Productivity and Human Capital across Countries

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Abstract

This paper addresses the *micro-macro puzzle* that has arisen in the literature with regard to the role of human capital in economic growth. It analyzes productivity indices obtained from two production models, one that includes human capital as a direct input and another that does not. The differences in coefficients obtained from cross-section regressions of these productivity indices show that human capital affects output both as a *direct* input and *indirectly* through its positive influence on aggregate productivity. The novelty of the method is that it does not require the use of the noise-prone time dimension of the available human capital data. (*JEL Classification*: O1, O3, O4; *Keywords:* Economic Growth, Human Capital.)

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1. Introduction

This paper shows that human capital affects output both as a *direct* input and *indirectly* through its positive influence on aggregate productivity. This is helpful in resolving the *micro-macro puzzle* that has arisen in the literature with regard to the role of human capital in economic growth. The exact way in which human capital (H) influences output (Y) is under debate for some time now. It is generally agreed that human capital should be a *direct* input in a production model, just as physical capital is. That being the case, there should be a positive impact of human capital accumulation (ΔH) on growth of output (ΔY). At the micro level, such a relationship has been established well empirically. The whole literature on Micerian regressions shows that increases in education level of individuals are associated with increases in their earnings.[2] At a macro level, this relationship has also been established *within a country* for the US and some other developed countries by such detailed growth accounting works as of Dale Jorgenson and his associates.[3] However, at a macro level *across countries*, establishing a significant positive relationship between ΔH and ΔY has run into problems. In many cross country regressions of ΔY on ΔH (and other relevant right hand side variables), the coefficient on ΔH has been found to be either insignificant or even negative.[4] This has given rise to the 'micro-macro puzzle,' which refers to the fact that while at a micro level ΔH and ΔY are positively related, at a macro level across countries, they

[1] I would like to thank Joy Mazumdar and Jesus Felipe for helpful discussions. All remaining errors are mine. Please do not quote without permission. Send your comments to nislam@icsead.or.jp
[2] See for example, Mincer (1970, 1974).
[3] See for example, Jorgenson (1995a and 1995b), and Jorgenson, Fraumeni, and Gollop (1987)

appear not to be. In view of the latter finding, some researchers have emphasized the role of human capital in (total factor) productivity, *A*, the generic shift term of aggregate production functions. Several researchers have indeed provided evidence of *indirect* influence of *H* on *Y* running through *A*.[5] Other researchers however have sounded caution against discounting the influence on *Y* of *H* as a *direct* input. Thus, Krueger and Lindhal (2001) point to measurement errors in *H* as a possible reason for the absence of a positive relationship between ΔY and ΔH in cross-country growth regressions.

Evidence indeed indicates that measurement errors are more serious with the time dimension of the human capital data than with its cross-section dimension. This is because the available human capital data are based mainly on schooling years, which are not adjusted for quality differences. Measured by school years therefore many (developing) countries show much progress even though in real terms their human capital has not increased by that much.[6] Along the cross-section dimension however the variation in average years of schooling is still quite large to dominate the measurement errors arising from the above, lack of quality adjustment and other sources.

This paper shows that the micro-macro puzzle with regard to human capital's role in growth can be addressed without having to use the noise-prone time dimension of the available human capital data. This is done by first obtaining estimates of *A* from two alternative production models, one that includes human capital as a direct input and the other that does not. These productivity estimates are then subjected to a cross-section analysis with human capital as one of the explanatory variables. The differences in estimated values of human capital coefficients from these two sets of regressions provide the necessary evidence. The results show that both the direct and indirect influence of human capital on output exists, and they both seem to be substantial. These results have significant implications for both growth theory and policy.

The remaining of the paper is organized as follows. Section-2 describes the production models and the productivity estimates obtained on their basis. Section-3 presents the main empirical results. Sction-4 offers some concluding remarks.

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[4] See for example, DeGergio (1992), Benhabib and Spiegel (1994), Islam (1995, 2003).)

