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Can institutions or education explain world poverty? An augmented Solow model provides some insights

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Abstract

When the Solow model is augmented with variables for institutions and human capital and estimated with national data for rates of investment in education, it can explain most of the variation in cross-country standards of living. The empirical results indicate that human capital is as important as physical capital in the determination of national income and that a high government share of consumption substantially reduces total factor productivity (TFP) and national income. The results also indicate that government integrity is endogenous in the development process and has an uncertain effect on total factor productivity.

JEL classification: E121; E132; O11; O57

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This paper follows in the footsteps of Mankiw, Romer, and Weil (MRW). In their well-known article MRW (1992) added a human capital variable to the basic Solow growth model and found that human capital is as important as physical capital in the determination of national income. Since this model explained 78% of the variation in living standards across 98 countries, they concluded "that the augmented Solow model provides an almost complete explanation of why some countries are rich and other countries are poor."

Critics rejected MRW's claim, citing model mis-specification, deficient statistical techniques, and invalid data as deficiencies in their analysis. But these methodological deficiencies do not negate the validity of MRW's overall approach. Micro studies consistently show that investment in human capital contributes to worker productivity, which in the aggregate should raise national income. And the Solow model structure provides a rigor-

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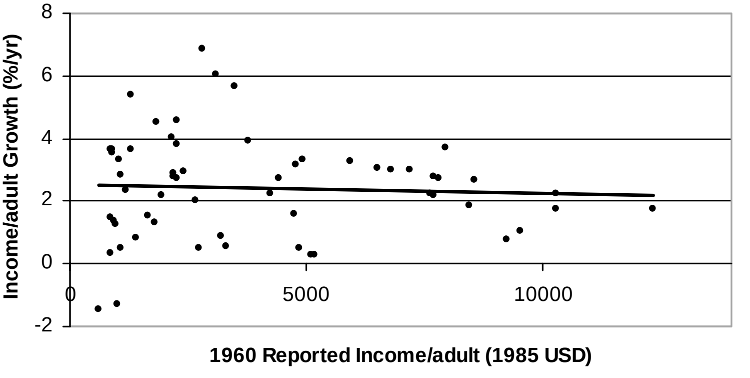

Fig. 1. 1960–1985 income growth vs. 1960 income.

ous, neoclassical framework for analyzing cross-country differences in national economic output.

This paper shows that if institutional variables are added to MRW's version of the Solow model and a superior data set is used for human capital, this model can provide an almost complete explanation of why some countries are rich and others are poor. The empirical results support MRW's finding that human capital is approximately equal to physical capital in the determination of national income and show that a large government share of national consumption substantially lowers national income. The results also indicate that government integrity is an endogenous variable in the economic development process and that the direction of causality runs in large part from national income to government integrity. Whether the level of government integrity affects TFP to any substantive degree is uncertain.

This paper is organized as follows. The first section presents the conceptual basis for using government integrity and the government's share of consumption to estimate a nation's total factor productivity (TFP). The second section incorporates these institutional variables into an augmented Solow model. The third section presents a revised data set for cross-country investment in formal education. The fourth section presents the empirical results for the augmented model. The last section presents some concluding remarks.

1. Conceptual framework

The basic Solow model cannot explain why poor countries remain poor. By assuming that levels of TFP are the same across countries, neoclassical theory predicts that all countries should converge to the same level of income/worker via international capital flows that lead to convergence in cross-country rates of investment/worker.[1] But there is little evidence that levels of national income and investment rates tend to converge. Fig. 1 shows that mean

[1] Convergence could also occur through cross-country migration of labor, but immigration restrictions limit this potential convergence process.

Fig. 2. Trends in physical investment ratios.

cross-country economic growth rates for reported income/adult were remarkably similar during the 1960–1985 period despite widely divergent national income levels. Fig. 2 shows that high-income countries had much higher investment ratios than poor countries over this period and that these rates showed little tendency to converge.[2]

Although the lack of convergence in income levels and investment rates could be seen as a negation of neoclassical theory, stable income growth and investment rates over time are consistent with the behavior of the Solow model when countries are in a condition of steady-state growth. If poor countries have stable cultural or other characteristics that restrict their ability to utilize physical capital and labor as efficiently as rich countries, then the economic behavior shown in Figs. 1 and 2 is consistent with neoclassical theory.

The form of the Solow growth model is a production function, which places emphasis on the importance of technical and economic efficiency and the magnitude of factor inputs in the determination of national income levels. In this model any country-specific characteristics that reduce the efficiency with which factors of production are utilized leads to lower national income/worker. So the missing elements in the basic Solow model are any relevant production factors other than (physical) capital and labor and any institutional or other factors that alter country-specific levels of resource conversion efficiency.

MRW (1992) argued that the basic Solow model cannot explain cross-country levels of income because it does not include human capital. When they included a measure for education in the model, they found that investment in education was as important as investment in physical capital, and their results were highly statistically significant. Critics of MRW's empirical results attacked the validity of their model, their statistical analysis, and their data. Islam (1995) provided strong evidence that MRW substantially overestimated the importance of human capital in the determination of national income by omitting key variables that could explain cross-country differences in TFP. Subsequently, Klenow and

[2] The ratios in Fig. 2 are the average by income category of each country's ratio $s_k/(n+g+d)$, which is the rate of investment in physical capital (I/GDP) divided by the sum of the labor growth rate, the productivity growth rate, and the rate of depreciation. In the Solow model this ratio is constant when a country is on a steady-state growth path.

Rodriguez-Clare (1997) used micro data on the private return on investment in education to argue that MRW's estimate of education's contribution to national income was much too large. They concluded that country-specific TFP is more important than education in the determination of cross-country differences in income. Dinopoulos and Thompson (1999) argued that MRW's empirical results were invalid because the data they used to represent cross-country investment in education (the share of the work force in secondary school) are an invalid proxy for actual rates of investment. Using other proxies for cross-country levels of human capital, they found little support for the importance of human capital. Temple (2001) recently reviewed the evidence on the relationship between education and growth and concluded that the aggregate evidence "continues to be clouded with uncertainty."

But if physical and human capital differences cannot explain income differences across countries, what factors could explain these differences? North (1990) has argued that it is a country's institutions that determine its long-run economic performance, by defining the way its political/economic system operates. North identifies the government's enforcement of property rights, its share of GNP, and the regulations it imposes as the most important determinants of economic performance. These institutions clearly could have a significant effect on the TFP of a country's economic system.

Recent econometric studies provide evidence for North's hypothesis. Barro (1997) argues that the rule of law affects economic growth. Hall and Jones (1999) present evidence that cross-country TFP differences are due to differences in social infrastructure, which they argue affects economic output through the mechanism of institutions and policies. Acemoglu et al. (2001) argue that cross-country differences in institutions due to different patterns of European settlement in their colonies continue to have substantial effects on national economic performance today.

Researchers have generally used models of the rate of economic growth to evaluate the factors that determine national income levels. But a weakness of these models is that they lack a rigorous formal structure. As discussed by Levine and Renelt (1992), the high correlation between the explanatory variables in these models makes the uncertainty about the validity of the estimated relationships much greater than it appears in the statistical tests.

