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The Determinants of Saving Behavior in Latin America

Prepared by Donogh McDonald*

Approved by Anthony Lanyi

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Summary

The role of real interest rates in the determination of saving behavior has been attracting a great deal of attention from policymakers and policy analysts. There remains, however, much controversy concerning the empirical importance of the effects of interest rates on saving. With regard to developing countries, recent research has concentrated on the experience of certain Asian countries, and suggests a positive reaction of saving to changes in the real deposit rate of interest. This paper concentrates on Latin American countries, for which there seems to be little published evidence on this subject.

Consumption functions have been estimated for 12 Latin American countries with attention focused on the behavior of private consumption. For most of the countries in the sample the evidence points to a negative relationship between real deposit rates of interest and consumption, though for some countries the results are sensitive to whether or not a time trend is incorporated in the equation.

While attention was focused on the influence of interest rates, some other features of the estimates are worth noting. First, an attempt was made to adjust income for the effects of the inflation tax--an adjustment that proved to be significant for some of the countries. Second, an attempt was made to capture some distributional considerations by including as an explanatory variable the share of exports in GNP. This variable was significant for many of the countries in the sample.

In interpreting the results, one must bear in mind certain caveats. The nature of the available data necessitated compromises in the specification of the equations and in the choice of estimation techniques. Furthermore, it should be noted that for most of the countries examined the variability of the real interest rate comes principally from movements

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in the inflation rate. To the extent that the inflation rate has effects on consumption through channels other than its impact on the real rate, caution should be exercised in considering the implications of these results for interest rate policy.

I. Introduction

Development economists have long placed emphasis on the domestic saving rate as a key variable in the development process. This has been mirrored in the substantial empirical literature on the subject discussed in the surveys by Mikesell and Zinser (1973) and Snyder (1974). Although these surveys reviewed the various factors thought to influence saving behavior, they were able to report relatively little about the role of interest rates in savings determination.

This lack of empirical work on the interest responsiveness of saving, to a large extent, reflects considerable difficulties in obtaining the relevant data. For example, in the case of many developing countries sufficiently long series on nominal interest rates are difficult to obtain. In addition, it is only in the last decade or so that financial policies pursued by developing countries have come to the fore of development policy debates, in the wake of the publication of books by McKinnon (1973) and Shaw (1973).

There is now substantial agreement that relative rates of return affect the allocation of wealth among different assets. For example, the literature on the demand for money in developing countries indicates that real rates of return have a significant influence on holdings of real money balances. 1/ A more controversial subject is the influence of rates of return on the consumption/saving decision. In economic theory the sign of the consumption response to changes in real interest rates is ambiguous. A compensated increase in the real rate of interest will reduce current consumption (the substitution effect) but for an uncompensated change, the income effects of the change will tend to push consumption in the opposite direction. In addition, it is important to note that a compensated increase in the real rate of interest does not

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1/ See for example Khan (1980), Meiselman (1970), Aghevli et. al. (1979). Demand for money studies have tended to focus on expected inflation rates rather than real rates of return. However, nominal deposit rates have tended to be very stable in many of the countries. Equations estimated by the author while working on this paper indicate that real deposit rates of interest have a positive and significant impact on the demand for broad money in most of the countries that are dealt with here. It is, however, the expected inflation rate which generates most of the variability in the real interest rate variable.

necessarily increase current saving despite the fact that it reduces current consumption. 1/

Considerable research effort has been devoted to determining the interest responsiveness of saving behavior in the United States, but controversy still exists. 2/ In the case of the developing countries, the available research concentrates on the experience of Asian countries. Recent work for Asian countries tends to suggest a positive reaction of saving to changes in real deposit rates of interest. Work which points in this direction has been done by Fry (1978, 1980) for a sample of 12 Asian countries and is supported in individual country studies by van Wijnbergen (1982) for Korea, Qureshi (1981) for Pakistan and Sundararajan and Thakur (1980) for India.

However, there seems to be little published work on the interest responsiveness of saving in Latin American countries. Landau (1971), Chenery and Eckstein (1970) and Leff and Sato (1975) all exclude interest rates from their set of explanatory variables. Accordingly, this paper focuses on the factors determining saving behavior in Latin American countries, with particular attention given to the influence of interest rates.

While data problems make most developing countries less amenable than the industrial countries to sophisticated empirical analysis, other characteristics of the countries chosen for this study encourage our interest. 3/ Most of these countries have, for long periods, closely regulated their financial markets, frequently by imposing low ceilings on nominal rates of interest. Given the high and variable rates of inflation in some of these countries, the interest responsiveness of saving behavior becomes a matter of serious policy concern. A second point of interest is the great diversity of experiences among the 12 Latin American countries under examination (see Table 1). For example, while high and variable inflation rates seem to be endemic in some of these countries, in a number of others the average inflation rate over the 20-year period has been below 10 per cent. Practices with respect to

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1/ See Feldstein (1978). One possible way of compensating for the income effects of the increase in the real interest rate is to reduce current income. Whether current saving goes up or down depends upon whether the compensating fall in income is less than or greater than the fall in consumption. To achieve higher future consumption it is not necessary to increase current saving since the rate of return on saving has increased. Of course, the compensation for income effects may also be effected by adjusting future money incomes.

2/ See Boskin (1978) and Howrey and Hymans (1978) for some recent U.S. research on the topic and discussions of previous empirical work. The comments following the Howrey and Hymans paper also make worthwhile reading.

3/ The countries are Argentina, Chile, Colombia, Costa Rica, Guatemala, Haiti, Honduras, Mexico, Panama, Paraguay, Peru and Uruguay.

