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The Effects of Interest Rates on Savings in Developing Countries

Bela Balassa

Time-series estimates for individual countries and cross-section and time-series estimates for a number of countries show the positive effects of interest rates on savings.

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This paper provides evidence on the effects of interest rates on savings in developing countries. While the evidence is not conclusive, time-series estimates for individual countries as well as cross-section and time-series estimates for a number of countries point to the positive effects of interest rates on savings. At the same time, a variety of factors may have reduced the statistical significance of the estimates.

First of all, estimates of savings in developing countries are subject to considerable error. These estimates are usually obtained as the difference between domestic investment and foreign saving, both of which are observed with error. There are poor data on domestic fixed investment and, especially, on inventory accumulation that constitute domestic investment. In turn, foreign saving is derived as the difference between exports and imports, both of which are observed with considerable error.

Also, while ideally the estimate should relate to personal saving, such data are rarely available in developing countries — hence the inclusion of business saving and government saving that do not respond to interest rates. There are further errors associated with the measurement of interest rates and inflation rates, which are necessary to derive real interest rates.

At the same time, people may not react to small transitory changes in interest rates. In fact, the effects of interest rates on savings appear to be the strongest in countries, such as Korea, where large changes in interest rates occurred.

Finally, there is evidence that negative real interest rates bring a shift to gold, real estate, and consumer durables, which latter are included in savings as measured in national income statistics. There is further evidence of capital flight in response to higher interest rates abroad.

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THE EFFECTS OF INTEREST RATES ON SAVINGS IN DEVELOPING COUNTRIES

Bela Balassa *

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The Effects of Interest Rates on Savings in Developing Countries

Bela Balassa

This paper reviews available evidence on the effects of interest rates on savings. While it focuses on developing countries, the paper also reports on recent work on the interest elasticity of savings in the United States that has relevance for the interpretation of the developing country results.

I. The Interest Elasticity of Savings in the United States

A review of estimates of the interest elasticity of savings for the United States concluded "that the bulk of the empirical evidence accumulated since 1967 supports the view that consumption and interest rates are inversely related" (Gylfason, 1981, pp. 235-36). The author added that "the results reported in this paper ... confirm this view" (Ibid, p. 235).

Among the reported estimates, from the methodological point of view particular interest attaches to those of Boskin (1978), who utilized after-tax real interest rates in a structural estimation of the U.S. aggregate consumption function by the use of instrumental variables. Boskin obtained an interest elasticity of savings of 0.4, statistically significant at the 1 percent level.

Gylfason (1981) estimated the interest elasticity of savings to be 0.3. The estimation was done by the use of quarterly time series from the data bank of the Federal Reserve Board-MIT-University of Pennsylvania econometric model of the U.S. economy. It involved separately introducing in the estimating equation nominal interest rates and the expected rate of inflation, both of which were statistically significant at the 1 percent level. The estimates are reasonably robust to the choice of the variables.

In turn, Summers derived an aggregate savings function in a continuous time life-cycle framework (1981). Summers' point of departure was the traditional two-period model, in which all income is received in the first period. The individual is assumed to maximize an intertemporal utility function of the form $U(C_1 C_2)$, subject to a lifetime budget constraint:

$$(1) \qquad C_1 + \frac{C_2}{1+r} = W_1,$$

where W_1 represents labor income in the first period. In this framework the interest elasticity of savings depends on the elasticity of substitution between present and future consumption. If this elasticity is greater (less) than one, savings respond positively (negatively) to increases in the interest rate.

Summers suggested that the two-period formulation obscures two important aspects of reality. One is that all savings are eventually dissaved and net positive savings arise only because the young who save are more affluent and more numerous than retired dissavers. The other is that increases in interest rates reduce the present value of lifetime income.

In a multiperiod setting, the endowment W_1 in equation (1) represents the present value of future labor income. When the interest rate rises, this endowment declines as future income is more heavily discounted. As a result of this "human wealth effect," consumption will fall as interest rates rise. Since saving represents a small fraction of income, even a small effect on consumption can translate into a large effect on saving.

