INCOME LEVELS AND GROWTH RATES

(Ib)

Doç. Dr. Süleyman ÖZMUCUR
Boğaziçi Üniversitesi
İktisat Bölümü

1. *Introduction :*

Is there a relationship between the rate of growth and the level of development or the level of income? If there is, what is the theoretical explanation for such a relationship? Is there any basis for the inverted 'U' shape relationship in cross-sectional data on growth rates and income levels?

Several economists have tried to answer these relatively old and fascinating questions. According to Russett et.al (1964, p. 309-310) and Horvat (1974, p. 383-94) reasons for the inverted 'U' shape relationship between growth rates and income levels are: Low growth rates for low income countries may be caused by low investment ratios; higher growth rates may be attained as an industrial base is established; the highest growth rates may be obtained at somewhat higher incomes through the borrowing of technology from industrialized countries; rich countries may grow more slowly as they have to generate their own technology and resources are diverted from investment to consumption; the early phase of increasing growth rates may be spurred on by declining capital/output ratio, a larger combined factor productivity and greater shifts to manufacturing; decelerating growth among high income countries is partially attributable to a declining share of manufacturing in total output. These reasons are not convincing (Wright, 1979, p. 332).

Countries exibit different patterns for different reasons (Wright, 1979, p. 340). Slow growth rates may be due to channelling of a high proportion of potential investments into military investments or due to corrupt bureaucracies, and high growth rate may be achieved by forced investment schemes, as in centrally planned economies(1). The growth rate also depends on historical and geographical factors, as well as on sociological, cultural values and established production relationships(2).

The purpose of this paper is to supply further evidence on the relationship between growth rates and income levels and try to give an explanation for such a relationship. The paper is in seven parts. Section 2 presents the results of earlier studies. Alternative models, and empirical results on growth rates and income levels are given in Sections 3 and 4. The relationship between investment ratios and income levels, and labor productivity and income levels are presented in section 5. Section 6 is devoted to identification of the determinants of economic growth. Major conclusions are stated in section 7.

2. *Earlier Estimates :*

Hagen and Hawrylyshyn (1969, p. 49) report that, «... the hypothesis sometimes advanced that the fastest growth will be found in the middle-income countries is not supported by data», and that the relationship between the rate of growth and the logarithm of per capita GDP is weak or non-existent (Hagen and Hawrylyshyn, 1969, p. 88). Horvat (1974, p. 392), «Due to the relatively low rate of growth, the most advanced countries cannot run ahead of the rest of the group too much. Except for those in the initial phase of development, all other countries are catching up with the most advanced pioneers. This

(1) The World Bank (1979, p. 126-127) classifies countries into five groups: low income, middle-income, industrialized, capital surplus oil exporters, and centrally planned. During 1960-1977 middle income countries had the highest growth rate in per capita GDP. The average figure is 3.6 percent per capita GDP. The average figure is 3.6 percent per annum. However, growth rates range from −4.8 to 7.9. This, in a way, proves that there are many other factors, besides the level of income. It is not fair to classify countries with different resources, and sociological and cultural values into one group as it they are homogeneous. It may make more sense to do the grouping by regions, e.g. Latin Lmerica, South Asia, etc.

(2) See Myrdal (1968), Bhagwati (1966), Myint (1964), Todaro (1977), Harrington (1977), Robinson (1979), Lewis (1955, 1972), Higgins (1968), Kindleberger and Herrick (1977).

catching up process is being accelerated towards the point of discontinuity which separates the developed from the less developed world.» Wright (1979, p. 339) concludes that, «there are no grounds for Horvat's assertion... The unfortunate truth is that there is no evidence of any relative improvement in international income disparities, while the absolute differentials between rich and poor countries increasing.» Haq (1976, p. 2), «... the concept of catching up must be rejected. Catching up with what? Surely the Thirld World does not wish to imitate the life styles of the rich nations? It must meet its own basic human needs within the framework of its own cultural values, building development around people rather than people around development.» Morawetz (1977, p. 14-16). «The disparity between richer and poorer developing countries has increased significantly since 1950, but it is not true at the aggregate level that the initially rich have got richer while the initially poor have got poorer... on the average, todays highest income developing countries grew fastest, whereares the lower-income grew more slowly... But the relation between initial regional per capita income and subsequent regional growth rate is by no means uniform: initially rich Latin America grew relatively slowly, whereares initially poor China and East Asia grew more rapidly.» Morawetz (1977, p. 17 and 21) finds out that simple correlation coefficient, between 1950 GDP per capita and 1950-1975 growth rate in per capita GDP is 0.17, which is not significantly different from zero. Morawetz also reports that rank correlation between 1950 GDP per capita and 1975 GDP per capita is 0.91. This implies that there is virtiually nb change in relative positions of 77 countries examined during those years.

