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GROWTH VARIATIONS ACROSS DEVELOPING COUNTRIES: HOW MUCH AND WHY?

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GROWTH VARIATIONS ACROSS DEVELOPING COUNTRIES: HOW MUCH AND WHY?

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The paper examines the extent and the causes of variations in economic growth across twenty-nine developing countries. The sample countries come from Asia, Africa, and South/Central America. It finds that while Brazil, Cameroon and Korea have witnessed a relatively higher growth rates; Chile, Ethiopia, Ghana, India, and Jamaica have experienced lower growth rates during the Sixties and Seventies. The principal factors responsible for varying performances are found to be the saving/investment rate, export, government expenditure, price distortions and multi-national corporations' economic penetration rate. While the first three factors promote economic growth, the last two hamper it.

1. Introduction

The economic growth rate has varied quite widely in most countries over time as well as in most periods across countries. Quite a few papers have been published on the subject but surprisingly no one seems to have attempted a comprehensive study. In particular, while most of the explanatory variables for growth variations have been tried, none of

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the articles has used all these variables simultaneously. Instead, the literature contains studies which use some select variables in one paper and some another set of select variables in some other publications. In consequence, the researchers explain a maximum of about 50 per cent of the variation in economic growth across countries, and obtain incompatible estimates for various parameters. The earlier researchers seem to worry about the directions of effects only without concerning with the magnitudes of the effects. The present study attempts to fill-up this gap through identifying all possible causal variables on which data were available, and by carefully attempting the regression analysis to attain the highest possible degree of explanatory power and the appropriate estimates for various parameters. In addition, attempts are made to estimate the contribution of various factors to the degree of variation in economic growth across countries, and to identify the over and under-achieving nations. Three alternative measures of economic growth are used in the analysis.

The study is restricted to developing countries only and among these to the ones on which data on all the important variables were available. The list of the sample countries is

available in Table 1 and it is the same as used in the World Bank Study (1983) barring two countries (viz. Turkey and Yugoslavia) which had to be left out due to non-availability of some relevant data. The study is based on the data for the decades of Sixties and Seventies, the latest period for which data were available.

2. Growth Variations: Over Time and Across Countries

There is no perfect and unique measure of the economic well-being of a nation. In the absence, a few alternative variables have been used. In the present study, three economic variables, viz. gross domestic product (GDP), Industrial output and per capita GDP have been used for the purpose. The annual compound growth rates in these variables during the decades 1960-70 and 1970-81 were collected from the World Development Reports and World Tables, and the same are reported in Table 1. It is apparent from the Table that the economic growth rate, as measured by any one of the three criteria, have varied quite widely across countries and to a certain extent even over time. While the average growth rate in the gross domestic product in the sample countries turned out to be exactly the same both in 1960s and 1970s (4.9%), that in industrial output as well as in per capita GDP was lower in 1970s (6.2% and 2.3%) than in 1960s (7.6% and 3.0%). Thus, like in industrially advanced

Table 1
Growth rate variations

(Percentages)

Country	Growth Rate During 1960-70 in			Growth Rate During 1970-81 in		
	GDP	Industrial output	Per capita GDP	GDP	Industrial output	Per cap GDP
1. Argentina	4.2	5.9	3.2	2.2	1.8	0.4
2. Bangladesh	3.7	8.0	0.9	3.9	9.5	1.5
3. Bolivia	5.2	6.2	2.2	4.8	4.3	1.7
4. Brazil	5.4	N.A	5.4	8.4	9.3	5.5
5. Cameroon	3.7	N.A	12.6	5.6	8.6	4.0
6. Chile	4.5	4.8	2.4	2.4	0.2	0.3
7. Colombia	5.1	6.0	3.0	5.9	4.9	3.6
8. Egypt	4.3	5.4	0.9	7.4	6.8	4.9
9. Ethiopia	4.4	7.4	1.2	2.0	1.4	0.6
10. Ghana	2.1	12.5	0.8	-0.1	-1.2	-3.2
11. India	3.4	5.4	2.6	3.6	4.5	1.5
12. Indonesia	3.9	5.2	5.2	7.6	11.1	5.3
13. Ivory Coast	8.0	11.5	3.5	6.7	10.5	1.1
14. Jamaica	4.4	4.8	3.3	-1.1	-3.5	-2.6
15. Kenya	6.4	N.A	2.5	6.5	10.2	2.1
16. Korea	8.6	17.2	7.8	9.5	15.4	7.2
17. Malawi	4.9	N.A	1.4	6.3	7.0	2.5
18. Malaysia	6.5	N.A	3.2	7.8	9.7	5.
19. Mexico	7.2	9.1	4.4	5.2	6.6	3.
20. Nigeria	3.1	12.0	-2.9	6.5	8.1	-0.
21. Pakistan	6.7	10.0	3.8	4.7	5.2	1.
22. Peru	4.9	5.0	0.5	3.0	3.7	0.
23. Phillippines	5.1	6.0	2.1	6.3	8.7	3.
24. Senegal	2.5	4.4	-1.0	2.5	3.7	-0.
25. Sri Lanka	4.6	6.6	3.4	4.1	4.0	3.
26. Tanzania	6.0	N.A	3.1	4.9	1.9	0.
27. Thailand	8.4	11.9	5.6	7.2	10.0	4.
28. Tunisia	4.7	8.2	3.0	7.5	9.0	5.
29. Uruguay	1.2	1.1	2.7	3.5	5.2	2.
Mean (Airthmatic)	4.9	7.6	3.0	4.9	6.2	2.