Table 1. Some Indicators of Savings and Interest Rates for Selected Latin American Countries (1960-79)

	Savings Ratio 1/			Inflation Rate			Real Interest Rate 2/		
	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
				(In per cent)					
Argentina	0.18	0.26	0.21	7.65	443.17	77.84	-71.28	2.07	-18.43
Chile	0.01	0.18	0.12	7.69	506.03	99.56	-67.33	16.93	-10.34
Colombia	0.15	0.26	0.19	3.01	33.05	15.22	-20.96	0.96	-5.58
Costa Rica	0.08	0.17	0.14	-0.64	30.08	5.88	-17.97	4.67	0.00
Guatemala	0.07	0.19	0.12	-1.13	16.62	4.67	-7.51	4.81	0.70
Honduras	0.08	0.19	0.14	-1.78	12.79	4.27	-4.36	5.53	0.92
Haiti	0.03	0.13	0.08	-4.99	22.69	5.73	-12.77	10.14	-0.18
Mexico	0.14	0.22	0.18	0.59	29.09	8.63	-18.45	4.50	-2.76
Panama	0.09	0.25	0.18	0.16	16.89	3.51	-9.75	4.68	1.27
Paraguay	0.10	0.23	0.15	-0.90	28.16	7.67	-15.73	8.98	-0.14
Peru	0.08	0.23	0.15	4.94	66.69	18.13	-24.73	1.96	-6.48
Uruguay	0.08	0.18	0.12	10.78	125.38	54.65	-52.08	0.80	-22.27

1/ Calculated on a gross national saving basis (i.e., gross national savings divided by gross national income).

2/ Defined as the nominal rate minus the expected inflation rate divided by one plus the expected inflation rate. For the purpose of this table the current inflation rate has been used for the expected inflation rate. Details of interest rates used are to be found in the Appendix.

restrictions on international financial flows have also varied considerably. Some countries have had very few such restrictions (e.g., Haiti, Honduras, Mexico, and Panama). Most of the others have for most of the relevant period (all of it in many cases) severely restricted capital movements.

The next section of the paper deals with issues related to specification. Section III of the paper will contain a discussion of the methodology and empirical results. The paper will end with a brief review of the findings. There will also be an appendix which contains additional detail concerning the empirical work.

II. Model Specification

The discussion of model specification will focus first on the definition of the dependent variable and then turn to the choice of the explanatory variables. The objectives of the present study have led to a focus on private consumption behavior where private consumption is defined as aggregate consumption less government consumption (general government consumption as defined in the United Nations System of National Accounts (SNA)) and aggregate consumption is gross national income less investment (inclusive of stock building) plus the current account deficit. All the estimation is carried out in real per capita terms with the consumer price index (CPI) being used to convert all nominal variables into real terms. Private consumption was chosen as a dependent variable since it would not have been possible to construct a private saving variable given the available data--for most countries in the sample the government accounts data needed to construct a private disposable income variable were not available. In principle, it makes no difference whether one estimates a consumption function or a saving function--one is easily derived from the other. However, this data problem is of concern in selecting the explanatory variables. In particular, given the unavailability of a private disposable income variable, this study makes use of a total income variable.

While the study focuses principally on private consumption, some aggregate consumption functions were also estimated. A discussion of these results is presented in Appendix A.

For the purpose of investigating the interest responsiveness of consumption behavior, measures of consumption should, ideally, be adjusted to exclude components of consumption which have, in effect, many of the characteristics of investment. Leaving aside concerns about the reliability of fixed investment and stock-building data, 1/ it must be kept in

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1/ Private consumption is derived as a residual in the National Accounts and (assuming an accurate measure of income) will thus be contaminated by errors in investment measures.

mind that the national accounts measures of consumption include expenditure on durable consumption goods and inflation hedges. These elements of measured consumption would be expected to be negatively related to real interest rates--an increase in real interest rates encouraging reallocations of saving away from such "consumption" items to financial saving. To the extent, therefore, that results show that measured consumption (saving) is negatively (positively) related to real interest rates, it may, in part, reflect not a response of aggregate consumption but the reallocations of saving just discussed. Such a result would nevertheless have important policy implications since savings diverted to inflation hedges are not available to finance productive investment.

The explanatory variables to be used in the study are now considered. Before discussing these, the general specification adopted is first set out:

$$QCDP = f(QYP, QGCP, PTP, QXP, R, TTR)$$

where QCDP is real per capita private consumption, QYP is real per capita gross national income (i.e., GNP plus net unrequited transfers from abroad), QGCP is real per capita government consumption, PTP is the real per capita inflation tax, QXP is real per capita exports, R is a real rate of return variable and TTR is a time trend. The definition of and the justification for each of these variables will be discussed below. 1/

Economic theory treats the current consumption of an individual as being determined by his intertemporal budget constraint and the relative price of present and future consumption. In applying this theory one needs a measure of wealth which includes not only the value of physical assets but also of intangibles, such as human capital. In the absence of such a wealth variable, an appropriate specification would have consumption as a function of "permanent" labor income and the conventional, narrower, wealth concept, based on tangible assets. The importance of appropriately specifying the budget constraint has been emphasized by Summers (1981) who points out that interest rates affect not only the relative price of present and future consumption but also directly affect wealth by affecting the rate at which future incomes are discounted. Unfortunately, given data constraints, a traditional income specification of the consumption function involving a current income variable must be used. Frequently, a distributed lag of the income variable is used to incorporate some aspects of the permanent income notion. Here, because of the small number of degrees of freedom available, a general lagged adjustment formulation is used to allow, albeit

1/ In the aggregate consumption function (discussed in Appendix A) QGCP and PTP do not appear as explanatory variables--these variables are included in the private consumption function to capture redistribution between the private and public sectors.

in a rather crude fashion, for this and other dynamic aspects of consumption behavior.

Some other limitations of the income data which affect the present study can be mentioned at this point. For explaining private consumption behavior, private disposable income seems a more appropriate variable than total income. Long consistent time series on the components of government current revenues and expenditures are, however, difficult to obtain for many of the countries in our sample. Accordingly, the study has to make do with the total income variable.

Another limitation relates to the fact that all net interest payments abroad are included in the current account of the balance of payments. However, in an inflationary environment these should be adjusted to reflect the gain from the decline in the real value of net financial liabilities. However, since data on net foreign indebtedness are unavailable, it is not possible to make appropriate adjustments to the data. 1/ A similar problem relates to economic depreciation of the domestic capital stock. Clearly, net income is more appropriate than gross income for explaining consumption behavior. However, national accounts depreciation data are not reliable for this purpose.