[5] See for example, Benhabib and Speigel (1994), Islam (1995), and Hojo (2003).

[6] Pritchet (2001) puts forwards the additional hypothesis that even if human capital increased in many developing countries, it was not put to proper use, and that explains the absence of a positive relationship between ΔY and ΔH in cross country growth regressions.

2. Production Models and Productivity Indices with and without Human Capital

Consider first a production model that does not include human capital as a direct input. Equation (1) gives the simplest form of the neoclassical production function in its Cobb-Douglas specification:

(1) $$Y_t = K_t^{\alpha} (A_t^{IS} L_t)^{1-\alpha},$$

where Y is output, K is physical capital, L is labor, and A^{IS} is the productivity shift term that is specific to this production function. With L measured by the *number* of people (workers), human capital remains excluded as a direct input from this production model. Proceeding from this equation, we have

(2) $$\ln Y - \alpha \ln K - (1-\alpha)\ln L = (1-\alpha)\ln A^{IS}$$

Now consider production models that include human capital as a direct input. A prominent example is the 'human capital augmented' production function by Mankiw, Romer, and Weil (1992), given as follows:

(3) $$Y = K^{\alpha} H^{\varphi} (A^{MRW} L)^{1-\alpha-\varphi}.$$

Here H stands for human capital, and A^{MRW} is the productivity shift term specific to this function. Proceeding from this equation, we have

(4) $$\begin{aligned} \ln Y - \alpha \ln K - (1-\alpha)\ln L &= (1-\alpha-\varphi)\ln A^{MRW} + \varphi(\ln H - \ln L) \\ &= (1-\alpha)\ln A^{MRW} + \varphi(\ln h - \ln A^{MRW}) \end{aligned},$$

where h is human capital per unit of L. Together with (2) this implies that

(5) $$\ln A^{IS} = \left(\frac{1-\alpha-\varphi}{1-\alpha}\right)\ln A^{MRW} + \frac{\varphi}{1-\alpha}\ln h.$$

This shows that productivity, A^{IS}, computed using equation (2) contains a human capital component in addition to A^{MRW}.

Another example of a production function with human capital as a direct input is inspired by Mincer and has been used by Bills and Klenow (1996), Hall and Jones (1996, 1999), and others. This is given by equation (6).

(6) $$Y = K^{\alpha}(A^{HJ}H)^{1-\alpha},$$

where A^{HJ} is the productivity shift term specific to this function, and H is specified to be $e^{\phi(E)}L$, with E being the average years of education for L. With this specification, the relationship between A^{IS} and A^{HJ} is simply as follows:

(7) $$\ln A^{IS} = \ln A^{HJ} + \phi(E)$$

This shows again that A^{IS}, the productivity term obtained on the basis of equation (2), contains a term representing human capital.[7] In contrast, neither A^{HJ} nor A^{MRW} includes a human capital component unless these embody an *indirect effect* of human capital. In other words, in order for A^{HJ} or A^{MRW} to have a human capital effect, they should have the following general specification:

(8) $$A^{HJ} = A^{HJ}(H, \mathbf{X})$$

(9) $$A^{MRW} = A^{MRW}(H, \mathbf{X})$$

where, **X** represents the set of other variables that influence aggregate productivity.

We can now use this distinction between A^{IS} and A^{HJ} to examine the existence and strength of direct and indirect effects of human capital on output.[8] The empirical implications of the above may be distilled in the form of the following two propositions. If human capital has an indirect effect on output in addition to its direct effect, then in cross-section regressions of A^{IS} and A^{HJ} on human capital and **X**, the following will hold:

Proposition-1: The human capital coefficients in the A^{HJ} regressions will prove significant.

Proposition-2: The human capital coefficients in the A^{IS} regressions will (in addition to being significant) prove to be numerically larger than the corresponding human capital coefficients obtained from the A^{HJ} regressions.

We now proceed to test these propositions.

