a change in the interest rate on the difference between

<sup>10</sup> These results are obtained by using equations (16) and (35) to write  $\delta W^c = -[(1/r^s)B^c]\delta r$ , and by setting the exchange rate at unity after differentiation.

desired and actual wealth; and  $e_\pi$  is the elasticity of the trade balance with respect to the exchange rate (the Marshall-Lerner-Robinson condition) and is assumed to be positive throughout.

The signs of the elements in the vector on the left-hand side of (36) reflect an implicit pairing of prices and flows with individual markets. I assume that the goods market is cleared by changes in output (income), that the bond market is cleared by changes in the price of bonds (the reciprocal of the interest rate) or by transactions with foreigners, and that the money market is cleared by changes in the price of money (the reciprocal of the exchange rate) or by movements of reserves.

The elements in the first vector on the right-hand side of (36) denote three simple policies and an exogenous shift in demand. The terms  $\delta Z^g$  and  $\delta G$  are fiscal policies (an increase in the government deficit accomplished by reducing taxes and a balanced-budget increase in government expenditure). The term  $\delta Z^c$  is a monetary policy (an open-market purchase of government bonds). The shift in demand,  $\delta X^a$ , is a permanent increase in the foreign demand for domestic output (exports).

The elements in the second vector denote changes in stocks that occur over time. Changes in  $B$  and  $B^c$  result from the policies  $Z^g$  and  $Z^c$ . Changes in  $B^f$  result from the market-clearing flows  $B^f$  defined by equation (30'). Changes in  $R$  result from the market-clearing flows  $R$  defined by equations (29') and (30'). Thus, equations (29') and (30') serve not only as market-clearing equations but also as dynamic equations in  $B^f$  and  $R$ . They can be used to establish local stability—to show that  $B^f$  and  $R$  tend to zero in the long run—and to solve for the long-run changes in  $B^f$ ,  $R$ , and the other market-clearing variables.<sup>11</sup> When the policies  $Z^g$  and  $Z^c$  have been brought to their conclusions, pursuant to equations (18') and (25), and  $B^f$  and  $R$  have gone to zero, the market-clearing equations for money and bonds become

$$L(r, Y) - (1/q)[R + (1/r)*B^c - W^c] = 0, \quad (37)$$

$$W(r, Y - \hat{G}) - [(1/r)(*B - B^f) + R - W^c] = 0, \quad (38)$$

and the market-clearing equation for goods becomes

$$X(1/\pi) - \pi M(\pi, Y) = 0. \quad (39)$$

<sup>11</sup> With flexible exchange rates and no capital mobility,  $R = B^f = 0$ , and there is no need to prove stability. With flexible rates and perfect mobility, the necessary and sufficient condition for stability is that  $(dB^f/dB^f) < 0$ . With pegged exchange rates and no mobility, the corresponding condition is that  $(dR/dR) < 0$ . With pegged rates and perfect mobility, the matrix formed from  $(dB^f/dB^f)$ ,  $(dB^f/dR)$ ,  $(dR/dB^f)$ , and  $(dR/dR)$  must have a negative trace and a positive determinant.

The total derivatives of these equations can be solved for the long-run changes in  $Y$ ,  $r$  or  $B'$ , and  $\pi$  or  $R$  resulting from long-run changes in the policy variables,  $G$ ,  $B$ , and  $B^c$ , and from a permanent shift in the foreign demand for domestic output.<sup>12</sup>

Finally, notice that the right-hand side of (36) contains the term  $-[(1 - \lambda^s W_y)\delta Z^g + \lambda^s W_y \delta G + \lambda^s (1/r)\delta B]$ , and that the exogenous variables  $\delta Z^g$ ,  $\delta G$ , and  $(1/r)\delta B$  appear in no other configuration. The effects of a balanced-budget change in expenditure,  $\delta G$ , bear an invariant relationship to those of a government deficit. In the short run, they will be  $[\lambda^s W_y / (1 - \lambda^s W_y)]$  times those of a change in the deficit,  $\delta Z^g$ ; in the long run, they will be  $W_y$  times those of the change in the debt,  $(1/r)\delta B$ , resulting from a deficit. Hereafter, then, I make no reference to the policy  $\delta G$ .

### Solving the Model

The system (36) yields four sets of solutions. There are two for the case of no capital mobility, one each for pegged and flexible exchange rates. There are two for the case of perfect capital mobility.

*No Capital Mobility.* When there is no capital mobility,  $\delta B' = \delta B^c = 0$ . When, in addition, the exchange rate is pegged,  $\delta \pi = 0$ . The system (36) takes this form:

$$\begin{bmatrix} -E_y & -\lambda^s E_r & 0 \\ -\lambda^s W_y & -\lambda^s E_r & 1 \\ q\lambda^h L_y & q\lambda^h L_r & -1 \end{bmatrix} \begin{bmatrix} \delta Y \\ \delta r \\ \delta R \end{bmatrix} = \begin{bmatrix} \dots & \dots & \dots \\ \dots & \dots & \dots \\ \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} \delta Z^g \\ \delta Z^c \\ \delta X^a \end{bmatrix} + \begin{bmatrix} \dots & \dots & \dots \\ \dots & \dots & \dots \\ \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} (1/r)\delta B \\ (1/r)\delta B^c \\ \delta R \end{bmatrix}, \quad (40)$$

the matrices on the right-hand side being identical to those of (36), apart from the deletion of the column pertaining to  $\delta G$ . The determinant is  $-D$ , where  $D = \lambda^s E_r (M_y + q\lambda^h L_y) - q\lambda^h L_r E_y = q\lambda^h \lambda^s H + M_y (\lambda^s E_r - q\lambda^h L_r)$ , and  $H = (L_y E_r - L_r W_y)$ . Hence  $D > 0$  (because  $L_r < 0$ ).

The short-run effects of  $\delta Z^g$ ,  $\delta Z^c$ , and  $\delta X^a$  on income, the interest rate, and the flow of reserves are shown in Table 1. A larger government deficit increases income (output) and raises the interest rate. An open-market purchase of securities increases income and reduces the interest rate. Both policies cause a loss of reserves. (Under pegged exchange rates, exports are exogenous, and imports depend exclusively on income. Hence, the change in the flow of reserves induced by a policy

<sup>12</sup> This is the long-run model used in Kenen (1976a).

TABLE 1  
SOLUTIONS OF THE MODEL WITH NO CAPITAL MOBILITY AND  
PEGGED EXCHANGE RATES\*

Effect on	Effect of		
	Fiscal Policy <sup>a</sup>	Monetary Policy <sup>b</sup>	Increase in Exports <sup>c</sup>
Short run:			
Income	$(1/D)q\lambda^h(1 - \lambda^s W_y)(-L_r)$	$(1/D)\lambda^s E_r$	$(1/D)(\lambda^s E_r - q\lambda^h L_r)$
Interest rate	$(1/D)(1 - \lambda^s W_y)(M_y + q\lambda^h L_y)$	$-(1/D)E_y$	$-(1/D)(\lambda^s W_y - q\lambda^h L_y)$
Reserves <sup>d</sup>	$-M_y(1/D)q\lambda^h(1 - \lambda^s W_y)(-L_r)$	$-M_y(1/D)\lambda^s E_r$	$(1/D)q\lambda^h \lambda^s H$
Long run:			
Income	0	0	$[1/M_y]$
Interest rate	$[1/(E_r - qL_r)]$	$-[1/(E_r - qL_r)]$	$-[(W_y - qL_y)/M_y(E_r - qL_r)]$
Reserves <sup>e</sup>	$-[q(-L_r)/(E_r - qL_r)]$	$-[E_r/(E_r - qL_r)]$	$[qH/M_y(E_r - qL_r)]$

\* All expressions prefixed by minus signs are negative; all others are positive. These results follow from the facts that  $\lambda^s W_y < 1$ ,  $L_r < 0$ , and  $\lambda^s W_y > \lambda^h L_y > q\lambda^h L_y$  because  $q < 1$ .

<sup>a</sup> The policies  $\delta Z^a$  and  $(1/r)d^*B$ .    <sup>b</sup> The policies  $\delta Z^b$  and  $(1/r)d^*B^c$ .    <sup>c</sup> The disturbances  $\delta X^a$  and  $dX^a$ .    <sup>d</sup> The flow change  $\delta R$ .    <sup>e</sup> The stock change  $dR$ .

change must be equal with opposite sign to  $M_y$  times  $\delta Y$ , the corresponding income change.) An autonomous increase in the foreign demand for exports causes an increase of income and an inflow of reserves (a trade surplus). The former raises the demand for money, but the latter raises the supply even more rapidly. The interest rate declines.

To study the long-run behavior of the model, use the system (40) to write the derivative of  $R$  with respect to all long-run arguments:

$$dR = q\lambda^h \lambda^s L_r (M_y/D)(1/r)d^*B - \lambda^h \lambda^s E_r (M_y/D)(1/r)d^*B^c + q\lambda^h \lambda^s (H/D)dX^a - \lambda^h \lambda^s (E_r - qL_r)(M_y/D)dR. \quad (41)$$

As  $(dR/dR) < 0$ , the system is stable. The flow  $R$  goes to zero in the long run, and equation (41) can then be employed to derive the cumulative changes in reserves shown in the lower part of Table 1. Finally, replacing  $\delta R$  with the corresponding solutions for  $dR$ , one can solve the system (40) for the long-run changes in income and the interest rate shown in the table.

Fiscal and monetary policies have no long-run effects on income. With a pegged exchange rate, the level of income is determined in the long run by equation (39), which says that trade must be balanced.<sup>13</sup>

<sup>13</sup> Myhrman (1976) has criticized McKinnon and Oates (1966) because their model has this same strong property. He should have criticized all authors who deal in stationary states but treat the permanent level of expenditure as a function of the interest rate. Any permanent change in expenditure caused by a change in the interest rate implies a permanent change in saving or investment. These assumptions do not square with the working supposition that, initially and after the change in the interest rate, the economy is stationary.

Concomitantly, a permanent increase of exports leads eventually to an increase of income that is exactly large enough to offset the change in exports. There are, of course, long-run changes in the interest rate and the stock of reserves, and these have the same signs as the corresponding short-run changes, but they must be interpreted differently.

