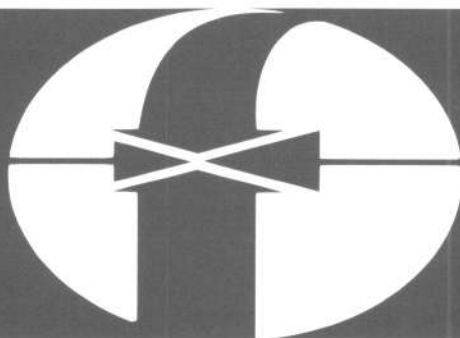


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Quarterly Review - No. 1 - 1987 - XI



Savings and Development

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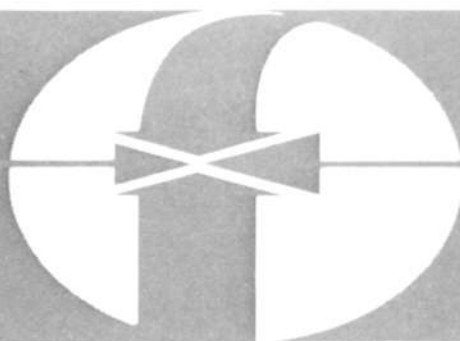
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FOREIGN CAPITAL, EXPORTS, SAVINGS AND GROWTH IN THE ASIAN REGION (*)

Pradumna B. Rana
Asian Development Bank

1. Introduction

The impact of foreign capital on the economic growth of developing countries as well as the relative significance of the various types of foreign capital *vis-a-vis* trade, are controversial. Early writers (Rosenstein-Rodan 1961, Chenery and Strout 1966) assumed that each dollar of foreign capital inflows augmented resources available for capital formation by a dollar. Given this assumption and the assumption that the incremental capital-output ratio was stable, it was possible to show that foreign capital had a favorable effect on economic growth. More recently Areskoug (1969), Griffin (1970), Leff (1968) and Weiskopf (1972) challenged these assumptions, demonstrating that foreign capital could affect the growth rate adversely.

Meanwhile, the question on the relative significance of the various types of foreign capital and trade in the economic growth of developing countries has also figured prominently in the recent North-South dialogue. While the South has recognized the contribution that trade can make to growth, it has placed more emphasis on the need for a massive inflow of concessional resources from the North to stimulate rapid growth and eradicate widespread poverty. Some industrialized countries, have rejected this claim and emphasized the importance of self-help and well-functioning market mechanisms to promote development. The major components of the self-help procedures are trade and exchange liberalization and policies to attract private foreign investment. Behind both of the controversies, of course, lie more fundamental issues: for example, the role of multinationals in developing countries, the technology transfer issues, and the role of the public *vis-a-vis* private sectors. There are, however, important narrower questions — more macro-economic in nature — which are of immediate concern and which have implications for the debates. These are the impact of foreign capital on growth, and the relative quantitative significance of the various types of foreign capital and exports in explaining growth of the developing countries. In other words, does foreign capital affect growth favorably and which is more beneficial to developing countries — foreign aid, private foreign investment or trade? This paper addresses itself to these narrowly defined questions using the experience of the Asian developing countries (ADCs).

* The author is grateful to I. Ali, B. Campbell, and J.M. Dowling for helpful comments and suggestions. Views expressed are those of the author and not necessarily those of the Asian Development Bank.

Numerous authors (e.g. Rahman 1968, Areskoug 1969, Griffin and Enos 1970, Voivodas 1973, Papanek 1972, 1973, Weiskopf 1972, Stoneman 1975 and Gupta and Islam 1983, Dowling and Hiemenz 1982, Fry 1984) have attempted to provide answers to these questions. Most of these attempts have focussed on examining the effect of foreign capital on growth and have comprised an estimation of the impact of foreign capital (together with exports, in some cases) on the saving or the real growth rate. The common approach has been to specify the saving rate or the growth rate as a function of foreign capital inflow and to estimate them by using single equation techniques. The results obtained by such procedures could be misleading because the estimates are biased and inconsistent. There are two reasons for this. First, these studies do not isolate the independent influence of export performance on the saving and the growth rate and, therefore, contain specification bias. Second, the studies ignore the simultaneity between the saving and growth rates. We have by now numerous empirical and theoretical studies which show that the two variables affect each other. A proper appreciation of the quantitative influences of foreign capital on growth must, therefore, take into account the influence of trade performance as well as resolve the simultaneity issue.

For these purposes, we specify a simple two-equation model consisting of a growth and a saving equation. Both of these equations include an export performance variable on the right-hand side. Also in order to answer the questions raised in the North-South debate, we disaggregate net financial flows which is an exogenous variable in our model into the foreign private investment components.

The rest of the paper is organized as follows: Section 2 presents the two-equation model; Section 3 contains the estimation results using data from Asian developing countries; and Section 4 presents the summary and conclusions.