The process by which government corruption or weak legal institutions reduce economic growth is not explicit in growth rate models. In a production function, however, it is clear that any negative effects of corruption on output must occur either through its effect on rates of investment or on TFP. Corruption might be expected to reduce TFP for various reasons:

- First, a more corrupt country is less likely to be operating on its maximum production possibility frontier. Government may make investment and employment decisions based on favoritism rather than public welfare criteria. Firms may take actions to avoid paying bribes or because property is not protected that cause production factors to provide less output than they would if corruption did not exist.
- Second, a nation with more political corruption is more likely to have monopolistic industrial conditions. This situation may cause firms to operate off of the technologically efficient frontier and is certain to reduce their economic efficiency. In the absence of competition, firms are under less pressure to remain efficient, and this could cause TFP to be lower than otherwise.

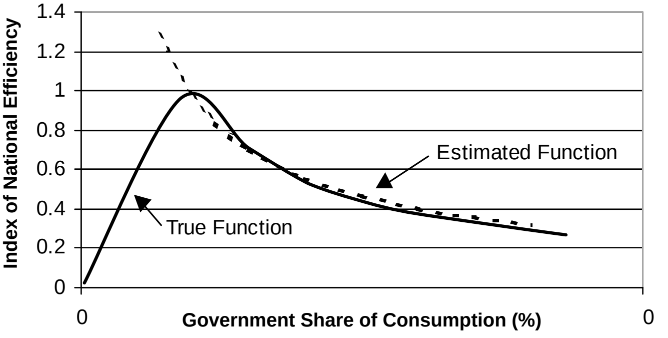

Fig. 3. Government size and economic efficiency.

- Third, Friedman et al. (2000) have provided evidence that corrupt countries have larger underground economies. As a consequence, higher corruption is likely to be correlated with more missing income/capita. If investment is correctly measured and income is underestimated, then measured TFP will be lower than actual TFP. So some portion of the lower TFP in poor countries is likely to be measurement error.
- Fourth, private/public relations in a more corrupt country are likely to be characterized by bribery. To the degree that bribes are included in the investment data, the true investment rate is overestimated, and again the effect would be to reduce the estimated TFP from reported investment.[3] Once again, this is a measured, not a real, effect.

Another characteristic of a country that could affect productivity is the government's share of consumption. Government is a necessary institution that potentially provides enormous benefits by eliminating anarchy, creating and enforcing the rule of law, and providing necessary public infrastructure. These government services are critical for a productive economy, but they can be provided by a relatively small government. When the government's share of consumption becomes larger, the government inevitably becomes involved in producing goods and services that could be provided more efficiently by the private sector.[4] The government sector is less efficient for some types of activity because it makes decisions in part for political reasons, rather than solely to maximize profits. Since profit maximization leads to the highest level of economic efficiency, any other decision criteria must yield a lower level of efficiency.

This reasoning implies that the government's marginal contribution to GDP is positive as its share of consumption increases until this share reaches an optimal level. As it then takes on activities best performed by the private sector (e.g. when an industry is nationalized), its marginal contribution to GDP becomes negative. Fig. 3 shows the implied relationship between government's share of consumption and national economic efficiency.

[3] Summers and Heston (1991) found that the local price of capital goods in poor countries was 55% higher than in rich countries in 1980.

[4] Majumdar (1998) examined government-owned, mixed sector, and private sector enterprises in India for the period 1973–1989 and found that the government-owned enterprises were much less efficient than the mixed or completely private enterprises.

The exponential function shown in the figure can estimate the negative effect of an increasing government share of consumption on (average) national efficiency, as long as all countries have a government share of consumption that equals or exceeds the optimal level.

While low TFP is likely to be associated both with a high index of political corruption and with a high government share of consumption, these two institutional characteristics are likely to capture distinct effects. This yields the following model:

$$E_{it} = f_1(\text{GInt}_{it}, \text{GCons}) \tag{1}$$

where E_{it} is the country-specific national efficiency with which the world's technology can be combined with capital and labor to produce goods and services, GInt_{it} is the level of government integrity, and GCons_{it} is the government's share of consumption. The sign on government integrity is expected to be positive and the sign on the government's share of consumption is expected to be negative.

Schneider and Enste (2000) present evidence that the underground economy is a large share of reported income, particularly in poor countries. This means that reported national income RY_{it} differs from actual income Y_{it} in a substantial, non-random manner, as follows:

$$\text{RY}_{it} = (1 + u_{it})^{-1} Y_{it} \tag{2}$$

where u_{it} is the size of the underground economy relative to reported national income.

Friedman et al. (2000) present evidence that the size of the underground economy is correlated with the level of government corruption, but not with the level of taxes, suggesting that the overall level of government intervention in the economy does not affect the size of the underground economy. They argue that businesses go underground to avoid the burden of government bureaucracy and corruption rather than to avoid taxes. This leads to the following model:

$$(1 + u_{it})^{-1} = f_2(\text{GInt}_{it}) \tag{3}$$

as with the efficiency index, in (3) the sign on government integrity is expected to be positive.

2. Adding institutional variables to the Solow model

The original Solow model of economic output is a Cobb-Douglas production function with two inputs, physical capital and labor, and constant returns to scale. MRW (1992) augmented the Solow model to include a human capital term H_{it} analogous to the physical capital term. In this paper a country-specific efficiency factor E_{it} is added to the MRW model to distinguish the country-specific efficiency effect from the trend in TFP in the most productive countries. In countries with the highest TFP, E_{it} is equal to 1 by definition, while in countries where TFP is lower, $E_{it} < 1$.[5] This leads to the following model of reported

[5] Inefficiency in this model is not "x-inefficiency," which refers to firms within a country that are less efficient than others due to organizational deficiencies (Altman, 2000). In the model presented here, all firms in some countries are less efficient than all firms in other countries due to the institutional or cultural characteristics of these countries.

national income, as defined in (2):

$$\mathrm{RY}_{it} = (1 + u_{it})^{-1} K_{it}^{\alpha} H_{it}^{\beta} [A_t E_{it} L_{it}]^{1-\alpha-\beta} \tag{4}$$

where K_{it} is the physical capital stock, H_{it} is the human capital stock, A_t is the labor-augmenting world level of technological productivity, L_{it} is the number of (homogeneous) workers, α is the share of national income accruing to physical capital, β is the share of national income accruing to human capital, and the other variables are as defined above.

This augmented Solow model can be rewritten on a per *effective* worker basis as follows:

$$\mathrm{r}y_{it} = (1 + u_{it})^{-1} (E_{it})^{1-\alpha-\beta} (k)_{it}^{\alpha} (h)_{it}^{\beta} \tag{5}$$

where $y_{it} = Y_{it}/A_t L_{it}$, $k_{it} = K_{it}/A_t L_{it}$, and $h_{it} = H_{it}/A_t L_{it}$. Implicitly an *effective* worker in this model is one whose labor productivity is on the world's maximum production possibility frontier. A country whose workers are effective in this sense has the maximum national efficiency, $E_{it} = 1$.