The short-run changes in *flows* of reserves induced by fiscal and monetary policies reflect the income and trade-balance effects of those policies. The long-run changes in *stocks* of reserves reflect the requirements imposed by equations (37) and (38). Desired holdings of wealth, money, and bonds must equal actual holdings.<sup>14</sup> The fiscal policy  $(1/r)d^*B$  has direct effects on the supplies of wealth and bonds but no direct effect on the supply of money. With larger supplies of wealth and bonds, the interest rate must rise to enlarge desired holdings (and also to compress the market value of the supply of bonds). With a higher interest rate, however, there is a reduction in desired money holdings, and the economy must dispose of the redundant supply. It does so by running a trade deficit and expelling reserves. (The temporary increase of income shown in the first part of Table 1 generates the requisite trade deficit.) The monetary policy  $(1/r)d^*B^c$  has no direct effect on actual wealth but reduces the supply of bonds and enlarges the supply of money. The interest rate must fall to reduce desired bond holdings (and also to enlarge the market value of the supply). This adds to desired holdings of money. But desired money holdings do not rise sufficiently to take up all the money created by the central bank. Again, the economy must dispose of redundant money by expelling reserves.

When the exchange rate is fully flexible,  $\delta R = \delta R = 0$ , and the system (36) takes this form:

$$\begin{bmatrix} -E_y & -\lambda^s E & -1 \\ -\lambda^s W_y & -\lambda^s E_r & 0 \\ q\lambda^h L_y & q\lambda^h L_r & 0 \end{bmatrix} \begin{bmatrix} \delta Y \\ \delta r \\ -e_r \delta \pi \end{bmatrix} \\ = \begin{bmatrix} \dots & \dots & \dots \\ \dots & \dots & \dots \\ \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} \delta \hat{Z}^a \\ \delta \hat{Z}^c \\ \delta X^a \end{bmatrix} + \begin{bmatrix} -\lambda^s & 0 \\ -\lambda^s & 0 \\ 0 & \lambda^h \end{bmatrix} \begin{bmatrix} (1/r)\delta B \\ (1/r)\delta B^c \end{bmatrix}. \quad (42)$$

The determinant is  $-q\lambda^h\lambda^s H$ , where, as before,  $H = L_y E_r - L_r W_y > 0$ .

<sup>14</sup> These conditions are not independent; when two are satisfied, the third is satisfied. It is impossible, however, to explain the behavior of the model using only one of them. This is my objection to naive monetary theories that try to explain the balance of payments (changes in reserves) by looking at just one equation. The level of reserves must satisfy equation (37), but the disturbance affecting reserves, such as  $(1/r)d^*B$ , may appear in another equation.

The short-run effects on income, the interest rate, and the exchange rate are shown in Table 2. A larger government deficit stimulates income and raises the interest rate, just as it did under pegged exchange rates. And the signs of the effects of monetary policy are what they were before. Furthermore, both policies cause the exchange rate to depreciate, which is what would have happened in the pegged-rate case if the central bank had not met the excess private demand for foreign currency by sales from its own reserves. (The size of the depreciation, moreover, is always  $M_y$  times  $\delta Y$  divided by the elasticity of the trade balance,  $e_\pi$ .) An autonomous increase of exports, however, has very different effects under flexible exchange rates. The exchange rate moves to clear the foreign-exchange market, insulating the domestic economy from the external disturbance.

TABLE 2  
SOLUTIONS OF THE MODEL WITH NO CAPITAL MOBILITY AND  
FLEXIBLE EXCHANGE RATES\*

Effect on	Effect of		
	Fiscal Policy <sup>a</sup>	Monetary Policy <sup>b</sup>	Increase in Exports <sup>c</sup>
Short run:			
Income	$(1/\lambda^s H)(1 - \lambda^s W_y)(-L_r)$	$(1/\lambda^s H)(1/q)E_r$	0
Interest rate	$(1/\lambda^s H)(1 - \lambda^s W_y)L_y$	$-(1/\lambda^s H)(1/q)W_y$	0
Exchange rate	$(M_y/e_\pi)(1/\lambda^s H)(1 - \lambda^s W_y)(-L_r)$	$(M_y/e_\pi)(1/\lambda^s H)(1/q)E_r$	$-(1/e_\pi)$
Long run:			
Income	$[-L_r/H]$	$[(1/q)E_r/H]$	0
Interest rate	$[L_y/H]$	$-[(1/q)W_y/H]$	0
Exchange rate	$(M_y/e_\pi)[-L_r/H]$	$(M_y/e_\pi)[(1/q)E_r/H]$	$-(1/e_\pi)$

See corresponding notes to Table 1.

Because there are no endogenous changes in stocks, there is no need to prove dynamic stability. The long-run effects of monetary and fiscal policies and of the autonomous change in the demand for exports can be obtained directly from the system (42) and resemble quite closely their short-run counterparts. Thus, fiscal and monetary policies have long-run effects on income, and the long-run changes in the interest rate reflect the influence of income changes on desired holdings of wealth and money (they contain the partial derivatives  $W_y$  and  $L_y$ ).

The differences between the long-run results shown in Tables 1 and 2 are proof of a familiar proposition about flexible exchange rates. Because they serve to separate national economies, especially their money markets, flexible exchange rates can insulate each economy from disturbances arising in others and can contain within an economy dis-

turbances arising domestically, including changes in national policies.<sup>15</sup> When the exchange rate is free to clear the foreign-exchange market, there is no need for income to do so. And because the central bank need not intervene in the foreign-exchange market, the economy cannot adjust its money supply endogenously by running a surplus or deficit in its balance of payments. The long-run requirements set forth by equations (37) and (38), that desired holdings of wealth and money must equal actual holdings, are satisfied by changes in the interest rate and income, not by changes in the interest rate and reserves. Thus, an open-market purchase of securities, causing a permanent increase in the supply of money and a permanent decrease in the supply of bonds, requires a reduction in the interest rate and an increase in income. The interest rate must decline to restore equality between desired and actual holdings of bonds, just as it did under pegged rates. Income must rise to restore equality between desired and actual holdings of money.

Before turning to the study of capital mobility, another point needs emphasis. Although monetary policy has a permanent effect on income under pegged exchange rates and no permanent effect under flexible exchange rates, the *modus operandi* of monetary policy is the same in the short run under both exchange-rate regimes. In the absence of capital mobility, an open-market purchase by the central bank, reducing the supply of bonds available to households and commercial banks, reduces the interest rate. This diminishes the difference between desired and actual wealth (the effect  $E_r$ , in Tables 1 and 2) and discourages saving. Households spend larger fractions of their incomes, augmenting the aggregate domestic demand for domestic output. Although monetary policy has no direct effect on the demand for goods, unlike fiscal policy, it can have a powerful indirect effect by way of saving and consumption.<sup>16</sup> I call this particular indirect effect the saving-consump-

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<sup>15</sup> Indeed, it can be shown that the policy effects in Table 2 are the same as those in a closed economy (see Allen and Kenen, 1976). Of course, when bonds are traded between countries, economies are not perfectly insulated. Money markets are still separate, but bond markets are not. More important, a change in the exchange rate that clears the foreign-exchange market does not always clear the goods market. Hence, disturbances that affect simultaneously the markets for goods and bonds, leading to current- and capital-account flows, are not always neutralized by changes in exchange rates. These points are taken up in different terms below.

<sup>16</sup> Notice that this indirect effect occurs whenever  $E_r > 0$ , and this condition is satisfied even when  $W_r = 0$  (when desired wealth does not depend on the interest rate). In an economy with capital formation, of course, the reduction of saving caused by a fall in the interest rate would be supplemented (perhaps dominated) by an increase of investment.

tion route, to distinguish it from another indirect effect that plays an important role below.

*Perfect capital mobility.* When the foreign demand for domestic bonds is infinitely elastic,  $\delta r = dr = 0$ . When, in addition, the exchange rate is pegged, the system (36) takes this form:

$$\begin{bmatrix} -E_y & 0 & 0 \\ -\lambda^s W_y & -1 & 1 \\ q\lambda^s L_y & 0 & -1 \end{bmatrix} \begin{bmatrix} \delta Y \\ (1/r)\delta \dot{B}^f \\ \delta \dot{R} \end{bmatrix} = \begin{bmatrix} \dots & \dots & \dots \\ \dots & \dots & \dots \\ \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} \delta \hat{Z}^y \\ \delta \hat{Z}^c \\ \delta X^a \end{bmatrix} \\ + \begin{bmatrix} \dots & \dots & \dots \\ \dots & \dots & \dots \\ \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} (1/r)(\delta B - \delta B^f) \\ (1/r)\delta B^c \\ \delta R \end{bmatrix}. \quad (43)$$

The determinant is  $-E_y$ , the sum of the marginal propensities to save and import.

The short-run effects on income, foreign bond holdings, and reserves are shown in Table 3. As before, fiscal policy stimulates income. Here, however, it causes an inflow of reserves rather than the outflow experienced without capital mobility. The bonds issued to finance a government deficit are sold to foreigners, producing a capital inflow, and the inflow is larger than the increase of imports caused by the rise in income.<sup>17</sup> In this instance, moreover, monetary policy has no effect on income, even in the short run. It cannot follow the saving-consumption route described above, because it cannot alter the domestic interest rate. Foreigners furnish all the bonds bought by the central bank, and there is no change in the supply available to households and commercial banks. Nor can it follow the exchange-rate route described below in the discussion of flexible exchange rates, because it cannot alter the supply of money, even temporarily. When foreigners furnish the bonds bought by the central bank, there is a capital outflow, and the central bank must intervene to defend the exchange rate. It must sell foreign currency from its reserves in an amount exactly equal to its bond purchases. Thus,  $(1/r)\delta \dot{B}^f = \delta \dot{R} = \delta \hat{Z}^c$  in Table 3, and there is no change in the supply of high-powered money.<sup>18</sup>

<sup>17</sup> The increase of imports is  $M_y \delta Y$ , or  $(M_y/E_y)(1-\lambda^s W_y)\delta \hat{Z}^y$ . This is also the difference between the capital inflow and the change in reserves shown in the table.

<sup>18</sup> Under pegged exchange rates, then, perfect capital mobility serves to speed up the process described in Table 1. The income effect of monetary policy is vitiated immediately, because the endogenous adjustment of the money supply *via* reserve movements takes place instantaneously by way of the bond market and capital account, not gradually by way of the goods market and current account. I revert to this point below.

