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THE CATCHING-UP DEBATE: A STATISTICAL INVESTIGATION

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Working Paper #252 - April 1998

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This paper is based on two lectures delivered at the University of Rochester (18 September 1997) and the Kellogg Institute, University of Notre Dame (9 October 1997).

ABSTRACT

The growth patterns during the last three decades are divergent. There was no catching up to the standard of living of the rich countries by the poor countries. The countries in the North do not exhibit any strong evidence of convergence among themselves. The countries in the South, on the other hand, experienced a strong force of divergence. This phenomenon of divergence has been noticed not only for the South as a whole but also for its different geographical regions, such as Africa, Asia, and Latin America (including the Caribbean).

RESUMEN

Durante las tres últimas décadas los patrones de desarrollo han sido divergentes. Los países pobres no han conseguido ponerse a la par de los niveles de vida de los países ricos. No existe evidencia significativa de convergencia entre los países del Norte. Los países del Sur, por otro lado, sufren el efecto de una poderosa fuerza de divergencia. Este fenómeno de divergencia ha sido registrado no sólo en el Sur como un todo, sino también en sus diferentes regiones geográficas, tales como Africa, Asia y América Latina (incluyendo el área del Caribe).

I. INTRODUCTION

Is there any evidence of catching up to the level of development of the advanced countries by the backward countries? Is the gap between the poor and rich countries narrowing? The present paper is concerned with questions of this type.

The Catching-Up Hypothesis

Two polar opposite views can be traced through the history of economic thought. One is known as the catching-up/convergence hypothesis. The other is called the divergence hypothesis. The convergence/catching-up idea can be traced back to 1752, when it appears in the writings of David Hume (1752) on 'specie-flow price mechanism.' Hume argued that, through the mechanism of trade, the wages of poor countries would rise to the level of rich countries, leading to a convergence of their standard of living—the rich being less rich and the poor being less poor. Josiah Tucker (1774) criticized Hume's idea of convergence and argued that the low-wage advantage of poor countries would be more than counter-balanced by the other advantages of rich countries, such as higher labor productivity and a higher endowment of skills, capital, and knowledge. In fact, anticipating the essence of the new growth theory, Tucker expected divergent growth patterns (Semmel, 1970). In Adam Smith's writings, on the other hand, ideas both of convergence and divergence can be found (Elmslie and Milberg, 1996).

In the early twentieth century, it was perhaps first in Veblen (1915) that the ideas of convergence and catching up can be found. He analyzed the economic development of Germany and England and pointed out 'the advantages of relative backwardness': the latecomers in industrialization tend to grow faster because it is cheaper and faster to learn and imitate than to undertake R and D for original discovery and innovation. Gerschenkron (1952) updated and extended the work of Veblen to include Russia, France, and Italy. Later on, Nelson and Phelps (1966) formalized the idea and emphasized the role of human capital in absorbing the new products or ideas innovated elsewhere (see also Gomulka, 1987).

The Doctrine of Uneven Development and the Divergence Hypothesis

Parallel to this convergence/catching-up idea, radicals such as Baran (1957) launched the doctrine of uneven development. An idea of divergence lies in the essence of the doctrine: the world is divided into rich and poor, and there is an ever-increasing gap between the two because of the fundamental inequalizing process at work in the present world economic order. Frank

(1967) and the Latin American structuralist/dependency school[1] also subscribed to this view. The idea can also be traced to the work of less radical writers, such as Prebisch (1950), Singer (1950), Myrdal (1957), and Lewis (1977), as Krugman (1981) has rightly noted. An explanation of the phenomenon of uneven development can be found in Kaldor (1972,1985): due to the existence of dynamic scale economies, the advanced countries with an initial productivity lead would continuously diverge away from the lagging countries. Krugman (1981) formalized a similar idea and showed that, through free trade, a pioneering country will out compete the lagging countries from a given industry, under the condition of external economies.