E_{it} may increase (unless $E_{it} = 1$) or decrease, as changes in country-specific institutional characteristics affect the ability of managers to convert resources into economic output. For example, growing civil instability or an increase in rent-seeking activity reduces E_{it}, while improving resource management practices (in a country with $E_{it} < 1$) at a rate greater than the growth rate of A_t implicitly increases E_{it}. In this model if E_{it} does not change, total factor productivity will rise based solely on improvements in the level of world technology. In growth models that do not include institutional characteristics, an increase in E_{it} in the less efficient countries would be viewed as an increase in the rate of technology diffusion from the more efficient countries. In the model presented here, world technology and a "world-class" level of resource conversion efficiency are available to all countries if they adopt the institutional structure required.

MRW (1992) outlined the implications of steady-state growth with their augmented model. At steady-state a constant fraction of reported output $s_{ki} = I_{kit}/\mathrm{RY}_{it}$ and $s_{hi} = I_{hit}/\mathrm{RY}_{it}$ are invested, E_{it} is constant, A_t is growing at rate g, and L_{it} is growing at rate n_i. K_{it} and H_{it} are growing at rate $n_i + g$ on a net basis and at rate $n_i + g + d$ on a gross basis, where d is a presumed uniform depreciation rate for capital in all countries. The rates n_i, g, and d are all constant. Under these conditions k_{it} and h_{it} change over time as follows:

$$\frac{\mathrm{d}k_{it}}{\mathrm{d}t} = s_{ki} y_{it} - (n_i + g + d) k_{it} = (s_{ki} E_i^{1-\alpha-\beta} k_{it}^{\alpha}) - ((n_i + g + d) k_{it}) \tag{6a}$$

$$\frac{\mathrm{d}h_{it}}{\mathrm{d}t} = s_{hi} y_{it} - (n_i + g + d) h_{it} = (s_{hi} E_i^{1-\alpha-\beta} h_{it}^{\beta}) - ((n_i + g + d) h_{it}) \tag{6b}$$

At steady state $\mathrm{d}k_{it}/\mathrm{d}t = 0$ and $\mathrm{d}h_{it}/\mathrm{d}t = 0$, so k_{it} converges to k_i^* and h_{it} converges to h_i^* and (3) and (4) can be solved as follows:

$$k_i^* = E_i \left[\frac{s_{ki}^{1-\beta} s_{hi}^{\beta}}{(n_i + g + d)} \right]^{1/(1-\alpha-\beta)} \tag{7a}$$

$$h_i^* = E_i \left[\frac{s_{ki}^{\alpha} s_{hi}^{1-\alpha}}{(n_i + g + d)} \right]^{1/(1-\alpha-\beta)} \tag{7b}$$

The functions for efficiency (1) and the size of the underground economy (3) from the previous section can be combined and hypothesized to take the form of an exponential function:

$$(1 + u_{it})^{-1} E_{it} = c_1 \mathrm{GInt}_{it}^{\gamma} \mathrm{GCons}_{it}^{\delta} \tag{8}$$

Substituting (7) and (8) into (5), transferring A_t to the right hand side of the equation, and taking logs, yields the following:

$$\ln\left(\frac{\mathrm{RY}}{L}\right)_i = C + \gamma \ln[\mathrm{GInt}_i] + \delta \ln[\mathrm{GCons}_i] + \frac{\alpha}{(1-\alpha-\beta)} \ln\left[\frac{s_{ki}}{(n_i+g+d)}\right] + \frac{\beta}{(1-\alpha-\beta)} \ln\left[\frac{s_{hi}}{(n_i+g+d)}\right] \tag{9}$$

One note of clarification relates to the interpretation of the coefficients of the model in (9). In this model the capital and labor components are presumed to be the inputs to the Cobb-Douglas structure with constant economies of scale, while the government integrity and government share of consumption variables are characteristics in the form of indices that determine the country-specific level of efficiency E_{it}. Given the manner in which they were derived above, it should be evident that the GInt_{it} and GCons_{it} variables are not inputs into the Cobb-Douglas structure, even though they have a similar mathematical form.

3. Investment in human capital

As discussed by MRW (1992), any conceptually (and empirically) correct estimate of the level of investment in education must include both the direct expenditures for teachers, materials, and classrooms, as well as the earnings foregone by students and implicitly invested when they forego work to pursue education. Since foregone earnings are implicit, they are not included in official statistics and have generally been ignored in cross-country econometric studies.

Kendrick (1976) estimated the magnitude of all explicit and implicit investment in the US in 1969 as a share of GDP, including the share corresponding to foregone earnings. These estimates are shown in Table 1. Kendrick estimated that students' foregone earnings in the US were similar in magnitude to the level of direct expenditures for education and training.

Measured on a unit basis, both the direct cost of education and foregone earnings rise with the level of schooling. For example, in the US currently the total investment cost of a year of (basic) university education is likely to be at least twice the cost of a year of secondary school, which in turn is twice the cost of a year of primary school.[6]

Many cross-country growth studies have used estimates of the mean years of education in the working population as their proxy for the stock of human capital. These indices implicitly assume that within a country all years of education have the same investment cost. By failing to account for the higher unit cost of higher education, they substantially underestimate the

[6] Calculated from education cost and earnings data taken from the U.S. Census Bureau, 1998.

Table 1
U.S. capital investment in 1969 (percent of adjusted GDP)

Physical capital	22.9
Other investment	26.6
Raising children to age 14	5.1
Direct cost of education and training	8.1
Foregone earnings of students	7.3
Worker health	2.2
Worker relocation	1.7
Corporate R&D	2.1
Total investment	49.5

Source: Kendrick (1976).

difference in the relative levels of human capital between rich and poor countries. In addition, these studies implicitly assume that the quality of education is identical in rich and poor countries, which is clearly not the case.

Unfortunately, there are serious obstacles to developing country-specific estimates of the level of foregone earnings and direct expenditures. First, foregone earnings of students must be imputed based on age and education-specific real wage rates that vary over time. Second, available data on expenditures for education typically include only public expenditures. Third, the reported level of public expenditures is typically provided as a share of national income (expenditures/GDP), which overestimates the true rate of investment in corrupt countries because the numerator may include funds that are diverted from their intended purpose and the denominator excludes income for the underground economy.

MRW's (1992) index for relative cross-country rates of investment in education was the share of the working age population in secondary school.[7] Dinopoulos and Thompson (1999) observed that this index would underestimate the investment in poor countries that provide little education beyond primary school. It is a better index of relative foregone earnings, however, since foregone earnings are low at the primary school level. And despite its obvious limitations, MRW's index is potentially superior to mean years of schooling as a cross-country proxy for relative investment in education because it implicitly adjusts for differences in the quality of education and the cost of providing non-tradable services across countries.

This study improves MRW's index of each country's investment in formal education by creating a new data set that is the sum of direct expenditures and foregone earnings. The available estimates of *public* expenditures on education are used as the basis for estimating *total* direct expenditures, and the rate of public expenditures is increased to account for the missing private expenditures. MRW's SCHOOL index is used as the basis for estimating foregone earnings, and the magnitude of their index is reduced since using students' share of the labor force as the foregone earnings fails to adjust for the below-average wages of young workers.