TABLE 3  
SOLUTIONS OF THE MODEL WITH PERFECT CAPITAL MOBILITY AND  
PEGGED EXCHANGE RATES\*

<i>Effect on</i>	<i>Effect of</i>		
	<i>Fiscal Policy<sup>a</sup></i>	<i>Monetary Policy<sup>b</sup></i>	<i>Increase in Exports<sup>c</sup></i>
Short run:			
Income	$(1/E_y)(1 - \lambda^s W_y)$	0	$(1/E_y)$
Foreign bond holdings <sup>d</sup>	$(1/E_y)(1 - \lambda^s W_y)(M_y + q\lambda^s L_y)$	-1	$-(1/E_y)(\lambda^s W_y - q\lambda^s L_y)$
Reserves <sup>e</sup>	$(1/E_y)q\lambda^s(1 - \lambda^s W_y)L_y$	-1	$(1/E_y)q\lambda^s L_y$
Long run:			
Income	0	0	$[1/M_y]$
Foreign bond holdings <sup>f</sup>	1	-1	$-[(W_y - qL_y)/M_y]$
Reserves <sup>g</sup>	0	-1	$[qL_y/M_y]$

\* All expressions prefixed by minus signs are negative; all others are positive. These results follow from the facts that  $\lambda^s W_y < 1$ , and  $\lambda^s W_y > \lambda^s L_y > q\lambda^s L_y$  because  $q < 1$ .

<sup>a</sup> The policies  $\delta Z^o$  and  $(1/r)d^*B$ .    <sup>b</sup> The policies  $\delta Z^c$  and  $(1/r)d^*B^c$ .

<sup>c</sup> The disturbances  $\delta X^a$  and  $dX^a$ .    <sup>d</sup> The capital inflow  $(1/r)\delta B^f$ .

<sup>e</sup> The flow change  $\delta R$ .    <sup>f</sup> The change in foreign holdings  $(1/r)dB^f$ .

<sup>g</sup> The stock change  $dR$ .

The short-run effects of an increase in exports are straightforward. Income rises by  $(1/E_y)\delta X^a$ , the Keynesian income multiplier for a small open economy. As it does so, moreover, saving rises too, and households enlarge their purchases of bonds. The bonds are supplied by foreigners, but the concomitant capital outflow is not large enough to offset the trade surplus caused by the increase in exports. There is an increase in reserves, just as there was without mobility.<sup>19</sup>

To study the long-term counterparts of these effects, use the system (43) to obtain the derivatives of  $(1/r)B^f$  and  $R$  with respect to all long-run arguments, set them equal to zero, and use them to form

$$\begin{aligned} & \begin{bmatrix} -[\lambda^s(W_y - qL_y) + M_y] & -q\lambda^s L_y \\ M_y & -M_y \end{bmatrix} \begin{bmatrix} dR \\ (1/r)dB^f \end{bmatrix} \\ & = \begin{bmatrix} -q\lambda^s L_y & E_y & -qL_y \\ -M_y & 0 & W_y \end{bmatrix} \begin{bmatrix} (1/r)d^*B \\ (1/r)d^*B^c \\ dX^a \end{bmatrix}. \quad (44) \end{aligned}$$

The trace is negative, the determinant is positive, and the model itself has therefore to be stable. The flows  $\dot{R}$  and  $(1/r)\dot{B}^f$  tend to zero, and the cumulative changes in the stock of reserves and in foreign holdings of

<sup>19</sup> The change in the trade balance is  $(\delta X^a - M_y \delta Y)$  or  $(\lambda^s W_y / E_y) \delta X^a$ . This is also the difference between the capital outflow and the change in reserves shown in the table.

bonds can be obtained from the system (44). These long-run changes are shown in Table 3, along with the corresponding changes in income.

The effects of monetary policy and of an increase in exports resemble in every respect their short-run counterparts. Monetary policy leads to a capital outflow and loss of reserves equal to the cumulative open-market purchase,  $(1/r)d^*B^c$ . An increase of exports leads to a change in income sufficient to satisfy equation (39); the trade balance is brought back to zero. The changes in foreign bond holdings and in reserves are those required to satisfy the domestic demands for bonds and money corresponding to the new levels of income and wealth.

The effects of fiscal policy, however, differ from their short-run counterparts. Once the government has ended its deficit, fiscal policy has no direct effect on income. No policy, indeed, can have any permanent effect on income under pegged exchange rates. As long as income is different from what it was initially, the trade balance cannot be zero, reserves will be changing, and the system cannot settle down to a stationary state. When it does settle down, moreover, it will show no changes in desired holdings of bonds or money (because there are no changes in income or the interest rate). In consequence, the new bonds issued by the government,  $(1/r)d^*B$ , must find their way to foreigners, and there is no change in the stock of reserves.

If I were fully faithful to the argument of Chapter II, I would not analyze the remaining case. When the exchange rate is flexible, the foreign demand for domestic bonds cannot be perfectly elastic; bonds denominated in one currency cannot be perfect substitutes for bonds denominated in another.<sup>20</sup> It is useful to do so, however, in order to compare the properties of the model developed here with those of other models that study this case. When capital is perfectly mobile and the exchange rate freely flexible, the system (36) takes this form:

$$\begin{bmatrix} -E_y & 0 & -1 \\ -\lambda^s W_y & -1 & 0 \\ q\lambda^h L_y & 0 & 0 \end{bmatrix} \begin{bmatrix} \delta Y \\ (1/r)\delta B^f \\ -e_\pi \delta \pi \end{bmatrix} = \begin{bmatrix} \dots & \dots & \dots \\ \dots & \dots & \dots \\ \dots & \dots & \dots \end{bmatrix} \begin{bmatrix} \delta Z^a \\ \delta Z^c \\ \delta X^a \end{bmatrix} \\ + \begin{bmatrix} -\lambda^s & 0 \\ -\lambda^s & 0 \\ 0 & \lambda^h \end{bmatrix} \begin{bmatrix} (1/r)(\delta B - \delta B^f) \\ (1/r)\delta B^c \end{bmatrix} \quad (45)$$

The determinant is  $-q\lambda^h L_y$ .

The short-run effects on income, foreign bond holdings, and the exchange rate are shown in Table 4. An autonomous increase of exports

<sup>20</sup> The model developed in the Appendix allows explicitly for this fact. Domestic banks do not regard domestic and foreign bonds as perfect substitutes.

TABLE 4  
SOLUTIONS OF THE MODEL WITH PERFECT CAPITAL MOBILITY AND  
FLEXIBLE EXCHANGE RATES\*

Effect on	Effect of		
	Fiscal Policy <sup>a</sup>	Monetary Policy <sup>b</sup>	Increase in Exports <sup>c</sup>
Short run:			
Income	0	$(1/q\lambda^h L_y)$	0
Foreign bond holdings <sup>d</sup>	$(1 - \lambda^s W_y)$	$-(1/q\lambda^h L_y)\lambda^s W_y$	0
Exchange rate	$-(1/e_\pi)(1 - \lambda^s W_y)$	$(1/e_\pi)(1/q\lambda^h L_y)E_y$	$-(1/e_\pi)$
Long run:			
Income	0	$[1/qL_y]$	0
Foreign bond holdings <sup>f</sup>	1	$-[W_y/qL_y]$	0
Exchange rate	0	$(1/e_\pi)[M_y/qL_y]$	$-(1/e_\pi)$

See corresponding notes to Table 3.

has effects identical to those it displayed in the absence of capital mobility. The exchange rate adjusts to hold the trade balance at zero and insulates the domestic economy from the external disturbance.<sup>21</sup> But the effects of fiscal and monetary policies are different from those displayed in previous tables.

Fiscal policy has no effect on income, even in the short run. This is because a government deficit induces saving and a deterioration in the trade balance, and the sum of the two offsets exactly the government's demand for domestic output. The saving results from the temporary tax cut (increase in disposable income) which the government employs to generate a deficit, and all of the saving must be used to buy government bonds (there being no change in the supply of money). The rest of the bonds issued to finance the deficit,  $(1 - \lambda^s W_y)\delta Z^g$ , are sold to foreigners, causing the exchange rate to appreciate and the trade balance to deteriorate by the amount of the capital inflow.

Monetary policy causes income to rise and the exchange rate to depreciate, just as it did in the absence of capital mobility. It does so, however, by a route quite different from the one described before. The central bank cannot control the supply of bonds available to households and commercial banks; foreigners will make good any difference between the sum of household and commercial-bank demands and the sum of government and central-bank supplies. But when households or

<sup>21</sup> The domestic economy would not be insulated, however, from a foreign financial disturbance. This possibility is studied in the Appendix.

commercial banks buy bonds from foreigners to replace the ones bought by the central bank, they must pay in foreign currency; and when the exchange rate is flexible, the central bank does not supply it. The exchange rate depreciates and the trade balance moves into surplus, enlarging the domestic and foreign demands for domestic output. Monetary policy affects the goods market by way of the bond and foreign-exchange markets, not by affecting saving and consumption.<sup>22</sup>

These trade-balance effects of monetary policy are the ones cited by Mundell (1963) and Sohmen (1969), among others, to explain its *modus operandi* when capital is mobile and exchange rates flexible. But monetary policy has permanent effects on income and the exchange rate, effects that outlast the capital outflow and trade-balance surplus which account for the short-run results described above. To derive the relevant long-run results, use the system (45) to write the derivative of  $(1/r)B^f$  with respect to all long-run arguments:

$$(1/r)d\dot{B}^f = \lambda^s(1/r)d^*B - (\lambda^s W_y/qL_y)(1/r)d^*B^c - \lambda^s(1/r)dB^f. \quad (46)$$

As  $(d\dot{B}^f/dB^f) < 0$ , the system is stable. The capital flow goes to zero in the long run, and equation (46) can be employed to derive the cumulative change in foreign holdings of domestic bonds. That change, in turn, is used to solve the system (45) for the long-run changes in income and the exchange rate shown in Table 4.