The Convergence Implication of Neoclassical Growth Theory and Its Confrontation by the New Growth Theorists

The neoclassical growth theory pioneered by Solow (1956) and Swan (1956), on the other hand, implies convergence, because of the assumption of the law of diminishing returns to reproducible capital. In this framework, a relatively poor country with a lower stock of capital per worker enjoys higher marginal productivity of capital and a higher rate of return to capital. As a result, its rate of growth of output per capita is higher until the attainment of the steady-state level of output per capita. The process is accelerated through international capital mobility: capital moves from the low-productivity and low-return area to the high-productivity and high-return area, speeding up the process of convergence. The 'new' growth theory propagated by Romer (1986,1990), Lucas (1988), Rebelo (1991), and many others came as a challenge to the old neoclassical growth theory. Bringing in the role of human capital formation in growth, technical progress was endogenized, and the law of diminishing returns to capital and its convergence implication were questioned.

Convergence versus Divergence: The Statistical Debate

The issue of convergence and catching up has been a subject of much discussion and debate. The recent spurt of debate in mainstream economics owes much to the new growth theorists. With the publication of historical time series data in Maddison (1982) and internationally comparable cross-country data for the post-Second World War period, known as the Penn World Tables (PWT) (see Summers and Heston, 1984, 1991), the theoretical debate spread rapidly to the realm of data analysis (see Baumol, 1986; Baumol and Wolff, 1988; De Long, 1988; Dowrick and Nguyen, 1989; Barro, 1991; Barro and Sala-i-Martin, 1992, 1995; Mankiw, Romer, and Weil, 1992; Sala-i-Martin, 1996; Sheehey, 1996, etc.)

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[1] For a collection of papers written in this Latin American tradition, see Seers (1981).

The present study also examines the issue of convergence/catching-up; it asks whether or not the poor countries are experiencing a faster real rate of growth in their income per capita than the rich countries. In essence, development or growth in the standard of living is measured by the real rate of growth in income per capita; data on any better measure of development for a substantial number of countries over a reasonable period of time are not available. The study uses the national account statistics of different countries reported in several UN publications. The popular PWT data, argues Nuxol (1994), exhibit some downward bias in estimating growth rates of poor countries (poorer than Hungary) and upward bias in estimating growth rates of rich countries (richer than Hungary). Hence, the series may favor the divergence hypothesis: the poorer a country, the lower is its growth rate; the richer a country, the higher is its growth rate.

In the next section (Section II), the data source and methodology are described along with the findings. The concluding observations are presented in the last section (Section III).

II. THE PRESENT STUDY

Data Source and Methodology

In UNCTAD (1994,1995), annual growth rates of real GDP per capita are collected for a sample of 110 countries (for the list of countries, see Table I, note 2) over the period 1960–93 divided into a number of subperiods:[2] 1960–70, 1970–75, 1975–80, 1980–85, 1985–90, 1990–91, 1991–92, and 1992–93. The UNCTAD Statistical Office calculated growth rates by fitting an exponential trend equation to the data for all of the years of each subperiod (not just by calculating the difference between the beginning and end year observations). The 1960 figures for GDP per capita (in US $) are collected for all these countries by the United Nations (1976).[3]

As in Baumol (1986), a semi-log linear relationship is fitted:

$$(1) \qquad Y_{it} = a + b \log X_{i60},$$

where Y_{it} is the annual rate of growth of real GDP per capita for the i-th country in the t-th period, X_{i60} is its GDP per capita in 1960, a and b are the intercept and slope parameters (respectively) to be estimated from the data collected here.

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[2] For some countries we do not have data for all of the periods: 1990–91,1991–92 and 1992–93.

[3] For some poor countries 1960 GDP figures are not available. We have used 1963 figures for some countries and 1970 figures for others. We do not expect any substantial alteration of the basic results.

Equation (1) is fitted through the OLS (Ordinary Least Squares) procedure. If the problem of heteroscedasticity is found in any case, the t-ratios are reestimated through the procedure established by White (1980).