2. The model

In order to account for the interdependence between the saving and growth rate, we specify the following simultaneous model

$$GR = a_0 + a_1 AID + a_2 FPI + a_3 S + a_4 CX + a_5 CLF + u_t \quad (1)$$

($a_1 \leq 0$) ($a_2 \leq 0$) ($a_3 > 0$) ($a_4 > 0$) ($a_5 > 0$)

$$S = a_6 + a_7 AID + a_8 FPI + a_9 CX + a_{10} GDPN + a_{11} GR + V_t \quad (2)$$

($a_7 \leq 0$) ($a_8 \leq 0$) ($a_9 > 0$) ($a_{10} > 0$) ($a_{11} > 0$)

where

GR	= growth rate of GDP
AID	= foreign aid as percentage of GDP
FPI	= foreign private investment (including long-term borrowing) as percentage of GDP
S	= gross domestic saving as percentage of GDP
CX	= change in export as percentage of GDP
CLF	= change in labor force
GDPN	= GDP per capita
u, v	= stochastic error terms, and
$a_0 \dots a_{11}$	= parameters

This model consists of two endogenous variables (GR and S) and five exogenous variables (AID, FPI, CX, CLF and GDPN)¹.

The expected signs of the parameters are given in parenthesis below the equations. Given the controversy between economists, the sign of a_1 and a_2 and a_7 and a_8 could be either positive or negative.

The structural model described above consists of a growth equation and a saving equation. The growth equation is derived from a traditional export-augmented neoclassical production function (Feder 1982 and Rana 1985), and the saving equation is the traditional Keynesian-type augmented by the export variable, the per capita income and the growth rate variables.

The export variable is included in the growth equation for at least four reasons. First, it enables countries to specialize in the production of commodities in which they have a comparative advantage; resources are saved with can then be used for investment. Second, trade provides a vent for surplus commodities which bring otherwise unemployed resources into employment. Third, trade can expand production possibilities through its effect on such factors as competition, access to new knowledge, technology and ideas; these are the so-called dynamic gains from trade. Fourth, trade enables

1 There are situations when this exogeneity may not hold. See Section 3 for a discussion of the problems involved and empirical evidences from ADCs.

countries to purchase goods from abroad which can be important for two reasons. The first, is that if there are no domestic substitutes, the ability to import can relieve bottlenecks in production and thus increase savings and investment. The second is that imports may simply be more productive than domestic resources.

Export performance is also expected to influence the saving rate for several reasons. First, exports specially primary exports often produce highly concentrated income and standard savings theory show that the propensity to save from such income is high (Papanek 1972). Second, countries whose export performance is good tend to face less foreign exchange constraint on investment and therefore tend to provide more of an incentive to save. Third, to the extent that trade taxes are a major source of revenue, exports tend to increase government savings.

The inclusion of the growth rate and per capita income in the saving equation is fairly standard (see the survey article by Mikesell and Zinser 1973). The growth rate variable is justified on the ground that rapid growth leads to changes in relative income and life-time consumption patterns and increases in transitory income in relation to permanent income; the former influences the saving rate more than the latter. The per capita income variable reflects the state of development of a country and is expected to have a favorable influence on the saving rate. Another variable that is commonly included in a saving equation is the dependency ratio. This variable was not included in our specification because of Fry's (1984) finding that this variable tends to be highly correlated with per capita income.

The reduced form growth and saving equations which are obtained by substituting equation (2) in equation (1) and vice versa, can be written as:

$$GR = \pi_0 + \pi_1 AID + \pi_2 FPI + \pi_3 CX + \pi_4 CLF + \pi_5 GDPN + \epsilon_t \quad (3)$$

where

$$\begin{aligned} \pi_0 &= \frac{a_0 + a_3 a_6}{1 - a_3 a_{11}}, \quad \pi_1 = \frac{a_1 + a_3 a_7}{1 - a_3 a_{11}}, \quad \pi_2 = \frac{a_2 + a_3 a_8}{1 - a_3 a_{11}} \\ \pi_3 &= \frac{a_4 + a_3 a_9}{1 - a_3 a_{11}}, \quad \pi_4 = \frac{a_5}{1 - a_3 a_{11}}, \quad \pi_5 = \frac{a_3 a_{10}}{1 - a_3 a_{11}} \end{aligned}$$

$$S = \pi_6 + \pi_7 AID + \pi_8 FPI + \pi_9 CX + \pi_{10} CLF + \pi_{11} GDPN + \eta_t \quad (4)$$

where

$$\begin{aligned}\pi_6 &= \frac{a_6 + a_0 a_{11}}{1 - a_3 a_{11}}, \quad \pi_7 = \frac{a_7 + a_1 a_{11}}{1 - a_3 a_{11}}, \quad \pi_8 = \frac{a_8 + a_2 a_{11}}{1 - a_3 a_{11}} \\ \pi_9 &= \frac{a_9 + a_4 a_{11}}{1 - a_3 a_{11}}, \quad \pi_{10} = \frac{a_5 a_{11}}{1 - a_3 a_{11}}, \quad \pi_{11} = \frac{a_{10}}{1 - a_3 a_{11}}\end{aligned}$$

We can analyse the implications of simultaneity by comparing the parameters of the structural and reduced form equations. While the coefficients structural growth equation estimate the *direct effect* of foreign capital, domestic saving rate, exports and labor force on growth, the coefficients of the reduced form growth equation estimate the *total effect* of the exogenous variable on growth — they incorporate the *indirect effect* of foreign capital and exports on growth which arise because of the effect of these variables on the savings rate. For example, a_1 measures the direct effect of aid on growth,

while $\pi_1 = \frac{a_1 + a_3 a_7}{1 - a_3 a_{11}}$ is the total effect because it incorporates a_7 and a_3 .