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[7] We may note here that human capital, represented by E, appears in this specification in *level* form. This is different from equation (5), where human capital appears in *log* form. Some researchers are investigating which of these two is a better specification of human capital as a *direct* input of production. See for example Soto (2003).

[8] We express the propositions in terms of A^{IS} and A^{HJ}. However, it is clear that the same holds in terms of A^{IS} and A^{MRW}

3. Cross-section Analysis of Productivity Indices

In testing the above two propositions, we make use of the fact that productivity estimates using production models with and without human capital as a direct input are already available in the literature. Thus, Islam (1995) presents estimates of A^{IS} on the basis of panel estimation of a specification derived from equation (1). On the other hand, Hall and Jones (1996, 1999) present estimates of A^{HJ} computed through a cross-section growth accounting exercise based on the production function given by equation (6). We will refer to A^{IS} and A^{HJ} as the *IS index* and *HJ index* of productivity, respectively. To make them conform to each other, we convert these indexes to measure the relative productivity level of a country with the US productivity level as 100. These indexes serve as the dependent variable for the analysis in this paper.

An important issue in analyzing productivity concerns the variables to be included in **X**. Total factor productivity (TFP) is an omnibus term, aptly characterized by Abramovitz (1956) as the 'measure of ignorance.' Despite much research since this characterization, the issue of determinants of productivity continues to be hotly debated. This paper cannot resolve this broader issue. In choosing **X**, we therefore adopt what may be called the best practice in the literature. We note that Barro (1991) pioneered the current phase of empirical research on growth and continues to remain an important authority in this field. Barro (1997) provides a recent update of this work. We therefore follow Barro (1997) in choosing **X**.

Barro's (1997, Table 1.1) growth regressions include a variety of variables. Since our dependent variable is *productivity level* instead of *output growth*, only a subset of these variables can be candidate for inclusion in **X**. In particular, we need to leave out the direct input growth variables, as input growth has already been accounted for in estimation or computation of the productivity indices. This suggests that the following variables should be included in **X**: (i) Government consumption, (ii) Democracy, (iii) Terms of trade shock, (iv) Inflation, and (v) Rule of Law.[9]

[9] Drawing a clear distinction between variables that should enter output growth regressions and variables that should enter productivity level regressions is however not easy. Just leaving out input growth related variables does not solve the problem. First of all, there are variables that may affect both input growth and productivity. Second, input growth and productivity can also influence each other, making the distinction even more problematic. Abramovitz (1956), Abramovitz and David (1973), Wolff (1991), and others have highlighted the latter interaction. This paper however is not the place to resolve these thorny issues. Our exploration however indicates that, in qualitative terms, the basic results of this paper survive many alternative choices of **X**.

Table-1 compiles the results from regressions with *IS* productivity index as the dependent variable. (Henceforth, we will call these simply *IS* regressions. Similarly, we will call regressions with the *HJ* productivity index as the dependent variable simply *HJ* regressions.) In order to cope with the possible endogeneity of many of the right hand side variables, the two-stage least-squares (2SLS) estimator is used. The details of variable and instrument construction are given in the notes to the Table, and hence are not repeated here.[10] Column (1) shows the results of the bi-variate regression of the *IS* index on human capital (*H*). We see that *H* coefficient appears very strongly.[11] In the bivarate regression, however, the human capital variable picks up the influence of many other variables, and hence results of column (1) do not give a proper measure of the association between the *IS* index and human capital. The rest of the columns of Table-1 show what happens to this association when we control for the Barro (1997) covariates. Space constraints prevent us from detailed perusal of the coefficients of these variables. In general, we see that most of the Barro covariates display anticipated signs, though many of these do not prove significant in any of the specifications. (We will come back to this issue later.) Focusing on our main variable of interest, human capital, we see that its coefficient remains substantial and statistically significant in all the specifications.