In one respect, an attempt has been made to bring the income variable used into line with the disposable income concept. This relates to the inflation tax (i.e., the erosion of real private sector financial claims on the government caused by inflation), which is of particular interest in the high inflation Latin American countries. This may be an appropriate variable to incorporate in the private consumption function, though it should be noted that some controversy exists as to whether such claims can be considered private sector wealth (see Barro, 1974). 2/ The inclusion of the inflation tax variable may be particularly important in analyzing the effect of real interest rates on consumption, because the effects of inflation on consumption through the inflation tax and the real interest rate may be of different signs. On the one hand, an increase in inflation increases the inflation tax, thereby reducing income and consumption. On the other hand, if substitution effects dominate income effects, an increase in inflation increases consumption through

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1/ For additional discussion of this matter, in a different context, see Sachs (1981).

2/ Barro's point, essentially, is that government liabilities are ultimately the taxpayers' liabilities and, therefore, cannot be seen as private sector wealth. Thus, such liabilities should not have an influence on private consumption. For this point to be entirely valid, however, requires some strong assumptions about the nature of intergenerational transfers and the existence of perfect capital markets.

its effect on expected inflation and the real interest rate. In this study, the inflation tax is measured as the capital loss due to the erosion of the real monetary base outstanding at the end of the previous period. 1/

A second means of trying to incorporate government behavior into the private consumption function is by directly introducing government consumption into the private consumption equation. Two justifications can be made for this. If the private sector takes into account the implications of the consumption and investment decisions of government in making its own expenditure plans (i.e., there is no "veil" between the government and private sectors), then the relevant variables in the private consumption function would be total income and government consumption. One would expect an increase in government consumption to be offset by a decline in private consumption but not on a one-for-one basis since it is very unlikely that private consumption and government consumption are perfect substitutes. 2/ The second justification rests on the assumption that over time, increases in the government consumption to income ratios are likely to be paralleled by increases in the tax-to-income ratio. For both these reasons real government per capita consumption is included as an additional explanatory variable.

Apart from redistributions between government and the private sector, redistribution within the private sector is also frequently thought to be important for consumption behavior in developing countries. Unfortunately, data to allow exploration of such redistributive effects are not readily available. As an alternative, it was decided to include a measure of the relative size of the export sector. 3/ First, the export sector tends in many countries, particularly mineral exporters, to be a high average

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1/ The per capita inflation tax, PTP, is defined as PTP = QMBP(-1)* $\pi/(1+\pi)$ where QMBP is the real per capita monetary base and π is measured for the purpose of this calculation, as the December to December inflation rate. Our measure only takes into account part of the net claims of the private sector on the government sector. However, little information is available on the total stock of such claims. In addition, since our income measure is aggregate income, and not disposable income, we would also need to know how the interest rate on such claims has varied with the inflation rate.

2/ The cost of the "unwanted" part of government consumption is carried in part by current private consumption and in part by future private consumption. This division will, of course, depend on whether the change in government consumption is perceived to be permanent or temporary.

3/ The survey by Mikesell and Zinser notes studies by Chenery and Eckstein (1970), Lee (1971) and Maizels (1968) which include export variables to allow for distributional effects. None of these studies, however, looks at the interest responsiveness of consumption.

saver. Second, it may also be a high marginal saver since commodity export booms and recessions have large temporary components. Finally, an increase in the ratio of export to GNP will, in many countries, increase the tax share in GNP. Through its effects on disposable income, private consumption would be reduced. Therefore, increases in the relative size of the export sector are likely to have a negative effect on consumption.

With regard to the real interest rate variable, this has two components, the nominal interest rate and the expected rate of inflation. Frequently, the real rate of interest is defined as the nominal rate less the expected rate of inflation. While this may give a satisfactory approximation in low inflation rate countries, it is not appropriate for high inflation countries. Here the real rate of interest is defined as:

$$r = \frac{1 + i}{1 + \pi^*} - 1$$

where r is the real rate, i the nominal rate and π^* the expected inflation rate.

It is generally difficult to put together long series of interest rate data for developing countries, and Latin American countries are no exception. Fortunately, a considerable amount of work in this area has already been done by Galbis (1979 a, b) whose series form the basis for the interest rate data used here. The information required for updating these series is readily available; extending the series backward from Galbis' starting point was achieved for a significant number of countries by using past IMF staff country reports and publications of the respective countries. More specific details of the series used for each country will be given in Appendix B. In general, rates used are average annual deposit rates in the banking sector on deposits of three to six months maturity.

The major problem with these interest rate series is that for most countries and for most of the period covered they reflect ceiling rates on deposits imposed by the monetary authorities. It seems a reasonable assumption that these ceilings were binding since rarely did they significantly exceed inflation rates in these countries and were frequently considerably below these inflation rates. It should be pointed out, however, that these rates are gross deposit rates. It has not been possible to take into account the effect of taxes and thereby produce series on deposit rates net of tax. A more problematic assumption implicit in the use of these rates is that they reflect the marginal rates available to savers. In a number of countries the rates on "unofficial" markets and on the nonbank financial markets may be more relevant. However, continuous time series of sufficient length are, in general, not available for these markets. Where foreign currency deposits have been available,

they have sometimes assumed a significant share of bank deposits. But, to measure the expected rate of return on these deposits would involve the very difficult task of measuring the expected rate of depreciation of the domestic currency. In some countries with very open capital markets, movements in foreign interest rates may be a useful proxy for effective domestic interest rate movements. Countries, in the sample, that fall into this category for most of the period include Mexico, Haiti, Panama, and Honduras. 1/

For countries whose capital markets have been open intermittently, allowing for these international influences presents considerable difficulty. This, moreover, represents a specific example of a wider problem in working with financial markets in these countries, namely the number of major institutional changes which have occurred over the period. Examples of such changes include introduction of index-linked saving instruments and frequent changes in the range of financial instruments available. Here some attempt, albeit crude, will be made to incorporate some of these changes by the inclusion of dummy variables.

Turning to the other component of the real interest rate, the expected inflation rate, additional problems are encountered. Little is known about the way in which inflationary expectations are formed. Here an adaptive expectations framework is adopted as is frequently done in developing country studies. However, there is clearly potential for major misspecification here. First, it is possible that such a mechanism can give rise to a large systematic component to expectational errors. One could avoid this by adopting a rational expectations approach. A second and associated problem is the rigidity of the coefficient of adaptation in the adaptive expectation framework. In principle it is possible to allow this coefficient to vary in some specified way. For example, Khan (1977) related this coefficient to the level of inflation and changes in the level of inflation. However, the shortness of the time series available discouraged experimentation with more sophisticated expectations mechanisms. The final issue concerns the information set used by agents in forming inflationary expectations. Do they adjust their inflationary expectations in light of the discrepancy between the current inflation rate and last period's expectation or does the information set used reflect some lags in the availability of and/or use of information about inflation developments?

