Impact of foreign capital inflow on domestic savings...

339.43 Harvard University.
W433 Impact of foreign capital inflow on domestic savings in underdeveloped countries. Thomas E. Weisskopf.
July 1970.
11 p.
Bibliography throughout.
Economic Development Report no. 156.
Contract no. AID/csd-1543.

1. Saving and investment. 2. Models, Economic. 3. Capital. I. Weiss- kopf, Thomas E. II. Contract. III. T . IV. Constraints on growth of underdeveloped countries.

PN-ABI 389
ISN 72267

# THE IMPACT OF FOREIGN CAPITAL INFLOW ON DOMESTIC SAVINGS IN UNDERDEVELOPED COUNTRIES

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Economic Development Report No. 156.

July 1970.

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# THE IMPACT OF FOREIGN CAPITAL INFLOW ON DOMESTIC SAVINGS IN UNDERDEVELOPED COUNTRIES

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This paper was prepared for presentation at the Second World Congress of the Econometrics Society at Cambridge, England, in September, 1970. The research was sponsored by the Harvard Project for Quantitative Research in Economic Development through funds provided by the United States Agency for International Development, Contract CSD-1543, and by the National Science Foundation, Grant GS 1914.

I am indebted to Shankar Acharya, Samuel Bowles, Hollis Chenery and Moises Syrquin for helpful comments and suggestions, and I am especially grateful to Shankar Acharya for his assistance with the computational work.

## I. INTRODUCTION

The objective of this paper is to test the hypothesis that the level of domestic savings in underdeveloped countries is behaviorally related not only to the level of national income, but also to the level of net foreign capital inflow. The accounting relationship that equates investment with the sum of domestic and foreign savings suggests that the two forms of saving are additive. Furthermore, most development planning models concerned with the role of foreign aid in underdeveloped economies assume that external resources add to the overall availability of savings, without in any way substituting for savings made available from domestic sources.[1] Domestic savings behavior is thus typically considered to be independent of foreign capital inflow.

Yet there are persuasive theoretical reasons for believing that an inflow of foreign capital should have a negative impact on domestic intentions to save. Foreign capital inflow represents an addition to the total supply of resources available to a country and thereby increases the possible magnitude of domestic expenditures. Any plausible utility function, balancing the immediate benefits derived from current consumption and the future benefits to be derived from current investment, would lead to a marginal allocation of expenditures partly to consumption and partly to investment. But to the extent that private or public decision-makers wish to use the additionally available external resources to increase private or public consumption, there will be a decline in intended domestic savings, for domestic income remains unchanged. Thus a case in which foreign capital inflow had no impact on domestic savings behavior would appear to be extreme rather than typical.[2]

Two attempts to apply statistical evidence to this question have supported the view that domestic savings is inversely associated with foreign savings. Using cross-country data for 31 underdeveloped countries for the year 1962, Rahman[3] obtained the following estimated relationship:

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[1]See, for example, H.B. Chenery and A.M. Strout, "Foreign Assistance and Economic Development," American Economic Review, Sept. 1966, pp. 679-733.

[2]The same point has been persuasively argued in K.B. Griffin and J.L. Enos, "Foreign Assistance: Objectives and Consequences," Economic Development and Cultural Change, April 1970, pp. 313-327, and demonstrated mathematically in Md. A. Rahman, "The Welfare Economics of Foreign Aid," Pakistan Development Review, Summer, 1967.

[3]Md. A. Rahman, "Foreign Capital and Domestic Savings: A Test of

$$S/Y = .14 - .25\ F/Y \quad (t = 2.6)$$

where S, F and Y represent domestic savings, foreign capital inflow and gross national product. A similar regression carried out by Griffin and Enos[4] with data for 32 countries for the three-year period 1962-64 yielded a more striking inverse relationship:

$$S/Y = .11 - .73\ F/Y \quad (t = 6.6)$$

Such results are suggestive but not conclusive. In the first place, the authors failed to exclude from the regressions countries for which there was a net outflow of capital. Where the flow of capital is outward, one would expect the causality to run from domestic savings to the capital flow rather than the other way round. Secondly, the authors did not address themselves to the question of whether the level of domestic savings observed in each country reflected an *ex ante* behavioral function or merely an *ex post* accounting relationship. It will be argued below that this distinction is extremely important.[5]

The present paper seeks to study the relationship between foreign capital inflow and domestic savings by examining time series evidence from a sample of 44 underdeveloped countries during the recent postwar period. In order to do this, it will be necessary first in Part II to introduce a simple analytical model of a capital-receiving country. This model is used to develop a test to distinguish those countries in which a behavioral savings function can be econometrically identified from those in which it cannot. In Part III, the empirical results of this test are presented and savings functions are estimated where appropriate to determine the impact of foreign capital inflow on domestic savings behavior. The paper concludes with a brief summary in Part IV.