This high degree of association between the *IS* index and human capital however does not surprise us. We know from section-2 that A^{IS} embodies a human capital effect even if there is no indirect effect. However results from *IS* regressions by themselves do not enable us to distinguish between direct and indirect effects of human capital. In order to see separate and clear evidence of human capital's indirect effect, we need to look at the *HJ* regressions.

The results from the *HJ* regressions are presented in Table-2. Given that the *HJ* index pertains to a more recent year, many of the right hand side variables obtained from Barro and Lee (1994) are predetermined, lessening thereby the necessity of using instruments. However, to be on the cautious side, we use 2SLS estimator to estimate most of specifications of the *HJ* regression too. The details of variable construction and instruments are again presented in the notes to Table-2 and hence are not repeated here. Column (1) presents a bivariate regression

[10] Following Barro (1997), the instrumentation is done mainly using the lagged values of the suspected endogenous variables. Hence, the instruments in most cases are pre-determined and not strictly exogenous. The validity of pre-determined variables to serve as instruments requires that the error term be not serially correlated. Based on his decadal regressions, Barro (1997) indeed finds that the error term does not have any high degree of serial correlation. This justifies the use of pre-determined variables as instruments.

[11] These being 2SLS regressions, the R^2's do not have their classical interpretation. Nevertheless, we see that the ratio of the sum of squares of the fitted values to the sum of squares of the original values of the *IS* index in this simple bivariate regression is already very high, 59 percent.

analogous to that in column (1) of Table-1. We see a strong association between the *HJ* productivity index and human capital. Being a bivariate regression, the human capital variable again picks up the influence of many other determinants of productivity. The remaining columns of Table-2 show what happens to this association when Barro (1997) covariates are included in the *HJ* regression. As we can see, the numerical magnitude and significance level of the Barro (1997) covariates vary depending on the specification chosen. However, the human capital variable remains always significant and substantial. This validates Proposition-1.

To check on Proposition-2, we need to compare the human capital coefficients obtained from the *IS* regressions with those obtained from the *HJ* regressions. We noted earlier that *IS* and *HJ* indexes are in conformity because they both measure the relative productivity level of a country with the US productivity level as 100. Similarly, the human capital variable in the two sets of regressions is also the same, namely average years of education in the adult population. This makes the human capital coefficients from the *IS* and *HJ* regressions directly comparable. Looking at the Tables, we see that the *H* coefficient in the *IS* regressions ranges from 8.14 to 4.65. On the other hand, the numerical magnitude of the *H* coefficient in the *HJ* regressions ranges from 5.45 to 2.96. Clearly, the *IS* human capital coefficients prove to be much larger in magnitude than the corresponding *HJ* human capital coefficients.

Among the Barro covariates that prove significant in *HJ* regressions are ‘government consumption’ and ‘terms of trade.’ Limiting to these (in addition to human capital) as the right-hand-side variables, we obtain the specification in column (8) of Table-2. The *H* coefficient from this regression turns out to be 3.59. Similarly, among the Barro covariates that prove significant in *IS* regressions are ‘government consumption’ and ‘democracy.’ When the list of right hand side variables is limited to these (in addition to human capital), we get the specification shown in column (8) of Table-1. The *H* coefficient from this specification is 5.20, which is about 1.5 times larger than the analogous *H* coefficient from *HJ* regression mentioned above. Limiting the specifications to only human capital and ‘government consumption,’ the Barro covariate that prove significant in both *IS* and *HJ* regressions, the *H* coefficients prove to be 6.72 and 4.02, respectively. Again we see the *H* coefficient from the *IS* regression to be about 1.7 times larger than the analogous *H* coefficient from the *HJ* regression, showing that human capital has a significant direct effect, in addition to the indirect effect. The relative magnitudes of the human capital coefficient from the *IS* and *HJ* regressions therefore support Proposition-2.