Notes: N.A: Not available

countries (which are outside the purview of this study), there is an evidence for the falling growth rate over time in developing economies. The cross-country analysis reveals still more significant variations. In terms of the GDP growth rate, Korea topped the sample countries in both the decades with an 8.6 per cent growth rate in 1960s and 9.5 per cent in 1970s. The least growth rate on this measure was achieved by Uruguay in 1960s (1.2%) and Jamaica in 1970s (-1.1%). Korea enjoyed the first rank even in terms of the other two measures in 1970s (15.4% and 7.2%) and in terms of the growth rate in industrial output in 1960s (17.2%); this position in terms of per capita GDP was taken up by Cameroon in 1960 (12.6%). The last position in terms of the industrial output and per capita GDP growth rates went respectively to Uruguay (1.1%) and Nigeria (-2.9%) in 1960s, and Jamaica (-3.5%) and Ghana (-3.2%) in 1970s.

Table 2 presents the classification of the sample countries in terms of the high growth, low growth and average growth countries, and the countries which have moved from low growth in 1960s to high growth in 1970s and vice versa. The high and low growth rates are assigned through comparing the actual growth rates with the corresponding country-average growth rates

Table 2

Ratios of actual to country-average growth rates

	Unambiguous		Ambiguous	
	1960s and 1970s		1960s and 1970s	
A : High growth countries:	Korea	: 2.3	Cameroon	: 1.5
	Thailand	: 1.7	Ivory Coast	: 1.4
	Brazil	: 1.6	Malaysia	: 1.4
	Mexico	: 1.2	Kenya	: 1.3
B : Low growth countries:	Senegal	: 0.4	Jamaica	: 0.2
	Chile	: 0.5	Ghana	: 0.4
	Ethiopia	: 0.6	Uruguay	: 0.6
	Peru	: 0.6	Argentina	: 0.6
	India	: 0.7	Bolivia	: 0.8
C : Average growth countries			Malawi	: 1.0
			Colombia	: 1.0
			Bangladesh	: 1.0
			Nigeria	: 0.9
			Sri Lanka	: 0.9

		1960s	1970s			1960s	1970
D : Countries moved from low to high growth:	Indonesia:	0.9	1.8	Tunisia	:	1.0	1.6
	Egypt :	0.7	1.4				
	Philippines :	0.9	1.4				
E : Countries moved from high to low growth:	Pakistan :	1.3	0.9	Tanzania	:	1.2	0.6

and the sum of the growth rates in all the three variables is used for this classification. Against each country, the ratio of the sum of the actual growth rates in three variables to the sum of the country-average growth rates in three variables in the corresponding period is also presented for the purpose of ranking the countries under each category. To illustrate, for the first country in the Table (Korea) the said number (2.3) was obtained from the data in Table 1 as follows:

$$\frac{8.6 + 17.2 + 7.8 + 9.5 + 15.4 + 7.2}{4.9 + 7.6 + 3.0 + 4.9 + 6.2 + 2.3} = \frac{65.7}{28.9} = 2.3$$

Further, within each growth category, countries have been divided into unambiguous and ambiguous groups, the former category reveals consistent category over both the decades and all the three growth measures, while the latter category is not consistent over decades or/and growth measures. Over the decades, the growth rates varied significantly in case of six countries only and therefore the decade-wise analysis was attempted for those six countries only.