## II. THE MODEL

The model to be presented here is an aggregative model of an economy based on standard macroeconomic relationships and embodying the two independent constraints on growth that have been emphasized in the

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Haavelmo's Hypothesis with Cross-Country Data," *Review of Economics and Statistics*, Feb. 1968, pp. 137-138.

[4]K.B. Griffin and J.L. Enos, *op. cit.*

[5]See Part II, p. 6.

literature on "two-gap analysis."[6] Such a model is necessary for an evaluation of the role of foreign capital because foreign capital inflow contributes both to the potential availability of savings, thereby easing the savings constraint, and to the potential availability of imports, thereby easing the trade constraint. It turns out that the identification of a behavioral savings function depends upon which of the constraints is in fact binding for a given country during the time period in question.

The model consists of seven equations in nine variables, and three inequality constraints which limit the remaining two degrees of freedom.[7] The first three equations are the macroeconomic accounting identities:

$$(1)\quad Y + M = C + I + E$$

$$(2)\quad S = Y - C$$

$$(3)\quad F = M - E$$

where Y is defined as gross domestic product, M is total imports, C is consumption, I is gross investment, E is total exports, S is gross domestic savings and F is net foreign capital inflow.[8] A behavioral savings function of the following form is introduced.

$$(4)\quad S^* = a + bY + cF + dE$$

where S* is *ex ante* gross domestic savings (as distinct from the *ex post* variable S), and the parameter c describes the marginal impact of foreign capital inflow on *ex ante* domestic savings. *Ex ante* imports, defined as the minimum level of imports required to sustain the current level of production, and investment is given by

$$(5)\quad M^* = \alpha + \beta Y + \gamma I$$

where the parameter $\beta$ represents the marginal imported input content of domestic production and $\gamma$ the marginal imported capital good content of domestic capital formation. The total value of export earnings and the net availability of foreign capital are considered exogenous to the model and defined accordingly:

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[6] See, for example, H.B. Chenery and A.M. Strout, *op. cit.*, and R. McKinnon, "Foreign Exchange Constraints in Economic Development and Efficient Aid Allocation," *Economic Journal*, June 1964, pp. 388-409.

[7] The model presented here is the same one that is discussed in much greater detail in T.E. Weisskopf, "An Econometric Test of Alternative Constraints on the Growth of Underdeveloped Countries," Economic Development Report #155, Project for Quantitative Research in Economic Development, Harvard University, June, 1970, Part III. It is similar to other "two-gap" models that have appeared in the literature on economic development, resembling most closely the one described in R. McKinnon, *op. cit.*, Part II-B, pp. 392-396.

[8] All of the variables are assumed to carry the same time subscript 't', which is omitted to simplify the exposition.

(6) $E = \bar{E}$

(7) $F = \bar{F}$

The three inequalities include first of all the savings and trade constraints relating ex post to ex ante savings and imports:

(8) $S \leq S^*$

(9) $M \geq M^*$

The third inequality limits the value of gross domestic product to the exogenously given productive capacity of the economy ($\bar{Y}$):

(10) $Y \leq \bar{Y}$

The reasons for preferring this particular specification of a two-gap model to other possible alternatives have been discussed in detail elsewhere;[9] suffice it to mention one point here. The validity of the regressions to be carried out later depends critically on the assumption that foreign capital inflow (F) can indeed be regarded as exogenous. There is good reason to believe that foreign aid and foreign private investment are not endogenously related to any of the variables in the model.[10] Yet, because of the unavailability of more precise data, F is defined here as the trade deficit (M - E). F therefore includes also a component of compensatory short-term capital flows that arise specifically in response to short-run fluctuations in imports and exports. In order to minimize the significance of this unavoidable problem, the data are used in Part III in the form of three-year moving averages rather than single-year values.