Two possible formulations were used in this study. In what we call formulation (A)

$$\text{(A)} \qquad \pi_t^* = \sum_{i=0}^{\infty} \alpha(1-\alpha)^i \pi_{t-i}$$

1/ Here again, strictly speaking, account should be taken of the expected changes in exchange rates. However, all these countries except Mexico, had unchanging dollar exchange rates over the relevant period. This does not necessarily imply, however, that expected exchange rate changes were zero at all times.

where π_t^* is the expected inflation rate (at time t) for the coming 12 months, and π_t is the actual inflation rate over the previous 12 months. 1/ The coefficient of adaptation α reflects how quickly current developments in the inflation rate are reflected in inflationary expectations. 2/ Here agents are assumed to have up-to-date information on inflationary developments and use that information in forming inflationary expectations.

An alternative formulation is

$$\text{(B)} \qquad \pi_t^* = \sum_{i=0}^{\infty} \alpha(1-\alpha)^i \pi_{t-i-1}$$

which reflects a 12-month lag in information about or perceptions of the inflation rate. While a 12-month lag in information might be seen to be extreme, particularly for those countries with high and variable inflation rates, in other circumstances the assumption that agents have knowledge of current inflationary developments may also be too strong. The approach adopted here is an empirical one--letting the data provide the appropriate specification. 3/ In constructing these variables for inflationary expectations the calculation was truncated at the eighth lag (i.e., i=8).

The final explanatory variable remaining to be discussed is the inclusion of a time trend. This can be interpreted in a number of ways. It may be seen to represent the influence of an excluded variable which is growing at a fairly constant rate. For example, if wealth is growing at a constant rate then

$$W = Ae^{gt}$$

and

$$Ln(W) = Ln(A) + gt.$$

1/ π is defined as $\frac{P_t - P_{t-1}}{P_{t-1}}$ where P_t is the average value for the consumer price index in the current year.

2/ The specification of A comes from the expectations formulation mechanism

$$\pi_t^* = \alpha\, \pi_t + (1 - \alpha)\pi_{t-1}^*$$

3/ One must also continue to bear in mind that there is little theoretical basis for choosing an adaptive expectations mechanism and theory cannot tell whether formulation A or B is closer to the "real" mechanism.

Thus, since the estimating equation is specified in log terms, the coefficient on the time trend reflects the product of the growth rate of the variable concerned and its "structural" coefficient. An alternative interpretation of the time trend is that it takes into account effects of gradual structural change.

III. Methodology and Results

In this section attention turns to the estimation procedures used and the principal results. Consumption functions have been estimated for 12 Latin American countries. The choice of countries was dictated by data considerations. For some excluded countries there was difficulty in putting together interest rate series; 1/ for others, the problem was a lack of continuous national accounts data on a consistent basis. 2/ A general log consumption function was adopted and the interest variable used is the log of the interest factor where the interest factor is defined as one plus the real rate of return. 3/ The value of α, the coefficient of adaptation, was chosen by searching over a grid of values between .1 and 1 for that value which minimized the standarad error of the estimate.

The export and government consumption variables are entered in ratio form, the denominator in both ratios being real per capita income. Since a log specification is being used, it makes no difference to point estimates of these variables or to the general properties of the equations whether one uses the ratio or level form. However, use of ratio form facilitates interpretation of the results for the income coefficient.

As indicated in the previous section, there is uncertainty as to the formulation of the expectations formation mechanism, the coefficient of adaptation in this mechanism, and whether the income variable should be adjusted for the inflation tax or not. The resolution of these issues was decided on an empirical basis, i.e., choosing the specification which minimized the standard error of the estimate (SEE). The decision on

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1/ In general, interest rate data for the 1960s are only available for those countries which had regulated deposit rates.

2/ The problem here is due to the fact that a number of countries' national accounts derived according to the present SNA have not been revised back far enough for our purposes.

3/ For real interest rates close to zero the current specification is, of course, very similar to a specification with the level of the real interest rate.

whether or not to include a variable was made on the basis of the sign and statistical significance of the coefficient estimate. 1/

The results presented are ordinary least squares (OLS) estimates. Corrections for first order autocorrelation were carried out in all cases. One might raise the legitimate complaint that OLS methods are not suitable for estimating consumption functions, since the income variable is endogenous. By not adopting an instrumental variables approach for the interest rate variable one assumes that the real interest rate is exogenous, and in particular that the expected inflation rate is exogenous with respect to consumption demand. While there are certainly models of inflation in which demand changes act slowly on inflationary expectations, this is, nevertheless, a strong assumption. 2/

Table 2 presents the estimated equations for private consumption (excluding the time trend). The discussion focuses, first on the income and "distribution" variables and then turns to the rate of return variable. Results of estimates including the time trend are discussed later in this section. Some additional details of the empirical work by country appear in Appendix B.

1. Income and "distribution" variables

For all countries (except Panama and Haiti) the income variable was tried both with and without the inflation tax adjustment. 3/ For four countries (Colombia, Honduras, Mexico and Uruguay) the final specification incorporates the inflation tax adjustment. In one other, Argentina, the inflation tax is included as a separate explanatory variable. However, for these countries, the general nature of the results is not sensitive to whether or not the inflation tax adjustment is made. In interpreting the income coefficients, it must be borne in mind that they are elasticities and not marginal propensities to consume. Except for the cases of Uruguay and Honduras, which are outliers, the long-run elasticities lie between approximately 0.7 and 1.1. Theoretical considerations would suggest long-run elasticities in the vicinity of unity though of course one should be

1/ This procedure, of course, was only used to delete one variable at a time. In general, a variable was deleted if its t-statistic was less than 1.5, this being an arbitrary, though not unreasonable, procedure. This procedure was not applied to the interest rate variable. A variable was also deleted if the sign of the estimated coefficient was inconsistent with prior expectation.

2/ However, it should be remembered that the attractiveness of simultaneous equation techniques comes from their large sample properties; less is known about the relative merits of OLS and instrumental variable techniques with samples as small as the one being used here.

3/ Because of the nature of the monetary system in Panama, there is no domestically issued monetary base. The inflation tax adjustment is not made for Haiti since the estimated equations are for aggregate consumption.