Horvat (1974, p. 392) claims that less developed centrally planned economies (Bulgaria, Rumania, and U.S.S.R.) move above the development curve, the more developed ones (Czechoslovakia, East Germany, Poland, Hungary) below the curve. It is clear from Wright (1979, p. 335) that socialist countries have higher growth rates than non-socialist ones at the same level of development. For socialist countries the relationship between growth rates and income levels is inverse, e.g. low income socialist countries enjoy higher growth rates. Kirschen (1974, p. 245) reports that if per capita national income goes up by one hundred U.S. dollars, growth rate will decline by 3.51 percent per annum.

3. Models :

Three models (or functional forms) are used to explain the relationship between growth rates and income levels(3):

$$G \text{ (or } GP) = a + b\,Y + c\,Y^2 \quad (1)$$

$$G \text{ (or } GP) = a + b\,\text{Log } Y + c\,[\text{Log } Y]^2 \quad (2)$$

$$\text{Log } G \text{ (or Log } GP) = a + b\,\text{Log } Y + c\,[\text{Log } Y]^2 \quad (3)$$

where, G is the total growth rate
Y — per capita GNP
GP is the per capita growth rate, and

All equations express the hypothesized parabolic relationships. Both 'b' and 'c' should be statistically significant for the support of the inverted 'U' hypothesis. Furthermore, 'b' should be greater than, and 'c' should be less than zero.

To see the effect of population, two more models similar to those suggested by Chenery and Syrquin (1975, p. 16-17) are also estimated:

$$G \text{ (or } GP) = a + b\,Y + c\,Y^2 + d\,N + e\,N^2 \quad (4)$$

$$G \text{ (or } GP) = a + b\,\text{Log } Y + c\,[\text{Log } Y]^2 + d\,\text{Log } N + e\,[\text{Log } N]^2 \quad (5)$$

where, N is the population

4. Data and Empirical Results(4):

Horvat (1974, p. 382-383) and Wright (1979, p. 335-336) include countries with «critical mass» of 1 million population and a half a billion dollars of income. As Horvat (1974, p. 383) admits these limits are rather arbitrary. Horvat (1974, p. 390-392) also excludes some 20 countries because they have expreinced political instability (Morocco, Uruguay, Argentina, United Kingdom, Ireland, Bolivia, Chile, Ghana) or had excessive oil rents (Iran, Saudi Arabi), or have benefited from war, foreign bases or foreign aid (Taiwan, South Korea, Israel, Puerto

(3) Russett et.al. (1964, p. 309-310) suggest that the relationship is between per capita growth and per capita income. Horvat (1974, p. 385-386) assumes that the total GDP growth rate is the correct variable. Wright (1979, p. 336-338) and Hagen and Hawrylyshyn (1969) use both total and per capita growth rates in their analyses. Kirschen (1974, p. 245) and Morawetz (1977, p. 21) also use per capita growth rates.

(4) List of Variables and data sources: 1) Y (income level), Per capita GNP in 1965 (in 1964 U.S. dollars), Chenery and Syrquin (1975, p. 188-191); 2) N (Population), Midyear population in millions, Chenery and Syrquin (1975,

Rico, Thailand, United Arab Republic, Zambia, Sysria). These reasons are unacceptable to Wight (1979, p. 339).

This paper tries to include every country provided that data are available. For technical reasons, countries with negative growth rates are excluded. This enables us to estimate the coefficients of Model 3. However, Models 1 and 2 are also estimated using data on 99 countries. The results are very similar to those obtained from data on 81 countries(5). We try to find a relationship between 1965 GNP per capita

p. 188-191); 3) GP (Per capita GDP growth rate), Average annual growth rate (1965-1973) in real per capita GDP, The World Bank (1976), p. 488-494); 4) G (total growth rate), average annual growth rate in real GDP (1965-1973), The World Bank (1976, p. 488-494); 5) I (Investment ratio), share of gross domestic investment in GDP (as percentage of GDP) (1965-1973 average), except Angola and Mozambique (1963 share) and Haiti (1965 share), The World Bank (1976, p. 44-283) except Angola, Haiti, and Mozambique. Data on these countries are obtained from Chenery and Syrquin (1975, p. 188-191); 6) L (labor force growth), Average annual growth of labor force (1960-1970) except for Greece (1970-1977), The World Bank (1979, p. 162-163); 7) G60 (total growth rate), Average annual growth rate in real GDP (1960-1970), The World Bank (1979, p. 128-129); 8) P (labor productivity growth), Average annual growth rate in labor productivity (1960-1970), computed as the difference between G60 and L.