The long-run effects of an increase in exports are the same as its short-run effects, and the long-run effects of a government deficit are the same as those obtained under pegged exchange rates. But the long-run effects of monetary policy are different in form from the short-run effects and different also from the long-run effects shown in previous tables. There is a permanent increase in income. This increase is required to equate desired and actual money holdings. Because an open-market purchase by the central bank raises permanently the stock of money, it must also engineer a rise in desired money holdings. When capital was not mobile, it did so by reducing the interest rate and raising the level of income. Here, it can act only on income, and the change in income shown in Table 4 is larger than the one in Table 2. For this same reason, the change in the exchange has also to be larger than it

<sup>22</sup> There is additional saving, but this is the result, not the cause, of the increase in income. As some of the saving is used to buy government bonds, the domestic demand for them rises by  $[(\lambda^s W_y - q\lambda^b L_y)/q\lambda^b L_y]\delta Z^c$ . But the supply of bonds diminishes by  $\delta Z^c$ . Hence the excess supply is  $[\lambda^s W_y/q\lambda^b L_y]\delta Z^c$ , which is equal with opposite sign to the change in foreign holdings.

was without capital mobility. The larger change in income adds to the demand for imports and must be offset by a larger depreciation.

### *The Implications of Capital Mobility*

To sum up and conclude this analysis, consider the implications of capital mobility for the conduct of fiscal and monetary policies and for the manner in which an economy adjusts to an exogenous disturbance.

The model developed here replicates a number of familiar conclusions concerning the effectiveness of fiscal and monetary policies under alternative exchange-rate regimes and the influence of capital mobility on their effectiveness.

Looking first at the income effects of monetary policy, the choice between exchange-rate regimes appears at once to be much more important than the presence or absence of capital mobility. Under pegged exchange rates, monetary policy can have no permanent effects on income. All changes in the stock of high-powered money initiated by open-market operations are offset sooner or later by the changes in reserves resulting from the need for central-bank intervention in the foreign-exchange market. Under flexible exchange rates, by contrast, monetary policy has permanent effects on income. An open-market purchase of securities enlarges the stock of money permanently, and income must increase sufficiently to augment the demand for money.

Capital mobility is important chiefly for its influence on the speed and size of the accommodation to an open-market operation. Under pegged exchange rates, a perfectly elastic foreign demand for domestic bonds (or, in the Appendix, perfect substitutability between domestic and foreign bonds) channels the accommodation through the capital account of the balance of payments. Bonds bought by the central bank are supplied by foreigners, who must be paid in foreign currency. The central bank must intervene in the foreign-exchange market to supply that currency, and its reserves have therefore to decline apace with the increase in its holdings of domestic bonds. There can be no change, not even temporarily, in the supply of high-powered money or level of domestic income. When, instead, there is no foreign demand for domestic bonds, the accommodation must take place by way of the current account. The economy trades money for goods, not for bonds, and the long-run reduction of reserves is accomplished by a temporary increase of income that augments the economy's demand for foreign goods.

Under flexible exchange rates, a perfectly elastic foreign demand for domestic bonds serves again to channel the accommodation through

the capital account, but this does not vitiate the domestic impact of an open-market operation. Instead, it alters the *modus operandi* of monetary policy, causing it to function by way of the exchange rate and the trade balance, rather than by way of the interest rate, saving, and consumptions. Furthermore, the changes in income are larger in the short and long runs alike than they are in the absence of capital mobility.

The situation in respect of fiscal policy is more complicated and less symmetrical. Under pegged exchange rates, the cumulative increase of debt caused by deficit spending has no permanent effect on income. This is true whether or not capital is mobile (though the reasons are different in the two instances). Under flexible exchange rates, an increase in the stock of debt can have a permanent impact on income, but only when it can cause an irreversible change in the exchange rate *and* the interest rate. Hence, fiscal policy can have no long-run impact when capital is perfectly mobile, pegging the interest rate.

One can make additional assertions about the short-run consequences of deficit spending, but they are complicated too. In the absence of capital mobility, deficit spending is more powerful when the exchange rate is flexible than when it is pegged; the short-run change in income is larger in Table 2 than in Table 1. With perfect capital mobility, however, deficit spending is more powerful when the exchange rate is pegged; the short-run change in income is larger in Table 3 than in Table 4 (where it goes to zero). Running the comparison another way, capital mobility enhances the power of deficit spending under pegged exchange rates; the change in income is larger in Table 3 than in Table 1 (because the increase of income is not curbed by a rising interest rate). But capital mobility diminishes the power of deficit spending under flexible exchange rates; the change in income is larger in Table 2 than in Table 4.

There is one more point to be made about fiscal policy. Absent capital mobility, deficit spending weakens the balance of payments. Reserves decline temporarily and permanently in Table 1, and the exchange rate depreciates in Table 2. With perfect mobility, by contrast, deficit spending strengthens the balance of payments temporarily. There is an inflow of reserves in Table 3, and the exchange rate appreciates in Table 4. (The results in Table 3 suggest one more way to compare the effects of capital mobility on the endogenous accommodation to fiscal and monetary policies. A government deficit causes a capital inflow but does not alter the stock of reserves. Instead, it produces a temporary increase of income that leads to an increase of

imports. The economy swaps bonds for goods. An open-market sale of securities causes a capital inflow too, but does not alter income, even temporarily. Instead, it produces an increase of reserves equal to the inflow. The economy swaps bonds for money.)

I turn now to the point made at the end of Chapter II concerning the size and speed of the adjustment to an exogenous change in exports under pegged exchange rates.

Using the results in Tables 1 and 3, it is easy to show that capital mobility has no effect on the size of the ultimate change in income required to eliminate the trade surplus associated with an increase of exports. It is  $(1/M_y)$  times the increase of exports in each instance.<sup>23</sup> It is equally easy to show, however, that capital mobility defers part of the change in income. The immediate (short-run) change in income shown in Table 3 is smaller by  $(\lambda^s E_r / E_y)[\lambda^s W_y - q\lambda^b L_y] / D$  than the corresponding change shown in Table 1.

What are the reasons for this difference? Begin by recalling that any change in the trade balance must be matched by an equal change in saving. Before any change in the interest rate, then, an exogenous increase of exports causes  $(\lambda^s W_y / E_y)\delta X^a$  of additional saving. But some of this saving will be used to build up cash balances, and the amount that will be used to buy bonds is only  $[(\lambda^s W_y - q\lambda^b L_y) / E_y]\delta X^a$ . When the foreign demand for bonds is perfectly elastic, bonds are bought from foreigners; the term  $[(\lambda^s W_y - q\lambda^b L_y) / E_y]\delta X^a$  measures the capital outflow in Table 3. When there is no foreign demand for bonds, the additional domestic demand bids up bond prices; the interest rate declines by  $[(\lambda^s W_y - q\lambda^b L_y) / D]\delta X^a$  in Table 1. A decline in the interest rate, however, generates a secondary change in the saving rate. Desired wealth falls, actual wealth rises, and the two together reduce the saving rate by  $\lambda^s E_r$  times the decline in the interest rate, raising the immediate change of income by the amount shown in the previous paragraph.<sup>24</sup>

Consider, next, the difference between changes in reserves. Here,

<sup>23</sup> Ingram (1973) and Scitovsky (1969) suggest that there will be a smaller change in income with capital mobility but offer no reason.

<sup>24</sup> This account is modeled on Scitovsky's (1969) work, in which the adjustment process is powered by wealth changes—the direct wealth effect of a current-account surplus and the indirect interest-rate effect of a wealth-induced increase in the demand for bonds. The model implicit in Scitovsky's work, however, allows for only one indirect effect (the change in actual wealth caused by a change in bond prices); the model used here allows for a second (the change in desired wealth caused by a change in the interest rate). It should, of course, be noted that the deferral of income effects with capital mobility implies a larger change over some subsequent interval of time (since the requisite long-run change is the same with and without mobility).

mobility is even more influential. It reduces the cumulative (long run) change as well as the rate of change. The cumulative change in the stock of reserves in Table 3 is smaller by  $-qL_r[(W_y - qL_y)/M_y(E_r - qL_r)]$  than it is in Table 1. The initial change in the flow of reserves is smaller by  $q\lambda^h[(\lambda^s E_r/E_y)L_y - L_r][(\lambda^s W_y - q\lambda^h L_y)/D]$ .

There are two ways to account for these differences in movements of reserves—by looking at the evolution of the balance of payments and by looking at the evolution of the demand for money. Following the balance-of-payments approach, note first that perfect capital mobility causes a smaller increase of imports because it reduces the initial change in income. Taken by itself, this effect implies a larger initial inflow of reserves. But with perfect mobility there is also a capital outflow and this effect reduces the inflow of reserves. The smaller increase of the reserve flow shown above is, then, the difference between the reserve-reducing capital outflow and the smaller change in imports. Following the demand-for-money approach, recall that the change in the demand for money caused by a reduction in the interest rate is the sum of an income effect,  $\lambda^h L_y$ , *times* the change in income induced by a change in the interest rate, and a direct interest-rate effect,  $\lambda^h L_r$ , *times* the change in the interest rate. The two together account for the short-run increase in the demand for money caused by the reduction in the interest rate shown in Table 1, and the corresponding change in the demand for high-powered money (reserves) is the change in the demand for money *times* the reserve requirement. Thus, the larger reserve flow occurring in the absence of capital mobility is  $q[(\lambda^s E_r/E_y)\lambda^h L_y - \lambda^h L_r]$  *times* the change in the interest rate, and this gives the expression shown above.

The difference between cumulative changes in reserves is most readily explained by the change in the demand for money. As the long-run change in income is the same in Tables 1 and 3, there can be only one cause for a difference in desired money holdings—the change in the interest rate that takes place in the absence of mobility. Thus, the change in desired money holdings is larger by  $-L_r$  *times* the long-run change in the interest rate shown in Table 1, and the change in reserves is larger by  $-qL_r$  *times* the change in the interest rate.

These results support the Ingram-Scitovsky case for capital mobility. Although mobility can have no effect on the size of the change in income required to offset a change in the demand for a country's exports, it does serve two related functions. First, it defers the endogenous change in income caused by a shift in the demand for exports. Second, it reduces the short-run change in the flow of reserves and the long-run change in the stock of reserves evoked by a shift in export demand.

Capital flows substitute in part for reserve flows, and changes in foreign holdings of domestic debt substitute in part for changes in the stock of reserves. There is, then, less need to conserve reserves by using monetary and fiscal policies to accelerate the change in income or by manipulating trade flows directly.

## APPENDIX

### THE CASE OF TRADE IN FOREIGN BONDS

This Appendix adds a foreign bond to the model developed in the text. The bond is a consol, has an interest rate  $r'$ , and is denominated in foreign currency. The foreign supply of the bond is infinitely elastic at that interest rate (the changes  $\delta r'$  and  $dr'$  are exogenous).

