PRINCETON STUDIES IN INTERNATIONAL FINANCE NO. 25

Financial Capital Flows in the Balance of Payments of the United States: an Exploratory Empirical Study

Ralph C. Bryant
and
Patric H. Hendershott

INTERNATIONAL FINANCE SECTION
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FINANCIAL CAPITAL FLOWS IN THE BALANCE OF PAYMENTS OF THE UNITED STATES: AN EXPLORATORY EMPIRICAL STUDY

I. INTRODUCTION

Despite the growing awareness within the United States of American balance-of-payments difficulties and other related international financial problems, surprisingly little empirical research has been done on the financial capital account in the balance of payments.[1] This state of affairs contrasts sharply with the volume of econometric work that has been or is presently being done on the determination of domestic interest rates, on the linkages between financial markets and expenditures on real goods and services, and even on the impact of prices and real expenditures on the current account in the balance of payments.

An econometric study of international capital movements should, like any econometric study, be composed of three parts. A relevant set of specific economic theories, or postulates, must be selected. The abstract theory must be applied to the particular behavioral units being analyzed, and empirical counterparts to the theoretical constructs must be obtained. Finally, the behavioral relationships themselves must be estimated.

Existing studies of international capital movements are weak in each of these three areas. Most importantly, many studies have been based on very weak theoretical foundations. Posited behavior has in some cases clearly been inconsistent with utility-maximizing behavior. Further, no study has provided a general framework that allows for the impact of governmental restrictions on capital flows, an impact of substantial importance in the last decade or two. Our theoretical framework is presented in Chapter II.

[1] In this study we use the expression "financial capital account" or "financial capital flows" to connote all parts of the capital account in the balance of payments other than direct investments. The main published empirical work on the financial capital account of which we are aware is that of Arndt [1], Bell [7], Black [8], Branson [9], Hawkins [15], Kenen [20], Prachowny [26], Rhomberg [28] and Stein [29]; see References at the back. We have also seen some unpublished research by Peter Kenen, by Sung Kwack, by Arthur Laffer, by John Patrick, and have recently received a draft of a paper by Miller and Whitman [23]. This last paper, like our theoretical framework in Chapter II, draws on the portfolio approach to the demand for and supply of financial instruments.

The most difficult and possibly most important problem that arises in applying theory to empirical data in the area of international finance is the problem of *sufficiently* taking into account institutional, governmental, and cultural differences among different regions of the world. Differences of negligible importance for this analysis ought, of course, to be ignored, but those that importantly affect the capital flows being studied must be taken into account. Many studies, especially those that have used highly aggregated data, have largely ignored this facet of the problem. The time series of the dependent variables employed have often been taken indiscriminately from the summary table of the balance of payments of the United States or from summary tables on capital flows. Many theoretically relevant independent variables, which were not available at the same level of aggregation, have been excluded altogether. Chapter III contains a brief summary of developments in the financial capital account of the United States in the 1959–68 period, and considers the question of the appropriate type and level of disaggregation in more detail. Chapter III also explains why we have focused our exploratory empirical efforts on capital flows to Japan.

Chapter IV is a detailed discussion of the problems that arise in applying our theoretical framework to Japanese short-term borrowing from the United States.

The difficulties of estimation that arise in econometric studies generally —for example, the problems of estimating simultaneous relationships, nonlinear relationships, and lagged relationships—also exist in econometric studies of international capital movements. The problem of errors in measurement may be, if anything, more severe when working with data on capital movements (see Appendix B). These difficulties, too, have frequently been ignored in international studies.[2] This shortcoming, however, is not as serious as are weaknesses in the theory and its application. One can often obtain adequate estimates without using the most sophisticated estimation techniques if his theory and empirical application are correct, but it is difficult to imagine obtaining adequate estimates with any estimation technique if the theory or application is faulty. Moreover, inadequate theory or inadequate empirical application of theory are more often than not the direct causes of difficulties in estimation.[3] Our

[2] Two important exceptions are Stanley Black's treatment of simultaneous-equations and errors-of-measurement bias [8, especially pp. 51–56] and William Branson's investigation of lagged responses [9].