Countries (60 low and middle income, 21 high income): Upper Volga, Somalia, Ethiopia, Guinea, Mali, Malawi, Burma, Afghanistan, Tanzania, Zaire, Haiti, Uganda, Indonesia, India, Pakistan, Togo, Central African Republic, Cameroon, Thailand, Bolivia, Sierra Leone, Egypt, Sri Lanka, Philippines, Ghana, Mozambique, Papua, Syria, Angola, Ivory Coast, Morocco, Liberia, Equador, Tunisia, Rhodesia, Paraguay, Algeria, Honduras, Dominican Republic, Brazil, Colombia, El Salvador, Turkey, Iraq, Malaysia, Guatemala, Peru, Nicaragua, Costa Rica, Portugal, Yugoslavia, Chile, Jamaica, Mexico, Lebanon, Panama, Hong Kong, South Africa, Spain, Greece, Japan, Argentina, Ireland, Venezuella, Italy, Austria, Israel, Netherlands, Finland, United Kingdom, Belgium, Norway, West Germany, Australia, France, Denmark, New Zealand, Canada, Switzerland, Sweden, United States.

Following 18 countries are also included to get the '99 country sample': Chad, Niger, Nigeria, Sudan, Kenya, Cambodia, South Vietnam, South Korea, Zambia, Senegal, Taiwan, Jordan, Iran, Saudi Arabia, Uruguay, Singapore, Libya, Puerto Rico.

(5) Results based on 99 countries:

$$G = -22.639 + 9.602 \text{ Log } Y - 0.792 [\text{Log } Y]^2$$
$$(-3.34) \quad (4.02) \quad (-3.87)$$
$$R^2 = 0.1413, \quad F = 9.06, \quad D.W = 2.11$$

$$GP = -18.628 + 6.893 \text{ Log } Y - 0.518 [\text{Log } Y]^2$$
$$(-2.75) \quad (2.88) \quad (-2.53)$$
$$R^2 = 0.1614, \quad F = 10.4, \quad D.W. = 2.19$$

Compare these results with those given in Table 1. Model 1 is also estimated. Results are very similar to those reported in Table 1.

(initial GNP per capita) and 1965-1973 average annual growth rate in real GDP (or per capita GDP). However, 1960-1970 growth rates are also used to compare our results with Wright's [1979, p. 338] (6). Prior to estimation, countries were ranked according to per capita GNP, so that Durbin-Watson statistics can be used as an indicator of the «correct» functional form (Ahluwalia, 1976).

Table 1 presents regression coefficients, corrected (or adjusted) coefficient of determination, Durbin-Watson statistic and F ratio. These equations prove that there is a relationship betwen the total growth rate (and per capita growth rate) and income levels. Regression coefficients are significant at the one percent level, and they have correct signs. Determination coefficient is also significant as indicated by F ratios. Model 3 seems to be the «best». Adjusted determination coefficient is relatively high, F ratio is significant, and Durbin-Watson statistic is around two, indicating a correct functional form. Models 1 and 2 are used by Wright (1979, p. 336). Using data on 57 countries Wright (1979, p. 338) rejects the existence of such a relationship, although his figure 2 (Wright, 1979, p. 335) suggests the presence of

(6) See Kirschen (1974, p. 245) and Morawetz (1977, p. 17-21). If 1960-1970 growth rates are used (total growth rate in real GDP), following regression functions are obtained :

$$G60 = \underset{(13.86)}{4.508} + \underset{(2.33)}{0.0021}\, Y - \underset{(-2.35)}{0.000000892}\, Y^2$$
$$R^2 = 0.0442, \quad D.W. = 1.73, \quad F = 2.84$$

$$G60 = \underset{(-3.15)}{-15.19} + \underset{(4.02)}{6.811}\, \text{Log } Y - \underset{(-3.81)}{0.550}\, [\text{Log } Y]^2$$
$$R^2 = 0.1812, \quad D.W. = 2.03, \quad F = 10.15$$

$$\text{Log } G60 = \underset{(-2.49)}{-3.941} + \underset{(3.22)}{1.795}\, \text{Log } Y - \underset{(-2.97)}{0.141}\, [\text{Log } Y]^2$$
$$R^2 = 0.1506, \quad D.W. = 2.26, \quad F = 8.09$$