By substituting equations (1) to (7) into inequalities (8) and (9), the model can be expressed in reduced form as three inequality constraints on the two endogenous variables I and Y. These three constraints are as follows:

(8') $I - bY \leq a + (1+c)\bar{F} + d\bar{E}$

(9') $I + \beta/\gamma\, Y \leq -\alpha/\gamma + 1/\gamma\, \bar{F} + 1/\gamma\, \bar{E}$

(10) $Y \leq \bar{Y}$

Together with non-negativity constraints on I and Y, inequalities (8'), (9') and (10) define a feasible two-dimensional region in I-Y space. Where a given country in a given year finds itself within this region depends both upon the shape of the feasible region and upon the relative weight placed upon I and Y in the relevant objective function for the country.

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[9] See T.E.Weisskopf, op. cit., Part III.

[10] It might be suggested that foreign aid flows more readily to countries when and where the need for it is indicated by low rates of domestic saving. For a convincing refutation of this proposition, see K.B. Griffin and J.L. Enos, op. cit.

It can be shown that under simplifying assumptions about the nature of the objective function, the optimal solution for a country will be located at a corner of the feasible region defined by the operation of two of the three inequality constraints.[11] Thus there are three possible cases, each of which is defined by a pair of binding constraints. Case I involves a binding savings constraint (8') and full capacity output (10). Case III involves a binding trade constraint (9') with full capacity output (10). The intermediate case II represents a hybrid situation in which both the savings (8') and trade (9') constraints are active at the cost of excess productive capacity.

The three alternative cases have different implications for the role of foreign capital inflow and its impact on gross investment. These implications can be explored by solving in each case the two simultaneous equations in I and Y corresponding to the binding constraints. The results are as follows, for cases I, II and III, respectively:

$$(11)\quad I = a + b\bar{Y} + (1 + c)\,\bar{F} + d\bar{E}$$

$$(12)\quad I = \lambda + \mu\bar{F} + \gamma\bar{E}$$

$$(13)\quad I = -\alpha/\gamma - \beta/\gamma\,\bar{Y} + 1/\gamma\,\bar{F} + 1/\gamma\,\bar{E}$$

where $\lambda = (a\beta - \alpha\beta)/(\beta + b\gamma)$

$\mu = ((1 + c)\beta + b)/(\beta + b\gamma)$

$\gamma = (d\beta + b)/(\beta + b\gamma)$

Equation (13) can be further simplified with the help of equation (3):

$$(13')\quad I = -\alpha/\gamma - \beta/\gamma\,\bar{Y} + 1/\gamma\,\bar{M}$$

The three different investment functions (11), (12), and (13') suggest a way of determining which of the three possible cases characterized a given country during a given period of time. The proposed test examines whether or not time series data for a given country during a given period yield estimated investment functions consistent with *a priori* expectations about the nature of the function in each of the three cases.

*A priori* knowledge about the range of permissible values for the original coefficients b, c, d, $\beta$ and $\gamma$ makes it possible to determine corresponding ranges of values for the coefficients in equations (11), (12) and (13'). It is clear from equations (4) and (5) that

[11] See T.E. Weisskopf, *op. cit.*, Part III.

$b \geq 0$, $c \leq 0$, $d \geq 0$, $\beta > 0$, and $\gamma > 0$. These ranges in turn imply that $\partial I/\partial \bar{Y} \geq 0$, $\partial I/\partial \bar{F} \leq 1$ and $\partial I/\partial \bar{E} \geq 0$ in equation (11); $\partial I/\partial \bar{F} > 0$ and $\partial I/\partial \bar{E} > 0$ in equation (12); and $\partial I/\partial \bar{Y} < 0$ and $\partial I/\partial \bar{M} > 1$ in equation (13'). The test as applied to a given time series thus involves three different regressions with investment as the dependent variable. After each regression, the numerical values of the estimated coefficients must be checked for consistency with the ranges noted above to determine which of the three cases - if any - is applicable to the country in question.