Regression Results: Strong Evidence of Divergence for the Whole Sample

First, Equation (1) is fitted to the whole sample (110 countries and 867 observations). In view of the problem of heteroscedasticity,[4] the White t-ratios are estimated. The estimates are reported in Table 1. The estimates of the regression coefficient (slope) b and its t-ratio (given in parentheses) show a positive relationship (of very high statistical significance) between initial GDP per capita and its subsequent growth rate in real terms: a typical country with lower GDP per capita in 1960 experienced a lower real rate of growth in its GDP per capita than that experienced by a typical country with higher GDP per capita. That means, the gap between the per capita GDP levels of poor and rich countries widened during the period of our study.

No Strong Evidence of Convergence in the North

The question is whether or not the same divergent relationship can be found for the two UN categories: 'Developed Market Economy' (hereafter called the North) and 'Developing Market Economy' (hereafter called the South).[5] To answer this question, Equation (1) is fitted separately to the two sub-samples: the North (24 countries, 192 observations) and the South (86 countries, 675 observations). For the North, there is some evidence of convergence—the slope parameter is negative and significant at the 5% level. But there exists strong evidence of the problem of heteroscedasticity.[6] The White estimate of the t-ratio of the slope parameter shows that the convergence is not robust—the slope is not significant at the 5% level (Table 1, panel 2).

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[4] Tests of heteroscedasticity based on regression of squared residuals on squared fitted values give the following results: Chi-Sq(1) = 24.29 and F(1,865) = 24.93. Both indicate the presence of heteroscedasticity.

[5] In UN data compilation, the 'market economy' world excludes ex-Socialist countries (former Soviet bloc countries and China). It is divided into two sub-groups—the 'developed' and the 'developing'. The 'developed' covers all the 'market economy' countries of Europe, the USA, Canada, Japan, Israel, Australia, New Zealand, and South Africa. The rest of the 'market economy' countries constitute the 'developing' group.

[6] The null hypothesis of homoscedasticity is rejected as each of the test statistics has a very high value: Chi-Sq. = 5.24 and F(1,190) = 5.34.

Evidence of Divergence in Different Regions of the South

For the South, on the other hand, strong evidence of divergence has been found (Table I, panel 3). Fitting Equation (1) to the different regions of the South, such as Africa, Asia, and Latin America (including Caribbean countries), LAC, strong evidence of divergence has been found in each case (see Table I, panels 6–8).

Convergence for the Rich and Divergence for the Poor?

The conclusion that follows from the foregoing analysis is that the divergence hypothesis holds good for the relatively low income countries constituting the South; it does not hold for the high income countries constituting the North. Many other studies have observed convergence among the club of rich countries, the OECD (Dowrick and Nguyen, 1989; Barro, 1991; Barro, and Sala-i-Martin, 1992 and 1995, etc.).

An explanation can be found in Abramovitz (1986); the author argues that the potential to realize the 'advantages of relative backwardness' depends on certain 'social capabilities' that vary positively with income (for other explanations, see Azariadis and Drazen, 1990; Becker, Murphy, and Tamura, 1990).

Is there any threshold of income level after which the divergence hypothesis will cease to hold? An attempt to answer this question can be made by fitting a quadratic equation to the whole sample (as is done in Baumol and Wolff, 1988, and Sheehey, 1996):

$$(2) \qquad Y_{it} = c + d.\, X_{i60} + e(X_{i60})^2,$$

where c, d, and e are parameters to be estimated.

The estimates (with due attention to the problem of heteroscedasticity) confirm the slowing down of the force of divergence with the rise in initial GDP per capita across countries:

$$(3) \qquad Y_{it} = \underset{}{0.57} + \underset{(4.76)}{0.0026\, X_{i60}} - \underset{(-4.25)}{(0.10/10^5)\,(X_{i60})^2},$$
$$\qquad\qquad\qquad\quad (2.67)$$

where R bar sq = 0.02, F = 8.21, and Durbin-Watson statistic (D-W) = 1.42 (White estimates of t-ratios are in parentheses).

The regression results given in Equation (3) show that there is a threshold level of GDP per capita at which the rate of growth is maximum; it is d/2e = $1300. In our sample there are 11

countries with 1960 GDP per capita above $1300; these will be referred to as the Top 11,[7] and the rest will be called the Bottom 99.