Table 2. Estimated Equations for Per Capita Private Consumption (QCDP) 1/

(all variables entered in log form)

	Constant	QYP	QYP-PTP	PTP	R1	R2	QXP/QYP	QGCP/QYP	QCDP(-1)	p	S.E.E.	$\bar{R}^2$	α
Argentina	.087	.691		-.009	-.047		-.093	-.213		.031	.0072	.9924	1.0
	(.79)	(21.90)		(2.69)	(5.34)		(8.73)	(7.89)					
Chile	.322	.682				-.153	-.054		.340	.117	.0287	.9951	1.0
	(3.51)	(8.41)				(3.69)	(1.54)		(4.26)				
Colombia	1.516		.811		-.038					.379	.0237	.9730	1.0
	(3.10)		(15.97)		(.47)								
Costa Rica	.429	.640			-.043				.288	.091	.0259	.9879	0.7
	(1.45)	(5.28)			(0.34)				(1.96)				
Guatemala	.234	.612				.282	-.068		.382	-.473	.0097	.9876	0.6
	(.69)	(8.31)				(3.58)	(3.27)		(4.00)				
Haiti	.967	1.118			-.188					.926	.0137	.9780	0.7
	(3.65)	(29.58)			(2.58)								
Honduras	1.221		.229			-1.080		-.078	.542	-.425	.0178	.8720	0.5
	(2.55)		(2.71)			(2.57)		(2.07)	4.81)				
Mexico	.642		.884		.021		-.059			.266	.0160	.9843	1.0
	(1.46)		(20.21)		(.21)		(4.42)						
Panama	.375	.794			-1.09			-.331		.372	.0382	.9022	1
	(.22)	(4.06)			(3.11)			(1.55)					
Paraguay	3.015	.703			-.166					.050	.0121	.9933	1.0
	(13.78)	(35.43)			(2.80)								
Peru	-.263	.786				-.147	-.096		.197	.171	.0108	.9930	0.8
	(.70)	(11.45)				(1.96)	(6.29)		(3.13)				
Uruguay	-2.34		.857			-.066			.417	-.369	.0281	.8196	1.0
	(2.55)		(7.44)			(2.19)			(3.24)				

1/ t statistics are in parentheses. QYP is real per capita income; PTP the real per capita inflation tax; R the interest factor; QXP real per capita exports; QGCP real per capita government consumption. Interest coefficient is entered under R1 if adjustment mechanism A is used and R2 if mechanism B is used. Estimation over period 1961-79 except Argentina 1960-78. For Haiti the dependent variable is aggregate consumption. (See Appendix.)

careful in expecting such long-run properties to be accurately manifested given the compromises that have had to be made in specification of the estimating equation.

Of the "distribution" variables the export variable appears in five of the equations while the government consumption variable appears in only three of the equations. The point estimate of the government consumption variable seems rather large in the case of Panama (although the standard error is also relatively large) and to a lesser extent in the case of Argentina. 1/ However, in no case is the coefficient on the rate of return variable much affected by the exclusion of the government consumption variable.

2. Rate of return variable

The short-run and long-run rate of return elasticities from the equations in Table 2 are presented in Table 3. For 10 of the 12 countries, the sign on this variable is negative, though in 2 of these cases it is not significant at the 90 per cent confidence level. Only in the case of Guatemala is the coefficient on the rate of return variable significantly positive. It can be noted in passing that for 7 of the countries expectations adjustment mechanism A provided the best fit, whereas for the other 5, mechanism B gave the best results. In interpreting these elasticities it must be remembered that these are elasticities with respect to the interest factor (i.e., one plus the real rate of return) and not the real interest rate. 2/ Second, it should be borne in mind that most of the variability of the real interest rate has been generated by inflation rate variability. To the extent that the inflation

1/ The response of private consumption with respect to changes in government consumption is derived by multiplying the estimated elasticity by the ratio of private consumption to government consumption.

2/ If the real rate of return is close to zero then a percentage point change in the rate of return is approximately equal to a percentage point change in the interest factor. If the real rate of return is negative a 1 per cent change in the real interest rate represents a larger-than-one-percentage point change in the interest factor and, conversely, if positive. It should also be borne in mind that a 1 percentage point change in the nominal interest rate has different quantitative effects on the real interest rate depending on the expected inflation rate: $\partial r/\partial i = 1/(1+\pi^*)$ where r is the real interest rate, i the nominal rate and π^* the expected inflation rate. Similarly, the effects of changes in π^* depend on r and π^*: $\partial r/\partial \pi^* = -(1+r)/(1+\pi^*)$.

Table 3. Short Run and Long Run Elasticities of Per Capita Private Consumption with respect to the Interest Factor

	S.R.	L.R.	Confidence Level 1/
Argentina	-.047	-.047	99
Chile	-.153	-.232	99
Colombia	-.038	-.038	28
Costa Rica	-.043	-.060	26
Guatemala	.282	.456	99
Haiti	-.188	-.188	97
Honduras	-1.080	-2.356	97
Mexico	.021	.021	16
Panama	-1.090	-1.090	99
Paraguay	-.166	-.166	98
Peru	-.147	-.183	92
Uruguay	-.066	-.113	96

1/ This column indicates the confidence level at which the short run coefficient is significantly different from zero.

results for interest rate policy. In addition, the results are sensitive to the assumed specification of the expectations formation mechanism. Finally, it should also be noted that the elasticities reported are consumption elasticities. The savings elasticity at any point is obtained by changing the sign and multiplying by the ratio of consumption to savings at that point. 1/

3. Results incorporating a time trend

The rationale for incorporating a time trend in the estimating equation was explained in Section 2. Table 4 contains the estimated private consumption functions incorporating a time trend. For seven of the countries, the coefficient on the time trend is significant. In three of these cases the coefficient has a positive sign and in the other four a negative sign.