On the basis of the summary measures also, Korea enjoys a significant lead among all the countries in the sample. Its growth rate turns out to be more than twice the mean growth rate attained by all the 29 countries in the two decades. On the other extreme lies Jamaica, where the two decade growth rate

stood at one-fifth of the country-average growth rate. The other nations in high growth rate group include Thailand, Brazil, Cameroon, Ivory Coast, Malaysia, Kenya and Mexico, in the descending order of their growth performances. The low growth countries, besides Jamaica, are Senegal, Ghana, Chile, Ethiopia, Peru, Uruguay, Argentina, India and Bolivia, in the descending order of their growth rates. The countries which have attained approximately the country-average growth rates include Malawi, Colombia, Bangladesh, Nigeria and Sri Lanka. Four countries are seen to have moved from low achievers in the Sixties to high achievers in the Seventies. These are Indonesia, Egypt, Phillippines, and Tunisia. In contrast, two countries, viz., Pakistan and Tanzania, have moved from the high achievers group to the low achievers group.

3. Determinants of Growth Variations: The Model

Since the economic growth rate has varied widely across countries in the sample, a multiple regression model was formulated and estimated in order to explain the variation. The specification

of the original model was the linear version of the following:

EG = f (SR or IR, PG, PDI, MNR, EG, GEG or GER, IPR, PIA,
FAR, ALR, PQI) ... . (1)

where EG = measure of economic growth rate (%), SR = saving rate (%), IR = investment rate (%), PG = population growth rate (%), PDI = pri distortion index (normalise to take a value of unity if no price distortion occured), MNR = multi-national corporation's economic penetration ratio (defined as the ratio of total stock of direct private fofeign investment and some measure of the total stock of domestic capital), EG = export growth rate (%), GEG = Government expenditure grouth rate (%), GER = government expenditure as a proportion of gross domestic product (%), IPR = industrial production as a proportion of gross domestic product (%), PIA = per capita income absolute (hundreds of USA $), FAR = foreign aid as a proportion of gross domestic product (%), ALR = adult literacy rate (fraction), and PQI = physical quality of life index (fraction).

Most of these explanatory variables have been used in previous studies and they need no rationalization. For example, saving or investment rate and population growth rate, which are used, due to data constraints, as proxies for capital and labor growth rates, respectively, have been tried by Robinson (1971), Singh (1985) and Ram (1986). Price distortion has been hypothesized

to adversely effect the growth rate in the World Bank Study (1983). Multinational Corporations' economic penetration rate is a relatively new argument in growth models but it has been employed in its variant forms by Papanek (1973), Gulati (1978) and Ram (1980), among others. Export growth rate found place in articles by Feder (1983) and Ram (1985). Government expenditure has been employed in alternative forms by Rubinson (1977), Landau (1983) and Ram (1986). The share of industrial output in gross domestic product has not been employed directly in the regression analysis but its importance has been highlighted by Robinson (1971) in empirical work and by theoreticians, politicians and administrators across the globe. The per capita income finds a place in Singh (1985) and its allows one to test the hypothesis that, ceteris paribus, rich nations grow faster than poor ones. Foreign aid was employed by several writers, including Chenery and Strout (1966), Papanek (1973) and Singh (1985). Adult literacy rate and physical quality of life index are technological variables, and their significance in growth models is well understood.

The three alternative measures of economic growth, as hitherto mentioned, are used: real GDP growth rate (YG), industrial production growth rate (IPG) and real per capita GDP growth rate (PYG). One or/and the other of these measures have been employed by several other researchers and thus there is no need to substantiate the choice.

4. Data and Estimates of Growth Models

The data on various variables in the model were drawn from the World Bank publications, viz. World Tables and World Development Reports, United Nations' Statistical Year Books and Soziologisches der Universitat, Zurich's publication on "Composition of Data for World Analysis". In collecting the data, enormous effort was made to use the corresponding period data only. However, when this was not possible, the data for the closest possible period were collected and utilized in the empirical work. Since the data on some important variables like price distortion and multi-national corporations' economic penetration, for the decade of the Sixties were not at all available, the regressions were attempted for the Seventies only.

The model contained in equation 1 was estimated through the ordinary least squares method. While only the linear version of the equation was used, alternative combinations of the explanatory variables were tried in the estimation process. In fact, some variables were used in more versions than specified in equation 1. For example, export was used not only in terms of export growth rate but also as export as a percentage of gross domestic product, government expenditure was used not only in the two forms specified in equation 1 but also as the product of

government expenditure growth and the ratio of government expenditure to gross domestic pro uct (vide Ram, 1986) and the per capita income variable was tried both in absolute terms as well as in the log form. The per capita income growth equations were estimated both with andwithout the population growth variable. The estimation results of the selected specifications are presented in Tables 3-5. It will be seen in the tables that while some regressions use the full sample of 29 countries, some others are based on 28, 25 or 24 observations. This was again due to the non-availability of data on some crucial variables, viz. government expenditure and the proportion of industrial production in gross oomestic product. The one country excluded from regressions using the sample size of 28 countries is Argentina the four countries not included in regressions based on 25 observations are Bangladesh, Egypt, Sri Lanka and Tanzania, and the five countries omitted include all the countries names in this sentence.