Fitting Equation (1) to each group, it is observed that the Bottom 99 shows even stronger evidence of divergence, but the Top 11 experiences neither convergence nor divergence of statistical significance (Table I, panels 11 and 12). This indicates that for the Top 11 countries, which were already rich in 1960, subsequent growth of real income (per capita) bears no relationship to initial level of income. Excluding these top eleven countries, the others have growth patterns in accordance with the divergence hypothesis.

This conclusion can be contrasted with that of Baumol and Wolff (1988), and Sheehey (1996). Their studies observed convergence for the top 17/14 countries (respectively) and divergence for the rest. Their sources of data, sample coverage, and period of study are different. Moreover, as Baumol and Wolff (1988) acknowledge, 'they compare only 1950 and 1980, with no attention to intermediate year figures.'

Furthermore, the following dummy variable analysis casts some doubt on the quadratic regression result. Assume that the intercept and slope parameters are as follows: a_h and b_h for the Top 11, and a_l and b_l for the Bottom 99 (respectively). To test whether $a_h = a_l$ and $b_h = b_l$, the following multiple regression is fitted:

$$(4) \qquad Y_{it} = a_l + b_l \log X_{i60} + a_{hl}.DT_{it} + b_{hl}.SDT_{it},$$

where DT_{it} is the intercept dummy (= 1 for the Top 11 countries and = 0 for other countries), SDT_{it} is the slope dummy (= $DT_{it}.X_{i60} = X_{i60}$ for the Top 11 and = 0 for other countries), $a_{hl} = a_h - a_l$ and $b_{hl} = b_h - b_l$.

Equation (4) is fitted to the whole sample. The estimated equation is as follows:

$$(5) \qquad Y_{it} = \underset{(-3.98)}{-3.37} + \underset{(5.67)}{0.87} \log X_{i60} + \underset{(0.62)}{3.60}\, DT_{it} - \underset{(-0.89)}{0.70}\, SDT_{it},$$

where R bar square = 0.03, F = 10.90, and D-W = 1.45 (White estimates of t-ratios appear in parentheses in view of the problem of heteroscedasticity).[8]

The estimates given in Equation (5) show that the divergence found in the Bottom 99 holds good in the Top 11 without any structurally different relationship ($a_{hl} = a_h - a_l$ and $b_{hl} = b_h - b_l$ are not significantly different from zero, implying $a_h = a_l$ and $b_h = b_l$).

The quadratic relationship, Equation (2), is also fitted to the two sub-samples, the North and the South. For the North, none of the regression coefficients (c and d) are statistically

[7] The top 11 countries are as follows: the USA, Canada, France, Germany, Luxembourg, Iceland, Sweden, Switzerland, UK, Australia, and New Zealand.

[8] OLS t-ratios do not tell a different story.

significant.[9] For the South, on the other hand, both coefficients are statistically significant and show strong evidence of a slowing down of the force of divergence:

$$(6) \qquad Y_{it} = \underset{(-1.40)}{-0.51} \; \underset{(4.61)}{+0.01 X_{i60}} \; \underset{(-3.58)}{- (0.92/10^5) (X_{i60})^2},$$

where R bar sq = 0.03, F = 13.05, and D-W = 1.45 (White estimates of t-ratios are in parentheses).

The threshold level of income is estimated to be $543, and the GDP per capita of only five countries (Reunion, Argentina, Uruguay, Trinidad and Tobago, and Venezuela) lies above this figure. Excluding these five countries, a far stronger[10] relationship of divergence is evident (Table I, panel 5).

Carrying the analysis further, the quadratic relationship, Equation (2), is fitted to the various sub-regions of the South, such as Africa, Asia, and Latin America (details are omitted). Evidence of slowing down of the divergent relationship can be found only for the LAC, and the threshold level of income is estimated to be $581, close to what has been observed in the case of the South. Four countries of LAC (Argentina, etc.), as noted above, are outside the zone of divergence. Excluding these four countries, a stronger[11] divergent relationship is evident (Table I, panel 10).

Using intercept and slope dummies for the top five countries of the South and four countries of LAC, and fitting multiple regressions similar to Equation (4) to the data for the South and LAC (respectively), no evidence of structurally different relationship is found for the countries lying at the top of the ladder (details of estimates are omitted).