Model 2 is superior to others. It has higher determination coefficient, and Durbin-Watson statistics is around 2, indicating a correct functional form. These results support the inverted 'U' hypothesis, contradicting Wright (1979, p. 338). It should be noted that determination coefficients in Model 2 and Model 3 dannot be compared since dependent veriables in these tvo models are not the same.

a relationship(7). Our results presented in Table 1 support the inverted 'U' hypothesis(8).

Population variable (N) increases the explanatory power of the regression (Model 4), indicating that large countries (except India) may expreince higher growth than small ones(9). Coefficients of the

(7) Wright (1979, p. 338) uses one-tail tests. Critical t values are for 60 degrees of freedom, although he has 57 observations (or 54 degrees of freedom). See Johnston (1972, p. 426). This procedure increases the possiblity of rejecting the hypothesis that regression coefficients are not significantly different from zero.

(8) Horvat (1974, p. 388-390) estimates regression coefficients for low income and high income countries. He obtains positive coefficients for low income, and negative coefficients for high income countries. We have also divided our sample into low income (60 countries) and high income (21) countries. For low income countries Model 3 gave the most satisfactory results:

$$\underset{}{\text{Log G}} = \underset{}{0.493} + \underset{(4.30)}{0.223}\ \text{Log Y},\quad R^2 = 0.2295,\quad F = 18{,}5,\quad \text{D.W.} = 2.09$$
$$(1.83)$$

$$\text{Log GP} = \underset{(-2.82)}{-1.509} + \underset{(4.46)}{0.461}\ \text{Log Y};\quad R^2 = 0.2432,\quad F = 19.9,\quad \text{D.W.} = 2.13$$

Both regressions are satisfactory, indicating that growth rates will be higher for relatively higher income countries.
For 21 high income countries, following results are obtained

$$\underset{}{\text{Log G}} = \underset{(3.79)}{4.643} - \underset{(-2.51)}{0.422}\ \text{Log Y},\quad R^2 = 0.2102,\quad F = 6.32,\quad \text{D.W.} = 1.84$$

Coefficient of the income level is significant at the five percent level, only. Per capita growth rate function is even less satisfactory:

$$\text{GP} = \underset{(5.32)}{5.723} - \underset{(-1.76)}{0.0011}\ \text{Y},\quad R^2 = 0.095,\quad F = 3.1\quad \text{D.W.} = 1.84$$

This is the best regression that is obtained. Determination coefficient is not significant at the five percent level. Coefficient of Y is significant at the 10 percent level, only. Based on these results, it is difficult to conclude that per capita growth rate goes down as the income level of the country goes up. Kirschen (1974, p. 245) also failed to find a significant relationship between per capita growth rates and income levels for Western European countries.

(9) Partial derivative relative to N:

$$\frac{\partial G}{\partial N} = 0.0246058 - \underset{(0.0000560468)}{(2)}\ N$$

$$\frac{\partial N}{\partial G} > 0 \quad , \text{if} \quad N < 219.5$$

India is the only country with population greater than 219.5.

population variable are not significant when Model 5 is used. This may be due to the presence of multicollinearity in logarithms of the variables retained in the regression function (Johnston, 1972, p. 159-168). Addition of population variables causes a decline in the adjusted determination coefficient.

The presence of a relationship between growth rates and income levels does not justify «Except for those in the initial phase of development, all other countries are catching up with the most advanced pioneers.» (Horvat, 1974, p. 392). Simulation experiments on income levels and per capita growth rates may clarify our point. These experiments assume that a country will move along the «Per capita growth rate-income level» curves estimated by Models 1, 2, and 3. Table 2 gives the number of years needed to reach a target level of per capita GNP(10). (For example, it will take 25 to 31 years to raise per capita GNP from $ 100 (Central African Republic, Cameroon) to $ 200 (Tunisia, Rhodesia, Paraguay, Algeria). Other things being constant, a country with $ 1000 per capita GNP (Austria) will reach $ 2000 per capita GNP (Canada) in 22 to 24 years. It will take 21 to 29 years to increase per capita GNP from $ 2000 (Canada) to $ 3200 per capita GNP (United States). Although income level is not the only determinant of per capita growth rate (as it is obvious from determination coefficients given in Table 1), these experiments are useful since they introduce the time element. Number of years needed to reach a target income level is important, because it is not fair to underestimate the effects of other factors like wars, revolutions, military interventions.