[7] MRW (1992) observe that since (9) is estimated in log form, the coefficient on human capital will be unbiased if the *relative* levels of investment across countries are correct even if the absolute levels are not.

Fig. 4. Public expenditures for education.

The calibrating mechanism for adjusting the two education investment streams is Kendrick's (1976) estimates of total direct expenditures and foregone earnings in the US in 1969, which are shown in Table 1. These estimates were 8.1 and 7.3% of adjusted GDP, respectively. Kendrick's estimates were compared to 1965–1969 U.S. public expenditure data and MRW's 1960–1985 estimates of secondary school share of the working population (SCHOOL) to create two generic cross-country adjustment factors. The Barro and Lee (1994) data for the U.S. rate of public expenditure on education over the 1965–1969 period was 5.6% of GDP. The ratio of Kendrick's total expenditures to Barro and Lee's public expenditures (8.1/5.6) was used to create a factor of 1.45 to estimate total direct expenditures as a function of public expenditures for all countries. MRW's data for U.S. investment in education (SCHOOL) was 11.9% of GDP. The ratio of Kendrick's estimate of foregone earnings to SCHOOL (7.3/11.9) was used to create a factor of 0.61 to estimate foregone earnings as a function of SCHOOL for all countries.

Fig. 4 shows the estimated rate of public expenditures for the 59 countries in the data set, separated into categories by income/capita. As shown, the rate of public expenditures in constant dollars (as a share of reported income) was rising over the period in countries at all income levels. The 1965–1969 level of public expenditures was used as the basis for calculating the human capital stock in place in 1985. The 1965–1969 period is an appropriate period for this estimate because public expenditures in the 1965–1969 period appear to be about equal to the average rates across rich and poor countries for the 1950–1980 time period, which is the relevant period for the workers in the labor force in 1985. In addition, the 1965–1969 period includes the date for Kendrick's estimate of the relative shares of direct expenditures and foregone earnings.

MRW's estimate of investment (SCHOOL) is the working time lost for secondary school students as a share of the total potential work force. This is not an unreasonable index of relative foregone earnings across countries. Primary school students have relatively low foregone earnings. University students have much higher foregone earnings, but for most countries a relatively small share of the population attended the university during the relevant time period for this study. Since the rich countries have a larger share of the population in the university, the exclusion of university education from this index might appear to bias it against the rich countries. But since the rich countries have a more educated work force, the

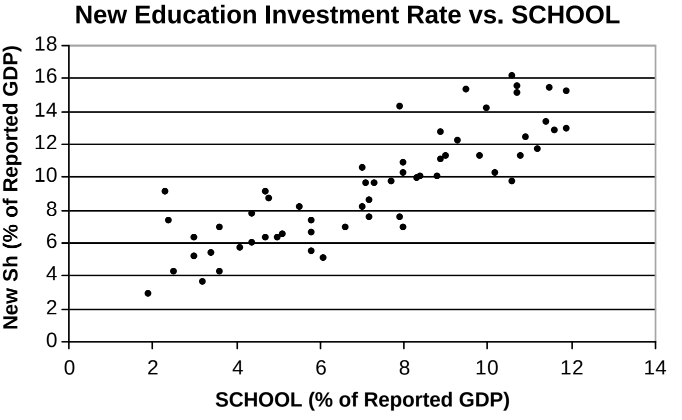

Fig. 5. New education investment rate vs. SCHOOL.

income of a secondary school age worker is lower relative to the average worker's income in the rich countries than in the poor countries. Since this higher relative wage in the rich countries is implicitly used in the foregone earnings calculation, the bias against the rich countries from excluding the foregone earnings of university students is offset.

Although the adjustment of educational investment data using the U.S. pattern may be reasonable for rich countries, it could be less accurate for poor countries. Fortunately, anecdotal evidence for India suggests that this may not be the case. Table 2 shows the ratios between public expenditures and private direct costs and foregone earnings for India in 1965–1969 based on the U.S. pattern and the same ratios for these cost elements in actual 1979–1980 data for India from Tilak (1988). The two sets of ratios are similar.

The new data set for investment in education and MRW's SCHOOL data set are shown in Appendix A. A plot of these two data sets is shown in Fig. 5. The influence of MRW's SCHOOL variable is visible in the new data set, but the pattern of cross-country variation in the new estimates of s_h is quite different from SCHOOL.

4. Empirical analysis

An implicit assumption in (9) is that RY/L_i is a reasonable estimate of the steady-state level RY/L_i^*. This means that OLS estimates of the coefficients on the variables in (9) are unbiased if the countries in the data set are on their steady-state growth path or are randomly distributed around it over the estimation period. If the countries are not at steady-state, the estimated coefficients on the variables in (9) are still unbiased, if the values of the variables are changing at similar rates because they are proportional to the steady-state level and (9) is estimated in log form.

The variables assumed to be exogenous and constant are GInt, GCons, h^*, and k^*. The variables h^* and k^* are constant if the ratios $s_k/(n+g+d)$ and $s_h/(n+g+d)$ are constant over time. Since g and d are constant by definition, this means that for a country on a steady-state

Table 2
Comparison of education investment rates for India

Source	Year	Measure	Public expenditure	Private expenditure	Total expenditure	Foregone earnings	Total investment
This Study	1965–1969	Percent of GDP	2.5%	1.1%	3.6%	3.1%	6.8%
Tilak (1988)	1979–1980	Percent of GDP	3.9%	1.9–3.5%	5.8–7.4%	4.2%	10.0–11.6%
This Study	1965–1969	Ratio to public expendioture	1.0	0.45	1.45	1.25	2.70
Tilak (1988)	1979–1980	Ratio to public expenditure	1.0	0.49–0.90	1.49–1.90	1.08	2.56–2.97

Fig. 6. Government share of reported consumption.

growth path, any changes in the labor force growth rate must be offset by changes in the investment rates for physical and human capital.

As shown previously in Figs. 1 and 2, the mean annual growth rate for reported income/adult is stable across levels of income, and the average investment ratios for physical capital $[s_{ki}/(n_i + g + d)]$ are stable by income categories over the 1960–1985 time period. Fig. 4 showed that the trend in government spending on education was rising over the 1960–1985 period, and Fig. 6 shows that the trend in the government share of consumption was also rising over the period. Since the growth rates seem to be similar across all national income levels, however, these changes in the values of the independent variables in the data set over time are not biasing the model's estimated coefficients in any obvious way.

4.1. Data

The countries included in the data set all had mixed, relatively diversified economies. MRW's (1992) data were used for income/adult in 1985 and for average investment rates for physical capital (s_k), secondary students' average share of the work force (SCHOOL), and growth in the labor force (n) over the 1960–1985 period. Since MRW's estimates for the physical capital investment rate came from the Summers and Heston PWT data that are adjusted for international prices, these rates have been reduced to remove any portion of the reported rates that correspond to country-specific bribes or other unusual costs. Summers and Heston's (1991) PWT data were used for the 1960–1985 average government share of GDP (GCons). Barro and Lee's (1994) data were used for the rates of public expenditure on education.