Only in those equations where it has a significant coefficient does introduction of the time trend change estimates sufficiently to merit comment. In the four cases where the time trend has a significantly negative coefficient the effect has, not surprisingly, been to increase the long-run income elasticity. For two (Uruguay and Mexico) of the three cases where it has a significantly positive coefficient, the impact has been in the opposite direction. In Table 4 it is seen that the export variable is significant for eight countries in comparison to five when the time trend is excluded (additional countries are Colombia, Haiti and Uruguay). The government consumption variable is no longer significant in the case of Honduras and its coefficient estimate in the case of Panama seems much too large. Turning to the interest rate variable it is seen that when the time trend is introduced, the estimates are no longer significant in the cases of Uruguay and Haiti but become significant in the cases of Colombia and Mexico (signficantly positive in the case of Mexico).

1/ Let η_{CR} be the consumption elasticity and η_{sr} the saving elasticity

$$\eta_{CR} = \frac{\partial C}{\partial R}\frac{R}{C}$$

$$\eta_{SR} = \frac{\partial S}{\partial R}\frac{R}{S} = -\eta_{CR}\cdot\frac{C}{S}$$

Since income is being held constant in this calculation, $dC = -dS$. It has not been possible to construct savings elasticities due to lack of data on private savings.

Table 4. Estimated Equations for Per Capita Private Consumption (QCDP) 1/ including the time trend

(all variables entered in log form)

	Constant	QYP	QYP-PTP	PTP	R1	R2	QXP/QYP	QGCP/QYP	QCDP(-1)	TRR	p	S.E.E.	$\bar{R}^2$	α
Argentina	.074	.697		-.009	-.047		-.092	-.209		-.0001	.044	.0075	.9917	1.0
	(0.45)	(11.56)		(2.56)	(5.12)		(7.85)	(5.50)		(.13)				
Chile	-.356	.873				-.145	-.056		.424	-.021	-.158	.0264	.9958	1.0
	(4.51)	(6.76)				(4.24)	(1.98)		(5.46)	(-2.11)				
Colombia	-3.668		1.309		-.229		-.239			-.012	-.138	.0210	.9786	0.9
	(2.44)		(8.94)		(2.43)		(2.30)			(2.79)				
Costa Rica	.900	.597			.011				.274	.003	.033	.0267	.9871	0.6
	(.75)	(4.24)			(.06)				(1.61)	(.43)				
Guatemala	-.373	.625				.283	-.658			.0001	-.474	.0100	.9866	0.6
	(.514)	(6.55)				(3.46)	(2.74)			(.22)				
Haiti	-.660	1.084			-.130		.032			-.005	.297	.0122	.9824	0.5
	(2.46)	(27.16)			(1.39)		(1.98)			(4.89)				
Honduras	.676		.287			-.900			.599	-.002	-.359	.0186	.8518	0.6
	(.93)		(2.57)			(2.17)			(4.70)	(1.37)				
Mexico	4.080		.506		.338		-.059			.014	-.153	.0150	.9863	
	(2.91)		(3.30)		(2.09)		(5.40)			(2.48)				
Panama	.206	.692			-.671			-.689		.014	-.259	.0344	.9200	1.0
	(.15)	(4.41)			(2.37)			(3.49)		(2.96)				
Paraguay	2.995	.705			-.164					.000	.008	.0126	.9930	1.0
	(4.95)	(12.39)			(2.62)					(.00)				
Peru	4.521	1.021				-.177	-.032		-.402	-.009	-.700	.0079	.9962	1.0
	(6.08)	(16.03)				(4.33)	(2.30)		(7.80)	(5.83)				
Uruguay	2.08		.675			-.021	-.083			.005	-.01	.0233	.8746	0.7
	(2.24)		(5.61)			(0.66)	(3.02)			(3.53)				

1/ See note to Table 2 for details of variables and period of estimation. TTR is the time trend variable.

IV. Conclusions

It was noted in the introduction that the effects of real interest rates on consumption have long been a source of controversy and that, on theoretical grounds, the effect could go in either direction. The aim of this paper has not been to finally resolve this issue. The debate is still very unsettled for the economies of the industrialized countries where the quality of the data enables researchers to engage in more sophisticated empirical analysis than has been attempted here. Nevertheless, in light of the wide variety of experiences of countries in the sample, the evidence produced by the study is interesting in that it points to a negative correlation between real interest rates and measured consumption for most of the countries in the sample. However, in interpreting this evidence, it is worthwhile to be aware of the many limitations of the study which have been noted earlier, both with respect to the techniques used and the quality of the data. Furthermore, it should be kept in mind that the effect on aggregate consumption is not the only, nor necessarily the most important, consideration in designing and implementing interest rate policies. What is relevant for economic efficiency are the compensated effects of interest rate changes on consumption. In addition, when considering interest rate policies, one must bear in mind the effects of these policies on the efficiency of investment.

Aggregate Consumption Functions

Tables 5 and 6 contain the estimates for the aggregate consumption function, those in Table 6 incorporating a time trend as an explanatory variable. The specification of the aggregate consumption function is the same as that for the private consumption function except that for reasons noted earlier, it does not include the inflation tax adjustment or the government consumption variable. The estimates for Haiti are the same as those given in Tables 2 and 4, since no private consumption data could be constructed for Haiti. Broadly speaking, the estimates for the other countries parallel those for the private consumption functions. The export variable is included for eight countries in Table 5 and nine in Table 6. The interest rate results are similar to those in the private consumption functions presented in Tables 2 and 4, except that Paraguay and Peru no longer have significant coefficients.

Table 5. Estimated Equations for Per Capita Consumption (QCP) 1/

(all variables entered in log form)

	Constant	QYP	R1	R2	QXP/QYP	QCP(-1)	p	S.E.E.	$\bar{R}^2$	α
Argentina	.750	.679	-.038		-.096		.289	.0094	.9863	1.0
	(5.57)	(18.79)	(3.94)		(7.54)					
Chile	.311	.755		-.139	-.078	.300	.259	.0226	.9971	1.0
	(4.12)	(11.51)		(4.08)	(2.68)	(4.88)				
Colombia	1.591	.812	-.022				.421	.0249	.9726	0.9
	(2.98)	(14.67)	(.23)							
Costa Rica	-.149	.673	-.026			.335	.116	.0225	.9927	0.7
	(0.69)	(5.63)	(.23)			(2.56)				
Guatemala	.076	.553		.262	-.037	.411	-.482	.0087	.9901	0.7
	(.26)	(8.05)		(4.14)	(2.01)	(4.64)				
Haiti	.967	1.118	-.188				.926	.0137	.9780	0.7
	(3.65)	(29.58)	(2.58)							
Honduras	1.328	.241		-1.060		.550	-.431	.0163	.9221	0.5
	(3.39)	(2.40)		(2.74)		(4.27)				
Mexico	0.906	.854	.011		-.058		.221	.0167	.9830	0.2
	(2.40)	(20.01)	(.22)		(3.36)					
Panama	1.575	.742	-.954				.437	.0303	.9569	1.0
	(2.58)	(8.42)	(3.59)							
Paraguay	2.79	.721	-.038		-.055		-.140	.0134	.9915	0.9
	(12.42)	(37.68)	(.56)		(2.33)					
Peru	-.339	.665		-.064	-.099	-.340	.186	.0117	.9928	0.8
	(.82)	(8.62)		(.76)	(5.98)	(5.13)				
Uruguay	.814	.848		-.116	-.115		.744	.0217	.8909	0.4
	(0.97)	(7.98)		(1.94)	(4.42)					