[3] Simultaneous-equations bias can be attributed in part to inadequate specification, which in turn causes estimation problems (see Appendix A). Inadequate specification is also the most frequent cause of serial correlation of the residuals.

empirical results, which are reported in Chapter V, reflect this ordering of priorities. In particular, we do not attempt in this study to correct for simultaneous-equations bias or to estimate lagged responses. We do, however, obtain nonlinear estimates as required by our theory.

In order not to mislead our readers, we should state at the outset that this study is not intended primarily to be a direct contribution to a detailed empirical analysis of the financial capital account. We have deliberately avoided an objective so ambitious—and at this point so unattainable—as an empirical investigation of the entire financial capital account. Rather our purpose is to outline a sound analytical framework for studying international capital flows and to show in a sample application that this framework can yield promising results.

II. DEMAND AND SUPPLY OF FINANCIAL INSTRUMENTS: THE THEORETICAL FRAMEWORK

Ideally in an approach to a study of international capital flows, one would want to specify both American and foreign demand and supply functions for each financial instrument (or homogeneous group of financial instruments) that is held or issued internationally. In addition, one would want to specify demand and supply functions for all the major financial instruments in the important industrial countries that are not held or issued internationally.[1] Such an approach would make it possible to capture all the simultaneous interactions of financial behavior. If pursued rigorously, however, this ideal approach would obviously lead to a model encompassing the entire balance of payments of the United States and all domestic and international financial markets. Given the level of disaggregation likely to be necessary in such a model, the number of international capital-flow equations, not to mention other equations in the model, would be extremely large.

Short of such an ideal approach, one could specify only the structural foreign demand equations (for financial assets held in the United States) and supply equations (of foreign financial liabilities to the United States) and then attempt to estimate the structural equations, ignoring all or nearly all simultaneous interactions between American and foreign behavior.[2] This is clearly the only possible procedure for an exploratory study such as ours. Only after extensive exploratory research has been successfully completed would one want to pursue the preferred but much more ambitious approach of estimating many simultaneous equations embedded in a multi-region financial model of the world.

We discuss below the arguments and the form of structural demand and supply equations which we feel have general applicability in the analysis of international financial transactions. First, a long-run desired relationship is specified. Then the treatment of some factors that cause discrepancies between desired and actual quantities, such as governmental restrictions on capital flows, is discussed. Finally, we present a short

[1] It would be necessary to specify all of these "domestic" demand and supply functions, since any shifts in or movements along the functions tend to have significant impacts on the demand or supply of internationally held financial instruments.

[2] A brief discussion of the problem of simultaneous-equations bias is given in Appendix A. See Black [8] for an excellent treatment of simultaneous-equations bias in the context of a model of the spot and forward-exchange markets.

analysis of the estimation of equations by which an initially determined aggregate financial quantity can be subdivided into its components.

A. *Structural Equations for Long-run Desired Quantities*

In the basic microeconomic relationship underlying our approach we express the desired quantity of a financial instrument (or an aggregate of similar financial instruments) as a function of a scale variable S, a vector of expected effective borrowing rates RB, a vector of expected effective lending rates RL, a vector of risks associated with each of the expected interest rates σ, and a vector of noninterest-rate distribution variables X that are also relevant to the desired demand or supply:

$$F^* = f(S, RB, RL, \sigma, X). \tag{2.1}$$

The intellectual lineage of this formulation goes back at least to the well-known works on portfolio choice by Markowitz [22] and Tobin [32] [33]. In these works the expected return and the "risk" associated with any given asset are taken to be the mean and the standard deviation (or variance) of the subjectively-determined probability distribution associated with investing in that asset.[3] This simplifying assumption allows one to derive strong and usually plausible conclusions about efficient portfolio selection, in particular the conclusion that maximization of expected utility will lead to portfolio diversification.[4]

A scale variable is that variable which, together with the utility function of the economic unit and the other variables in equation (2.1), determines the scale (total size) of the unit's portfolio of assets. Typically the net worth of the unit is assumed to serve this function.[5] If the economic unit has no

[3] The selection of an optimum portfolio of assets also requires explicit consideration of the covariances of the returns on the individual assets. The Markowitz–Tobin "mean-variance" framework is not without its problems. It is consistent with the theory of expected utility maximization only if utility functions can be closely approximated by quadratics, or alternatively, if all the subjective probability distributions are normal. See [22, Chaps. X and XIII]; and [33, pp. 14–21]. Moreover, use of the variance, or standard deviation, as the only measurement of risk implies an equal aversion to all extreme returns, even if they are favorable—obviously an unappealing assumption.