Using growth rates given in the World Bank (1976, p. 488-494) and per capita incomes reported in Ahluwalia (1976, p. 341), we have computed the rank correlation between per capita GNP and growth rate in per capita GDP. There is an inverse relationship between growth rates and income levels in socialist countries (Bulgaria, Yugoslavia, Poland, Hungary, Czechoslovakia, East Germany). This result is similar to the one obtained by Kirschen (1974, p. 245). We have found out that the

(10) Morawetz (1977, p. 29) reports the number of years needed to be at the level of OECD countries provided that 1960-1975 growth rates are continued. According to Morawetz it will take Singapore 22 years, Iran 45 years, Taiwan 75 years, Iraq 223 years, Brazil 362 years, and Turkey 675 years. Our method is probably better, since it assumes that growth rates change with income levels. However, additional assumption that every country would move along the growth curve is rather restrictive.

rank correlation between growth rates and income levels in socialist countries is -0.83(11).

5. *Income Levels, Investment Ratios, and Labor Productivity :*

Low growth rates for low income countries may be due to low investment ratios, or low labor productivity growth. Middle income countries may increase their productivity by borrowing technology. Higher income countries may experience low investment ratios, because of high military expenditures and overconsumption. To see whether these arguments are supported by cross-country data, Models 1 and 2 are estimated (investment ratio, and labor productivity growth as dependent variables). Results of these regressions are given in Tablo 3. Model 1 performs better for investment ratio, while Model 2 is more satisfactory to explain the variation in labor productivity growth. These results suggest an inverted 'U' shape curve between invesment ratios and income levels, and labor productivity growth and income levels(12).

6. *Accounting for Economic Growth :*

In this section, we try to identify the determinants of economic growth. The procedure applied is similer to 'growth accounting' developed by Denison [1967](13). Three factors (labor force growth, labor

(11) Alton (1977, p. 224) and the World Bank (1979, p. 126-127) report per capita GNP estimates for socialist countries. It must be noted that there are significant differences between these estimates of per capita GNP in U.S. dollars. It is unfortunate that any comparison between capitalist and socialist countries is subject to measurement errors.

(12) A linear model is also estimated :

$$I = \underset{(21.17)}{17.614} + \underset{(4.51)}{0.0043}\ Y, \quad R^2 = 0.1948, \quad D.W. = 1.87, \quad F = 20.3$$

However, regression functions presented in Table 3 are superior to this function. Therefore one cannot conclude that investment ratios will increase indefinetly as income levels go up.

(13) This is a production function approach :

$$YA = z\, e^{bt}\, LA^{c}\, KA^{d}\, PA^{a}$$

where, YA — total output, LA — labor, KA — capital stock, PA — labor

productivity growth, investment ratio) can explain 42 percent of the variation in growth rates, and 49 percent of the variation in per capita growth rates. It should be noted that labor rorce growth is inversely related to per capita growth. However, this coefficient is not significantly different from zero.

$$G = \underset{(1.89)}{1.157} + \underset{(3.99)}{0.623}\,L + \underset{(3.27)}{0.086}\,I + \underset{(4.40)}{0.407}\,P \qquad (6)$$

$$R^2 = 0.4239, \quad F = 20.62, \quad D.W. = 1.49$$

$$GP = \underset{(-0.004)}{-0.002} - \underset{(-0.96)}{0.148}\,L + \underset{(3.99)}{0.104}\,I + \underset{(4.53)}{0.412}\,P \qquad (7)$$

$$R^2 = 0.4946, \quad F = 27.0\ , \quad D.W. = 1.81$$

where, G — total growth rate,
GP — per capita growth,
L — labor force growth,
I — investment/GDP ratio,
P — labor productivity growth

Two warnings are in order. Growth rates and investment ratio figures are for the period 1965-1973, and labor force growth and labor productivity growth figures are for the 1960-1970 period. Although this may cause problems in interpretation, there is no way to determine the direction of bias, if there is any. Furthermore, instead of percentage change in capital stock ($\triangle K/K$), investment income ratio (I/Y or $\triangle K/Y$) is used. Therefore, regression coefficient should be divided by capital output ratio (K/Y). Since this ratio is not the same for each country, this procedure may lead to biases in our estimates.