The incorporation of the indirect effects in the reduced form equations implies that consideration of the direct effects alone could be misleading in two ways¹. First, the direct and total effects could be qualitatively different. This means that while the direct effect is positive the total effect could be negative and *vice versa*. Since generally $1 > a_3 > 0$, and $1 > a_{11} > 0$, this could occur when $a_7 < 0$. Second, the direct effect and total effect could be quantitatively different. This can happen either when $a_7 > 0$ or when $a_7 < 0$. While in the former case the direct effect underestimates the favourable effect of foreign capital on growth, in the latter case the direction of the bias is not certain.

3. Estimation results

The two-equation model specified in the previous section was estimated by both the ordinary least squares (OLS) and the indirect least squares (ILS) techni-

¹ Although the misleading nature of considering the direct effects above is illustrated by analysing the effect of aid on growth, similar arguments apply to the effect of foreign private investment on growth and the effect of aid and foreign private investment both on the saving rate.

que¹ using data from fourteen Asian DMCs² during the period 1965-1982. We obtained both time series as well as pooled cross-section and time series estimates of the model. Because of the relatively few number of observations and low variability of the independent variables, the time series estimates were generally unsatisfactory by the usual statistical criteria (e.g., low *t* and *R*² values). We, therefore, discuss only the pooled results. Since the pooled analysis constrains the coefficients, in order to obtain more meaningful results the samples were disaggregated by income levels (low income and middle income) and by time periods (pre-1973 and post-1973); further country intercept dummies were included within each income group.

As noted in the previous section the two-equation model assumes that while the domestic saving rate and the growth rate variables are endogenous, the foreign capital inflow variable (i.e., AID and FPI) are exogenous. There could, however, be cases when this may not be true. Both the saving rate, foreign inflows and on occasions the growth rate may be affected by a common exogenous factor³. In such cases it would be misleading to interpret the results as causal relationships. However, using time series data from a sample of Asian countries, Iwasaki (1985) has shown that in most cases «causality» (in the Pierce-Granger-Haugh sense) when detected ran from foreign capital to the saving and growth rate rather than the other way around. There is, in addition, another reason why the coefficients of the foreign inflow variables on the saving equation must be interpreted with caution. As noted by Papanek (1972) and Newlyn (1973) a

1 Consistent estimators of a system of simultaneous equations can be obtained in two ways. One can either estimate the structural equations by using a simultaneous technique and then solve for the reduced forms. Alternatively, one can estimate the reduced form using a single equation technique and then solve for the structural forms. The latter procedure is known as the indirect least squares technique and can be used only when the model is exactly identified both by the rank and the order conditions, as in the case with our model.

2 Bangladesh, Burma, Republic of China, Hong Kong, India, Indonesia, Republic of Korea, Nepal, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka and Thailand. See Appendix I for sources of data. In the pooled analysis the data were expressed as three year averages in order to remove annual fluctuations. Longer lags were not considered.

3 For example, a poor crop due to unfavourable weather conditions and adverse movement in the external terms of trade can lead to a decline in the saving rate and an increase in foreign inflows, if the latter is correlated to need. Also as Mosley (1980) has argued, aid inflows could be influenced by the growth rate and situations where high growth is associated with high savings and low aid inflows and *vice versa* could arise. Since the empirical analysis pools data from the dynamic newly industrialized countries as well as the less dynamic South Asian countries, an attempt was made to test Mosley's argument by including a third equation where aid was specified as a function of growth. This model, however, performed poorly and the growth variable did not have a statistically significant effect on aid inflows.

part of the negative statistical relationship between domestic saving and foreign inflows could be the result of an accounting convention and not a behavioral relationship¹. Hence it is within these constraints that the results of the paper must be interpreted.

Although the OLS estimates are biased and inconsistent they are reported for the aggregate sample for two reasons. First, our specification improves on earlier studies. Second, our study covers more recent periods and thereby provides a useful comparison with earlier studies.

3.1. OLS (Single Equation) Results

The estimated growth and saving equation obtained by the OLS method for the aggregate sample of the fourteen Asian developing countries are presented in Table 1. The country intercept dummies which were introduced to account for cross-country differences were generally not significant and were dropped.

The results confirm the findings of the earlier studies that the various types of foreign capital as well as the domestic saving rate have had a favorable effect on economic

1 Papanek (1972) and Newlyn (1973) argue that a saving function should be identified as

$$S' = \alpha + \beta \text{ GDP} \quad (1)$$

where S' is saving out of GDP (= GDP - CGDP where C is consumption out of GDP).