Thus, the findings of the quadratic relationship can be questioned. There is neither a convergence club of rich nor one of the poor, in contrast to the expectation raised in Quah (1996) and in some theoretical growth models (see Galor, 1996).

There is little basis on which to choose between the quadratic and semilog-linear regressions; the estimates of R Bar Square are not only very low in each case, but are also very close to each other—the semilog-linear trend has a marginally better fit in most cases (no worse fit than in the other cases). Even the regressions with dummies, Equations (5) and (6), do not have a better fit. Using dummies for the North, the R bar square does not improve (although the dummies are found to be significant).

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[9] For the North, the estimated quadratic relationship is

$$Y_{it} = \underset{(4.48)}{2.95} \; \underset{(-1.69)}{-0.0023 X_{i60}} \; \underset{(1.39)}{+ (0.38/10^6) (Xi60)^2},$$

where R bar sq = 0.01, F = 2.38, and D-W = 1.32 (White estimates of t-ratios are in parentheses).

[10] Comparing the estimates of slope given in Table I (panels 3 and 5), a stronger relationship can be found.

[11] This can be checked against the estimates reported in Table I (panels 8 and 10).

For our purpose, low R Bar Square does not matter very much, as we do not have a fully specified model. Our focus is limited to the question of whether or not there is any evidence of convergence and catching up, whether or not the countries that were poor in the initial period experienced a higher rate of growth in the subsequent period. Given this limited objective, primary importance is attached to the results of the tests of significance of the regression coefficients.

One Modification: Use of 1960 Income Level Data from the Penn World Tables

As a measure of the initial level of development, the study uses the 1960 per capita GDP of the countries covered in the sample. These are UN data not strictly suitable for international comparison. The PWT data are especially suitable for this kind of international comparison, as a given set of international prices is used to calculate the GDP of all of the countries. Nuxol (1994) also recommends the PWT series on GDP per capita, particulary for level of income comparisons across countries. Hence, it is useful to repeat our earlier analysis, replacing UN data on 1960 GDP per capita with PWT data, while retaining UN data on growth rates. This is done below.

PWT publishes a number of series on real GDP per capita at constant dollars. For measuring real income per capita we have used the RGDPT series, Real GDP per capita in constant dollars adjusted for changes in the terms of trade. The series uses 1985 international prices for aggregating domestic absorption and current prices for exports and imports to allow for changes in the terms of trade that influence real income. Due to non-availability of data for two African countries (Sudan and Somalia) and one Asian country (Afghanistan), these three countries are excluded from our study (we now have a sample of 107 countries).

Fitting the semi-log regression, Equation (1), over the whole sample, it is observed that our earlier conclusion of divergence holds good:

$$(7) \qquad Y_{it} = -2.85 + 0.56 \log X_{i60}\,,$$
$$\qquad\qquad\quad (-2.74) \quad (4.19)$$

where R bar sq = 0.02, F = 15.64, and D-W = 1.43 (White estimates of t-ratios are in parentheses).

For the North, on the other hand, there is insignificant evidence of convergence:

$$(8) \qquad Y_{it} = 7.74 - 0.69 \log X_{i60},$$
$$\qquad\qquad\quad (2.27) \quad (-1.77)$$

where R bar sq = 0.02, F = 4.07, and D - W = 1.32 (White estimates of t-ratios are in parentheses).

For the South, on the other hand, there is strong evidence of divergence:

$$(9) \qquad Y_{it} = -5.11 + 0.546 \log X_{i60},$$
$$(-2.82) \quad (3.49)$$

where R bar sq = 0.02, F = 13.26, and D-W = 1.44 (White estimates of t-ratios are in parentheses).

Fitting a quadratic equation, Equation (3), over the whole sample, there is some evidence of a decline in the force of divergence as we move across the countries from poor to rich:

$$(10) \qquad Y_{it} = -0.18 + 0.00087 X_{i60} - (0.9/10^7) (X_{i60})^2,$$
$$(-0.64) \quad (4.73) \qquad\qquad (-4.56)$$

where R bar sq = 0.02, F = 9.97, and D - W = 1.43 (White estimates of t-ratios are in parentheses).