The empirical results are very encouraging. As indicated in the beginning of this paper, none of the studies in the literature utilized all the theoretically relevant causal variables and thus they suffer from a rather low R^2 value. The

Dependent Variables	Coefficients (and t-ratios) Equation Numbers															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Constant	3.85	3.73	2.19	4.82	3.77	3.81	6.38	5.85	3.08	0.43	2.16	4.06	5.84	5.41	5.83	6.49
R	.094 (1.25)	.093 (1.28)	.171 (2.68)	.058 (0.94)	.138 (2.63)	.136 (2.74)	.152 (2.22)	.172 (3.56)				.179 (2.83)	.172 (3.16)	.196 (3.64)	.171 (3.11)	.179 (3.47)
R									.124 (1.21)	.194 (2.52)	.184 (2.64)					
G	.485 (1.05)	.488 (1.08)	.682 (1.58)	.461 (1.14)	.858 (2.14)	.868 (2.31)	.087 (0.22)	.577 (1.61)	.253 (0.48)	.717 (1.64)	.779 (1.90)	.570 (1.38)	.573 (1.41)	.456 (1.21)	.581 (1.35)	.451 (0.98)
DI	-1.92 (1.84)	-1.87 (1.95)	-1.07 (1.25)	-2.21 (2.65)	-1.54 (1.85)	-1.53 (1.86)	-2.45 (2.80)	-2.11 (2.68)	-1.63 (1.69)	-0.85 (0.93)	-1.16 (1.32)	-1.68 (2.09)	-2.10 (2.55)	-2.13 (2.71)	-2.11 (2.62)	-2.14 (2.67)
NR	-.76 (1.78)	-.73 (1.93)	-1.01 (2.37)	-.68 (1.91)	-.85 (1.98)	-.83 (2.30)	-.87 (2.38)	-.97 (2.65)	-.97 (2.16)	-.94 (2.16)	-.75 (1.77)	-1.08 (2.96)	-.97 (2.46)	-.92 (2.47)	-.97 (2.56)	-.93 (2.43)
G	.136 (1.40)	.142 (1.73)	.115 (1.65)	.157 (2.05)	.126 (1.76)	.130 (1.84)			.088 (0.78)	.099 (2.16)	.166 (1.58)					
EG	.253 (1.55)	.248 (1.59)		.332 (2.39)			.232 (1.48)		.311 (2.15)							
R			.043 (0.55)		.007 (0.09)					-.027 (0.36)	-.054 (0.69)					
PR	.014 (0.24)	.016 (0.30)	.014 (0.28)						.014 (0.24)	.035 (0.78)		.034 (0.71)				
IA	.014 (0.14)								.027 (0.27)				.002 (0.02)			
AR														.089 (1.01)		
LR															.030 (0.02)	
QI																-.81 (0.45)
Overall Statistics																
R^2	0.81	0.81	0.75	0.80	0.71	0.70	0.76	0.66	0.80	0.75	0.71	0.71	0.66	0.68	0.66	0.67
$\bar{R}^2$	0.71	0.72	0.67	0.73	0.63	0.64	0.69	0.61	0.70	0.66	0.63	0.64	0.59	0.61	0.59	0.60
F-Statistic	8.0	9.8	8.7	11.9	8.9	11.1	11.6	11.9	7.9	8.3	8.9	10.8	9.1	9.7	9.1	9.2
Sample Size	24	24	28	25	29	29	24	29	24	28	29	28	29	29	29	29

Industrial production growth rate equations
(Dependent variable : IPG)