Because I shall assume that the foreign bond is held only by banks, its introduction does not alter equations (1) through (3) or (5) through (9) of the text, pertaining to households. There is a small change in equation (4) defining disposable income, but I postpone it momentarily. The first major change occurs in the banks' balance sheet:

$$W^b + L = L^c + (1/r)B^b + \pi(1/r')F^b, \quad (10a)$$

where  $F^b$  is the number of foreign-currency coupons held by banks. Correspondingly, equation (11) becomes:

$$\dot{W}^b = -[(1/r^2)B^b]\dot{r} - [\pi(1/r'^2)F^b]\dot{r}' + [(1/r')F^b]\dot{\pi}. \quad (11a)$$

There are no changes in equations (12) and (13), pertaining to the supply of money, but equation (14) gives way to

$$\dot{L} = \dot{L}^c + (1/r)\dot{B}^b + \pi(1/r')\dot{F}^b, \quad (14a)$$

and two new equations are needed to define the banks' desired holdings of foreign bonds,  $*F^b$ , and the rate at which banks adjust those holdings. Desired holdings are defined by

$$\pi(1/r')*F^b = F(r', r, L, W^b), \quad (A.1)$$

where  $F_{r'} = -F_r > 0$ , and  $0 < F_L < (1 - q)$ , while  $F_w = 1$  for changes in  $W^b$  arising from capital gains or losses on bank holdings of foreign bonds, and  $F_w = 0$  for changes arising from gains or losses on domestic bonds. The strong conditions on  $F_r$ ,  $F_{r'}$ , and  $F_L$  can be derived from weaker suppositions.<sup>1</sup> The assertions about  $F_w$  are inde-

<sup>1</sup> The conditions on  $F_r$  and  $F_{r'}$  can be derived from the weaker supposition that the own effects of changes in interest rates are no smaller than the cross effects. Write the banks' desired holdings of domestic bonds as  $(1/r)^s B^b = B(r, r', L, W^b)$ , and substitute into the banks' balance sheet:  $W^b + (1 - q)L - B(r, r', L, W^b) - F(r', r, L, W^b) = 0$ . Differentiating with respect to bank wealth,  $B_w + F_w = 1$ . Differentiating with respect to interest rates,  $B_r + F_r = 0$  and  $B_{r'} + F_{r'} = 0$ .

pendent simplifications designed to delete wealth effects from the derivative of equation (A.2). They say, in effect, that the banks do not realize capital gains on bonds. (When, for example,  $F_w$  is unity,  $B_w$  is zero; changes in  $W^b$  arising from capital gains on foreign bonds do not cause banks to buy domestic bonds.)

The rate at which banks alter their bond holdings is defined by

$$F^b = \lambda^f (*F^b - F^b), \quad \lambda^s < \lambda^f < \infty. \quad (\text{A.2})$$

The banks' holdings of foreign bonds have always to equal the supply available from foreigners (no other sector holds them). Therefore,

$$F^b = F^f, \quad (\text{A.3})$$

and

$$\dot{F}^b = \dot{F}^f. \quad (\text{A.4})$$

There are no changes in equations (15) through (18'), describing the central bank and its policies, but there is a change in the balance-of-payments equation:

$$\pi \dot{R} = (X - \pi M) + (T^f - B^f + \pi F^f) + (1/r)\dot{B}^f - \pi(1/r')\dot{F}^f. \quad (19a)$$

Furthermore, the definition of  $T^f$  is modified to take account of interest income earned on foreign bonds:

$$T^f = B^f - \pi F^f, \quad (23a)$$

so that the balance-of-payments equation becomes

$$\pi \dot{R} = (X - \pi M) + (1/r)\dot{B}^f - \pi(1/r')\dot{F}^f. \quad (19a')$$

The banks' interest income has also to be added to the definition of disposable income, equation (4), but drops out again when equations (21) and (23a) are used to rewrite it. Equation (4') is not altered.

There is no change in any other definition or assertion relating to the government or to foreign trade, or in the market-clearing equations for goods, money, and government bonds, equations (28), (29), and (30).

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The supposition about own and cross effects, however, says that  $F_r \leq -F_r$  and  $B_r \leq -B_r$ , and the second of these statements can be written as  $-F_r \geq F_r$ . Thus, the several statements about interest-rate effects can be satisfied simultaneously only when  $F_r = F_r$ . The condition on  $F_L$  can be derived from the weaker supposition that  $F_L > 0$  and  $B_L > 0$  (that neither asset is inferior). Differentiating the balance-sheet equation above with respect to deposits,  $F_L + B_L = (1 - q)$ . It follows directly that  $0 < F_L < (1 - q)$ .

The last of these, however, is rewritten. Using equations (28), (29), and (31), it becomes

$$\pi \dot{R} + \pi(1/r')\dot{F}^b - (1/r)\dot{B}^f - (\dot{X} - \pi\dot{M}) = 0, \quad (30a)$$

which is, of course, the excess demand for foreign currency.

As I will not deal here with trade in domestic bonds, equation (32) applies; equations (32') and (33) do not. Using equation (32) and the new ones pertaining to the foreign bond, equation (30a) can be written as

$$- \left[ X(1/\pi) - \pi M(\pi, Y) \right] + \lambda^f [F(r', r, L, W^b) - \pi(1/r')F^f] + \pi \dot{R} = 0. \quad (30a')$$

Finally, the market-clearing equation for foreign bonds is

$$\dot{F}^b - \dot{F}^f = \lambda^f [F(r', r, L, W^b) - \pi(1/r')F^f] - \pi(1/r')\dot{F}^f = 0. \quad (A.5)$$

The four market-clearing equations (28'), (29'), (30a'), and (A.5) contain four market-clearing variables,  $Y$ ,  $r$ ,  $\pi$  or  $R$ , and  $F^f$ , and the endogenous stocks  $L$ ,  $W^h$ ,  $W^b$ , and  $F^f$ . The first of these stocks is defined by equation (10'). The third is defined by the new version of equation (1'):

$$W^h = (1/r)B + \pi R + \pi(1/r')F^f - W^c, \quad (1'a)$$

so that the system may be deemed to contain two endogenous stocks,  $R$  and  $F^f$ , two exogenous stocks,  $B$  and  $W^c$ , and two wealth terms,  $W^b$ , and  $W^c$  (which serve only to collect capital gains).

Taking the total derivatives,<sup>2</sup>

$$\begin{bmatrix} -E_y & -\lambda^s E_r & 0 & (e_\pi + \lambda^s E_\pi) & 0 \\ q\lambda^h L_y & q\lambda^h L_r & 1 & 0 & 0 \\ M_y & \lambda^f F_r & -1 & -e_\pi & 0 \\ 0 & \lambda^f F_r & 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} \delta Y \\ \delta r \\ -\delta \dot{R} \\ \delta \pi \\ \delta \dot{F}^f \end{bmatrix}$$

<sup>2</sup> I do not examine balanced-budget changes in expenditure,  $\delta G$ , and I neglect two small flow changes,  $[\pi(1/r')F^f]\delta r'$  and  $[(1/r')F^f]\delta \pi$ . As usual,  $\pi$  is set at unity after differentiation. The ordering of terms on the left-hand side of (A.6) reflects an implicit pairing of markets and market-clearing variables. It assumes that changes in income clear the goods market, that changes in the domestic interest rate clear the money market, that changes in the exchange rate or central-bank reserves clear the foreign-exchange market, and that changes in the supply of foreign bonds clear the market for foreign bonds.

$$\begin{aligned}
&= \begin{bmatrix} -(1 - \lambda^s W_y) & 0 & -1 & \lambda^s E_r' \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & \lambda^j F_r \\ 0 & 0 & 0 & \lambda^j F_r \end{bmatrix} \begin{bmatrix} \delta Z^g \\ \delta Z^c \\ \delta X^a \\ \delta r' \end{bmatrix} \\
&+ \begin{bmatrix} -\lambda^s & 0 & -\lambda^s & -\lambda^s \\ 0 & \lambda^h & \lambda^h & 0 \\ 0 & -\lambda^j(F_L/q) & -\lambda^j(F_L/q) & \lambda^j \\ 0 & -\lambda^j(F_L/q) & -\lambda^j(F_L/q) & \lambda^j \end{bmatrix} \begin{bmatrix} (1/r)\delta B \\ (1/r)\delta B^c \\ \delta R \\ (1/r')\delta F^j \end{bmatrix}, \quad (\text{A.6})
\end{aligned}$$

where  $E_y$ ,  $E_r$  and  $e_\pi$  are defined as they were in the text, while  $E_\pi = (1/r')F'$ , and  $E_r' = (1/r'^2)F'$ , so that  $E_\pi$  and  $E_r'$  are the wealth effects of changes in  $\pi$  and  $r'$ .

### Pegged Exchange Rates

Under pegged exchange rates,  $\delta\pi$  goes to zero, and the fourth column drops out of the matrix on the left-hand side. The determinant is  $Q = \lambda^s E_r(M_y + q\lambda^h L_y) - (\lambda^j F_r + q\lambda^h L_r)E_y = D - \lambda^j F_r E_y > 0$  (because  $L_r < 0$  and  $F_r < 0$ ). The short-run effects of the policies  $\delta Z^g$  and  $\delta Z^c$  are shown in Table A.1a; those of the disturbances  $\delta X^a$  and  $\delta r'$  are shown in Table A.1b.