For what he considered the "plausible logarithmic utility case," Summers' simulation model showed that the interest elasticity of savings

varied between 1.9 and 3.4, depending on the rate of interest. Summers added that "the basic conclusion, a significant long-run interest elasticity of aggregate savings, is quite robust to changes in all of the parameter values ... Almost any plausible life cycle formulation is likely to imply a high long-run elasticity of savings with respect to the interest rate" (pp. 536-37). In fact, the simulations showed that the human wealth effect far outweighs in importance the elasticity of substitution between present and future consumption. Under plausible parameter values, the interest elasticity of savings were high even for low values of the substitution elasticity.

Summers further established a relationship between his figures and Boskin's. This was done by assuming that the interest elasticity of wealth is 0.5. Now, as Boskin obtained a "direct" interest elasticity of savings of 0.4 and a savings elasticity of 2.8 with respect to changes in wealth, the "full effect" interest elasticity of savings will be 1.9, which is within the range of Summers' estimates.

Finally, Summers introduced the possibility of bequests. He suggested that the desire to leave bequests was a much more important source of savings than accounted for by the life-cycle hypothesis on the assumption of no bequests. With the human wealth effect increasing in importance in the event of bequests, Summers claimed that his conclusions were strengthened in this case.

Summers' conclusions were criticized by Evans (1983). While in his simulation model Evans obtained interest elasticities of savings approximating those of Summers under the assumption of positive rate of time preference, the elasticity values declined if zero or negative time preference was assumed. However, as Summers (1984) noted, the interest elasticity of savings remained

generally above 0.3 even under these assumptions and a negative rate of time preference does not appear realistic.

The interest elasticity of savings declined also if lower rates of return and lower population growth were assumed. But, apart from the case of an unrealistically low (0.2) intertemporal substitution elasticity of consumption, the interest elasticity of savings remained above 0.3 if a positive rate of time preference was assumed.

Evans further claimed that the inclusion of bequests will reduce rather than increase the interest elasticity of savings. Summers objected to this statement, noting that "as long as any part of the population is saving for altruistic bequests, the long-run partial equilibrium elasticity of savings with respect to the rate of return will be infinite. Illustrative calculations suggest that it is likely to be very high in the short run as well" (Summers, 1984, pp. 250-51; italics in the original). Summers (1984) also referred to the empirical estimates reported in his NBER Working Paper (1982) and those of Shapiro (1984) and Hansen and Singleton (1983). He wrote:

> "I find in the more reliable estimates in my working paper values of the intertemporal elasticity of substitution which cluster at the high end of the range Evans and I considered. Similar estimates are found using micro data by Shapiro, and by Hansen-Singleton ... It is also noteworthy that if proper allowance is made for trend growth in the economy, estimated time preference rates are positive, reinforcing the positive effects of higher rates of return on savings."

Summers (1982) estimated the interest elasticity of savings based on the life-cycle hypothesis from a consumption function incorporating data on the after-tax real rate of interest (R), nonhuman wealth (A), expected income from labor (YL^e), and a risk premium (d). The estimating equation, shown in (2), contains the human wealth effect discussed earlier. Alternative estimates

$$(2) \qquad C_t = \alpha + [\beta_1 + \beta_2 (R_t)] \left[A_t + \frac{YL^e}{R_t + d}\right]$$

were made based on the utility function of the representative consumer and linking the wealth-labor income ratio to the after-tax rate of return in reduced form equations. All three methods "suggest a significant response of savings to changes in the rate of return" (Summers, 1982, p. 43).

In turn, in making calculations for the same time period as Boskin had, Friend and Hasbrouck (1983) obtained mixed results. Savings were shown to respond positively to increases in the real interest rate using the Christensen-Jorgensen series employed by Boskin but a negative relationship was shown if an autoregressive procedure was utilized to derive rates of return. The latter conclusion also obtained if quarterly or semi-annual data were used for a later period. However, Friend and Hasbrouck did not allow for the human wealth effect.

Finally, in a time-series aggregate consumption function, Blinder and Deaton (1985) found that the elasticity of consumption of nondurable goods and services with respect to the nominal rate of interest was -2.3, which corresponds to a high savings elasticity. However, as the authors note, "the strong elasticity is to the nominal interest rate and does not appear if only the real rate is allowed in the regression" (1985, p. 489). Also, the elasticity declines to -0.8 if the "surprise" version of the equation favored by the authors, which includes unanticipated income and wealth, is replaced by a "non-surprise" version.