Independent variables	Coefficients (and t-ratios) [Equation Numbers]															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Constant	3.02	3.68	1.44	4.33	2.91	2.47	9.02	8.53	2.64	1.02	2.81	6.06	8.54	8.23	9.24	9.50
SR	.047 (0.39)	.048 (0.41)	.155 (1.31)	.002 (0.02)	.097 (1.06)	.106 (1.22)	.160 (1.33)	.212 (2.24)				.212 (1.62)	.213 (1.90)	.224 (2.09)	.234 (2.18)	.222 (2.20)
IR									.063 (0.38)	.104 (0.72)	.083 (0.67)					
PG	1.00 (1.35)	0.98 (1.36)	1.72 (2.15)	1.06 (1.69)	2.03 (2.90)	1.93 (2.93)	0.26 (0.39)	1.07 (1.52)	0.88 (1.06)	1.95 (2.37)	2.06 (2.84)	1.11 (1.29)	1.05 (1.32)	1.01 (1.34)	.86 (1.03)	.88 (0.97)
PDI	-2.40 (1.44)	-2.68 (1.73)	-1.17 (0.73)	-3.19 (2.45)	-1.85 (1.27)	-1.90 (1.33)	-4.32 (2.82)	-3.62 (2.36)	-2.36 (1.37)	-1.38 (0.80)	-1.79 (1.16)	-3.12 (1.87)	-3.61 (2.24)	-3.63 (2.32)	-3.54 (2.26)	-3.67 (2.33)
UNR	-.84 (1.24)	-.97 (1.59)	-.95 (1.19)	-1.00 (1.80)	-.83 (1.11)	-1.01 (1.61)	-1.41 (2.20)	-1.45 (2.02)	- .95 (1.32)	-.90 (1.09)	-.72 (0.97)	-1.61 (2.13)	-1.44 (1.86)	-1.42 (1.92)	-1.39 (1.88)	-1.39 (1.84)
EG	.389 (2.49)	.350 (2.62)	.386 (2.99)	.346 (2.89)	.390 (3.12)	.379 (3.13)			.366 (2.02)	.391 (2.87)	.405 (3.12)					
GEG	.616 (2.36)	.640 (2.55)		.693 (3.20)			.563 (2.05)		.645 (2.79)							
GER			-.027 (0.19)		-.068 (0.49)					-.082 (0.57)	-.108 (0.78)					
IPR	-.002 (0.02)	-.017 (0.19)	-.011 (0.13)						-.002 (0.02)	.027 (0.32)		.054 (0.54)				
PIA	-.083 (0.52)								-.076 (0.47)				-.005 (0.03)			
FAR														.044 (0.25)		
NLR															-1.31 (0.46)	
PQI																-1.22 (0.34)
Overall Statistics																
R^2	0.82	0.81	0.69	0.82	0.67	0.67	0.73	0.53	0.82	0.67	0.66	0.55	0.53	0.53	0.53	0.53
$\bar{R}^2$	0.72	0.73	0.58	0.75	0.59	0.59	0.65	0.45	0.72	0.56	0.57	0.49	0.42	0.43	0.43	0.43
F Statistic	8.4	10.1	6.4	13.3	7.6	9.4	9.6	6.8	8.4	5.9	7.3	5.4	5.2	5.2	5.3	5.2
Sample size	24	24	28	25	29	29	24	29	24	28	29	28	29	29	29	29

Table 5

Per capita income growth rate equations
(Dependent variable: PYG)