To analyze long-run behavior, use the system (A.6) to obtain the total derivatives of  $R$  and  $F^j$  with respect to all long-run arguments and arrange them as

$$\begin{aligned}
&\begin{bmatrix} -Q_{RR} & qQ_{RF} \\ Q_{FR} & -Q_{FF} \end{bmatrix} \begin{bmatrix} dR \\ (1/r')dF^j \end{bmatrix} \\
&= \begin{bmatrix} -q\lambda^s(L_r M_y - \lambda^j F_r L_y) & [Q_{RR} + q\lambda^s(L_r M_y - \lambda^j F_r L_y)] \\ -\lambda^s F_r(M_y + q\lambda^h L_y) & -[Q_{FR} - \lambda^s F_r(M_y + q\lambda^h L_y)] \end{bmatrix} \begin{bmatrix} (1/r)dB \\ (1/r)dB^c \end{bmatrix} \\
&+ \begin{bmatrix} -q(\lambda^s H - \lambda^j F_r L_y) & -q[Q_{RF} F_r - \lambda^s(L_r M_y - \lambda^j F_r L_y)(E_r' + F_r)] \\ F_r(\lambda^s W_y - q\lambda^h L_y) & [Q_{FF} F_r + \lambda^s F_r(M_y + q\lambda^h L_y)(E_r' + F_r)] \end{bmatrix} \begin{bmatrix} dX^a \\ dr' \end{bmatrix}, \quad (\text{A.7})
\end{aligned}$$

$$\begin{aligned}
\text{where } Q_{RR} &= \lambda^s(M_y + \lambda^j F_r L_y)H^j - (F_r + F_L L_r)U_f, \\
Q_{RF} &= \lambda^s(\lambda^j L_y)H^j - L_r U_f, \\
Q_{FR} &= \lambda^s(M_y + q\lambda^h L_y)(F_L/q)E_r - F_r U_h - L_r(\lambda^h F_L E_y), \\
Q_{FF} &= \lambda^s(M_y + q\lambda^h L_y)(E_r - F_r) - qL_r \lambda^h E_y,
\end{aligned}$$

$$\begin{aligned}
\text{while } H^j &= E_r - qL_r - (F_r + F_L L_r), \\
U_f &= \lambda^s \lambda^j [W_y - (q + F_L)L_y] + (\lambda^j - \lambda^s)M_y, \\
U_h &= \lambda^s \lambda^h (W_y - qL_y) + (\lambda^h - \lambda^s)M_y.
\end{aligned}$$

As I have assumed that  $\lambda^h > \lambda^s$ ,  $\lambda^f > \lambda^s$ , and  $W_y > L_y$ , while  $F_r < 0$  and  $L_r < 0$ ,  $H^f$ ,  $U_f$ , and  $U_h$  are positive. So, too, are  $Q_{RR}$ ,  $Q_{RF}$ ,  $Q_{FR}$ , and  $Q_{FF}$ . Under these assumptions, then, the trace in (A.7) is negative, and the determinant,  $\lambda^s M_y Q H^f$ , is positive. The flows  $R$  and  $F^f$  go to zero in the long run, and the systems (A.6) and (A.7) can be employed to solve for the long-run effects of fiscal and monetary policies and of the disturbances  $dX^a$  and  $dr^f$ . These are also shown in Tables A.1a and A.1b.

When foreign and domestic bonds are imperfect substitutes, the domestic effects of fiscal and monetary policies resemble those displayed in Table 1 of the text (the table pertaining to pegged rates and no capital mobility). But fiscal policy has a larger effect on income, and monetary policy has a smaller effect. This is because asset substitution limits changes in the interest rate to a fraction,  $1/[1 - \lambda^f F_r (E_y/D)]$ , of what they were without trade in foreign bonds. Furthermore, asset substitution can reverse the sign of the change in reserves caused by a government deficit (it will be positive, not negative, if  $\lambda^f F_r L_y < L_r M_y$ ), and serves always to enlarge the loss of reserves caused by an open-market purchase. A government deficit causes a capital inflow (sales of foreign bonds) because it raises the domestic interest rate; an open-market purchase causes a capital outflow because it lowers the domestic interest rate.

The signs of the changes in income, the interest rate, and reserves produced by an increase of exports are the same in Table A.1b as they were in Table 1. Here again, however, asset substitution limits the decline in the interest rate, reducing the short-run increase of income, and leads to a capital outflow, reducing the increase of reserves.

The outcomes in Tables A.1a and A.1b can also be compared with those in Table 3 (pertaining to a perfectly elastic foreign demand for domestic bonds). When, indeed, foreign and domestic bonds are perfect substitutes (i.e.,  $-F_r \rightarrow \infty$ ), the outcomes are the same. (The changes in the domestic interest rate go to zero; the changes in domestic holdings of foreign bonds are equal but opposite in sign to the changes in foreign holdings of domestic bonds shown in Table 3.) As Branson (1974) and others have shown, perfect substitutability between domestic and foreign bonds has the same implications for fiscal and monetary policies as a perfectly elastic foreign demand for domestic bonds. By fixing the domestic interest rate (at  $r = r^f$ ), perfect substitutability extracts the largest multiplier effects from deficit spending (there is no "crowding out" of the induced private spending), and it reduces to zero the short-run effects of open-market operations.

Consider, finally, the effects of an exogenous increase in the foreign interest rate, shown by the second column of Table A.1b. Because it

TABLE A.1a

## EFFECTS OF FISCAL AND MONETARY POLICIES WITH TRADE IN FOREIGN BONDS AND PEGGED EXCHANGE RATES

Effect on	Effect of	
	Fiscal Policy <sup>a</sup>	Monetary Policy <sup>b</sup>
Short run:		
Income	$-(1/Q)(1 - \lambda^s W_y)(q\lambda^h L_r + \lambda^j F_r) > 0$	$(1/Q)\lambda^s E_r > 0$
Interest rate ( $r$ )	$(1/Q)(1 - \lambda^s W_y)(M_y + q\lambda^h L_y) > 0$	$-(1/Q)E_y < 0$
Foreign bond holdings <sup>c</sup>	$(1/Q)\lambda^j F_r(1 - \lambda^s W_y)(M_y + q\lambda^h L_y) < 0$	$-(1/Q)\lambda^j F_r E_y > 0$
Reserves <sup>d</sup>	$(1/Q)q\lambda^h(1 - \lambda^s W_y)(L_r M_y - \lambda^j F_r L_y) \geq 0$	$-(1/Q)(\lambda^s E_r M_y - \lambda^j F_r E_y) < 0$
Long run:		
Income	0	0
Interest rate ( $r$ )	$(1/H^j) > 0$	$-(1/H^j) < 0$
Foreign bond holdings <sup>e</sup>	$(1/H^j)(F_r + F_L L_r) < 0$	$-(1/H^j)(F_r + F_L L_r) > 0$
Reserves <sup>f</sup>	$(1/H^j)qL_r < 0$	$-(1/H^j)[E_r - (F_r + F_L L_r)] < 0$

<sup>a</sup> The policies  $\delta\hat{Z}^o$  and  $(1/r)d^*B$ .    <sup>b</sup> The policies  $\delta\hat{Z}^c$  and  $(1/r)d^*B^c$ .    <sup>c</sup> The capital outflow  $(1/r')\delta\hat{F}^j$ .

<sup>d</sup> The flow change  $\delta\hat{R}$ .    <sup>e</sup> The change in domestic holdings of foreign bonds  $(1/r')dF^j$ .    <sup>f</sup> The stock change  $dR$ .

TABLE A.1b

EFFECTS OF EXTERNAL DISTURBANCES WITH TRADE IN FOREIGN BONDS AND PEGGED EXCHANGE RATES

<i>Effect on</i>	<i>Effect of Increase in</i>	
	<i>Demand for Exports</i>	<i>Foreign Interest Rate</i>
Short run:		
Income	$(1/Q)[\lambda^s E_r - (q\lambda^h L_r + \lambda^f F_r)] > 0$	$(1/Q)\lambda^s[(E_r + E_r')\lambda^f F_r + E_r' q\lambda^h L_r] < 0$
Interest rate ( $r$ )	$-(1/Q)[\lambda^s W_y - q\lambda^h L_y] < 0$	$-(1/Q)[\lambda^s(M_y + q\lambda^h L_y)E_r' + \lambda^f F_r E_y] \geq 0$
Foreign bond holdings <sup>e</sup>	$-(1/Q)\lambda^f F_r[\lambda^s W_y - q\lambda^h L_y] > 0$	$-(1/Q)\lambda^f F_r[\lambda^s(E_r + E_r')(M_y + q\lambda^h L_y) - q\lambda^h L_r E_y] > 0$
Reserves <sup>d</sup>	$(1/Q)q\lambda^h[\lambda^s H - \lambda^f F_r L_y] > 0$	$(1/Q)q\lambda^h[\lambda^s(E_r + E_r')\lambda^f F_r L_y - L_r(\lambda^f F_r E_y + M_y \lambda^s E_r')] \geq 0$
Long run:		
Income	$(1/M_y) > 0$	0
Interest rate ( $r$ )	$-(1/H^f M_y)[W_y - (q + F_L)L_y] < 0$	$-(1/H^f)(E_r' + F_r) \geq 0$
Foreign bond holdings <sup>e</sup>	$(1/H^f M_y)[F_L H - F_r(W_y - qL_y)] > 0$	$-(1/H^f)[F_r(E_r - qL_r) + E_r'(F_r + F_L L_r)] > 0$
Reserves <sup>f</sup>	$(1/H^f M_y)[H - L_y E_r] > 0$	$-(1/H^f)qL_r(E_r' + F_r) \geq 0$

See corresponding notes to Table A.1a.

imposes capital losses (the effect represented by  $E_r'$ ), it reduces wealth, stimulates saving, and depresses income. It also enlarges the demand for foreign bonds; the saving and asset-substitution effects work in the same direction. But its net effects on reserves and the interest rate are ambiguous. Saving reduces imports, improving the balance of payments, but the improvement may not be big enough to offset the larger capital outflow (the increase in purchases of foreign bonds). Similarly, saving tends to reduce the interest rate by augmenting the demand for domestic bonds, but asset substitution tends to raise it.<sup>3</sup> These ambiguities persist in the long run (although they have then to be interpreted differently).