MRW's (1992) assumption that $g + d = 0.05$ was adopted for use in this study. Since Jorgenson's (2001) estimates indicate that TFP growth in the US was about 0.5% annually over the 1960–1985 period, implicitly the assumed depreciation rate for physical and human capital is 0.045. Moderate increases in this rate do not change the empirical results.

Mauro's (1995) "bureaucratic efficiency" index was used as the index for government integrity (GInt). This index is the average of the following three business international indices for types of corruption-related risk affecting foreign business operations in 1980–1983:

- *Legal system, judiciary*—Efficiency and integrity of the legal environment as it affects business, particularly foreign firms.
- *Bureaucracy and red tape*—The regulatory environment foreign firms must face when seeking approvals and permits. The degree to which it represents an obstacle to business.
- *Corruption*—The degree to which business transactions involve corruption or questionable payments.

Although Mauro called this index “bureaucratic efficiency,” it is an index of the integrity with which a country’s public institutions create and enforce rules and regulations that are necessary for efficient private business operations. Although the indices for the three factors are correlated, the three combined seem to be a better measure of the overall integrity of a country’s government institutions, or quality of governance, from a business perspective than any single factor. “Bureaucracy and red tape” are included in the overall corruption index because extensive amounts of “red tape” are often used as a vehicle to extract bribes.[8]

While the original MRW non-oil country data set included 98 countries, Mauro’s index was only available for 68 countries, and only 63 countries had data available from both data sets. In addition, the OPEC members Venezuela, Algeria, and Nigeria were removed for consistency with the original concept of a non-oil country data set. And Barro and Lee data were unavailable for public expenditures on education in Angola. The net result was a reduction in the number of countries available for the empirical analysis from 98 in the MRW “non-oil” country data set to 59 in this study. The data set used in the regressions is provided in Appendix A.

An important issue is whether the 59-country data set is a reasonable sample for estimating a cross-country national production function. Fig. 7 shows the 1985 distribution of income for the countries included in the sample. There are 16 low-income countries with income/adult under US$ 3000, 20 medium-income countries with income/adult between US$ 3000 and US$ 8000 , and 23 high-income countries with income/adult between US$ 8000 and US$ 20000 (1985 dollars). The distribution also includes 22 OECD countries and 37 non-OECD countries, of which ten are Latin American, eight are sub-Saharan African, three are Asian “tigers,” and six are Islamic states. Although a larger sample would be better, the sample covers a wide range of countries and has a balanced distribution of countries by income level.

4.2. Initial empirical results

As mentioned earlier, an important test for the validity of the Solow model’s empirical results is the consistency of the model’s estimate of the share of national income accruing to physical capital (α). Table 3 presents Kendrick and Vaccaro’s (1980) estimates of α in 1973 for nine countries. The share varied substantially in 1973, but for this group

[8] Using data from 75 countries collected by the World Bank, Djankov et al. (2002) found that more extensive regulation is strongly and significantly related to higher levels of corruption.

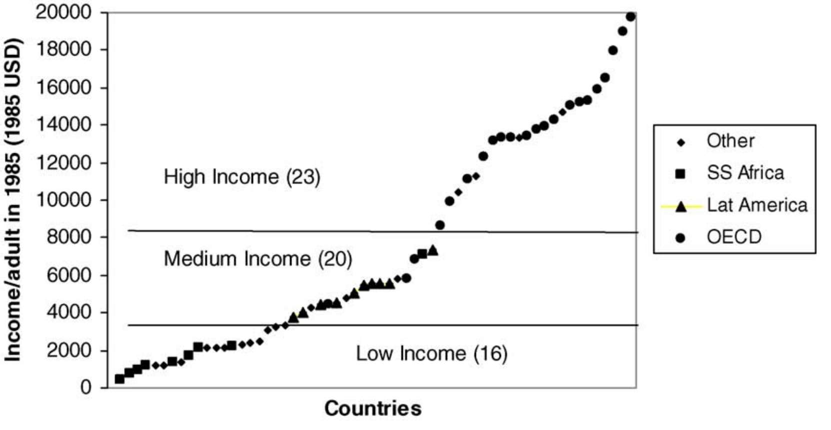

Fig. 7. Distribution of reported income for the 59 country sample.

on average $\alpha = 0.33$. The outliers in the group were Germany and Japan, which had much higher shares, and South Korea, which had a much lower share. While the different estimates of α for Germany, Japan, and South Korea could mean that the national production functions are different in those countries, they could also indicate the unusual conditions in those countries at that time. In 1973 Germany and South Korea were still recovering from major wars, and Japanese industries were receiving large subsidies for capital investment.

The empirical results for the OLS estimates of the model coefficients are shown in Table 4.

- The first column shows the published results from the original MRW (1992) study for the 98 countries they included in their non-oil data set. Their implied values for α and β, the effect of physical and human capital on income, were similar, and their value of $\alpha = 0.31$ is similar to the average share shown in Table 3.
- The second column presents the results obtained for the same MRW model but with the smaller data set containing the 59 countries used in this study. Reducing the number of countries in the data set had a noticeable effect on the empirical results. The implied value of α increased from 0.31 to 0.39, and the implied value of β declined from 0.28 to 0.25.
- Column 3 presents the results obtained when the institutional variables are added to the MRW model. The explained variance rises to 85%, and the coefficients on all of the

Table 3
Physical capital's share of national income in 1973

US	Canada	Germany	France	UK	Japan	Italy	Netherlands	S. Korea	Average
0.31	0.32	0.41	0.33	0.26	0.49	0.28	0.33	0.27	0.33

Source: Kendrick and Vaccaro (1980).

Table 4
Income/adult OLS results (dependent variable is ln(income/adult))

	1	2	3	4	5	6	7
	MRW (1992)	Small sample	Add institutions	Replace MRW's SCHOOL	Add dummy variable	Test s_h OECD/non-OECD	Test government OECD/non-OECD
Countries/sample size	98	59	59	59	59	59	59
Constant	7.86** (0.14)	7.43** (0.26)	9.84** (0.47)	9.83** (0.52)	9.63** (0.55)	9.83** (0.59)	9.84** (0.58)
$\ln((s_k)/(n+g+d))^2$	0.73** (0.12)	1.15** (0.23)	0.65** (0.17)	0.69** (0.19)	0.50** (0.17)	0.63** (0.19)	0.57** (0.20)
$\ln((\text{SCHOOL})/(n+g+d))^2$	0.67** (0.07)	0.60** (0.20)	0.42* (0.16)				
$\ln((s_h)/(n+g+d))^2$				0.49 (0.25)	0.23 (0.20)		0.33 (0.26)
OECD $\ln((s_h)/(n+g+d))$[a]						0.68** (0.24)	
Non-OECD $\ln((s_h))/(n+g+d))$[a]						0.23 (0.31)	
ln(government integrity)			0.88** (0.21)	0.80** (0.24)	0.84** (0.18)	0.82** (0.23)	0.83** (0.24)
ln(government share of consumption)			−0.56** (0.15)	−0.65** (0.17)	−0.50* (0.20)	−0.64** (0.19)	
OECD ln(government share of consumption)							−0.51* (0.19)
Non-OECD ln(government share of consumption)							−0.63** (0.19)
OECD					0.34 (0.25)		
Asian "Tigers"					0.17 (0.27)		
Islam					0.09 (0.20)		
Latin America					0.06 (0.20)		
Sub-Saharan Africa					−0.57* (0.25)		
R^2	0.78	0.74	0.85	0.84	0.90	0.85	0.85
Adjusted R^2		0.73	0.84	0.83	0.88	0.84	0.84
Implied α	0.31	0.42	0.31	0.32	0.28	0.28 OECD 0.34 non-OECD	0.30
Implied β	0.28	0.22	0.20	0.22	0.14	0.29 OECD 0.12 non-OECD	0.17