Robustness of the results: The results presented above prove to be robust to alternative choices of variables, instruments, and samples. For example, in the *HJ* regressions reported in Table-2, the human capital variable is measured by schooling years obtained from Hall and Jones' Appendix provided in their web site. However, the results do not change much if instead schooling years from Barro and Lee (1994) are used. The *H* coefficient then ranges between 5.49 and 2.84, across the specifications in Table-2, instead of between 5.45 and 2.96, as above. The results prove robust with respect to the sample choice too. In fact, the results presented in Tables1 and 2 already bear this out to some extent. In both these Tables, sample sizes for different specifications differ because of differences in the availability of data on different variables. We see that despite these somewhat random differences in sample sizes, the general results validating Propositions 1 and 2 nevertheless come through. However, to check further on this issue, we constrain the *HJ* regression to be estimated on the basis of the same sample as the *IS* regression. The results from such re-estimation of the most parsimonious specification, namely the one including human capital and government consumption only, can be see in column (8) of Table-2. We see that the *H* coefficient is now 3.90, instead of 4.02 (reported in column (2)), when the sample size was not constrained to be the same. Comparing with column (2) of Table-1, we see that the *IS* human capital coefficient (equaling 6.72) is now about 1.7 times larger than the *HJ* human capital coefficient. Similarly, Propositions 1 and 2 are both held intact, at least in qualitative terms, when the *IS* and *HJ* regressions are estimated with alternative choices of instruments.[12]

Economic Significance: Space constraints prevent us from dwelling much on the coefficient values of the various right hand side variables of the regressions. However, a word or two about the economic significance of the estimated human capital coefficients are very much in order. The construction of the dependent variable and the human capital variable makes the economic significance quite transparent. For illustration we may focus on the most parsimonious specification (that has only human capital and government consumption as the right hand side variables). The *HJ* regression results suggest that an increase by one year in the average years of education is associated with about four-percentage point increase in the relative productivity level of a country (with the US productivity level as 100). This increase would be achieved through the indirect effect of human capital on output. The coefficient

[12] The details are available from the author upon request.

from *IS* regression suggests that with direct and indirect effects combined, an increase by one year in the average years of education is associated with about seven percentage point increase in the relative productivity level of a country. These are fairly substantial direct and indirect effects of human capital on output.

4. Concluding Remarks

The results of this paper show that both direct and indirect influence of human capital can be established as a cross-country regularity if the investigation can be conducted in an indirect way that avoids the use of the particularly noisy time dimension of the available human capital data. The results of this paper therefore helps resolve the 'micro-macro puzzle' that arose in the empirical growth literature with regard to the role of human capital.

The evidence of indirect influence of human capital presented in this paper however needs to be taken with some grain of salt. This is because the data used in this exercise, as in other cross-country growth papers, are too aggregate and crude. Dale Jorgenson and his associates have shown that once quality differences are allowed in capital and labor inputs, the relative importance of total factor productivity as a source of growth diminishes significantly.[13] Introduction of more refined measures of physical and human capital is therefore likely to affect the results regarding the relative importance of direct and indirect effect of human capital across countries too.

Nevertheless, the results of this paper suggests that at least at the level of aggregation and crudity that current empirical growth and productivity research is operating with, neither the direct nor the indirect effect of human capital can be ruled away. Even if more refined data chips some of it away, indirect effect of human capital working via aggregate productivity is likely to remain. This has important implications for both growth theory and practice. With regard to theory, the results provide some support to growth models that emphasize broader effects of accumulation of human capital. To policy makers, the results suggest that in deciding about investment in human capital, both direct and indirect beneficial effects of human capital need to be taken into cognizance.

[13] As Jorgenson, Gollop, and Fraumeni (1987) report, distinguishing quality differences in capital and labor inputs allow them reduce the role of total factor productivity as a source of output growth from about eighty percent to only about twenty percent.