See notes to Tables 2 and 4 for information on variables and periods of estimation.

Table 6. Estimated Equations for Per Capita Consumption (QCP) including Time Trend 1/

(all variables entered in log form)

	Constant	QYP	R1	R2	QXP/QYP	TTR	QCP(-1)	p	S.E.E.	$\bar{R}^2$	α
Argentina	0.558	0.743	-.038		-.082	-.002		.434	.0087	.9881	1.0
	(3.35)	(15.45)	(4.39)		(6.37)	(1.85)					
Chile	-.337	.867		-.132	-.081	-.015		.374	.0222	.9972	1.0
	(4.38)	(7.62)		(3.99)	(2.86)	(1.23)					
Colombia	-4.19	1.345	-.144		-.035			-.306	.0231	.9761	1.0
	(2.84)	(9.47)	(1.60)		(3.18)						
Costa Rica	.147	.648	.002			.002	.324	-.092	.0232	.9921	0.7
	(.15)	(4.61)	(.02)			(.31)	(2.22)				
Guatemala	.473	.529		.267	-.044	.002	.366	-.493	.0090	.9894	0.7
	(.64)	(6.54)		(4.11)	(2.02)	(.60)	(3.10)				
Haiti	-.660	1.084	-.130		-.032	-.005		.297	.0122	.9824	0.5
	(2.46)	(27.16)	(1.39)		(1.98)	(4.89)					
Honduras	1.477	.238		-1.02		.001	.529	-.414	.0169	.9160	0.5
	(1.97)	(2.32)		(2.39)		(.24)	(3.38)				
Mexico	4.110	.515	.127		-.050	.016		-.358	.0121	.9937	[illegible]
	(4.22)	(4.83)	(1.25)		(6.54)	(3.98)					
Panama	3.207	.491	-.948			.008		.271	.0295	.9591	1.0
	(2.68)	(2.69)	(3.54)			(1.51)					
Paraguay	3.914	.615	-.073		-.050	.004		-.080	.0119	.9939	1.0
	(7.13)	(12.05)	(1.25)		(2.34)	(2.17)					
Peru	-3.702	.794		-.750	-.049	-.008	.558	-.306	.0099	.9948	1.0
	(3.41)	(9.26)		(1.31)	(2.50)	(3.25)	(7.31)				
Uruguay	1.100	.805		-.118	-.106	.004		.599	.0216	.8908	0.4
	(1.14)	(6.40)		(1.96)	(3.39)	(1.23)					

1/ See notes to Tables 2 and 4 for information on variables and periods of estimation.

Information on Interest Data Used and Summary of Additional Results

This appendix contains some notes relevant to the estimates presented in the paper. In addition, there are some brief references to the results obtained from additional econometric work not reported here. The discussion of these additional results is selective, focusing only on results which are of interest in light of results reported in the paper.

Argentina

1. The interest rate series is a deposit rate contained in Gaba (1981). The period of estimation was 1960-78, national accounts data not being available at the time of estimation for the years after 1978.

2. The significance and magnitude of the rates of return coefficients are not very sensitive to the exclusion of either the government consumption variable and/or the inflation tax variable.

3. The estimates presented use inflation expectations mechanism A. If mechanism B is used the interest rate coefficients were of positive sign with significant t-statistics. However, the fit was less good than with mechanism A.

Chile

1. The interest rate series used for Chile is a result of combining two separate series. For 1974 and after, the 30-day time-deposit rate is used. For the years prior to 1974, the legal maximum lending rate is used as a proxy for the deposit rate. 1/

2. In the estimated equation reported in Table 2, the export coefficient is not significant at the 10 per cent level though it does fulfill the criterion of $t > 1.5$. If it is excluded the magnitude and significance of the interest coefficient are not much affected.

3. The results reported in the text make use of expectations formulation mechanism B. If formulation A is used, the sign of the real rate of return coefficient in the private consumption equations are negative and significant at the 97 per cent level but quantitatively smaller (-.08 in the short run and -.15 in the long run) than those reported in the text. Formulation A also gives a less good fit than formulation B.

Colombia

1. The interest rate series used for Colombia was a six-month time-deposit rate.

1/ The process of financial liberalization was initiated in 1974 and the level of interest rates rose sharply. Problems in splicing together the two interest rate series are probably dwarfed by this large increase in interest rates.

2. Colombia introduced indexation of financial instruments on a limited scale (liabilities of the newly created savings and loan system) toward the end of 1972. A dummy variable for 1973 and the following years did not improve the fit of the equation.

Costa Rica

The interest rate used for Costa Rica was the six-month time-deposit rate.

Guatemala

1. The interest rate used for the equation reported in the text is the domestic rate on time and savings deposits. Use of the U.S. Treasury bill rate produced very similar results for the rate of return coefficient.

2. The results presented in the text used inflation expectations formulation B. If formulation A is used the magnitude of the coefficient on the rate of return is only slightly smaller though with lower t-statistics.

Haiti

1. All results for Haiti are for aggregate consumption functions, since no national accounts breakdown of consumption between government and private consumption was available.

2. The interest rate series used is the U.S. Treasury bill rate. This is justified by reference to the absence of restrictions on capital flows and the fixed exchange rate vis-à-vis the U.S. dollar.

3. No firm evidence on domestic interest rates is available prior to 1970 (interest rates in the commercial banking sector were not regulated prior to 1970). However, if one assumes that rates prior to 1970 were stable, 1/ and estimates an equation on that basis, the results are very close to those reported in the text.