Note. White-adjusted standard errors are given in parentheses.

[a] s_k is investment in physical capital/GDP; s_h is investment in education/GDP; n is the labor growth rate; g is the high-income country TFP growth rate; d is the depreciation rate.

* Significant at 5% level.

** Significant at 1% level.

variables are statistically significant at the 5% level. In this model the implied value of α is 0.31 and the implied value of β is 0.20.

- Column 3 presents the results obtained with the new data set for investment in education. The results are similar to the results using the SCHOOL data set, but the coefficient on the human capital variable is only statistically significant at the 10% level.
- Column 5 tests the model's results for potential omitted variables bias by adding in regional dummy variables. All of the coefficients on the structural variables decline in magnitude as expected due to the correlation of the model's structural variables with the regional dummy variables. The coefficients on physical capital, government integrity, and government share of consumption remain statistically significant at the 5% level, but the coefficient on human capital loses much of its significance.

One possible explanation for the low statistical significance of the coefficient on the human capital variable is that the structural relationship between education and economic output is different for the OECD and non-OECD countries. Poor countries are often criticized for underinvesting in primary school relative to upper levels of schooling, and anecdotal information indicates that university graduates in poor countries often have difficulty finding employment appropriate for their level of education. Column 6 tests for structural differences by including separate variables for human capital in the OECD and non-OECD countries. The empirical results yield noticeable differences for these two groups of countries. β becomes larger and statistically significant for the OECD countries and smaller and insignificant for the non-OECD countries. The implied values of α and β are 0.28 and 0.29, respectively, in the OECD countries, while the corresponding values are 0.34 and 0.12 in the non-OECD countries. While these results suggest that the model parameters may be different for the OECD and non-OECD countries, the results are not definitive. A Chow test of the structural stability of the model for the two groups of countries yielded an F value of 1.68, too low to reject the hypothesis of cross-group stability at the 5% level.

The empirical results in Table 4 suggest that institutions are more important than human capital in the determination of national income. The coefficient on education declines when the institutional variables are added to the model, and the institutional variables have greater statistical significance. And in the non-OECD countries, human capital explains little of the variation in national income.

But are these empirical results valid? Clearly, some aspects of these results are reassuring. The estimated coefficient on physical capital is almost identical to the independent estimates of the share of income accruing to physical capital in Table 3. The coefficients on government integrity and government share of consumption have the expected sign and are robust to the addition of dummy variables. Nevertheless, a common criticism in growth studies is that the direction of causality has not been proven, so that the OLS statistical estimates are biased because the explanatory variables are endogenous.

4.3. The issue of causality

Fortunately, causality is somewhat less of an issue in the estimation of a production function than when the dependent variable is the rate of economic growth. There is little doubt about the direction of causality between economic output in one year and the physical and human capital stock built up over the preceding 25 years or more, but the direction of causality is less clear for the institutional variables.

The data for the government share of national consumption are the average share over the 1960–1985 period. Nevertheless, this variable could still be endogenous if poor countries always choose to have large governments or if they always appear to have large governments because their reported income excludes a large underground economy. The data themselves suggest, however, that the share of government consumption is not determined entirely by the level of national income. As shown in Fig. 6, while the share of government has trended upward with growth in income over time, the trend in the cross-sectional distribution is the opposite; the poorest countries tended to have the largest governments over the 1960–1985 period. The negative cross-country correlation between government size and income seems likely to be at least partly the result of political ideology, which in many poor countries was oriented toward state control of the economy prior to the collapse of the Soviet Union in 1989.

If there is an endogeneity problem with the government share of consumption, it is consistent across all levels of income. Column 7 in Table 4 shows the empirical results when the relationship between national income and the government's share of consumption is examined separately for the OECD and non-OECD countries. The coefficients are significant and similar in magnitude for both groups of countries. This result indicates that the negative coefficient is not due solely to the large underground economy in the poor countries.

In the case of government integrity, the direction of causality is a more serious issue. Government integrity and the level of national income are highly correlated, and there appears to be a growing consensus that these two characteristics are endogenous in the development process. Paldam (2002) argues that the level of national income is the most important determinant of the level of government corruption, but that causality seems to run in both directions. If government integrity and national income are endogenous, then the OLS estimates of the coefficients in the models summarized in Table 4 are biased and inconsistent.

If models for both income/adult and government integrity can be specified, a Hausman specification error test can be performed to determine whether there is an endogeneity problem with the OLS estimate of the effect of government integrity on income/adult. If there is a problem, a consistent estimate of the effect of government integrity can be calculated if there is at least one determinant in the model of government integrity that is exogenous and distinct from the determinants of income/adult.

La Porta et al. (1999) performed a comprehensive empirical examination of the determinants of government quality. While numerous variables, such as the type of legal system, the type of religion, and ethnolinguistic characteristics were statistically significant in some of their regressions, these characteristics generally lost their significance when income and latitude were included in the models. Their results suggest that latitude, presumably by determining geographic conditions, may be an exogenous determinant of government integrity. Treisman (2000) performed a comprehensive empirical examination of the causes of corruption. He found that income was the most important determinant followed by whether

Table 5
Government integrity empirical results (OLS) (dependent variable is ln(government integrity))

	1	2	3	4
	Base model	Add British colony	Add latitude	Add protestant
Countries/sample size	59	59	59	59
Constant	−3.34** (0.29)	−3.43** (0.28)	−3.25** (0.26)	−3.29** (0.30)
ln(income/adult)	0.34** (0.04)	0.34** (0.03)	0.32** (0.05)	0.33** (0.04)
British colony		0.16* (0.06)		
Latitude			0.09 (0.17)	
Protestant share				0.001 (0.001)
R^2	0.63	0.67	0.63	0.64
Adjusted R^2	0.63	0.66	0.62	0.62

Note. White-adjusted standard errors in parentheses.
* Significant at 5% level.
** Significant at 1% level.

a country had been a British colony and/or the share of Protestants in the population. These two characteristics presumably would affect government integrity through their effect on social norms.