The importance of distinguishing between the three possible cases when studying the impact of foreign capital inflow on domestic savings can be seen by expressing equations (11), (12) and (13) in terms of savings rather than investment. Using the appropriate macroeconomic identities (1), (2) and (13) to substitute the variable S for I, the resulting equations are:

$$(12)\quad S = a + b\bar{Y} + c\bar{F} + d\bar{E}$$

$$(15)\quad S = \lambda + (\mu - 1)\bar{F} + \nu\bar{E}$$

$$(16)\quad S = -\alpha/\gamma - \beta/\gamma\ \bar{Y} + (1 - \gamma)/\gamma\ \bar{F} + 1/\gamma\ \bar{E}$$

It is clear that only in case I, when the savings constraint is active while the trade constraint is inactive, does *ex post* equal *ex ante* domestic savings and can the behavioral savings function defined in equation (4) be identified from observed time series data.[12] In case III, *ex post* saving is determined quite independently of the parameters b, c and d that characterize the *ex ante* savings function. In this case the binding trade constraint prevents *ex ante* saving from being fully realized *ex post*. In case II, the savings constraint is active, but the simultaneous operation of the trade constraint eliminates Y as an independent variable and results in a more complicated dependence of *ex post* saving on the variables F and E.

## III. THE RESULTS

Time series data on the relevant variables for a period of at least seven years were obtained from standard sources[13] for a sample

[12] That a binding savings constraint is required in order to estimate a savings function from time series data in a two-gap situation has been argued by J.C.H. Fei and G. Ranis in their "Comment" on H.B. Chenery and A.M. Strout, *op. cit.*, in the *American Economic Review*, Sept. 1968, pp. 897-916, esp. Part III, pp. 915-916.

[13] Data for all countries except India and Pakistan were compiled from United Nations, *Yearbook of National Accounts Statistics*, 1966 and 1967. In the case of India and Pakistan, specific country sources were used. The Indian data are based upon unpublished estimates prepared by the Perspective Planning Division of the Planning Commission, and the

of 44 underdeveloped countries.[14] The values for all variables were compiled originally at current domestic prices and subsequently converted to constant prices by means of a single gross domestic product deflator for each country.[15] The time series thus obtained were then converted into three-year moving averages for use in the regression analysis.

The 44 countries in the sample are listed in Table 1. Of these 44, six showed persistent trade surpluses during the periods for which data were available; these six were therefore eliminated from further consideration. The regressions required for testing the constraint cases were then carried out for the remaining 38 countries to which there was net foreign capital inflow. In some countries where the initial results were not conclusive, additional regressions were carried out on time series shorter than the full period for which data were available.[16] The time periods ultimately used for the purposes of classification, as well as the results of the test, are given in Table 1.

The criteria used for determining whether a given country during the period in question should be classified under case I, II or III, were as follows.[17] Where the estimated coefficients for the first investment function were all in the range consistent with case I, and the

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data for Pakistan were obtained from S.R. Lewis, Jr., "Domestic Saving and Foreign Assistance When Foreign Exchange is Undervalued," Research Memorandum No. 34, Center for Development Economics, Williams College, November 1969, Table A.

[14] For the purposes of the study, the "underdeveloped" countries were defined to include Israel, Puerto Rico, and all those countries except Japan whose per capita product in 1965 was less than $1000.

[15] It would be desirable in principle to make further adjustments to correct for possible distortions introduced by the use of an official exchange rate to convert values originally expressed in foreign exchange into domestic currency, when there is reason to believe that the official rate does not reflect the true value. It is shown in T.E. Weisskopf, op. cit., Appendix 2, that the bias introduced into the analysis when a domestic currency is over-valued is to over-state consistency with case III and under-state consistency with case I. Thus there is no danger on this score that a country might have been mistakenly classified under case I.

[16] A detailed description of the conditions under which additional regressions were undertaken and of the whole process of classification is given in T.E. Weisskopf, op. cit., Part IV.

[17] The rationale for the criteria used is discussed in T.E. Weisskopf, op. cit., Part IV. The criteria as developed in the earlier study are slightly more complicated and stringent than those described here, but the principle is the same and the end results are not significantly different.