Since the conventional indirect estimates of saving, S , are obtained either by deducting foreign saving from total capital formation or total consumption (i.e., CGDP + FCC, where FCC is consumption out of foreign inflow from GDP) equation (1) can be written as

$$S = \alpha + \beta \text{ GDP} - \text{FCC} \quad (2)$$

$$\text{or } S = \alpha + \beta \text{ GDP} - \frac{\text{FCC}}{\text{FC}} \text{ FC} \quad (3)$$

when one regresses S on GDP and FC, one obtains the following relationship

$$S = \hat{\alpha} + \hat{\beta} \text{ GDP} + \hat{\delta} \text{ FC} \quad (4)$$

A comparison of equations (4) and (3) shows that $\hat{\delta}$ would lie between 0 and -1.

growth of the Asian developing countries¹. The estimated coefficients of these variables are, however, lower than those of the earlier studies covering the 1950s and 1960s suggesting that the relative significance of these variables have declined in the more recent periods. The data also indicate that the estimated coefficient of the foreign investment variable is approximately two and a half times that of the aid variable suggesting that the former has contributed more to growth than the latter. While this finding supports the Stoneman (1975) and the Dowling and Hiemenz (1982) study, it contradicts the Gupta and Islam (1983) Papanek (1972) findings. Export performance has also contributed favorably to economic growth.

Table 1

ORDINARY LEAST SQUARES RESULTS: AGGREGATE SAMPLE, 1965-1982

Independent Variables									
Dependent Variables	Constant	AID	FPI	CX	CLF	GDPN	GR	S	R ²
GR	2.153 (1.861)**	0.195 (1.33)*	0.536 (2.09)***	0.101 (1.39)*	0.263 (1.27)*			0.106 (2.11)***	0.37
S	12.243 (6.12)****	-1.288 (-4.460)****	-0.219 (-0.354)	0.047 (0.219)		0.003 (3.010)	0.668 (2.636)***		0.63

* marginally significant
 ** significant at 10 per cent
 *** significant at 5 per cent
 **** significant at 1 per cent
 (t values in parenthesis).

As already noted, the strong negative effect of aid on domestic saving (which confirm Gupta and Islam (1983) finding) and the negative effect of foreign investment on domestic saving must be interpreted with caution. These results are more likely to be the

1 Although the coefficient of the AID variable is not statistically significant at the traditional levels of 5 or 10 percent, the estimated coefficient is larger than the standard error and so the coefficient is «marginally» significant. (See Gupta and Islam, 1983).

result of exogenous factors affecting both foreign inflows and saving rather than a causal relationship. Further, a part of the effect could be explained by the use of the conventional saving data. The results, however, also show that per capita GDP and growth rate have had a significant positive effect on the saving rate of the Asian developing countries. While the export performance variable has had a positive effect, it is not statistically significant.

3.2 ILS (*Simultaneous Equation*) Results

Although independent estimates of the two-equation growth model for the aggregate and the disaggregated samples were obtained, the results for the pre-1973 and post-1973 samples are not presented. This is because the Chow test led to the acceptance of the null hypothesis that the samples disaggregated by time periods came from the same population; it rejected a similar hypothesis where the samples were disaggregated by income levels.¹ Also as a rough test of homogeneity within the low and middle income groups country-specific goodness of fit measures were calculated by correlating the predicted growth and saving rate with the actual values (see Appendix II). The results broadly support the assumption of homogeneity between the two groups. Of course, as expected the results are less encouraging in the case of the low income sample.

The estimation results by the ILS method for the aggregate and the low and middle income samples are presented in Tables 2 to 4². While the top panels of these tables provide the estimated reduced form equations, the bottom panels provide the estimated coefficients of the structural equations derived by solving the reduced form estimates³.

The reduced form estimates for the aggregate sample indicate that the exogenous variables explain about a third of the fluctuations in the growth rate and two-thirds of the fluctuations in the saving rate. Both of these figures are fairly respectable for a pooled

1 When the sample was disaggregated by time periods, the computed F-statistic for the growth and saving equation were 1.91 and 2.05, respectively. This is lower than the tabulated value of approximately 2.2 with degrees of freedom, 6,63. Similarly when the disaggregation was by income levels the corresponding computed values were 3.83 and 3.56, respectively.

2 Given the findings of the Chow test, the results for the aggregate sample are not reliable. They are, however, presented for purposes of comparison.

3 See Appendix III.

study of this kind. The goodness of fit deteriorates when the sample is disaggregated. This is due primarily to the loss of degrees of freedom.

Table 2

TWO EQUATION SIMULTANEOUS MODEL OF GROWTH: AGGREGATE SAMPLE OF ADCs

	Constant	AID	FPI	CX	CLF	GDPN	GR	S	R ²
<i>Reduced Form</i>									
Growth Equation	4.185 (4.52)****	0.008 (1.53)*	0.688 (2.47)***	0.210 (2.15)***	0.323 (1.53)*	0.0003 (0.68)			0.33
Saving Equation	14.198 (6.89)****	-1.282 (-4.27)****	0.221 (0.36)	0.168 (1.21)*	0.519 (1.10)*	0.003 (2.69)****			0.60
<i>Structural Form</i>									
Growth Equation	2.764	0.134	0.666	0.193	0.271			0.100	
Saving Equation	7.473	-1.269	-0.885	-0.169		0.003	1.607		

* marginally significant
 ** significant at 10 per cent
 *** significant at 5 per cent
 **** significant at 1 per cent
 (t values in parenthesis)