II. The Interest Elasticity of Savings in Developing Countries: Time Series Estimates

The effects of interest rates on savings in developing countries were first reviewed by Mikesell and Zinser (1973). At the time, only two published studies on the subject were available; an unpublished study by Brown cited in the paper will be referred to subsequently in its published form. The two studies are by Williamson (1968) and by Gupta (1970).

In five out of six Asian countries, Williamson found the interest elasticity of savings to be negative. However, apart from the case of Japan, the estimates were not significant statistically in the regressions using permanent and transitory disposable income as explanatory variables. In turn, Gupta found the interest elasticity of savings to be positive and statistically significant at the 1 percent level for India, when per capita disposable income was used as explanatory variable.

Both Williamson and Gupta used the real rate of interest as explanatory variable in the estimation while the dependent variable was personal savings. In turn, in making estimates for Korea, Brown (1973) employed the real interest rate and, alternatively, the nominal interest rate and the rate of inflation combined as explanatory variables. The dependent variable was the ratio of private saving to private disposable income; other explanatory variables included private disposable income and, in some equations, last period's savings ratio and last period's rate of return to capital.

In the Brown study, the regression coefficients of the real interest rate and the nominal interest rate variables were positive and statistically significant at the 1 percent level in all the regression equations; the

coefficient of the rate of inflation variable was negative at the same level of significance. In the equation incorporating last period's savings ratio, the interest elasticity of savings was 0.07 at mean values of the explanatory variables and 0.21 at the peak interest rate reported in 1967. The corresponding elasticities were 0.38 and 0.43 in an equation that includes the nominal interest rate and the rate of inflation, together with last period's rate of return on capital.

The Korean results are of particular interest, given the great variability of interest rates during the period of estimation. Thus, real interest rates ranged from -17.0 percent in 1961 to 19.5 percent in 1967 within the period of estimation of 1957-71.

Brown's results were confirmed by subsequent estimates for Korea by Yusuf and Peter (1984). These authors' estimated gross national saving as a function of current GNP, permanent income (defined as a three-year average of GNP), GNP growth, the rate of inflation, the real time deposit rate, and, in some regressions, foreign saving. Estimates were made for the 1965-81 and the 1965-82 periods, experimenting with the introduction of dummy variables for the years 1980-81 and 1980-82, respectively. This was done to exclude years with poor growth performance in Korea.

The results showed the coefficient of the real interest rate variable to be positive and statistically significant at the 1 percent level in all the regressions. It further appears that a one percent rise in the interest rate was accompanied by an approximately one percent increase in gross national saving; i.e. an interest elasticity of savings of 1. The inclusion of a foreign saving variable and a dummy variable for the years 1980-81 (1980-82) did not affect these results.

The statistical significance and the size of the regression coefficient for the interest rate variable were reduced if gross national saving was replaced by gross domestic saving in the regressions. At the same time, gross national saving is the preferable concept because it measures the country's own efforts, at home or abroad, to mobilize resources for investment.

Savings were shown to positively respond to interest rates in Portugal and Turkey. In both cases, the ratio of national saving to GNP was regressed on the growth rate of GNP, the foreign saving rate, and the real deposit rate of interest (Fry, 1977 and 1979). The coefficient of the real interest rate variable was statistically significant at the 1 percent level in the two instances.

De Melo and Tybout (1986) found that "the real interest rate exhibits a positive, albeit weak, correlation with savings rates" (1986, p. 570) in Uruguay, with t-values of around 1.5. The dependent variable in the regression equation was the ratio of gross domestic saving to GDP; other independent variables were the growth rate of GDP and the ratio of foreign saving to GDP. The calculation pertained to the 1962-83 period.

The coefficient of the real interest rate variable was significant at the 1 percent level if the calculation was limited to the 1962-73 period. But the interest rate variable lost its statistical significance if the exchange rate variable was included in the regressions, in which case foreign saving were excluded from the equation. According to the authors, "one plausible explanation for this interest insensitivity is that movements in ex post interest rates during the tablita period [the post-1978 period of setting exchange rates in advance with a view of lowering inflation rates] largely

reflected movements in the expected rate of devaluation, rather than fluctuations in ex ante expected returns" (Ibid, p. 572).