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Table-1

Cross-section regression analysis of the *IS* productivity index

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	IS Index	IS Index	IS Index	IS Index	IS Index	IS Index	IS Index	IS Index
Estimator	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr
Sample	All	All	All	All	All	All	All	All
N	82	76	75	68	68	68	56	75
Human Capital	8.14 (.69) [.00]	6.72 (.80) [.00]	6.50 (.98) [.00]	6.16 (1.30) [.00]	4.72 (1.16) [.00]	4.65 (1.34) [.00]	4.66 (1.41) [.02]	5.20 (1.07) [.00]
Government Consumption		-1.08 (.42) [.01]	-1.16 (.48) [.02]	-1.03 (.55) [.07]	-.65 (.47) [.17]	-.75 (.57) [.19]	-1.85 (.97) [.06]	-.75 (.29) [.01]
Inflation			.04 (.13) [.75]	.11 (.14) [.46]	.09 (.12) [.46]	-.01 (.13) [.93]	.06 (.23) [.80]	
Terms of Trade				-1.15 (3.75) [.76]	1.39 (3.66) [.70]	2.56 (3.27) [.44]	2.70 (4.63) [.56]	
Democracy					.20 (.07) [.01]	-.23 (.35) [.51]	-.50 (.70) [.48]	.17 (.08) [.03]
Democracy^2						.004 (.003) [.19]	.006 (.007) [.39]	
Rule of Law/Political Stability							-29.44 (51.58 [.66]	
p-value of *F*	.00	.00	.00	.00	.00	.00	.00	.00
R^2	.59	.62	.62	.69	.76	.74	.77	.70

Notes to Table-1:

1) The dependent variable, *IS index* of productivity, is based on the estimated value of A^{IS} in the production function: $Y_t = K_t{}^{\alpha} (A_t^{IS} L_t)^{1-\alpha}$. The raw A^{IS} values are converted into relative productivity levels with US productivity level as 100. Thus, $IS\ Index_i = \left(A_i^{IS} / A_{USA}^{IS} \right) * 100$, where the values of A^{IS} are obtained from Islam (1995).

2) Estimation is conducted using the Two-Stage Least Squares (2SLS) estimator in order to cope with possible endogeneity of many of the right hand side variables.

3) Figures in parentheses are heteroskedasticity consistent standard errors. The dependent variable itself being a result of prior estimation, heteroskedasticity is expected. Figures in square brackets are the corresponding *p*-values.

4) *Human capital* is represented by 'the average of years of education among the population aged 15 years and above' during the period of 1961-85. This is instrumented by the lagged value of this variable pertaining to 1960. The data on human capital are from Barro and Lee (1994).

5) *Government consumption* is measured by 'the ratio of real government consumption expenditure net of spending on defense and education to real GDP,' and is obtained from Barro and Lee (1994), who in turn obtain it from Summers and Heston Mark 5.5. The average of this ratio (expressed as percent) for 1961-85 serves as the right hand side variable. It is instrumented by its lagged value pertaining to 1960.

6) *Democracy* variable is obtained from Barro (1997, Table 2.4). It is based on the indicator of political rights compiled by Gastil and his associates from 1972 to 1994. Barro converts the index from a 1 to 7 scale to a 0 to 1 scale and flips it so that 1 stands for the 'most political rights' and 0, the fewest. The variable pertains to 1975. To instrument the variable, we turn to Barro and Lee (1994), who provide quinquennial data on 'Political Rights' and 'Civil Liberties.' We average these two variables to create the variable 'Democratic Rights,' and use lagged value of this variable, as instrument.

7) *Terms-of-Trade* stands for 'terms of trade shock (growth rate of export prices minus growth rate of import prices).' The data on this variable are taken from Barro-Lee (1994), who in turn obtain the information from UNCTAD and the World Bank. The right hand side variable is the average for 1961-85. The instrument is the lagged value of the variable pertaining to 1960.

8) *Inflation* represents the 'price level of GDP (PPP GDP / Xrate relative to US) with US = 1.0.' The data on this variable is from Barro and Lee (1994), who in turn obtain the information from Summers and Heston Mark 5.5. The right hand side variable is the average for 1961-1985. The instrument is the lagged value of the variable pertaining to 1960.