Table 3

TWO EQUATION SIMULTANEOUS MODEL OF GROWTH: MIDDLE INCOME ADCs

	Constant	AID	FPI	CX	CLF	GDPN	GR	S	R ²
<i>Reduced Form</i>									
Growth Equation	4.807 (3.43)****	0.440 (1.29)*	0.123 (0.38)	0.588 (2.96)****	0.390 (1.71)**	0.0002 (0.39)			0.20
Saving Equation	21.534 (7.89)****	-1.819 (-2.74)****	-0.240 (-0.38)	0.085 (0.46)	0.011 (0.03)	0.002 (2.05)***			0.54
<i>Structural Form</i>									
Growth Equation	2.653	0.620	0.147	0.579	0.389			0.100	
Saving Equation	21.399	-1.807	-0.243	0.080		0.002	0.028		

* marginally significant
 ** significant at 10 per cent
 *** significant at 5 per cent
 **** significant at 1 per cent
 (t values in parenthesis)

Table 4

TWO EQUATION SIMULTANEOUS MODEL OF GROWTH: LOW INCOME ADCs

	Constant	AID	FPI	CX	CLF	GDPN	GR	S	R ²
<i>Reduced Form</i>									
Growth Equation	4.219 (3.17)****	0.189 (1.34)*	1.099 (1.86)**	-0.039 (-0.08)	0.626 (1.60)*	0.0009 (0.71)			0.13
Saving Equation	10.110 (2.86)****	-0.916 (-2.46)***	-0.202 (-0.12)	1.692 (1.33)*	0.970 (0.94)	0.0005 (0.15)			0.10
<i>Structural Form</i>									
Growth Equation	13.978	1.840	1.462	-3.085	-1.12			1.800	
Saving Equation	3.57	-1.210	-1.905	1.753		-0.0009	1.55		

* marginally significant
 ** significant at 10 per cent
 *** significant at 5 per cent
 **** significant at 1 per cent
 (t values in parenthesis)

The reduced form equations for the aggregate sample indicate that foreign investment and export performance have had a favorable and statistically significant effect on the growth of the ADCs. While the effect of foreign aid and labor force variable has also been favorable, its effect is only marginally significant. Although once again the strong negative relationship between aid and domestic saving must be interpreted with caution, as hypothesized per capita GDP has a positive and significant effect on the domestic saving rate. The effect of export performance is positive but only marginally significant.

While the reduced form estimates for the disaggregated samples generally support the findings of the aggregate sample, two major differences which support the case for disaggregation can be noted. First, while export performance has a statistically significant positive effect on the growth of the middle income countries, it is not significant in the low income countries. Second, foreign private investment is found to have a statistically significant positive effect in the growth rate of the low income countries but not in the growth rate of the middle income countries.

The structural equations which are presented in the lower panels of the tables indicate that in addition to the variables discussed in the earlier paragraphs, the domestic saving rate is an important determinant of the growth rate. Similarly, the growth rate is an

important determinant of the saving rate. This clearly supports our criticism of the earlier studies which ignore the simultaneity issue.

3.3 Direct Vs. Total Effects of Foreign Capital and Exports

As indicated in Section 2, while the coefficients of the structural equations measure the direct effects of a variable on the dependent variable, the coefficients of the reduced forms measure the total effects. In order to focus more clearly on these effects we reproduce the direct and total effects of aid, foreign investment and export performance on the growth rate (in Table 5) and on the domestic saving rate (in Table 6).

The data in Tables 4, 5 and 6 indicate the misleading nature of studies which focus on the direct effects alone. For example, while the total effects of aid and export performance on the domestic saving rate in the aggregate sample is positive, the direct effects alone are negative. Similarly, the data indicate that the direct effects alone generally overestimate the favorable effect of foreign capital on the growth rate and exaggerate the adverse effect of foreign capital on the domestic saving rate.

Table 5

DIRECT AND TOTAL EFFECTS OF FOREIGN CAPITAL AND EXPORTS ON GROWTH

	Direct			Total		
	AID	FPI	CX	AID	FPI	CX
Aggregate Sample	0.134	0.666	0.193	0.008	0.688	0.210
Low-income ADCs	1.840	1.462	-3.085	0.189	1.099	-0.039
Middle-income ADCs	0.620	0.147	0.579	0.440	0.123	0.588

Sources: Tables 2, 3 and 4.

Table 6

DIRECT AND TOTAL EFFECTS OF FOREIGN CAPITAL AND EXPORTS ON SAVING RATE

	Direct			Total		
	AID	FPI	CX	AID	FPI	CX
Aggregate Sample	-1.289	-0.885	-0.169	-1.282	0.221	0.168
Low-income ADCs	-1.12	-1.905	1.753	-0.916	-0.202	1.692
Middle-income ADCs	-1.807	-0.243	0.080	-1.819	-0.240	0.085

Source: Tables 2, 3, and 4.