TABLE 1

The Classification of Countries by Constraint Case

| Country | Time Period | Case |
|---|---|---|
| Argentina | 1954-65 | II |
| Barbados | 1953-59 | (Unclassifiable) |
| Bolivia | 1958-66 | (Unclassifiable) |
| Brazil | 1953-66 | III |
| Burma | 1953-62 | I |
| Ceylon | 1958-66 | (Unclassifiable) |
| Chile | 1960-66 | (Unclassifiable) |
| Colombia | 1953-66 | I |
| Costa Rica | 1957-65 | I |
| Cyprus | 1959-66 | III |
| Dominican Republic | 1955-66 | III |
| El Salvador | 1958-66 | II |
| Ghana | 1955-65 | I |
| Greece | 1953-66 | II |
| Guatemala | 1953-64 | III |
| Guiana | 1954-65 | I |
| Honduras | 1953-66 | I |
| India | 1950-65 | I |
| Iran | 1959-65 | (Trade Surplus) |
| Iraq | 1953-62 | (Trade Surplus) |
| Ireland | 1953-63 | III |
| Israel | 1953-64 | I |
| Jamaica | 1959-66 | (Unclassifiable) |
| Jordan | 1959-66 | I |
| Malaysia | 1955-65 | (Trade Surplus) |
| Malta | 1955-66 | I |
| Mexico | 1953-66 | I |
| Netherlands Antilles | 1957-65 | II |
| Pakistan | 1954-66 | III |
| Panama | 1960-66 | (Unclassifiable) |
| Paraguay | 1954-65 | III |
| Peru | 1954-64 | III |
| Philippines | 1953-62 | I |
| Portugal | 1954-64 | I |
| Puerto Rico | 1953-66 | I |
| South Africa | 1953-66 | (Trade Surplus) |
| South Korea | 1953-66 | I |
| Spain | 1955-64 | II |
| Taiwan | 1953-65 | I |
| Thailand | 1957-66 | II |
| Trinidad and Tobago | 1953-64 | (Trade Surplus) |
| Tunisia | 1960-66 | (Unclassifiable) |
| Uruguay | 1955-64 | I |
| Venezuela | 1960-66 | (Trade Surplus) |

estimated coefficients for the third investment function were not all in the range consistent with case III, the country was classified I. Where exactly the opposite was true, the country was classified III. Where the estimated coefficients for the second investment function were all in the range consistent with case II, and the estimated coefficients for neither the first nor the third investment function were all in the range consistent with cases I and III, the country was classified II. The seven countries where none of these conditions were satisfied for any time period of at least seven years were considered unclassifiable because of inadequate evidence.[18]

As shown in Table 1, 17 of the 31 countries that could be classified were found consistent with case I. There is therefore reason to believe that a behavioral savings function can be identified from time series data for the listed periods in these 17 countries. Accordingly, savings functions of the form described by equations (4) and (14) were estimated with the time series for the seventeen countries classified I, and the results are shown in Table 2.

The coefficient c represents the marginal response of *ex ante* domestic savings to a unit change in the level of net foreign capital inflow. Not surprisingly, the results in Table 2 show a uniformly negative response. This is to be expected since one of the requirements of consistency with case I was that the coefficient $\partial I/\partial \bar{F}$ in the corresponding investment function (11), which is equal to 1 + c, be less than or equal to one. What is of interest in the estimated savings equations is the *significance* of the negativity of c. The figures in Table 2 indicate that in eight of the 17 countries the negative value for c is significant at the 5% level, and in three more countries it is significant at 10%. Only in Colombia, Mexico and Uruguay is the absolute value of c so low as to cast serious doubt upon its negative value.[19]

In an effort to assess the average extent to which net foreign capital inflow substitutes for *ex ante* domestic saving, the time series data for the seventeen countries classified I were pooled into a single set of observations. With dummy variables to distinguish each of the countries, a pooled regression was then carried out to estimate the overall *ex ante* savings function. The result was as follows:

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[18] The initially available time series for these countries were among the shortest in the sample; a greater number of observations might have yielded more conclusive results.

[19] It should be noted that the bias introduced into the results by an over-valued domestic currency would tend to raise the estimated numerical value of c above its true value. Thus, to the extent that the domestic