[4] The same analysis can be readily adapted to explain the diversification of liabilities. In this case, disutility is attached both to the expected cost of borrowing and to the risk of the actual cost being greater than the expected cost. Given the size of total liabilities, minimization of disutility will lead in the general case to the issuance of more than one type of liability. For example, one might hedge against possible future increases in borrowing rates by long-term borrowing even if the expected cost of short-term borrowing is less, or against possible future decreases in rates by short-term borrowing, even if the expected cost of long-term borrowing is less.

[5] For households the use of net worth as a scale variable requires that income be predetermined (that is, that it be based on past decisions) and that the saving-con-

liabilities (that is, if expected returns from investing do not exceed the expected costs of borrowing by enough to overcome the risk aversion of the unit), total assets equal net worth. In the more general case where expected asset yields exceed expected liability costs by an amount sufficient to make borrowing desirable, the unit will have a determinate scale if its marginal utility of wealth is nonincreasing and if it has aversion to risk.[6] Given constant net worth, continued proportionate expansion of an economic unit's assets and liabilities implies greater and greater risk of insolvency or actual bankruptcy; a smaller and smaller percentage capital loss on assets is sufficient to eliminate the unit's net worth. The unit will only expand (issue liabilities and purchase assets) on a given net-worth base until the disutility of this increasing risk equals the declining marginal utility of wealth.[7] By reducing the risk associated with a portfolio of given size and composition, increases in net worth will lead to expansion of both assets and liabilities.

Assuming that assets are gross substitutes for each other, the demand for a financial asset is expected to be positively related to the own yield (an element in the vector *RL*) and negatively related to all other borrowing and lending rates. Similarly, if liabilities are gross substitutes, the supply of a financial liability should be negatively related to the own yield (an element of *RB*) and positively related to all other borrowing and lending rates. Furthermore, in line with the risk-aversion assumption, asset demand should be negatively related to the risks associated with the own yield and borrowing rates and positively related to those associated with other lending rates; similarly, liability supply should be negatively related to the risks associated with the own borrowing rate and the lending rates and positively related to those associated with other borrowing rates.

We emphasize the expected *effective* rates of return because of the existence of different tax treatments of interest income or expense (including such phenomena as the U.S. Interest Equalization Tax), of various forms of private or governmental credit rationing or interest-rate controls which make some quoted rates meaningless, and of the cost of forward-exchange

sumption decision be conceptually distinguished from balance-sheet decisions. For firms, it requires that profits be predetermined and that the dividend-retained earnings decision be conceptually distinguished from balance-sheet decisions.

[6] Firms will not have a determinate scale if they operate under constant or increasing returns to scale and if capital markets are perfect. Under such conditions the firm would issue additional equity and expand assets (and possibly liabilities) until either decreasing returns to scale set in or the firm's activities reach such proportions that the price of equity or the return on assets falls.

[7] The borrowing rates relevant to this economic unit will also, of course, be significantly affected by the scale of the unit relative to its net worth.

cover. Risks associated with the lending yields and borrowing costs include exchange-rate risks and risks of changes in asset and liability prices.

An example of a noninterest-rate distribution variable that is relevant to the demand and supply of financial instruments is national income, which serves as a proxy for income-account transactions. Given a basic transactions demand for money, an increase in national income should lead, ceteris paribus, to a substitution of money for other financial assets in asset portfolios and to an increase in total asset portfolios funded by additional liability issues.