Table 7

DIRECT AND TOTAL EFFECTS OF FOREIGN CAPITAL AND EXPORTS ON INCREMENTAL OUTPUT-CAPITAL RATIO

	Direct			Total		
	AID	FPI	CX	AID	FPI	CX
Aggregate Sample	1.0	29.4	1.1	0.4	2.1	0.7
Low-Income ADCs	12.9	11.7	-24.5	1.2	5.9	-3.6
Middle-Income ADCs	3.3	-0.3	2.0	0.7	-0.2	2.1

3.4 Foreign Capital and Efficiency of Investment

In terms of the Harrod-Domar and the two-gap models foreign capital contributes to growth in two ways. First, it augments funds available for capital formation. Second, it can increase the efficiency of investment as proxied by the IOCR¹. Although the IOCR is not an endogenous variable in our model, we can compute the effect of the exogenous variables on IOCR by using the parameter estimates of our model (see Table 7)². The data in Table 7 show that both aid and foreign private investment and ex-

1 Since the IOCR is effected among others by the gestation period of capital investment, the changes in composition of output and capacity utilization, some caution must be taken in interpreting it as reflecting the efficiency of investment alone. Private foreign capital (particularly, private investment) can improve the efficiency of investment by permitting access to the technology, managerial and marketing skills and skilled labor. Similarly, official lenders generally impose certain minimum thresholds on the rate of return of projects.

2 Rewriting equations (1) and (2) in terms of their mean values, we have

$$\begin{aligned}\overline{GR} &= \hat{a}_0 + \hat{a}_1 \overline{AID} + \hat{a}_2 \overline{FPI} + \hat{a}_3 \overline{S} + \hat{a}_4 \overline{CLF} + \hat{a}_5 \overline{CX} \\ \overline{S} &= \hat{a}_6 + \hat{a}_7 \overline{AID} + \hat{a}_8 \overline{FPI} + \hat{a}_9 \overline{CX} + \hat{a}_{10} \overline{GDPN} + \hat{a}_{11} \overline{GR}.\end{aligned}$$

$$\text{By definition, IOCR} = \frac{\Delta Y/Y}{I/Y} = \frac{\overline{GR}}{\overline{S} + \overline{AID} + \overline{FPI}}, \text{ and}$$

$$\text{taking partial derivatives, } \frac{\partial \text{IOCR}}{\partial (\overline{AID})} = \frac{\frac{\partial \overline{GR}}{\partial \overline{AID}} - \overline{GR} \left(\frac{\partial \overline{S}}{\partial \overline{AID}} + 1 \right)}{(\overline{S} + \overline{AID} + \overline{FPI})^2}$$

$$\text{where } \frac{\partial \overline{GR}}{\partial \overline{AID}} = \hat{a}_1, \frac{\partial \overline{S}}{\partial \overline{AID}} = \hat{a}_7 \text{ and bars above the variables indicate mean values.}$$

$$\frac{\partial \text{IOCR}}{\partial (\overline{FPI})} \text{ and } \frac{\partial \text{IOCR}}{\partial (\overline{CX})} \text{ can be calculated in a similar manner.}$$

port performance have generally increased the efficiency of investment in the Asian DMCs. For example, the data show that on the average a one percentage point increase in aid expressed as a percentage of GDP tends to increase IOCR by four-tenths. There are, however, two exceptions. In the middle income countries foreign investment tended to reduce efficiency of investment¹. A similar effect is associated with exports in the low income countries. The reliability of both of these estimates are, however, questionable because they are derived from coefficients which are not significant at traditional levels.

3.5 Relative Contribution of Aid, Foreign Investment and Exports to Growth

In addition to the impact of foreign capital on growth, another topic which has become important in recent years is the relative contribution of aid, foreign investment and exports to the growth of developing countries. Such a comparison can be made by considering the total effects of the different variables on the growth rate, the domestic saving rate and the efficiency of investment.

The data in Table 5 clearly indicate that in the case of the aggregate sample a percentage point increase in the ratio of foreign investment to GDP contributes more to economic growth than either change in exports or aid. Similarly, the data in Table 6 and Table 7 indicate that foreign investment contributes more to increasing the domestic saving rate and efficiency of investment than other factors. In relative terms, our results show that in the aggregate sample foreign private investment, followed by export performance followed by aid have contributed the most to the growth of the Asian region.

The results for the disaggregated samples, however, show that in the low income countries, foreign private investment followed by aid have been the most significant. In this case, the contribution of export performance is negative but not statistically significant. In the case of the middle income countries export performance followed by aid have been the most significant factors. Foreign private investment has not had a significant effect on growth. In brief, our findings tend to support the North's view that trade and foreign investment are more important than aid. We would only add the proviso that in the low income countries foreign private investment is more crucial than trade while in the middle income countries it is the other way around.

¹ This finding could be explained in two ways. First, the technology imported through foreign investment has been inappropriate. Second, long-term external borrowing may not have been used optimally.

3.6 Contribution of Foreign Capital Relative to Other Variables.

Another topic that is of interest is the relative contribution of foreign capital, exports and other factors (e.g., the domestic saving rate, change in labor force, and per capita GDP) to the economic growth of the ADCs. Such a comparison cannot be made directly by comparing the structural or the reduced form coefficients of the growth equation. This is because the independent or exogenous variables of these equations are not measured in identical units. To handle this problem, we compute two types of multipliers. We first compute the impact multipliers which are the elasticities at the mean values of aid, foreign investment, export performance, labor force and the saving rates in the structural growth equation. Second, we compute the elasticity multipliers based on the mean values of the exogenous variables in the reduced form growth equation¹. The calculated impact and elasticity multipliers of the various variables are presented in Tables 8 and 9 respectively.

The data in Table 8 indicate that the saving rate has contributed, by far, the most to the growth of the ADCs. This result remains unchanged in the disaggregated samples. While the aid variable ranks second in the low income sample, export performance ranks second in the middle income countries.