In a study of twelve Latin American countries, including Argentina, Chile, Colombia, Costa Rica, Guatemala, Haiti, Honduras, Mexico, Panama, Paraguay, Peru, and Uruguay, McDonald (1983) found evidence of a positive relationship between the real interest rate and private savings in most of the countries examined, with the estimated interest elasticities of saving clustering around 0.2.

Gupta (1984) estimated savings functions for twelve Asian countries (Burma, India, Indonesia, Korea, Malaysia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, and Thailand), separating financial savings and savings in physical assets, the hypothesis being that increases in the interest rate will affect positively the former and negatively the latter. The explanatory variables included permanent income, transitory income, expected inflation, unanticipated inflation, the nominal interest rate, the financial intermediation ratio, and uncertainty with respect to inflation.

Among the ten countries for which the interest rate variable could be defined, its coefficient was positive in nine of the financial savings equations. Of the nine equations, the coefficient of the interest rate variable was statistically significant at the 5 percent level in three cases, and it exceeded its standard error in four cases. In turn, as expected, the coefficient of the interest rate variable was generally negative in the physical savings equations. The coefficient was statistically significant at the 5 percent level in four cases and exceeded its standard error in three cases.

Finally, Giovannini (1985) estimated the ratio of consumption in the actual year to that of the preceding year as a function of the real rate of

interest for 18 countries, including Argentina, Brazil, Colombia, Jamaica, Mexico, Burma, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, Greece, Portugal, Turkey, and Kenya, generally from the mid-1960s to the late 1970s. Except for some equations for Brazil, India, and Malaysia, the coefficient of the real interest rate variable was positive in all equations indicating the responsiveness of savings to the real rate of interest. The coefficient was statistically significant at the 1 percent level in three cases, at the 5 percent level in two cases, and exceeded its standard error in three cases. At the same time, one may object to the omission of income variables in the regressions.

III. The Interest Elasticity of Savings in Developing Countries: Cross-Section and Time Series Estimates

Errors in observation may reduce to a considerable extent the statistical significance of the regression coefficients in time series estimates. This is particularly the case for developing countries where data on saving are subject to considerable error as discussed further below. Substantial errors are associated also with the data on other economic variables.

Given the error possibilities of the time series data, interest attaches to estimates that combine cross-section and time-series observation. At the same time, apart from errors of the data, these estimates have their own limitations because the underlying relationships may differ among countries.

Combined cross-section and time-series estimates of the savings function were made for seven Asian developing countries for the 1960s by Fry

(1978, 1980) and Fry and Mason (1982). The sample of countries included Burma, India, Korea, Malaysia, Philippines, Singapore, and Taiwan.

Fry (1978, 1980) estimated the effects on the ratio of gross national saving to the gross national product of the following variables: the growth rate of real GNP, per capita income, the real rate of interest, the share of foreign saving in GNP and, in some of the regressions, last period's domestic saving share. The real interest rate was defined, alternatively, by the nominal deposit rate of interest and the nominal government bond yield, adjusted for the expected rate of inflation. Country dummy variables were also included in the regression equation that was estimated by two-stage least squares.

The coefficient of the real interest rate variable had a positive sign and it was statistically significant at the 5 percent level in equations omitting last period's domestic saving ratio. In the equations incorporating this variable, the coefficient was significant at the 5 percent level if the deposit rate of interest and at the 10 percent level if the government bond rate was used in the calculations.

Fry and Mason (1982) replaced the per capita income variable by the population dependency ratio (the population under age 15 divided by the population aged 15 to 64). In the framework of a life-cycle model, the real interest rate variable, defined as the difference between the time deposit rate and the expected rate of inflation, appears multiplied by the GNP growth rate while the dependency ratio appears by itself as well as multiplied by the GNP growth rate.

As in the previous Fry papers, the ratio of national saving to the gross national product was used as the dependent variable. The empirical

results showed the coefficient of the real rate of interest variable to be positive and statistically significant at the 1 percent level.