Independent variables	Coefficients (and t-ratios) [Equation Numbers]															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Constant	5.54	4.89	4.94	6.70	6.50	5.11	8.14	7.51	7.56	7.12	4.36	6.51	7.44	4.32	7.16	6.57
SR	.012 (0.20)	.011 (0.18)	.075 (1.25)	.018 (0.29)	.077 (1.63)	.070 (1.24)	.155 (3.22)	.112 (2.45)				.082 (1.47)	.129 (2.83)		.125 (2.33)	.138 (2.79)
IR									-.084 (1.19)	-.091 (1.29)	.073 (1.01)			.072 (1.03)		
PG			-.151 (0.37)	-.328 (0.87)	-.161 (0.44)	-.115 (0.30)	-.647 (1.93)				-.104 (0.25)	-.260 (0.73)	-.354 (1.06)	-.109 (0.28)	-.374 (0.94)	-.365 (0.91)
PDI	-3.42 (4.09)	-3.12 (3.89)	-2.33 (2.91)	-3.50 (4.13)	-2.48 (3.27)	-2.32 (2.97)	-3.14 (4.08)	-3.11 (4.19)	-3.93 (4.73)	-3.69 (4.59)	-2.30 (2.70)	-3.63 (4.89)	-3.34 (4.70)	-2.31 (2.82)	-3.19 (4.19)	-3.04 (3.98)
MNR	-.86 (2.50)	-.71 (2.22)	-1.01 (2.51)	-.87 (2.53)	-.80 (2.06)	-.94 (2.79)	-.73 (2.10)	-.92 (2.66)	-.75 (2.21)	-.61 (1.94)	-.98 (2.41)	-.91 (2.77)	-.92 (2.81)	-1.00 (2.93)	-.83 (2.37)	-.86 (2.41)
EG	.104 (1.35)	.146 (2.16)	.115 (1.76)	.089 (1.12)	.134 (2.06)	.118 (1.89)			.149 (1.85)	.190 (2.69)	.111 (1.65)			.110 (1.68)		
GEG	.183 (1.52)	.159 (1.33)		.229 (1.73)					.261 (2.48)	.244 (2.34)						
GER			.022 (0.31)		-.003 (0.04)						-.007 (0.10)					
IPR	.056 (1.28)	.071 (1.69)	.043 (0.96)	.038 (0.80)		.043 (0.97)			.061 (1.51)	075 (1.94)	.056 (1.32)	.098 (2.15)		.057 (1.40)		
PIA	.092 (1.14)			.095 (1.17)					.083 (1.07)				.152 (2.19)			
ALR															1.74 (1.24)	
PQI																2.06 (1.26)
Overall Statistics																
R^2	0.86	0.85	0.77	0.87	0.74	0.77	0.76	0.67	0.87	0.86	0.77	0.81	0.81	0.77	0.78	0.78
$\bar{R}^2$	0.80	0.80	0.70	0.80	0.67	0.71	0.71	0.62	0.82	0.81	0.69	0.76	0.76	0.70	0.72	0.72
F-statistic	14.1	16.0	9.8	12.3	10.6	12.0	15.1	16.5	15.5	17.8	9.5	15.3	15.4	11.6	12.7	12.7
Sample size	24	24	28	24	29	29	24	29	24	28	28	24	24	28	24	24

results reported here possess as high a value for R^2 as 0.81 for the income growth (IG) equations, 0.82 for the industrial production growth(IPG) equations and 0.87 forthe per capita income growth (PIG) equations. Further, all the important determinants enter with the a priori signed and often with significant coefficients. A careful analysis of the results in three tables reveals that the crucial determinants of economic growth are saving (SR) or investment rate (IR), population growth (PG), price distortion (PDI), multinational corporations' economic penetration rate (MNR), export growth (EG), and government expenditure growth rate (GEG). While SR/IR, EG and GEG make positive contributions to economic growth, measured through any of the three variants (YG, IPG and PYG), PDI and MNR exercise negative role in it. The population growth contributes positively to YG and IPG but hampers PYG. These results are in conformity with the findings of earlier researchers. Further, the findings with regard to the role of government expenditure in economic growth supports Ram (1986)'s conclusion that this role is unambiguously positive if the government expenditure variable is defined in terms of growth rather than as a proportion to gross domestic product. The price distortion variable is used here for the first time in the regression analysis on the subject and the findings here on thedirection of its effect on growth tally exactly with the

observations made in the World Bank study (1983). Further, this variable has entered with a significant coefficient in most of the equations in all the three tables. Yet another new and interesting finding is that the effect of multinational corporations' on economic growth is negative and significant.

Each of the three tables provide a large number of alternative equations (16) andthe readers would expect a unique choice. This is difficult but possible. On the basis of both economic theory and statistical inference, the choice would go to equation 1 in each of the three tables. Each of these equations has the highest possible R^2 among its competitors (or close to that), contains all the relevant causal variables which entered with the a priori correct signs and possesses relatively high t-values for its coefficients. The further analysis is based on these selected equations.

Since the various variables enter the regressions under different definitions, which was entirely due to the conscious decision with regard to matching data availability with the theoretical appropriateness, it is pertinent to clarify their meanings. As explained in Robinson (1971) and Ram (1986), the

coefficients of SR, IR, GER, IPR, and FAR, are multipliers, while those of PG, EG and GEG are elasticities. The coefficients of the remaining arguments have no such well understood meanings. This would be clear from the following derivations:

Let the production function be

$$Y = F\ (K,\ P,\ E,\ PDI,\ .....) \qquad \ldots\ \ldots \quad (2)$$

where new notations are Y = gross domestic product, K = capital stock, P = population (proxy for labor input) and E = export.