7. *Conclusion :*

Empirical estimates support the inverted 'U' shape relatioship between growth rates and income levels. The relationship between investment ratios and income levels, and labor productivity growth and

productivity (can be interpreted as a proxy for technological improvement), t — time. Taking the logs and then first differences will give a function in percentage changes (or in growth rates):

$$G = b + c\,L + d\,K + a\,P$$

where, G — growth in total output, L — labor growth, K — growth in capital stock, P — labor productivity growth.

income levels are also inverted 'U' shape. These results imply that low income countries have low labor productivity growth, low investment ratio, and low growth rates. On the other hand, middle income countries expreince high growth rates in GDP, labor force and labor productivity.

The presence of such a relationship does not guarantee «catching up with the most advanced pioneers». Time needed to reach the level of developed economies is rather long. A careful consideration should be given to sociological, cultural values, historical and geographical factors, and existing production and ownership relationships. Furthermore, factors like military intervention, wars, foreign intervention, natural disasters or bonanza, «wrong» economic policies cannot be disregarded completely. Determination coefficients are significant at the one percent level, but they are rather low. About 25 percent of the variation in the dependent variable (growth in GDP, labor productivity growth, investment/GDP ratio) is explained by the level of income (GNP per capita). This is a clear indication of the presence of other factors at work.

Labor productivity growth, labor force growth, and investment/GDP ratio can explain almost 50 percent of the variation in per capita GDP growth rate. As a first approximation, this is an impressive result. Although they are not free of observation and measurement errors, cross-country data may give some idea about existing relationships. Since each country present a different pattern, it is essential to undertake historical studies to support the findings from cross-country data.

TABLE 1
INCOME LEVELS AND GROWTH RATES

Dependent variable	constant	Y	Y^2	Log Y	$[\text{Log Y}]^2$	R^2	D.W
G	5.034*	0.001589b	−0.00000085a			.0648a	1.66
	(17.18)	(1.93)	(−2.48)			(3.77)	
G	−15.772*			7.382*	−0.620*	.2122*	1.93
	(−3.62)			(4.82)	(−4.74)	(11.7)	
Log G	−2.608*			1.476*	−0.123*	.2363*	2.06
	(−3.18)			(5.12)	(−5.03)	(13.3)	
GP	2.197*	0.003341*	−0.00000121*			.1623*	1.76
	(7.48)	(4.09)	(−3.56)			(8.74)	
GP	−12.090*			4.762*	−0.355a	.2126*	1.82
	(−2.64)			(2.97)	(−2.56)	(11.8)	
Log GP	−4.663*			1.741*	−0.127*	.2623*	2.08
	(−2.94)			(3.12)	(−2.67)	(15.2)	

Notes: t-statistics and F ratio in parentheses.
(*) significant at the one percent level, (a) significant at the five percent level, (b) significant at the ten percent level.

TABLE 1 (CONTINUED)

Dependent Variable	Constant	Y	Y^2	N	N^2	R^2	D.W.
G	4.711*	0.001966a	−0.00000112*	0.0246*	−0.000056*	.130*	1.64
	(14.32)	(2.39)	(−3.16)	(2.72)	(−2.78)	(3.98)	
GP	1.778*	0.003791*	−0.00000153*	0.0262*	−0.000057*	.2293*	1.78
	(5.46)	(4.66)	(−4.34)	(2.94)	(−2.88)	(6.94)	

TABLE 1 (CONTINUED)

Dependent Variable	Constant	Log Y	$[\text{Log Y}]^2$	Log N	$[\text{Log N}]^2$	R^2	D.W.
G	−16.774*	7.687*	−0.647*	0.013	−0.024	.2038*	1.92
	(−3.72)	(4.91)	(−4.83)	(0.02)	(−0.30)	(6.11)	
GP	−13.565*	5.146*	−0.388*	0.303	−0.021	.2106*	1.84
	(−2.67)	(3.14)	(−2.77)	(0.63)	(−0.25)	(6.33	

Notes: t-statistics and F ratio in parantheses; (*) significant at the 1 percent level,
(a) significant at the 5 percent level.