Fry's earlier equation was re-estimated by Giovannini (1983) for the 1970s. With some differences, using domestic rather than national saving and defining the expected rate of inflation by the realized future rate, the estimating equation was identical to that used by Fry. At the same time, the coefficient of the real interest rate variable was not significant statistically in the regression results.

Subsequently, Giovannini (1985) re-estimated Fry's equation for the original period, omitting Korean observations for the years 1967 and 1968. He found that the omission of these two data points eliminate the statistical significance of the real interest rate variable.

In turn, Fry (1987) extended the Fry-Mason equation to a longer period (1961-83), adding seven more Asian developing countries, Bangladesh, Hong Kong, Indonesia, Nepal, Pakistan, Sri Lanka, and Thailand. The coefficient of the real interest rate variable was statistically significant at the 1 percent level in the new regression.

Combining the earlier Fry data for the 1960's and the Giovannini data for the 1970s, and adding more countries, then, gave statistically significant results for the real interest rate variable. Also, excluding the data for Korea increased slightly the value and the statistical significance of the coefficient of this variable in the estimates.

Thus, Fry succeeded in re-establishing the statistical significance of the real interest rate variable for a longer period, including as well as excluding data for Korea. He did not attempt to reproduce, however, Giovannini's cross section results for 18 countries that did not give

statistically significant results for the real interest rate variable. At the same time, Giovannini's methodology was criticized by Gupta: "given our findings that the two groups [Asia and Latin America] should not be pooled, Giovannini's findings may be suspect in view of the fact that his sample is even more heterogeneous than our total sample combining as it does countries from Africa, Asia, Latin America, the Middle East, and Europe" (1987, pp. 307-08).

Gupta considered two groups of countries: Malaysia, Sri Lanka, Singapore, Taiwan, Philippines, India, Thailand, Pakistan, and Korea from Asia and Venezuela, Panama, Honduras, Guatemala, El Salvador, Paraguay, Mexico, Ecuador, Dominican Republic, Uruguay, Peru, Colombia, and Bolivia from Latin America. He pooled cross-section and time series data for the 1967-76 period.

Gupta regressed gross national saving on permanent income, transitory income, the expected rate of inflation, the unanticipated rate of inflation, the nominal rate of interest, the financial intermediation ratio and the uncertainty with respect to inflation. He added, in some of the regressions, lagged saving and foreign saving as explanatory variables.

While Fry, Fry-Mason, and Giovannini used two-stage least squares, Gupta also made estimates by ordinary least squares as well as by the Fuller-Battese and Parks DV methods. The results showed the coefficient of the interest rate variable to be positive under all four methods of estimation and to be significant statistically at the 1 percent level under the Parks DV method, at the 5 percent level under two stage least squares, at slightly less than the 10 percent level under ordinary least squares, and below this level under the Fuller-Battese method in the Asian regressions. They were not significant statistically in the Latin American regressions; in the latter

case, rapid and variable rates of inflation may have affected the statistical significance of the results.

Leite and Makonnen (1986) used pooled cross-section data consisting of 14 observations for six African countries, Benin, Burkina Faso, Côte d'Ivoire, Niger, Senegal, and Togo, to regress gross private saving on lagged gross private saving, the rate of interest, and the share of exports in gross domestic product. In all equations interest rates were found to be positively related to savings and highly significant. However, the effect is much reduced and not statistically significant if changes in disposable income as introduced in the equation.

Khatkhate (1988) divided developing countries in three groups, depending on whether they had positive real interest rates, moderately negative real interest rates, and strongly negative real interest rates. But only 3.5 percentage points separate the first and the third groups, which is very little considering that real rates averaged for long period between +10 percent and -20 percent. These considerations apply a fortiori to the subsequent division of developing countries into two groups, according to whether they had real interest rates above or below the median. Further problem arise about the choice of interest rates that is not indicated in the paper.

Thus, one cannot obtain reliable results in the relationship between real interest rates and saving on the basis of the comparison of group data. To do so, it is necessary to undertake regression analysis for the entire sample as it was done by the authors cited above.