Table 5 shows the results of an OLS estimation of several models of government integrity that include income, the British colonial experience, the share of Protestants in the population, and latitude. The only model in the table that has a statistically significant exogenous variable is the one that includes British colonial experience:

$$\ln[\mathrm{GInt}_i] = a + b\ln\left[\left(\frac{\mathrm{RY}}{L}\right)_i + c\,\mathrm{BritCol}\right] \tag{10}$$

where BritCol is a dummy variable that takes the value of 1 if a country is a former British colony or the UK and 0 otherwise. The other variables were defined above.

A Hausman test performed using reduced form equations created from (9) and (10) indicates that the error term in (9) is highly correlated with government integrity, which means that government integrity is an endogenous variable in (9) and that the estimates of its coefficient in Table 4 are biased and inconsistent. Since the variable BritCol is an exogenous determinant of government integrity that is not expected to be a (direct) determinant of national income, BritCol can be used as an instrument for government integrity to address the endogeneity problem.

The results of the IV regression using BritCol as the instrument for government integrity are shown in column 1 of Table 6. The estimated coefficient on government integrity is much smaller than in the OLS regression, while the coefficient on investment in education is larger. Evidently in the OLS estimates in Table 4, the estimate of the effect of government integrity is biased upwards, while the estimate of the effect of education is biased downward. The smaller coefficient with the IV results and its low statistical significance indicate that the level of government integrity may have little effect on a nation's TFP.

Table 6
Further analysis of effect of government integrity (dependent variable is ln(income/adult))

	1	2	3	4	5
	Base model	Exclude integrity	Add dummies	OECD and non-OECD	Add dummies
Statistical technique	IV	OLS	OLS	OLS	OLS
Countries/sample size	59	59	59	59	59
Constant	9.59** (0.82)	9.34** (0.68)	8.80** (0.71)	9.33** (0.73)	8.84** (0.72)
$\ln((s_k)/(n+g+d))$[a]	0.78* (0.33)	0.89** (0.25)	0.68** (0.24)	0.83** (0.25)	0.72** (0.25)
$\ln((s_h)/(n+g+d))$[a]	0.66 (0.40)	0.85** (0.24)	0.65** (0.21)		
OECD $\ln((s_h)/(n+g+d))$[a]				1.03** (0.23)	0.96** (0.24)
Non-OECD $\ln((s_h)/(n+g+d))$[a]				0.62 (0.34)	0.49 (0.26)
ln(government integrity)	0.42 (0.81)				
ln(government share of consumption)	−0.68** (0.20)	−0.71** (0.21)	−0.48* (0.23)	−0.70** (0.23)	−0.50* (0.24)
OECD			0.45 (0.28)		0.19 (0.28)
Asian "Tigers"			0.51 (0.37)		0.50 (0.36)
Islam			0.14 (0.22)		0.13 (0.22)
Latin America			0.26 (0.19)		0.23 (0.19)
Sub-Saharan Africa			−0.43 (0.28)		−0.47 (0.28)
R^2	0.83	0.79	0.85	0.80	0.85
Adjusted R^2	0.82	0.78	0.82	0.79	0.83
Implied α	0.32	0.32	0.29	0.29 OECD	0.27 OECD
				0.34 non-OECD	0.33 non-OECD
Implied β	0.27	0.31	0.28	0.36 OECD	0.36 OECD
				0.25 non-OECD	0.22 non-OECD

Note. White-adjusted standard errors are given in parentheses.

[a] s_k is investment in physical capital/GDP; s_h is investment in education/GDP; n is the labor growth rate; g is the world TFP growth rate; d is the depreciation rate.

* Significant at 5% level.

** Significant at 1% level.

Columns 2–5 in Table 6 present the OLS results for a Solow model that excludes government integrity as a determinant of TFP. In these results the coefficient on human capital is much larger than in Table 4 and is significant at the 1% level, with or without the regional dummy variables. Human capital and physical capital are of equal importance in the determination of national income, as in MRW (1992). Columns 4 and 5 present the results when the coefficient on human capital is estimated separately for the OECD and non-OECD countries. These coefficients continue to show a weaker effect for education in the non-OECD countries, but the difference is not as large as before and is not statistically significant.

4.4. Substantive significance of the results

The estimated elasticity of the steady-state investment ratio for education on national income is about 0.7, which means that a 10% increase in the rate of investment in education will lead eventually to a 7% increase in income/adult. This effect will occur slowly, however, since an increase in the rate of investment in formal education does not lead to a comparable increase in the steady-state investment ratio until a country's entire work force has been educated at this higher rate.

The finding that formal education contributes strongly to economic output in the OECD countries is consistent with observation, since high profits in these countries are increasingly skewed toward the high technology industries, where human capital appears to be critical to success. The relative rates of investment in physical and human capital in the OECD countries could be instructive if the social return on both types of investment is similar to the private return. As shown in Table 1, Kendrick (1976) estimated that U.S. investment in education in 1969 was 67% of the investment in physical capital. If the social rate of return on both kinds of capital were the same, then if α were 0.33, β would be 0.22. The higher estimated value of β in Table 6 suggests that the social return in the OECD countries may be higher on investment in education than on investment in physical capital.

The estimated coefficient on the government share of consumption is about −0.6. This elasticity indicates that with the same estimated capital stock, an increase in the government's share of consumption from 15 to 20% (an absolute increase of 5%) is associated with a reduction in income/adult of 16%. This coefficient is surprisingly large in that it implies that a transfer of workers from the private sector to the public sector is more detrimental to economic output than just removing those workers from productive employment. This transfer apparently reduces the productivity of the remaining individuals in the private sector, implicitly through the mechanisms of bad government policies, mismanagement, monopolization, and poor treatment of the private sector. Alternatively, countries that choose to structure their economies around government activity must have other characteristics (e.g. risk aversion, a poor work ethic, or a lack of social mobility) that limit private sector TFP. The coeffficient could also be capturing the effect of a larger underground economy in some countries, since unreported income both decreases reported income and increases the estimated government share of consumption. Nevertheless, the similarity of the coefficients for the OECD and non-OECD countries indicates that they are capturing more than just the effect of unreported income.

5. Conclusions

A review of the historical data for income growth and rates of investment for physical capital across countries indicates that these rates are surprisingly stable over time. This stability at very different absolute levels of capital/worker is consistent with the hypothesis that national income per worker is determined by country-specific levels of human capital and institutional factors that affect total factor productivity.

The empirical results of this study provide evidence that an augmented Solow growth model that includes variables for human capital and the government's share of consumption is a valid model of world economic output. The structural variables in the model can explain most of the variance in the cross-country standard of living in 1985. This augmented Solow model is more complete and the data on investment in education are better than the data used by MRW (1992), but the estimated effect of physical and human capital on national income is similar.

In these results physical and human capital are of approximately equal importance in the determination of national income. In addition, a high government share of consumption reduces national income, presumably due to the lower efficiency of the government in providing most types of consumer goods and services.

Although government integrity and national income are highly correlated, an investigation of the relationship between these variables indicates they are endogenous in the development process. An analysis using experience as a British colony as an instrument indicates that the direction of causality may run more from national income to government integrity rather than the reverse. As a consequence whether the level of government integrity affects a nation's TFP to any substantive degree is uncertain.