We have chosen thus far to modify equation (2.1) by assuming that the desired function is homogeneous of degree one in the scale variable and noninterest-rate distribution variables, that is, that an increase of x per cent in S and X will, ceteris paribus, raise F^* by x per cent:

$$F^* = g\left(RB, RL, \sigma, \frac{X}{S}\right) S. \tag{2.2}$$

This particular assumption cannot, so far as we know, be directly justified in terms of the Markowitz–Tobin theory, since in general investors' preferences for risk must be expected to vary with the scale variable. A doubling of the scale variable and all noninterest-rate distribution variables, with all returns and risks unchanged, might not therefore lead to a straightforward proportionate doubling of all asset and liability holdings.[8]

[8] In the general case analyzed in the mean-variance framework, with the scale variable being wealth, the amount of any particular asset or liability held will depend on the investor's utility function and its derivatives (and hence on the wealth elasticity of the investor's preferences for risk versus expected return). In the *special* case where there is a riskless asset, Tobin has shown [32] [33] that the proportions in which risky assets (or liabilities) will be held in the portfolio will be independent of the utility function. For this special case, where F_i^* and F_j^* are any two of the risky assets and where there are zero covariances between the returns on the various assets, the result is:

$$\frac{F_i^*}{F_j^*} = \frac{(r_i - r_1)\sigma_j^2}{(r_j - r_1)\sigma_i^2}.$$

In this expression, r_1 is the return on the riskless asset; r_i, r_j, σ_i^2, and σ_j^2 are the expected returns and variances for assets i and j. For this special case, see also Hicks [18, p. 801]. If the ratio F_i^*/F_j^* is invariant to the utility function, it will also clearly be independent of the size of the portfolio. This fact suggests that one might theoretically justify the linear-homogeneity assumption used in the text if he could realistically assume little covariation among returns and if he were to define the scale variable as net worth *minus* the amount of riskless assets held in the portfolio; that is, $S = \sum_{i=2}^{n} F_i^* = NW - F_1^*$, where F_1^* is the desired quantity of riskless assets). We are grateful to Guy Stevens for his helpful discussions of this question with us and for letting us read his as yet unpublished manuscript, "Risk and Return and the Selection of Foreign

On the other hand, the assumption of linear homogeneity in the scale variable has an important advantage compared with some other specifications (see the next paragraph). We regard (2.2) as a practical modification of (2.1) which, given the present state of our theoretical and empirical knowledge, is as plausible as any other specific modification we might have made.[9]

The function (2.2) has the highly appealing attribute of making the impact of increments in the scale variable on the desired quantity dependent on the levels of the interest rates and the impact of changes in the interest rates dependent on the level of the scale variable. These responses can be shown by taking the first difference of equation (2.2):

$$(2.2)' \quad \Delta F^* = g\left(RB, RL, \sigma, \frac{X}{S}\right)\Delta S + S_{-1}\Delta g\left(RB, RL, \sigma, \frac{X}{S}\right),$$

since $\Delta(AB) = A\Delta B + B_{-1}\Delta A$. Equation (2.2)′ implies that in a growing (or declining) economic world—$\Delta S \neq 0$—changes in interest rates or risks bring about both "existing-stock" (the second term) and "continuing-flow" (the first term) impacts on capital flows. Given a "once-for-all" change in interest rates or risks, the existing-stock effect produces capital flows that are also once-for-all in nature (a reallocation of existing portfolios), while the continuing-flow effect persists indefinitely as long as $\Delta S \neq 0$. The continuing-flow effect follows from positing a multiplicative interaction of the interest rates with the scale variable in equation (2.2) rather than simply entering the rates and the scale variable as separate determinants. Both existing-stock and continuing-flow responses are reasonable. They imply that how one distributes an increase in wealth among different assets depends on the yields on the assets, and that how much one adjusts his existing portfolio in response to a given change in yields depends on the size of the portfolio.

In some of the early empirical work on capital flows, a serious theoretical error was made in relating capital *flows* to levels of interest rates.[10] This

Investments," which takes up some of the problems involved in applying the Markowitz–Tobin framework to foreign direct investments.

[9] See de Leeuw [11, pp. 471–72] for a brief discussion of the linear-homogeneity assumption in specifying demand and supply equations for financial instruments. This assumption has also been employed by Brainard and Tobin [6].

[10] Arndt [1], Hawkins [15], Kenen [20], Laffer [21], Powrie [24], Prachowny [26], Rhomberg [28], and Stein [29] have all reported equations containing this incorrect specification. Bell [7, contrast the form of the equations in Appendices II and III] and Black [8, contrast Models I and II] are also unclear on the issue. This stock-flow error has also been prevalent in many of the theoretical contributions to the internal-

"flow-theory" of capital movements has no theoretical justification; it leads to the ridiculous conclusion that desired equilibrium stocks of capital depend on the sum (integral) of the current and all past values of the relevant interest rates and thus that interest-rate elasticities are infinite. An alternative specification sometimes employed has related capital flows to changes in the levels of interest rates.[11] This formulation might approximate what we have termed the existing-stock responses, but it disregards the continuing-flow effects.