Taking total differentiation of equation 2 and dividing the result by Y yields

$$\frac{dY}{Y} = \left[\frac{\partial F}{\partial K}\right]\frac{dK}{Y} + \left[\frac{\partial F}{\partial P}\ \frac{P}{Y}\right]\frac{dP}{P} + \left[\frac{\partial F}{\partial E}\ \frac{E}{Y}\right]\frac{dE}{E} + \left[\left(\frac{\partial F}{\partial PDI}\right)\left(\frac{1}{Y}\right)\left(\frac{dPDI}{PDI}\right)\right] PDI + ...$$

or, $YG = \beta_1 IR + \beta_2 PG + \beta_3 EG + \beta_4 PDI + ...$ (3)

where β_1 = marginal product of capital, β_2 = elasticity of output with respect to population (labor), β_3 = elasticity of output with respect to export, and β_4 has no such usual interpretation.

On these interpretations, equation 1 of Table 3 indicates that the marginal productivity of capital (saving and investment are closely related) stood at 0.094 and elasticities of output

with respect to labor, export and government expenditure turned out to be 0.485, 0.136 and 0.253, respectively. These numbers for the selected industrial output growth equation (equation 1 table 4) stood at 0.047, 1.0, 0.389 and 0.616, respectively. The population growth variable always entered with a negatively signed and insignificant coefficient in the per capita income growth (PYG) equations and thus its selected form (equation 1 table 5) does not contain this argument. The marginal productivity of capital for PYG was estimated at 0.012 and elasticities for it with respect to export and government expenditure stood at 0.104 and 0.183, respectively. Thus, government expenditure enjoys a greater effect than export on each of the three alternative variables measuring economic growth. As expected, capital stock (saving/investment) exerts a greater effect on total output (GDP) than on industrial output or per capita income and on industrial output than on per capita income. These results sound reasonable on theoretical considerations.

The significant finding of the study is with regard to the relevance of the two relatively new determinants of economic growth. These are price distortions and multinational corporations' economic penetration. Both these variables enter with coefficients which are always negative, are usually significant at the 5 per cent level of significance by the usual t-test, and are fairly stable in magnitude over alternative spe-

cifications of the model.

5. Sources of Growth Variations

The contribution of a predetermined variable to the variations in an endogenous variable depends not only on the regression coefficient but also on the varation in that predetermined variable. One way to approximate such a contibution has been suggested by Goldberger (1959, p.72). Following this procedure, the relative contribution of various explanatory variables to variations in economic growth were found as follows:

$$R_{yx} = \beta_{yx} \left[\frac{\Sigma |\Delta x|}{\Sigma |\Delta Y|} \right] (100) \qquad \ldots \qquad (4)$$

where R_{yx} = relative contribution of the explanatory variable X to the variations in the dependent variable Y, measured in percentages, β_{yx} = regression coefficient of the explanatory variable X in the equation having Y as the dependent variable and Δ = change from one sample observation to another. Since changes in various variables have been both positive and negative, the sum of the absolute value of differences were used in the calculations. The results are presented in Table 6. The sum

Table 6

Relative contributions to growth variations

(Percentages)

Predetermined variable	Endogenous variable		
	GDP growth rate	Industrial production growth rate	Per capita GDP growth rate
Saving rate	24.5	8.0	3.0
Population growth	13.8	18.6	-
Price distortions	-29.4	-24.0	-50.3
Multi-national corporations' economic penetration	-20.4	-14.8	-22.2
Export growth	22.4	42.0	16.4
Government expenditure growth	23.4	38.1	16.5
Industrial production ratio	5.0	-0.5	19.2
Per capita income	2.2	-8.6	14.0

of the contributions of various determinants do not add up to 100 per cent, for these are based on stochastic equations and the methodology is also only an approximate one.

It will be seen from the table that price distortions have contributed the most, though negatively, to the variations both in the GDP growth rate as well as the per capita GDP growth rate. The export growth rate occupies the top position with regard to the contribution to the industrial production growth rate. The saving rate contributes quite heavily (24.5%) to the variations in the GDP growth rate only. Government expenditure growth rate and multinational corporations' economic penetration also contribute substantially to the variations in all the three economic growth rates. Industrial production rate and per capita income, though contribute only marginally to the first two economic growth rates, their contributions to the variations in per capita income growth rate are fairly high (19.2% and 14.0%).

6. Actual Versus Predicted Growth Rates

The model developed in this paper is more complete than the ones available in the literature. The selected equations (equation 1 in each of tables 3,4 and 5) have thus been used

to verify their predictive powers as well. The results are presented in Table 7.