All the described estimates are subject to the deficiency that they fail to account for the limitations of savings by low-income recipients due to

liquidity constraints. Liquidity constraints have been introduced in the estimation by Rossi (1986) in terms of the total stock of traded assets. Rossi made estimates by pooling time series and cross section data for six developing country regions. The regions include Sub-Saharan Africa (12 countries), North Africa and the Middle East (five countries), East and South Asia and the Pacific (nine countries), Central America and the Caribbean (eight countries), South America (nine countries), and Southern Europe (six countries). The initial year is 1973 while the terminal year varies between 1979 and 1983, depending on data availability for the individual countries.

In the estimating equation, next period's private consumption is expressed as a function of real disposable income, real government expenditure, the real rate of return, and a borrowing constraint. The rate of return is defined, alternatively, as the time deposit interest rate and the foreign interest rate adjusted for expected changes in the exchange rate. The author's conclusions are stated as follows:

> "Contrary to Giovannini's (1985) findings, there is clear-cut evidence of a positive relationship between the rate of growth of per capita consumption and the expected real interest rate. Furthermore, in three regions out of six (Middle East and North Africa, Southern Europe, and Central America) the coefficient of [the real interest variable] also turns out to be positive and significantly different from zero, although this result depends on the definition of the real interest rate ... It is important to stress that if the sample excluded 1982 and 1983 [the years of the debt crisis] South America would also have a positive [real interest rate] coefficient that was significantly different from zero" (pp. 120-23).

From the estimated equation, Rossi derives the interest elasticity of consumption, when the negative sign corresponds to a positive saving elasticity. Depending on the specifications employed, the elasticities were: Sub-Saharan Africa, -0.06 to -0.25; Middle East and North Africa, -0.24 to -1.25; East and South Asia and the Pacific, -0.08 to -0.18: Central America

and the Caribbean, -0.37; South America, -0.01 to -0.10; and Southern Europe, -0.05 to -0.18.

IV. Interpretation of the Results

As noted earlier, in a two-period model the interest elasticity of savings depends on the elasticity of substitution between present and future consumption. This statement may be reformulated in terms of substitution and income effects.

The substitution effect operates because a rise in the interest rate reduces the price of future consumption. Now, unless future consumption is an inferior good, individuals will substitute future consumption for present consumption; i.e. they will save more.

But, there is also an income effect in the sense that higher interest rates raise incomes. This fact will induce individuals to increase their present as well as future consumption; i.e. they will save less. In a particular case, the entire increment in income due to higher interest rates will be consumed today. This will be so if an individual saves a fixed amount e.g. for retirement. Now, a rise in interest rates will induce the individual to increase present consumption, with no change in future consumption.

The effects of changes in interest rates on savings in a two-period model are thus determined by the relative strengths of substitution and income effects, which are not known a priori. This statement, traditionally made in textbooks, needs to be modified by considering that, for borrowers, the income effect goes in the same direction as the substitution effect. Now, if savers and borrowers are private individuals, their income effects will compensate and we are left with the substitution effect.

This symmetry will not obtain if borrowers are businesses. Correspondingly, interest attaches to empirical estimates. These will be summarized below.

A number of empirical studies have been undertaken to estimate the interest elasticity of saving in the United States. The bulk of these studies show the elasticity to be positive. They also show it to be relatively high, 0.3-0.4, even excluding the human wealth effect; i.e. a one percent increase in interest rates would raise savings by 0.3-0.4 percent.

The estimates for developing countries tend to be lower, in the range of 0.1 to 0.2. Moreover, a number of estimates are not significant statistically. At the same time, a variety of factors may have reduced the statistical significance of the estimates.

First of all, estimates of saving are subject to considerable error. These estimates are usually obtained as the difference between domestic investment and foreign saving, both of which are observed with error.

In developing countries, fixed investment is customarily estimated from data on the importation and the domestic production of machinery and on materials used in construction, which are subject to error. This is the case even more for inventory accumulation. At the same time, inventories decline as interest rates go up, hence reducing savings at higher interest rates.

Foreign saving is derived as the difference between the exports and the imports of goods and services both of which are subject to considerable error. Also, depending on whether the exchange rate is overvalued or undervalued, we observe underreporting (overreporting) of exports and overreporting (underreporting) of imports. And, foreign saving is ipso facto

underestimated (overestimated) if the exchange rate is overvalued (undervalued).