B. *Discrepancies between Observed and Long-run Desired Quantities*

If observed holdings of financial instruments always equaled long-run desired holdings, equation (2.2) would illustrate the general form of our structural equations. Equation (2.2) will not be valid, however, if nonprice mechanisms clear markets, and this phenomenon seems to be more the rule than the exception in markets involving international transactions. While the importance of "private" credit rationing (by commercial banks, for example) is unclear, there can be no doubt about the prevalence of "credit rationing" via governmental controls. While the United States is a relatively recent postwar practitioner of this art, other countries have often placed restrictions or regulatory devices on capital flows.[12] The controls can take the form of restricting either capital outflows, such as American efforts to improve its balance of payments, or capital inflows, such as Japanese measures to prevent an inflow of funds from undercutting Japan's efforts to combat domestic inflationary pressures.

If capital controls are strictly binding on all economic units, the desired quantity framework described above becomes quite hypothetical. Capital outflows (or inflows) are what the government allows them to be; changes in economic determinants of capital holdings cannot have any impact on measured flows. But in most cases it is probably correct to assume that not all economic units are rigidly constrained in their behavior by the controls. For example, some American banks in the Voluntary Foreign Credit Restraint Program undoubtedly could and would

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external-imbalance literature, where capital flows are said to depend on the level of interest rates. For an early clarification of the stock-flow controversy generated by the empirical work of Bell [7], Kenen [20], and Stein [29], see Hendershott [16]. For a recent criticism of the incorrect inferences of the "flow theory" for interest-rate policy to correct an external imbalance, see Willett and Forte [34].

[11] See, for example, Branson [9].

[12] For a survey of capital controls in western Europe see Mills [25].

extend more loans to foreigners if the loans were to become relatively more profitable (the "voluntary" nature of the American program makes this particularly likely). In general, tightening and relaxing of controls, respectively, will reduce and increase the response of desired quantities to changes in their economic determinants.

This view of the impact of capital controls can be formalized by expressing the observed quantity of an international financial instrument as a fraction α of the short-run desired quantity F^s[13]

$$F = \alpha F^s; \quad 0 < \alpha \leq 1, \tag{2.3}$$

where α equals unity when the controls are absent or not binding at all and is less than unity when the controls keep the observed quantity below the desired quantity.[14] The fraction α itself can be written as a function of variables reflecting the capital controls. Letting C_i denote the ith such variable and β_i its impact on α, we arrive at a linear approximation of a more general function:

$$\alpha = 1 + \Sigma\beta_i C_i > 0; \quad C_i \geq 0, \beta_i < 0.\text{[15]} \tag{2.4}$$

The measurement of α in any given application of this theoretical framework will obviously not be simple. First, the variables that are proportional to the impact of the capital controls, the C_i's, must be identified or constructed. Second, the proportionality factors, the β_i's, must be estimated by some method other than simple linear regression, since α interacts with all of the determinants of the desired quantity of the financial instruments. (We discuss the estimation problems in Chapter V.) Despite the difficulties involved, we regard the measurement of α as a necessary part of the investigation of the determinants of many international capital movements. Substantial specification errors will often occur in the estimation of structural equations if capital restrictions are either ignored or inadequately dealt with.[16]

[13] This formula results in the same appealing attribute (and for the same reason) as the assumption employed in (2.2) of linear homogeneity in the scale variable. The impact of changes in control programs on observed holdings depends on the level of desired holdings and the impact of changes in desired holdings depends on the extent to which controls are binding.

[14] If one were dealing with capital controls which government authorities use to stimulate capital outflows, α could conceivably be allowed to take on values greater than 1.

[15] We are grateful to Peter Tinsley for several very helpful discussions on the research described in this paper. In one of the discussions he made the important suggestion that we experiment with this formulation of the impact of capital controls.

[16] A popular method of handling temporary phenomena such as capital controls is to add dummy variables that equal zero when the "ordinary" regime is operating,