TABLE 2

The Estimated Savings Functions S = a + bY + cF + dE

| Country | Time Period | a | b | c | d | $R^2$ |
|---|---|---|---|---|---|---|
| | | (t-ratios are given in parentheses) | | | | |
| Burma | 1953-62 | 99.2<br>(1.31) | 0.019<br>(0.61) | -0.484*<br>(-2.50) | 0.453<br>(0.94) | .964 |
| Columbia | 1953-66 | -280.1**<br>(-3.83) | 0.117**<br>(3.23) | -0.069<br>(-0.18) | 0.975**<br>(3.48) | .972 |
| Costa Rica | 1957-65 | -60.0*<br>(-2.54) | 0.342*<br>(2.83) | -0.584<br>(-1.25) | 0.072<br>(0.17) | .943 |
| Ghana | 1955-65 | -254.5*<br>(-2.46) | 0.197**<br>(3.51) | -0.765*<br>(-2.52) | 0.688**<br>(3.32) | .798 |
| Guiana | 1954-65 | -13.5<br>(-0.82) | 0.306<br>(1.37) | -0.355**<br>(-2.83) | 0.011<br>(0.04) | .970 |
| Honduras | 1953-66 | 5.6<br>(1.10) | 0.067*<br>(2.14) | -0.880**<br>(-2.40) | 0.271**<br>(2.62) | .940 |
| India | 1950-65 | -4968.0**<br>(-15.12) | 0.191**<br>(60.91) | -0.270**<br>(-5.91) | 0.812**<br>(4.35) | .999 |
| Israel | 1953-64 | 88.3**<br>(2.97) | 0.125**<br>(5.70) | -0.886**<br>(-10.40) | 0.621**<br>(5.79) | .999 |
| Jordan | 1959-66 | 1.0<br>(0.02) | 0.114<br>(0.42) | -0.955<br>(-2.63) | 0.220<br>(0.21) | .965 |
| Malta | 1955-66 | -29.7**<br>(-5.52) | 0.162**<br>(4.11) | -0.274**<br>(-4.41) | 0.386**<br>(4.45) | .949 |
| Mexico | 1953-66 | -1328.0**<br>(-6.96) | 0.125**<br>(17.90) | -0.055<br>(-0.25) | 1.064**<br>(6.61) | .994 |
| Philippines | 1953-62 | -415.0**<br>(-6.17) | 0.114**<br>(7.51) | -0.209<br>(-1.37) | 0.348**<br>(8.74) | .994 |
| Portugal | 1954-64 | -240.4**<br>(-8.38) | 0.275**<br>(4.57) | -0.758**<br>(-3.20) | 0.105<br>(0.53) | .995 |
| Puerto Rico | 1953-66 | -210.7**<br>(-36.03) | 0.254**<br>(3.58) | -0.537**<br>(-12.51) | 0.037<br>(0.24) | .999 |
| South Korea | 1953-66 | 147.6<br>(0.77) | 0.026<br>(0.27) | -0.817*<br>(-2.13) | 1.132**<br>(2.32) | .904 |
| Taiwan | 1953-65 | -80.8<br>(-1.62) | 0.151<br>(1.98) | -0.371**<br>(-2.95) | 0.397<br>(1.37) | .997 |
| Uruguay | 1955-64 | -769.7**<br>(-4.51) | 0.680**<br>(5.25) | -0.043<br>(-0.25) | 0 360**<br>(4.40) | .917 |

* indicates an estimate significant at a 10% level of confidence

** indicates an estimate significant at a 5% level of confidence

$$S = a + .183\ Y - .227\ F + .176\ E$$
$$(t = 65.9)(t = -5.3)(t = 4.6)$$

where the value of the intercept a varied from country to country according to the estimated coefficient of the corresponding dummy variable. According to this equation the impact of F on S is highly significant, and approximately 23% of net foreign capital inflow substitutes for domestic savings.[20]

## IV. CONCLUSION

The numerical results presented in Part III support the hypothesis that the impact of foreign capital inflow on *ex ante* domestic savings in underdeveloped countries is significantly negative. To an extent that varies from one country to another, foreign savings appear to have substituted for domestic savings. This finding is quite consistent with *a priori* expectations based upon intertemporal welfare-maximizing behavior on the part of the recipients of foreign capital. It implies that savings functions used for planning purposes in underdeveloped countries must include as an argument the magnitude of net foreign capital inflow.

The negative impact of foreign capital inflow on domestic savings applies to *ex ante* savings but not necessarily to *ex post* savings. Only in situations characterized by a binding savings constraint and a slack trade constraint is the relationship between foreign capital and *ex post* saving described by the *ex ante* savings function. When a trade constraint is active, the impact of foreign capital inflow on *ex post* savings is more likely to be positive, since external resources then help to relieve the independent limitation on investment imposed by a shortage of specific required imports. However, the results of the test designed to distinguish among alternative binding constraints suggest that the savings constraint has more often been binding than the trade constraint.[21]

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currency of a country is over-valued, the estimate of c shown in Table 2 under-states its absolute value and its significance. For an elaboration of this point, see footnote 15 and the reference cited therein.

[20] For the reasons indicated in footnote 19, the estimate of 23% should be regarded as a lower limit to the extent of substitution of foreign for domestic savings; the true value may be substantially higher.

[21] For a more thorough discussion of this conclusion, see T.E. Weisskopf, *op. cit.*, Part V.