Taking the difference between domestic investment and foreign saving, both estimated with error, will magnify the error of estimate in each. The resulting error in estimating national savings may have contributed to the fluctuations observed over time and reduced the statistical significance of the estimated interest elasticity of savings.

Also, ideally, the estimates should relate to personal savings. While this is the case for developed countries, for most developing countries such estimates are not available, hence the use of national savings data, which also include business saving and government saving that do not respond to interest rates. Correspondingly, the estimated interest elasticity of savings will be reduced and will be subject to error.

There are further errors associated with the measurement of interest rates. While most authors employed time deposit rates, for some countries Giovannini (1985) used commercial paper or Treasury bill rates, which may move independently from time deposit rates. And, time deposit rates are relevant for financial savings but not for nonfinancial savings. Moreover, time deposit rates may not move parallel with rates paid by borrowers whose dissavings reduce the total amount saved. Another source of error is the lack of consideration given to taxes on returns to savings.

A variety of approaches have been tried to estimate the expected rate of inflation. All of these approaches are subject to error as inflation expectations are not directly observed. Correspondingly, the estimation of the expected rate of inflation also tends to reduce the statistical significance of the coefficient of the real interest rate variable.

The same conclusion follows if we consider that the estimated relationships are of a short-term character as the savings and the interest rate observations refer to the same year. For one thing, there are lags in the adjustment process. For another thing, savings may not respond to transitional changes in the interest rates.

We have considered various factors that tend to lower the statistical significance of the estimated interest elasticity of savings. In turn, the size of the elasticity is reduced by reason of the omission of the human wealth variable as discussed in Section I and by the lack of consideration given to the liquidity constraint (except for the Rossi study) as noted in Section III.

The interest elasticity of savings may also be underestimated by reason of the fact that interest rates are often maintained over long periods under the interest controls observed in many developing countries. This will, then, limit the range of observations, which was not the case e.g. in Korea where large changes in interest rates occurred. At the same time, it is for Korea where one observed the highest, and statistically significant, interest elasticity of saving among developing countries. In turn, as suggested by Shaw, small and reversible changes in interest rates may not affect savings.

> "Savers may ignore a possible transitory increase from, say, 4 to 6 percent in rates of return, but they are less likely to maintain consumption-saving patterns when rates of return change, in the context of economic reform, from negative levels to positive 10 or 15 percent and more. Given the relative scarcity of wealth in the lagging economies, the income effect of higher rates of return should not be expected to overwhelm the effects of substitution of more wealth for less consumption now" (Shaw, 1973, p. 73).

Note finally, that estimates of the interest elasticity of saving have been made in a partial equilibrium framework, including different sets of

variables in the estimating equation. At the same time, the equations do not include the prices of alternative assets, such as gold, houses, and consumer durables.

The last point brings one to the choice of assets. There is evidence from several countries, including Portugal and Turkey, that negative real interest rates bring a shift to gold, real estate, and consumer durables, which latter are not included in savings as measured in the national income accounts.

Thus far, the discussion has proceeded in a domestic framework that has been used in all the reported estimates. But savers in developing countries have a choice between domestic and foreign assets. While this choice may be limited by currency restrictions, it exists nevertheless. If capital transactions are prohibited, there are black markets as well as possibilities for the underinvoicing of exports and the overinvoicing of imports.

Studies of capital flight have introduced interest rate variables. While domestic interest rates have not been significant statistically, possibly because of the existence of two-way causation, foreign interest rates have been significant in the equations for Mexico and Venezuela (Cuddington, 1987). Thus, for these countries, capital flight appears to respond to interest rates obtainable abroad.

In conclusion, although a positive coefficient has been obtained in most cases, available estimates are far from unanimous as to whether interest rates significantly affect savings in developing countries. But, errors in estimation tend to lower the statistical significance of the interest

elasticity of saving. Also, for various reasons, the size of the estimated coefficient is reduced.

At the same time, there is evidence that negative real interest rates lead to a shift from savings to the purchase of gold, real estate, and consumer durables. Furthermore, higher interest rates abroad contribute to the outflow of savings, thereby reducing the amount available for domestic investment.

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