Honduras

1. The interest rate used for the reported results is the domestic rate on six-month time deposits. If the U.S. Treasury bill rate is used, the SEE is virtually the same though the magnitude of the interest coefficient is considerably lower (its significance level is, however, little changed). 2/

1/ Galbis (1979a) indicates that before 1970 rates were low and stable.

2/ Again use of the U.S. Treasury bill rate is justified by the relatively open capital markets in Honduras and the fixed exchange rate vis-à-vis the U.S. dollar.

2. If inflation adjustment mechanism A is used the fit is less good and the interest rate coefficients while still negative are no longer significant at conventional confidence levels.

Mexico

The interest rate series used for Mexico is the U.S. Treasury bill rate. The choice of interest rate seems appropriate, given the proximity of the United States and the openness of Mexican financial markets (during the period covered by this study). The principal problem with using the U.S. t-bill rate is that in recent years the dollar/peso exchange rate has not been constant. For the years of our sample, this would not seem to be a problem since most of the movements occurred over a period of four months in late 1976 and for the rest of the floating rate period, the rate was relatively stable. However, what is relevant for portfolio discussions is expected exchange rate changes.

Panama

The interest rate used for the equations presented in the text is the rate on time and savings deposits. Panama is very open to financial capital flows and has had a constant exchange rate vis-a-vis the U.S. dollar. Accordingly, the U.S. Treasury bill rate was also tried, with little effect on the nature of the results.

Paraguay

1. The interest rate used is the six-month time-deposit rate.

2. In 1973, Paraguay introduced price level indexed financial instruments into the savings and loan system. Attempts to allow for this using a dummy variable did not improve the fit of the equation.

3. The interest rate used is the six-month time-deposit rate.

Peru

The interest rate used is the six-month rate on domestic time deposits.

Uruguay

The interest rate used for Uruguay is the six-month deposit rate. In Galbis (1979a) it is noted that the rate in effect in 1967 had been in

effect for several years prior to that time. On the basis of this, it was assumed that the interest rate in effect from 1961 to 1967 1/ was the same as in 1967. Accordingly, the regression was run for the period 1961-79. 2/

1/ In further support of this assumption, IMF country reports during this period do not specifically mention any change in deposit rates of interest.

2/ If one extends the interest rate assumption only to 1962 and runs the regression over the period 1962 to 1979 the results are very much the same.

Bibliography

Aghevli, B., et.al., "Monetary Policy in Selected Asian Countries," IMF Staff Papers (December 1979), p. 775.

Barro, R., "Are Government Bonds Net Wealth," Journal of Political Economy (October 1974), pp. 1095-1117.

Boskin, M., "Taxation, Saving, and the Rate of Interest," Journal of Political Economy (April 1978) Section 2, pp. S3-S28.

Chenery, H. and P. Eckstein, "Development Alternative for Latin America," Journal of Political Economy (July 1970), pp. 966-1006.

Feldstein, M., "The Welfare Cost of Capital Income Taxation," Journal of Political Economy (April 1978) Section 2, pp. S29-S52.

Fry, M., "Money and Capital or Financial Deepening in Economic Development?" Journal of Money Credit and Banking (November 1978), pp. 464-75.

___,"Interest Rates in Asia," International Monetary Fund (Washington, D.C.) (unpublished, 1981).

Gaba, E., "The Argentine Financial Reform--Lessons from an Experience," paper presented to the Central Bank Technician Meeting (The Dominican Republic, November 1981).

Galbis, V., "Inflation and Interest Rate Policies in Latin America, 1967-76," International Monetary Fund (Washington, D.C.) DM/79/1.

_____, "Inflation and Interest Rate Policies in Latin America 1967-76," IMF, Staff Papers (June 1979), pp. 334-66.

Howrey, E. and S. Hymans, "The Measurement and Determination of Loanable-Funds Savings," Brookings Papers on Economic Activity, The Brookings Institution (Washington, D.C.), (No. 3, 1978), pp. 655-705.

Khan, M., "The Variability of Expectations in Hyperinflations," Journal of Political Economy (August 1977), pp. 817-28.

____, "Monetary Shocks and the Dynamics of Inflation," IMF Staff Papers (June 1980), pp. 250-85.

Landau, L., "Differences in Savings Rates among Latin American Countries," in Studies in Development Planning, H. Chenery, editor (Cambridge, Massachusetts, Harvard University Press, 1969).

Lee, J., "Exports and the Propensity to Save in LDCs," Economic Journal (June 1971), pp. 341-51.

Leff, N., and K. Sato, "A Simultaneous Equation Model of Savings in Developing Countries," Journal of Political Economy (December 1975), pp. 1217-28.

Maizels, A., Exports and Economic Growth in Developing Countries, (Cambridge, England, University Press, 1968).

McKinnon, R., Money and Capital in Economic Development, The Brookings Institution (Washington, D.C., 1973).

Meiselman, D., editor, Varieties of Monetary Experience, University of Chicago Press (Chicago, 1970).

Mikesell, R. and J. Zinser, "The Nature of the Savings Function in Developing Countries: A Survey of the Theoretical and Empirical Literature," Journal of Economic Literature (March 1973), pp. 1-26.

Qureshi, Z., "Household Savings in Pakistan: Some Findings from Time-Series Data," Pakistan Development Review (Winter 1981), pp. 375-97.

Sachs, J., "The Current Account and Macroeconomic Adjustments in the 1970s," Brookings Papers on Economic Activity, The Brookings Institution (Washington, D.C.), (No. 1, 1981) pp. 201-68.

Shaw, E., Financial Deepening in Economic Development, (New York, Oxford University Press, 1973).

Snyder, D., "Economic Studies of Household Behavior in Developing Countries: A Survey," Journal of Development Studies (January 1974), pp. 139-53.

Summers, L., "Capital Taxation and Accumulation in a Life Cycle Growth Model," American Economic Review (September 1981), pp. 533-44.

Sundararajan, V. and S. Thakur, "Public Investment, Crowding Out and Growth: A Dynamic Model Applied to India and Korea," IMF Staff Papers (December 1980), pp. 814-55.

van Wijnbergen, S., "Stagflationary Effects of Monetary Stabilization Policies," Journal of Development Economics (1982), pp. 133-69.