The data on elasticity multipliers in Table 9 indicate that labor followed by export performance (except in the low income countries where aid ranks second) have been the most important factors influencing the growth of the Asian DMCs. The conclusion that we derive from this analysis is that while foreign capital, export performance, domestic saving and labor have contributed favourably to the growth of the Asian region, the latter variables have been relatively more important than foreign capital and export performance.

Table 8

IMPACT MULTIPLIERS ON THE GROWTH RATE

	AID	FPI	S	CX	CLF
Aggregate Sample	0.057	0.126	0.272	0.123	0.133
Low-Income ADCs	1.707	0.099	4.376	-0.460	-0.692
Middle-Income ADCs	0.141	0.147	2.840	0.148	0.060

¹ While the impact multipliers consider only the direct effects, the elasticity multipliers consider the total effects of the exogenous variables on the growth rate. It must be noted that since the saving rate is an endogenous variable in our model, its elasticity multiplier on the growth rate cannot be calculated.

Table 9

ELASTICITY MULTIPLIERS^a ON THE GROWTH RATE

	AID	FPI	CX	CLF	GDPN
Aggregate Sample	0.003	0.130	0.133	0.159	0.073
Low-Income ADCs	0.175	0.074	-0.006	0.387	0.152
Middle-income ADCs	0.100	0.029	0.156	0.171	0.055

4. Summary and conclusions

The basic objective of this study was to measure the impact of foreign capital on the economic growth of the Asian developing countries. It was noted that the existing studies on this topic suffered from two major shortcomings. First, the models used in these studies were misspecified. Second, these studies ignored the simultaneity between the saving rate and the growth rate. By considering only the direct effect of foreign capital, these studies, in general, tended to overestimate the favorable effects of foreign capital on growth and exaggerate the adverse effects on domestic saving rate.

This paper developed a two-equation simultaneous model of growth where both the growth and saving equation were more robustly specified. The models were estimated by using time series as well as pooled cross-section and time series data from fourteen ADCs during the period 1965-1982. The time series results were generally very poor with low significance of the variables and low goodness of fit values suggesting that one needs more observations in order to derive more meaningful results¹. Such information is not available at the present time and so we focussed on the results of a pooled analysis.

While the main advantage of the pooled estimation is the large number of observation (with significant amount of fluctuation) available for identifying behavioural relationships, its main disadvantage is that behavior is taken to be uniform across countries. In order to minimize some of the limitations we disaggregated the sample by income levels (i.e., high income and low income group) and by time periods (i.e., pre-1973 and post-1973). We also introduced country intercept dummies and calculated country-specific goodness of fit measures to test homogeneity within the disaggregated samples. Nonetheless, the present study (like earlier studies) is a cross-section study and is not a substi-

¹ This statement applies more to the growth equation than the savings equations.

tute for detailed country studies.

On the basis of single equation and simultaneous equation models and on the basis of disaggregated samples, we find that foreign capital has made a positive contribution to the growth of the ADCs — while private foreign investment has contributed more than foreign aid to the low income countries it is the other way around in the middle income countries¹. Our results also suggest that generally foreign private investment has contributed to growth both by augmenting resources available for capital formation and by increasing the efficiency of investment (except in the middle income countries). Our results also show that in addition to foreign capital, export performance, growth of labor force and the domestic saving rate have also made a positive contribution to the growth of the Asian region. In relative terms, foreign private investment and export performance have been more important than aid supporting the North's prescription of self-reliant approaches for the developing countries. Also growth of labor force and domestic saving rate have been more important than either foreign capital or exports.

These findings have several policy implications for both the deficit (or recipient) countries and for the surplus (or donor) countries. In the case of the deficit countries, the most important implication is that if the countries wish to achieve rapid economic growth, maximum efforts will have to be directed towards increasing the productivity of the labor force and towards mobilizing domestic resources. These tasks may involve difficult choices and tough policy measures, but there is no escaping the implication that reliance on foreign capital does not offer the solution for high and rapid growth. They should continue to accept foreign capital in those areas where domestic resources do not provide an adequate substitute.

The recipient country should be careful in deciding about the type of foreign capital to encourage and the type of trade policy it should adopt. Our analysis shows that based on relative productivity, the low income countries should attempt to attract foreign private investment (including long-term commercial credit) and rely relatively less on aid. Similarly, the middle income countries should rely relatively more on trade and less on aid. Whether the recipient countries possess much freedom of choice, of course, depends upon the supply considerations (i.e., institutional set-up in which the donor countries operate and the motivations of donor countries). In this context the North's emphasis on self-help procedures based on trade and exchange liberalization and policies to attract foreign private investment are of particular relevance.