9) *Rule of Law/Political Stability*: The 'Rule of Law' variable, obtained from Barro (1996), pertains to 1990s and hence poses some problem, because there are no lagged values of this variable to serve as instrument. We therefore use as a substitute the 'Political Instability' variable from Barro-Lee (1994) that is available on a quinquennial basis and instrument it using the lagged value for 1960.

Table-2

Cross-section regression analysis of the HJ productivity index

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var.	HJ Index	HJ Index	HJ Index	HJ Index	HJ Index	HJ Index	HJ Index	HJ Index	HJ Index
Estimator	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr	2SLSr
Sample	All	All	All	All	All	All	All	All	IS
N	104	93	93	91	90	90	90	91	76
Human Capital	5.45 (.88) [.00]	4.02 (.98) [.00]	2.79 (1.20) [.02]	2.59 (1.17) [.03]	2.94 (1.33) [.03]	2.96 (1.34) [.03]	3.25 (1.47) [.03]	3.59 (1.01) [.00]	3.90 (1.30) [.00]
Govt. Consumption		-1.76 (.54) [.00]	-1.66 (.53) [.00]	-1.51 (.50) [.00]	-1.32 (.49) [.01]	-1.28 (.48) [.01]	-1.28 (.48) [.01]	-1.57 (.49) [.00]	-2.02 (.79) [.01]
Inflation			.30 (.15) [.05]	.25 (.15) [.10]	.23 (.15) [.12]	.24 (.16) [.14]	.23 (.17) [.19]		
Terms of Trade				2.96 (.96) [.00]	2.83 (.99) [.01]	2.84 (.99) [.01]	3.15 (1.10) [.01]	3.16 (.93) [.00]	
Democracy					.04 (.09 [.64]	.14 (.28) [.61]	.11 (.29) [.70]		
Democracy^2						-.001 (.003) [.72]	-.001 (.003) [.78]		
Political Stability							10.22 (11.22 [.37]		
p-value of *F*	.00	.00	.00	.00	.00	.00	.00	.00	.00
R^2	.24	.42	.44	.49	.52	.52	.52	.47	.43

Notes to Table-2:

1) The dependent variable, *HJ Index* of productivity, is based on the estimated value of A^{HJ} in the production function: $Y = K^{\alpha}(A^{HJ}H)^{1-\alpha}$. These are converted into relative productivity levels with US productivity level as 100. Thus, $HJ\ Index_i = \left(A_i^{HJ} \big/ A_{USA}^{HJ} \right) * 100$, where the values of A^{HJ} are obtained from Hall and Jones (1996, 1999) and Charles Jones' web site.

2) Estimation is conducted using Two-Stage Least Squares (2SLS) estimator in order to cope with possible endogeneity of some of the right hand variables, in particular, of the human capital variable.

3) Figures in parentheses are heteroskedasticity consistent standard errors. Figures in square brackets are the corresponding *p*-values.

4) *Human capital* is represented by Hall and Jones's 'School' variable. This is instrumented by the 'average total years of schooling' pertaining to 1960 taken from Barro and Lee (1994).

5) *Government consumption* variable is the same as in Table-1 and pertains to 1985. It is therefore pre-determined with respect to the *HJ* index, which is for 1988.

6) *Democracy* variable is the same as in Table-1 and pertains to 1975 and hence is itself pre-determined with respect to the *HJ* index.

7) *Terms-of-Trade* variable is that same as in Table-1. The values used are for 1985 and hence are themselves pre-determined with respect to the *HJ* index.

8) *Inflation* variable is the same as in Table-1. The values used are for 1985 and hence are themselves pre-determined with respect to the *HJ* index.

9) *Rule of Law/Political Stability*: The 'Political Stability' variable is the same as in Table-1. The values used are for 1985 and hence are themselves pre-determined with respect to the *HJ* index.