TABLE 2

YEARS NEEDED TO REACH THE TARGET LEVEL OF INCOME

Present Level of Income	Target Level of Income	Years Needed		
		Model 1	Model 2	Model 3
100	200	27	25	31
200	300	15	12	15
300	400	10	8	10
400	500	7	6	7
500	600	6	5	6
600	700	5	4	5
700	800	4	4	4
800	900	3	3	4
900	1000	3	3	3
1000	1500	12	13	14
1500	2000	10	10	10
2000	2500	10	10	10
2500	3000	11	9	10
3000	3200	8	2	4

TABLE 3

INCOME LEVELS,INVESTMENT RATIOS AND LABOR PRODUCTIVITY

Dependent Variable	Constant	Y	Y^2	Log Y	$[\text{Log } Y]^2$	R^2	D.W.
I	15.228*	0.01505*	−0.000004773*			.3508*	2.31
	(16.58)	(5.91)	(−4.47)			(22.61)	
I	−4.500			5.489	−0.197	.3129*	2.20
	(−0.29)			(1.03)	(−0.43)	(19.21)	
P	2.295*	0.00332*	−0.000001251*			.1446*	1.80
	(7.47)	(3.90)	(−3.50)			(7.75)	
P	−14.243*			5.587*	−0.425*	.2194*	1.97
	(−3.02)			(3.37)	(−3.01)	(12.24)	

Notes: t-statistics and F ratio in parantheses.

(*) Significant at the one percent level.

References :

Ahluwalia, M.S., 1976, «Inequality, Poverty and Development», Journal of Development, Vol. 3.

Alton, T.P., 1977, «Comparative Structure and Growth of Economic Activity in Eastern Europe», in U.S. Joint Economic Committee, East European Economies Post-Helsinki. Washington: U.S. Government Printing Office.

Bhagwati, J., 1966, The Economics of Underdeveloped Countries, New York: Mc Graw-Hill.

Chenery, H. and Syrquin, M., 1975, Patterns of Development 1950-1070, Oxford: Oxford University Press.

Denison, E.F., 1974, Accounting for United States Economic Growth 1929-1969. Washington: The Brookings Institution.

Hagen, E.E. and Hawrylyshyn, O., 1969, «Analysis of World Income and Growth, 1955-1965», Economic Development and Cultural Change, Vol. 18, No. 1.

Haq, M., 1976, «Concessions or Structural Change» Paper Presented at A Special Meeting of the Club of Rome on the New International Order.

Harrington, M., 1977, The Vast Majority, A Journey to the World's Poor, New York: Simon and Schuster.

Higgins, B., 1968, Economic Development, Problems, Principles, and Policies, New York: W.W. Norton.

Horvat, B., 1974, «The Relation Between Rate of Growth and Level of Development», Journal of Development Studies, Vol. 10.

Johnston, J., 1972, Econometric Methods, New York: McGraw-Hill.

Kindleberger, C.P. and Herrick, B., 1977, Economic Development, New York: Mc Graw-Hill.

Kirschen, E.S., 1974, Economic Policies Compared, West and East, Vol. 1, Amsterdam: North-Holland.

Kuznets, S., 1972, «The Gap: Concept, Measurement, Trends», In G. Ranis, The Gap Between Rich and Poor Nations, London: MacMillan.

Lewis, W.A., 1955, The Theory of Economic Growth, Illinois: Richard D. Irwin.

Lewis, W.A., 1972, «Objectives and Prognosticatios», in G. Ranis, The Gap Between Rich and Poor Nations, London: Macmillan.

Morawetz, D., 1977, Twenty-Five Years of Economic Development 1950 to 1975, Washington: The World Bank.

Myint, H., 1964, The Economics of Developing Countries, London: Hutchinson.

Myrdal, G., 1968, Asian Drama, An Inquiry into the Poverty of Nations, New York: Patheon.

Robinson, J., 1979, Aspects of Development and Underdevelopment, London: Cambridge University Press.

Russett, B.M., et.al., 1964, World Handbook of Political and Social Indicators, New Haven: Yale University Press.

Todaro, M.P., 1977, Economic Development of the Third World, London: Longman.

World Bank, 1976, World Tables 1976, Baltimore: The Johns Hopkins University Press.

World Ban, 1979, World Development Report 1979, Washington: The World Bank.

Wright, C.L., 1979, «International Comparisons of Income Levels and Growth Rates», The Journal of Development Studies, Vol. 15, No. 4.