1 In fact, in the middle income countries, the foreign private investment term is statistically insignificant.

APPENDIX I

The definition of Variables and Sources of Data

- GR = growth rate of GDP based on GDP at constant prices, line 99 bp. x of *International Financial Statistics*, IMF. Data for Taiwan are from *Taiwan Statistical Data Book* 1982, Republic of China, and for Hong Kong from *Key Indicators*, Asian Development Bank (ADB).
- S = gross domestic savings as a ratio of GDP. The data are from *Key Indicators*, ADB, except for Nepal which is from the World Bank Data Tape: 1981 Update.
- AID = official flows from all sources as a ratio of GDP. The OECD data on official flows are from *Key Indicators*, ADB.
- FPI = foreign private investment including commercial borrowing as a ratio of GDP. The data are from *Key Indicators*, ADB.
- CX = change in exports (in dollars) as a ratio of GDP (in dollars). The data is line 70 d and line 99 b, respectively, of *International Financial Statistics*, IMF.
- CLF = growth of labor force. The data is from *Key Indicators*, ADB. Labor force data for Nepal was not available and so population data from *Key Indicators* was used as a proxy.
- GDPN = per capita GDP indices. This variable was derived from the 1970 per capita GDP indices estimated by Kravis, Heston and Summers (1978). For each country GDP in 1970 prices were rescaled using a deflator $X/\text{GDP } 1970$ where X is the Kravis, Heston and Summers index for the country and GDP 1970 is the real GDP in 1970.

Country Specific Goodness of Fit Measures

In order to judge the extent to which overall conclusions are influenced by the stringent simplifying assumption that is used to obtain pooled data for the low income and the middle income groups, we calculated country-specific measures of goodness of fit. These measures were obtained by calculating the correlation between the actual and fitted values of the growth rate and the savings rate by using the observations pertaining to each country in the pooled sample. The relevant correlation coefficients calculated for each country from the estimates of the reduced forms for the low income and the middle income groups are presented in Table A.1.

The results of this exercise is quite interesting in that it suggests that the simplifying assumptions of pooling could have contributed to serious in-sample prediction errors in only two out of the eight middle income countries. In the other six countries the correlation coefficient is larger than 70 percent and is significant at traditional levels. The result is less encouraging in the case of the low income group where in-sample prediction errors appear to be significant in three out of the six countries.

Table A.1

CORRELATION COEFFICIENTS BETWEEN ACTUAL AND PREDICTED VALUES OF GROWTH AND SAVINGS RATE

	Growth Rate	Savings Rate
Low-Income Countries		
Bangladesh	0.060 (0.180)	0.159 (0.900)
Burma	0.700 (0.122)	0.708 (0.553)
India	0.824 (0.086)	0.708 (0.115)
Nepal	0.713 (0.098)	0.771 (0.073)
Pakistan	0.031 (1.000)	0.046 (0.942)
Sri Lanka	0.084 (0.874)	0.276 (0.600)
Middle-Income Countries		
Republic of China	0.932 (0.007)	0.934 (0.006)
Hong Kong	0.251 (0.750)	0.372 (0.628)
Indonesia	0.793 (0.009)	0.137 (0.072)
Republic of Korea	0.733 (0.097)	0.947 (0.004)
Malaysia	0.768 (0.031)	0.739 (0.061)
Philippines	0.783 (0.032)	0.810 (0.051)
Singapore	0.864 (0.003)	0.947 (0.004)
Thailand	0.222 (0.673)	0.141 (0.790)

1 Levels of significance in parenthesis.

APPENDIX III

Solutions for Structural Coefficients

$$a_{11} = \pi_{10} \pi_4$$

$$a_3 = \pi_5 \pi_{11}$$

$$a_7 = \pi_7 - a_{11} \pi_1$$

$$a_8 = \pi_8 - a_{11} \pi_2$$

$$a_9 = \pi_9 - a_{11} \pi_3$$

$$a_6 = \pi_6 - a_{11} \pi_0$$

$$a_{10} = \pi_{11} (1 - a_3 a_{11})$$

$$a_5 = \pi_4 (1 - a_3 a_{11})$$

$$a_1 = \pi_1 (1 - a_3 a_{11}) - a_3 a_8$$

$$a_2 = \pi_2 (1 - a_3 a_{11}) - a_3 a_8$$

$$a_4 = \pi_3 (1 - a_3 a_{11}) - a_3 a_9$$

$$a_0 = \pi_0 (1 - a_3 a_{11}) - a_3 a_6$$

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CAPITAL EXTÉRIEUR, EXPORTATIONS, ÉPARGNE ET CROISSANCE DES PAYS EN VOIE DE DÉVELOPPEMENT ASIATIQUES

RESUME

L'objectif de cet article est de mesurer, l'impact du capital étranger (investissement étranger et aide extérieure) sur la croissance économique des pays asiatiques en développement à l'aide d'un modèle d'équations simultanées. Le modèle a été estimé utilisant «pooled cross-section and time series data» provenant de 14 pays asiatiques durant la période 1965-1982.

L'auteur trouve que le facteur: capital externe a joué un rôle positif sur la croissance des pays en développement de la région — alors que l'investissement privé externe a plus contribué à la croissance de pays à faible revenu; le résultat est inverse pour les pays à revenu moyen. L'investissement extérieur a non seulement accru les ressources nécessaires à la formation de capital mais a aussi contribué à augmenter son efficacité.

En outre, la croissance des exportations, du facteur travail et du taux d'épargne ont aussi contribué à la croissance des pays considérés. L'investissement étranger et la croissance des exportations ont joué un rôle plus important que l'aide extérieure. De même, la croissance du facteur capital et de l'épargne domestique ont joué un rôle plus important que le capital extérieur et les exportations.

Les conséquences de ces résultats sont aussi discutées.