All of them, however, disappear when foreign and domestic bonds are perfect substitutes. As  $-F_r \rightarrow \infty$ , the relevant short-run effects tend to these limits:

$$(\delta Y / \delta r') = -(1/E_y)\lambda^s(E_r + E_r') < 0,$$

$$(\delta r / \delta r') = 1,$$

$$(\delta \dot{R} / \delta r') = -(1/E_y)q\lambda^b[\lambda^s(E_r + E_r')L_y - L_r E_y] < 0.$$

#### *Flexible Exchange Rates*

Under flexible exchange rates,  $\delta \dot{R}$  and  $\delta R$  are zero, and the third column drops out of the matrix on the left-hand side of the system (A.6). The determinant is  $q\lambda^b Q_\pi$ , where  $Q_\pi = [e_\pi \lambda^s E_r - \lambda' F_r (e_\pi + \lambda^s E_\pi)] L_y - \lambda^s L_r (W_y e_\pi - E_\pi M_y)$ , so that  $Q_\pi > 0$  whenever  $W_y e_\pi \geq E_\pi M_y$ . I assume that this condition is satisfied hereafter and denote the nonnegative difference  $(W_y e_\pi - E_\pi M_y)$  by  $U_\pi$ .<sup>4</sup> The short-run ef-

<sup>3</sup> If foreign and domestic bonds are not substitutes, the ambiguities are resolved. When  $F_r = 0$ , the short-run effects become

$$(\delta Y / \delta r') = (1/D)\lambda^s E_r' (q\lambda^b L_r) < 0,$$

$$(\delta r / \delta r') = -(1/D)\lambda^s E_r' (M_y + q\lambda^b L_y) < 0,$$

$$(\delta \dot{R} / \delta r') = -(1/D)\lambda^s E_r' (q\lambda^b L_r) M_y > 0.$$

Thus the presence of foreign bonds in banks' portfolios gives the foreign interest rate some domestic leverage. An increase in that interest rate stimulates saving, depressing income, enlarging the demand for domestic bonds, and reducing imports. The domestic interest rate declines, and there is an inflow of reserves. This limiting case illustrates a point made in the text. It is important to distinguish the *domain* of an asset from the degree of substitutability between that asset and others. Here, domain (the wealth effect  $E_r'$ ) dominates substitutability, with the result that an increase in the foreign interest rate reduces the domestic rate.

<sup>4</sup> The statement that  $U_\pi \geq 0$  says that  $(e_\pi/E_\pi) \geq (M_y/W_y)$ . The effect of a change in income on the trade balance is not larger, relative to its effect on desired wealth,

fects of fiscal and monetary policies and of the two external disturbances are shown in Tables A.2a and A.2b. Long-run behavior can be studied by using the system (A.6) to obtain the total derivative of  $F^f$  with respect to all long-run arguments:

$$\begin{aligned}
 (1/r')d\dot{F}^f &= (\lambda^f\lambda^s/Q_\pi)\{[e_\pi F_r L_y](1/r)dB \\
 &+ (1/q)[e_\pi(F_L L_y)E_r - (F_r + F_L L_r)U_\pi](1/r)dB^c \\
 &- [E_\pi F_r L_y]dX^a - F_r[e_\pi(E_r + E_r')L_y - L_r U_\pi]dr' \\
 &- [H^\pi](1/r')dF^f\}, \tag{A.8}
 \end{aligned}$$

where  $H^\pi = [e_\pi(E_r - F_r)L_y - L_r U_\pi]$ . Because  $H^\pi > 0$  whenever  $U_\pi \geq 0$ , as assumed above,  $(d\dot{F}^f/dF^f) < 0$ , and the system displays local stability. The flow  $F^f$  goes to zero in the long run, and equation (A.8) can be solved for the change in the foreign-currency value of the stock of foreign bonds held by commercial banks. Furthermore, that equation can be used to extract from the system (A.6) the long-run changes in income, the domestic interest rate, and the exchange rate resulting from fiscal and monetary policies and from external disturbances. These are also shown in Tables A.2a and A.2b.

Space does not permit detailed discussion of these results, but a few points deserve emphasis. Notice, first, that a flexible exchange rate does not insulate the domestic economy from a change in the foreign demand for exports. Indeed, an increase of foreign demand depresses domestic income. It causes the exchange rate to appreciate, reducing wealth by  $E_\pi$  times the appreciation, and any decline in wealth stimulates saving.<sup>5</sup>

In several other instances, the inclusion of a foreign-currency asset complicates the outcomes under flexible exchange rates. Most of the complications vanish, however, when foreign and domestic bonds are perfect substitutes. The outcomes under this limiting assumption are

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than the effect of the exchange rate, relative to its effect on wealth. The statement is sufficient (not necessary) for  $Q_\pi$  to be positive: one might have assumed instead that  $F_r < (M_y L_r / \lambda^b L_y)$ , thereby to remove certain ambiguities afflicting the pegged-rate case. But the supposition that  $U_\pi > 0$  reappears below as the simplest sufficient condition for dynamic stability.

<sup>5</sup> This result, however, may be peculiar to the special case studied here, in which desired and actual wealth are defined in units of home output (and the former is a function of disposable income defined again in units of home output). The same perverse result does not occur in a more general model on which I am working, in which nominal saving depends on nominal disposable income and nominal wealth (a model in which there is no money illusion anywhere except the labor market). That model, though, differs in so many respects from the one used here that direct comparisons are invalid.

TABLE A.2a

## EFFECTS OF FISCAL AND MONETARY POLICIES WITH TRADE IN FOREIGN BONDS AND FLEXIBLE EXCHANGE RATES

<i>Effect on</i>	<i>Effect of</i>	
	<i>Fiscal Policy</i> <sup>a</sup>	<i>Monetary Policy</i> <sup>b</sup>
Short run:		
Income	$-(1/Q_{\pi})(1 - \lambda^s W_y) e_{\pi} L_r > 0$	$(1/\lambda^h Q_{\pi})(1/q)[\lambda^s E_r e_{\pi} - \lambda^j F_r (e_{\pi} + \lambda^s E_{\pi})] > 0$
Interest rate ( $r$ )	$(1/Q_{\pi})(1 - \lambda^s W_y) e_{\pi} L_y > 0$	$-(1/\lambda^h Q_{\pi})(1/q)\lambda^s U_{\pi} < 0$
Foreign bond holdings <sup>c</sup>	$(1/Q_{\pi})(1 - \lambda^s W_y) e_{\pi} \lambda^j F_r L_y < 0$	$-(1/\lambda^h Q_{\pi})(1/q)\lambda^s U_{\pi} \lambda^j F_r > 0$
Exchange rate	$(1/Q_{\pi})(1 - \lambda^s W_y)(\lambda^j F_r L_y - L_r M_y) \geq 0$	$(1/\lambda^h Q_{\pi})(1/q)(\lambda^s E_r M_y - \lambda^j F_r E_y) > 0$
Long run:		
Income	$-(1/H^{\pi}) e_{\pi} L_r > 0$	$(1/H^{\pi})(1/q) e_{\pi} [E_r - (F_r + F_L L_r)] > 0$
Interest rate ( $r$ )	$(1/H^{\pi}) e_{\pi} L_y > 0$	$-(1/H^{\pi})(1/q)[U_{\pi} - e_{\pi} F_L L_y] \geq 0$
Foreign bond holdings <sup>d</sup>	$(1/H^{\pi}) e_{\pi} F_r L_y < 0$	$(1/H^{\pi})(1/q)[e_{\pi} E_r F_L L_y - (F_r + F_L L_r) U_{\pi}] > 0$
Exchange rate	$-(1/H^{\pi}) M_y L_r > 0$	$(1/H^{\pi})(1/q) M_y [E_r - (F_r + F_L L_r)] > 0$

<sup>a</sup> The policies  $\delta \hat{Z}^g$  and  $(1/r)d^*B$ .<sup>b</sup> The policies  $\delta \hat{Z}^c$  and  $(1/r)d^*B^c$ .<sup>c</sup> The capital outflow  $(1/r')\delta \hat{F}'$ .<sup>d</sup> The change in the foreign-currency value of domestic holdings of foreign bonds  $(1/r')dF'$ .

TABLE A.2b

## EFFECTS OF EXTERNAL DISTURBANCES WITH TRADE IN FOREIGN BONDS AND FLEXIBLE EXCHANGE RATES

<i>Effect on</i>	<i>Effect of Increase in</i>	
	<i>Demand for Exports</i>	<i>Foreign Interest Rate</i>
Short run:		
Income	$(1/Q_\pi)\lambda^s E_\pi L_r < 0$	$(1/Q_\pi)[\lambda^s E_r' e_\pi + (e_\pi + \lambda^s E_\pi)\lambda^j F_r]L_r \geq 0$
Interest rate ( <i>r</i> )	$-(1/Q_\pi)\lambda^s E_\pi L_y < 0$	$-(1/Q_\pi)[\lambda^s E_r' e_\pi + (e_\pi + \lambda^s E_\pi)\lambda^j F_r]L_y \geq 0$
Foreign bond holdings <sup>c</sup>	$-(1/Q_\pi)\lambda^s \lambda^j E_\pi L_y F_r > 0$	$-(1/Q_\pi)\lambda^s [e_\pi (E_r + E_r')L_y - U_\pi L_r] \lambda^j F_r > 0$
Exchange rate	$-(1/Q_\pi)(\lambda^s H - \lambda^j F_r L_y) < 0$	$-(1/Q_\pi)[\lambda^s (E_r + E_r') \lambda^j F_r L_y - L_r (\lambda^j F_r E_y + M_y \lambda^s E_r')] \geq 0$
Long run:		
Income	$(1/H^\pi) E_\pi L_r < 0$	$(1/H^\pi) e_\pi L_r (E_r' + F_r) \geq 0$
Interest rate ( <i>r</i> )	$-(1/H^\pi) E_\pi L_y < 0$	$-(1/H^\pi) e_\pi L_y (E_r' + F_r) \geq 0$
Foreign bond holdings <sup>d</sup>	$-(1/H^\pi) E_\pi F_r L_y > 0$	$-(1/H^\pi) [e_\pi (E_r + E_r') L_y - U_\pi L_r] F_r > 0$
Exchange rate	$-(1/H^\pi)(H - F_r L_y) < 0$	$(1/H^\pi) M_y L_r (E_r' + F_r) \geq 0$

See corresponding notes to Table A.2a.