The empirical results indicate that a poor country with a large government share of consumption can raise national income through privatization of government activity or by increasing investment in education. Since cross-sectional results are implicitly long-term in nature, however, they provide no indication that privatization or more education would have a substantial positive effect on national income in the short run.

The results also suggest that the link between education and income may be weaker in the lower income countries. This result is plausible, but it could be due to data measurement error. Better data on cross-country investment in education is required to further analyze the relationship between education and national income in the lower income countries. Complete data on investment in education should include private expenditures and foregone earnings and cover a longer historic period.

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Appendix A

	Country	Category	Income per adult, 1985 (US$)	Government integrity index	Physical investment $s_k(I/Y)$ (%)	Labor growth (n) (%)	MRW's SCHOOL (%)	Educational investment s_h (I/Y) (%)	Government share of consumption (%)	BritCol dummy variable
1	Argentina	Latin America	5533	0.68	25.3	1.5	5	6.5	10.4	0
2	Australia	OECD	13409	0.98	31.5	2	9.8	11.4	10.9	1
3	Austria	OECD	13327	0.83	23.4	0.4	8	11.0	13.5	0
4	Bangladesh	Islam	1221	0.47	6.8	2.6	3.2	3.8	32.8	1
5	Belgium	OECD	14290	0.91	23.4	0.5	9.3	12.7	11.5	0
6	Brazil	Latin America	5563	0.52	23.2	2.9	4.7	6.6	10.8	0
7	Cameroon	SS Africa	2190	0.67	12.8	2.1	3.4	5.6	19.2	0
8	Canada	OECD	17935	0.96	23.3	2	10.6	16.6	12.8	1
9	Chile	Latin America	5533	0.86	29.7	2.3	7.7	10.0	21.2	0
10	Colombia	Latin America	4405	0.54	18	3	6.1	5.2	10.7	0
11	Denmark	OECD	16491	0.96	26.6	0.6	10.7	15.5	18.0	0
12	Domin Rep		3308	0.64	17.1	2.9	5.8	7.6	13.1	0
13	Ecuador	Latin America	4504	0.56	24.4	2.8	7.2	9.0	16.2	0
14	Egypt	Islam	2160	0.43	16.3	2.5	7	11.2	32.3	1
15	Finland	OECD	13779	0.93	36.9	0.7	11.5	15.8	13.1	0
16	France	OECD	15027	0.83	26.2	1	8.9	11.2	14.3	0
17	Ghana	SS Africa	727	0.36	9.1	2.3	4.7	9.8	16.7	1
18	Greece	OECD	6868	0.58	29.3	0.7	7.9	7.7	12.0	0
19	Haiti		1237	0.20	7.1	1.3	1.9	3.2	16.9	0
20	Hong Kong	Asian T	13372	0.93	19.9	3	7.2	7.7	6.1	1
21	India		1339	0.55	16.8	2.4	5.1	6.8	26.0	1
22	Indonesia	Islam	2159	0.23	13.9	1.9	4.1	6.1	13.1	0
23	Ireland	OECD	8675	0.87	25.9	1.1	11.4	13.6	14.7	1
24	Israel		10450	0.89	28.5	2.8	9.5	15.8	35.1	1
25	Italy	OECD	11082	0.63	24.9	0.6	7.1	10.0	11.9	0
26	Ivory Coast	SS Africa	1704	0.68	12.4	4.3	2.3	9.6	15.8	0
27	Jamaica		3080	0.54	20.6	1.6	11.2	12.1	11.1	1
28	Japan	OECD	13893	0.91	36	1.2	10.9	12.6	9.2	0
29	Jordan	Islam	4312	0.78	17.6	2.7	10.8	11.6	27.2	1
30	Kenya	SS Africa	1329	0.51	17.4	3.4	2.4	7.9	20.9	1

Appendix A (*Continued*)

	Country	Category	Income per adult, 1985 (US$)	Government integrity index	Physical investment $s_k(I/Y)$ (%)	Labor growth (n) (%)	MRW's SCHOOL (%)	Educational investment s_h (I/Y) (%)	Government share of consumption (%)	BritCol dummy variable
31	Liberia	SS Africa	944	0.37	21.5	3	2.5	4.6	19.8	0
32	Malaysia	Islam	5788	0.70	23.2	3.2	7.3	10.1	15.5	1
33	Mexico	Latin America	7380	0.48	19.5	3.3	6.6	7.2	7.5	0
34	Morocco	Islam	2348	0.59	8.3	2.5	3.6	7.3	16.2	0
35	Netherlands	OECD	13177	1.00	25.8	1.4	10.7	15.8	12.0	0
36	New Zeal	OECD	12308	1.00	22.5	1.7	11.9	13.2	13.7	1
37	Nicaragua	Latin America	3978	0.63	14.5	3.3	5.8	6.9	13.5	0
38	Norway	OECD	19723	0.97	29.1	0.7	10	14.6	14.6	0
39	Pakistan	Islam	2175	0.43	12.2	3	3	5.5	15.8	1
40	Panama	Latin America	5021	0.63	26.1	3	11.6	13.2	23.3	0
41	Peru	Latin America	3775	0.66	12	2.9	8	10.6	14.9	0
42	Philippines		2430	0.48	14.9	3	10.6	10.1	15.4	0
43	Portugal	OECD	5827	0.56	22.5	0.6	5.8	5.6	15.2	0
44	Singapore	Asian T	14678	1.00	32.2	2.6	9	11.5	8.8	1
45	South Africa	SS Africa	7064	0.70	21.6	2.3	3	6.6	17.7	1
46	South Korea	Asian T	4775	0.61	22.3	2.7	10.2	10.5	12.0	0
47	Spain	OECD	9903	0.64	17.7	1	8	7.1	9.6	0
48	Sri Lanka		2482	0.67	14.8	2.4	8.3	10.4	20.0	1
49	Sweden	OECD	15237	0.93	24.5	0.4	7.9	14.8	19.6	0
50	Switzerland	OECD	15881	1.00	29.7	0.8	4.8	8.8	8.2	0
51	Thailand		3220	0.27	18	3.1	4.4	6.4	13.7	0
52	Trinidad		11285	0.62	20.4	1.9	8.8	10.4	7.5	1
53	Turkey	OECD	4444	1.00	20.2	2.5	5.5	8.6	11.3	0
54	UK	OECD	13331	0.90	18.4	0.3	8.9	13.0	18.9	1
55	USA	OECD	18988	0.98	21.1	1.5	11.9	15.4	13.8	1
56	Uruguay	Latin America	5495	0.68	11.8	0.6	7	8.4	12.5	0
57	W. Germany	OECD	15297	0.87	28.5	0.5	8.4	10.2	14.4	0
58	Zaire	SS Africa	412	0.19	6.5	2.4	3.6	4.5	22.5	0
59	Zimbabwe	SS Africa	2107	0.80	21.1	2.8	4.4	8.0	12.7	1

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