The threshold value of initial income (after which the force of divergence is non-existent) is $4833. Sixteen countries of the North had per capita income (RGDPT) above this figure in 1960. But these countries did not show any significant evidence of convergence (details are omitted).

Similarly, the sub-sample South showed some evidence of a weakening force of divergence after a threshold value of income equal to $3000.[12] Only four countries in Latin America had RGDPT above this figure in 1960. These four countries did not exhibit any significant evidence of convergence. For the North, the quadratic equation did not show any significant evidence of convergence and/or its acceleration or deceleration.[13] Thus, our basic conclusion that relied fully on UN data can be maintained.

III. CONCLUDING COMMENTS

'Conditional Convergence': Some Observations

The present study is not concerned with whether Solow was right or wrong. This was the concern of the studies by Mankiw et al. (1992) and many others. In these studies, it is argued that

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[12] The estimated quadratic equation for the South is as follows:

$$Y_{it} = -0.71 + 0.0021 X_{i60} - (0.35/10^6) (Xi60)^2,$$
$$(-1.47) \quad (4.04) \qquad\qquad (-3.49)$$

where R bar sq = 0.03, F = 9.55 and D-W = 1.44 (White estimates of t-ratios are in parentheses).
The threshold value is estimated at $3000, and only four countries (Argentina, Chile, Uruguay, and Trinidad & Tobago) had per capita income (RGDPT) above this figure in 1960. They did not show any significant evidence of convergence (details are omitted).

[13] The estimated quadratic equation for the North is

$$Y_{it} = 2.4 - (0.2/10^4) X_{i60} - (0.12/10^7) (X_{i60})^2,$$
$$(-2.2) \quad (-0.05) \qquad\qquad (-0.4)$$

where R bar sq = 0.02 , F = 2.55 and D-W = 1.32 (White estimates of t-ratios are in parentheses).

in accordance with the neoclassical growth model, different groups of countries with different rates of saving and population growth, dependency ratios, stocks of human capital (proxied by school enrollment rates), etc. have different steady states. Keeping these factors fixed, it is shown that the countries faced convergent growth patterns—they are tending toward their respective steady states (see Barro, 1991; Barro and Sala-i-Martin, 1992, 1995; Mankiw et al., 1992, and Sheehey, 1996). This observed phenomenon is often called 'conditional' convergence and is taken to provide empirical support for the neoclassical growth model. Some studies (see Durlauf, 1996) have challenged this observation of conditional convergence and have provided support to the opposite camp, the new growth theorists.

In the context of the 'absolute' convergence/catching-up controversy with which the present paper is concerned, the 'conditional' convergence literature may be important in identifying some of the factors that explain divergent growth patterns. A poor country typically has a higher rate of population growth, higher dependency ratio, lower saving-investment rate, lower literacy rate, etc. than a typical rich country and, so, experiences a lower rate of growth. All of these factors are both causes and effects of poverty. After a certain stage of development, these factors may not differ very much. But a technological gap can exist. Bernard and Jones (1996) have demonstrated the existence of substantial technology gaps even across the OECD countries (constituting the North, loosely speaking). It is perhaps because of such considerations that the rates of growth among developed countries (of the North) do not show any relationship with their initial income levels.

CONCLUSION

The growth patterns during the last three decades do not show any sign of convergence. Typically, a country that was poor in the early 1960s did not experience higher real growth. Hence, there is no catching up to the standard of living of the rich countries by the poor countries. This is true not only for the South, but also for the North. There is strong evidence that growth patterns are divergent—instead of any catching up, the gap in the standard of living between the poor and the rich countries has widened. The force of divergence seems to be stronger in the lower income strata and non-existent at the top. There is no strong evidence in favor of the existence of a force of convergence/catching up at any level—either at the top or at the bottom. The advantages of relative backwardness emphasized in the Veblen-Gerschenkron hypothesis might be counter-balanced by the disadvantages of being latecomers (highlighted in Kaldor, 1972, 1985, and Krugman, 1981). The success stories of Japan, South Korea, and Taiwan cannot be generalized in the form of a convergence/catching-up hypothesis.