TABLE A.3

EFFECTS OF FISCAL AND MONETARY POLICIES AND OF AN INCREASE IN DEMAND FOR EXPORTS WITH PERFECT SUBSTITUTABILITY BETWEEN FOREIGN AND DOMESTIC BONDS ( $-Fr \rightarrow \infty$ ) AND FLEXIBLE EXCHANGE RATES\*

Effect on	Effect of		
	Fiscal Policy <sup>a</sup>	Monetary Policy <sup>b</sup>	Increase in Exports
Short run:			
Income	0	$(1/q\lambda^h L_y)$	0
Interest rate ( $r$ )	0	0	0
Foreign bond holdings <sup>c</sup>	$-(1 - \lambda^s W_y) \left( \frac{e_\pi}{e_\pi + \lambda^s E_\pi} \right)$	$(1/q\lambda^h L_y) \left( \frac{\lambda^s U_\pi}{e_\pi + \lambda^s E_\pi} \right)$	$\left( \frac{\lambda^s E_\pi}{e_\pi + \lambda^s E_\pi} \right)$
Exchange rate	$-(1 - \lambda^s W_y) \left( \frac{1}{e_\pi + \lambda^s E_\pi} \right)$	$(1/q\lambda^h L_y) \left( \frac{E_y}{e_\pi + \lambda^s E_\pi} \right)$	$-\left( \frac{1}{e_\pi + \lambda^s E_\pi} \right)$
Long run:			
Income	0	$(1/qL_y)$	0
Interest rate <sup>e</sup> ( $r$ )	0	0	0
Foreign bond holdings:			
In foreign currency <sup>d</sup>	-1	$(1/qL_y)(U_\pi/e_\pi)$	$(E_\pi/e_\pi)$
In domestic currency <sup>e</sup>	-1	$(W_y/qL_y)$	0
Exchange rate	0	$(1/qL_y)(M_y/E_\pi)$	$-(1/e_\pi)$

\* All expressions prefixed by minus signs are negative; all others are positive.

<sup>a</sup> The policies  $\delta\hat{Z}^a$  and  $(1/r)d^*B$ .    <sup>b</sup> The policies  $\delta\hat{Z}^b$  and  $(1/r)d^*B$ .

<sup>c</sup> The capital outflow  $(1/r')\delta F^j$ .

<sup>d</sup> The change in the foreign-currency value of domestic holdings of foreign bonds  $(1/r')\delta F^j$ .

<sup>e</sup> The change in the domestic-currency value of domestic holdings of foreign bonds  $(1/r')dF^j + E_\pi d_\pi$ .

shown in Table A.3. As  $Q_\pi \rightarrow \infty$  when  $-Fr \rightarrow \infty$ , asset substitution dwarfs the wealth effect  $E_\pi$  in all income and interest-rate responses to a shift in foreign demand. The domestic interest rate cannot differ from the foreign rate, and a change in the foreign demand for exports cannot affect domestic income. Perfect substitutability leads again to perfect insulation.

All the income terms in Table A.3 are in fact identical to those in Table 4 of the text, where the foreign demand for domestic bonds was perfectly elastic. The short-run changes in  $F^j$  and  $\pi$ , however, are always smaller than the corresponding terms in Table 4. This is because changes in  $\pi$  accomplish directly part of each desired change in the home-currency value of the foreign bonds held by commercial banks. There is, then, less scope for changes in capital flows, and smaller changes in these flows call in turn for smaller changes in the exchange rate.<sup>6</sup>

<sup>6</sup> With deficit spending, the capital inflow declines by  $(1 - \lambda^s W_y)[\lambda^s E_\pi / (e_\pi + \lambda^s E_\pi)]$ . With an open-market purchase, the outflow declines by  $(1/q\lambda^h L_y)E_y[\lambda^s E_\pi / (e_\pi + \lambda^s E_\pi)]$ . With an increase of foreign demand, there is a

When, of course, the flows  $F^i$  go to zero and the system reaches a new stationary state, the changes in  $\pi$  become identical to those in Table 4 and the cumulative changes in holdings of foreign bonds just suffice to offset the valuation changes caused by exchange-rate changes. (The changes in home-currency values shown on the penultimate line of Table A.3 are equal but opposite in sign to the changes in foreign holdings of domestic bonds shown in Table 4 of the text.)

Consider, next, the consequence of an increase in the foreign interest rate. As in the pegged-rate case above, the sign of the change in the domestic interest rate is ambiguous; it depends on the relative sizes of the wealth effect  $E_r'$  and the substitution effect  $F_r$ , and approaches unity as  $-F_r \rightarrow \infty$ . The sign of the change in the exchange rate also depends on the relative sizes of  $E_r'$  and  $F_r$ . In the short run, it is equal to  $-(1/q)(Q/\lambda^h Q_\pi)$  times the change in reserves under pegged exchange rates; in the long run, it is  $-(1/q)M_y(H'/H^*)$  times the corresponding change in reserves. In short and long runs alike, moreover, perfect substitutability produces a depreciation. Here, however, an increase in the foreign interest rate causes a permanent change in income. When  $F_r = 0$ , it reduces income; when  $-F_r \rightarrow \infty$ , it raises income.<sup>7</sup>

Notice, finally, that the pattern of policy effects in Table A.2a tends again to lie between the two extremes described by the tables in the text. When foreign and domestic bonds are not substitutes, the signs of the effects of fiscal policy are the same as those in Table 2 (and those of monetary policy would also be the same if, in addition,  $U_\pi$  were always larger than  $e_\pi F_L L_y$ ).<sup>8</sup> When the two bonds are partial substitutes, there is only one new outcome. Deficit spending can cause the exchange rate

capital outflow,  $[\lambda^h E_\pi / (e_\pi + \lambda^h E_\pi)]$ , in Table A.3 and no capital flow in Table 4 of the text. With deficit spending, then, the appreciation of the exchange rate is reduced by  $(1/e_\pi)$  times the reduction in the capital inflow, to a fraction  $[e_\pi / (e_\pi + \lambda^h E_\pi)]$  of the appreciation shown in Table 4. The same fraction applies to the changes in  $\pi$  caused by an open-market purchase and by a shift in the foreign demand for exports.

<sup>7</sup> The permanent increase of income caused by a rise in  $r'$  reflects the effects of perfect substitutability on the domestic interest rate and the long-run requirement that desired money holdings equal actual holdings. An increase in  $r'$  raises  $r$  by the same amount, reducing desired money holdings. As actual holdings cannot change under flexible exchange rates, income must increase by  $-(L_r/L_y)dr'$  to stabilize desired holdings.

<sup>8</sup> This more stringent condition reflects the effect of monetary policy on the banks' desired holdings of domestic and foreign bonds. An open-market purchase raises their desired holdings of domestic bonds by  $(1/q)[1 - (q + F_L)](1/r)dB^*$ . The larger  $F_r$ , the smaller the increase, and the smaller the decline in the domestic interest rate.

to appreciate (just as it can cause reserves to increase under pegged exchange rates). And when the two bonds are perfect substitutes, fiscal and monetary policies have effects similar to those shown in Table 4 of the text. There is just one difference between the policy outcomes in Table A.3 and those in Table 4. The former include the wealth effect  $E_\pi$  (which cannot affect the sign of any outcome when, as here, foreign and domestic bonds are perfect substitutes).

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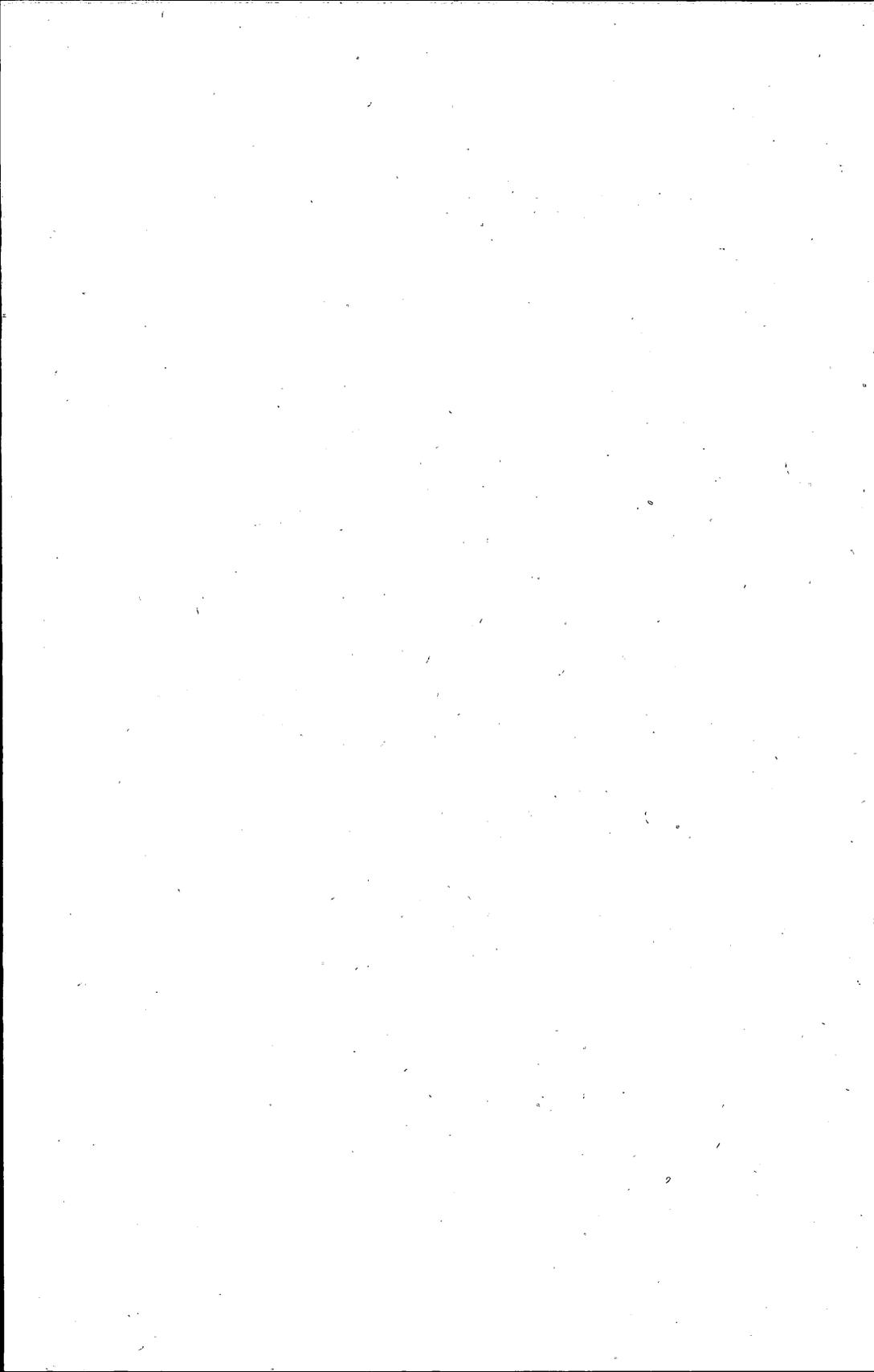
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