It is obvious from the table that the model performs quite well with regard to its predictive power as well. An analysis of the prediction error (residual) is provided in Table 8. The forecasting error (mean absolute percentage error) turns out to be 14.6% for the GDP growth rate, 22.5% for the industrial output growth rate, and 25.8% for the per capita GDP growth rate. A country-wise analysis reveals that Brazil, Cameroon, Korea, Pakistan and Uruguay have achieved growth rates higher than their predicted ones, while Chile, Ethiopia, Ghana, India, Jamaica, Mexico, Phillippines and Thailand have experienced growth rates lower than the ones forecast for them by the models. Among these, Brazil has emerged out as the significantly over-achieving country while India as the significantly under-achieving country. A careful analysis of the data for the last two countries would reveal that the major difference in these two countries lies with regard to the magnitudes of the per capita income and the extent of multinational corporations' economic penetration rate. Brazil is relatively a very rich country and it is characterised by a relatively high penetration from multinational corporations. Exactly opposite is true for India. Thus, it appears that the two principal determinants

Table 7

Actual Vs. predicted growth rates: 1970-81

(Percentages)

Country	GDP growth rate		Industrial production growth rate		Per capita GDP growth rate	
	Actual	Predicted	Actual	Predicted	Actual	Predicte
Bolivia	4.8	4.18	4.3	4.90	1.7	0.93
Brazil	8.4	5.46	9.3	6.44	5.5	3.63
Cameroon	5.6	4.67	8.6	5.26	4.0	2.13
Chile	2.4	3.22	0.2	3.22	0.3	1.62
Colombia	5.9	5.76	4.9	5.96	3.6	3.34
Ethiopia	2.0	2.89	1.4	2.8	0.6	0.75
Ghana	-0.1	0.54	-1.2	-0.74	-3.2	-3.07
India	3.6	6.08	4.5	8.04	1.5	2.86
Indonesia	7.6	7.56	11.1	11.23	5.3	4.45
Ivory coast	6.7	6.77	10.5	10.20	1.1	1.56
Jamaica	-1.1	0.05	-3.5	-1.60	-2.6	-1.96
Kenya	6.5	6.22	10.2	8.70	2.1	2.46
Korea	9.5	9.07	15.4	13.72	7.2	6.89
Malawi	6.3	5.40	7.0	6.69	2.5	3.43
Malaysia	7.8	7.36	9.7	9.83	5.2	4.46
Mexico	5.2	7.42	6.6	9.31	3.4	4.72
Nigeria	6.5	5.19	8.1	6.47	-0.1	0.15
Pakistan	4.7	3.36	5.2	3.73	1.9	0.16
Peru	3.0	3.03	3.7	2.12	0.5	0.89
Philippines	6.3	7.20	8.7	8.99	3.4	4.43
Senegal	2.5	2.30	3.7	3.65	-0.7	-0.36
Thailand	7.2	8.14	10.0	11.65	4.6	5.37
Tunisia	7.5	7.37	9.0	9.62	5.0	4.95
Uruguay	3.5	3.04	5.2	2.44	2.7	2.15
Mean Absolute % error	14.6%		22.5%		25.8%	

Table 8

Analysis of prediction error

Measurement	Prediction error in		
	GDP growth rate	Industrial output growth rate	Per capita GDP growth rate
Mean absolute error	0.72	1.46	0.74
Mean of actual rate	4.93	6.49	2.86
Mean absolute percentage error	14.6%	22.5%	25.8%
Countries having error more than 50 % of actual rate, or around 2 % or more:			
- Over-achieving	Brazil	Brazil Cameroon Uruguay	Brazil Cameroon Pakistan
- Under-achieving	Ghana India Jamaica Mexico	Chile Ethiopia India Jamaica Mexico	Chile India Nigeria Peru
Over/under achieving countries with regard to all the three growth rates:			
- Over-achieving	Brazil, Cameroon, Korea, Pakistan, Uruguay		
- Under-achieving	Chile, Ethiopia, Ghana, India, Jamaica, Mexico, Philippines, Thailand		

of the performance are the per capita income level and multinational corporations' economic penetration rate.

7. Conclusions

Economic growth rate has varied both over time and across countries. While the GDP rate has remained constant, there is a decline both in the industrial output growth rate as well as in the per capita GDP growth rate in Seventies as compared to Sixties. Among 29 countries in the sample, Korea has experienced the highest economic growth rate. The other nations which have generally achieved a higher than average growth rate are Brazil, Cameroon, Malaysia, Mexico and Thailand. The countries which have usually witnessed a rather low rate of economic growth include Jamaica, Ghana, Senegal, Chile, Ethiopia, Peru and India.

The important determinants of economic growth are found to be price distortions, multinational corporations' economic penetration rate, saving/investment rate, export growth rate, and the growth rate of government expenditure. While the first two of these variables exercise a negative role, the latter three determinants make a positive contribution to the rate of economic growth.

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