Table I

Per Capita Gross Domestic Product, 1960 and Its Real Rate of Growth, 1960–93: Pooled Regression Results

Estimates[a]				
Intercept	**Slope**	**R Bar Sq**	**F**	**D-W**
1. WHOLE SAMPLE (110 countries; Number of observations (n) = 867)[b]				
-1.96	0.58	0.03	23.52	1.43
(-2.94)	(4.85)			
[-2.99]	[5.32]			
2. NORTH (24 countries; n = 192)				
5.65	-0.55	0.02	4.21	1.32
(3.02)	(-2.05)			
[2.73]	[-1.89]			
3. SOUTH (86 countries; n= 675)				
-4.28	1.06	0.03	24.62	1.45
(-3.95)	(4.96)			
[-3.80]	[4.85]			
4. SOUTH (Top 5 countries; n = 38)				
5.54	-0.58	-0.03	0.04	1.46
(0.30)	(-0.21)			
5. SOUTH (excluding top 5; n = 637)				
-5.41	1.30	0.04	26.64	1.44
(-4.32)	(5.16)			
6. AFRICA (42 countries; n = 326)				
-4.72	1.02	0.02	6.88	1.64
(-2.55)	(2.62)			
7. ASIA (18 countries; n = 142)				
-6.11	1.84	0.11	19.12	1.50
(-2.90)	(4.37)			
8. LATIN AMERICA & CARIBBEAN (24 countries; n = 191)				
-4.63	1.00	0.02	5.36	1.53
(-1.88)	(2.32)			
9. LATIN AMERICA & CARIBBEAN (Top 4 countries, n = 32)				
9.72	-1.28	-0.03	0.20	1.55
(0.52)	(-0.45)			
10. LATIN AMERICA & CARIBBEAN (Excluding top 4 countries, n = 159)				
-9.39	1.90	0.05	9.38	1.55
(-2.76)	(3.06)			
11. Bottom 99 with 1960 GDP per capita < $1300 (n = 779)				
3.38	0.87	0.04	29.77	1.44
(-3.98)	(5.46)			
[-3.98]	[5.67]			
12. Top 1960 GDP per capita > $1300 (n = 88)				
0.23	0.17	-0.01	0.04	1.47
(0.03)	(0.18)			

[a] A Semi-log linear relationship is fitted using the OLS procedure :

$$Y_{it} = a + b \log X_{i60},$$

where Y_{it} is the annual rate of growth of real GDP per capita for the i-th country in the t-th period,

X_{60} is its GDP per capita in 1960, and a and b are the intercept and slope parameters (respectively).

Chi-Square and F-tests of heteroscedasticity are conducted on the basis of regression of squared residuals on squared fitted values. If the problem of heteroscedasticity is found, the t-ratios are reestimated on the basis of White's (1980) covariance matrix. These t-ratios are given third, in brackets.

[b] The whole sample covers 110 countries. The South ('Developing Market Economy'—86 countries): Algeria, Angola, Egypt, Morocco, Sudan, Tunisia, Benin, Botswana, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Ivory Coast, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Niger, Nigeria, Reunion, Rwanda, Senegal, Sierra Leone, Somalia, Swaziland, Togo, Uganda, Tanzania, Zaire, Zambia (42 countries from Africa); Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Guyana, Paraguay, Peru, Surinam, Uruguay, Venezuela, Barbados, Costa Rica, Dominican Republic, El Salvador, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Trinidad and Tobago, Venezuela (24 countries from Latin America and Caribbean, LAC); Cyprus, Jordan, Syria, Turkey, Afghanistan, Bangladesh, Hong Kong, India, Indonesia, South Korea, Malaysia, Mynamar, Nepal, Pakistan, Phillipines, Singapore, Sri Lanka, Thailand (18 countries from Asia); Fiji and Papua New Guinea (2 countries from Oceania).

North ('Developed Market Economy'—24 countries): Canada, USA, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, Australia, New Zealand, South Africa, Japan.

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