HUMAN CAPITAL, TECHNOLOGY DIFFUSION AND ECONOMIC GROWTH IN LOW-TO-MIDDLE INCOME COUNTRY: A TIME SERIES PERSPECTIVE OF GUATEMALA, 1950-2001

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Abstract

This paper investigates the impact of human capital on economic growth in Guatemala for 1951-2001 through the application of an error-correction methodology. Two channels are analyzed by which human capital is expected to influence growth. A better-educated labor force appears to have a significant impact on economic growth both via factor accumulation as well as on the evolution of total factor productivity. The results have been found robust concerning data issues and parameter stability.

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1. Lack of case study evidence

Guatemala has enjoyed relative macro-economic stability during the past decades with average annual growth rates of about 3.9 percent. However, due to rapid population growth, per capita growth has averaged only about 1.3 percent per year. A continuation of this growth rate would imply that the average Guatemalan would need approximately 53 years to double his real income. According to

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World Bank (2003) estimates, about 56 percent of Guatemala's population live in poverty. Economic growth is regarded as an essential ingredient for expanding economic opportunities for poor people depending on innumerable factors, including the accumulation of human capital.

While there is a rather strong theoretical support for a key role of human capital on growth, the empirical evidence is not clear-cut. In contrast to microeconomic studies which generally suggest significant returns to education on individual earnings, growth regressions on the macro level have often failed to find a significant and positive contribution of human capital to economic growth. Moreover, the relationship between most measures of human capital and output growth has frequently been found surprisingly weak. The evidence comes almost entirely from cross-country regressions, and there is very little empirical analysis for individual countries (see Loening 2004). For the case of Guatemala there is no single study that assesses the direct impact of education on economic growth.

The aim of this article is to fill this gap. For the case of Guatemala, the main findings suggest that a better-educated labor force appears to have a significant impact on economic growth both via factor accumulation as well as on the evolution of total factor productivity. The reminder of this paper is organized into four sections. Section 2 discusses the econometric methodology. Section 3 presents the empirical results. Section 4 concludes.

2. Econometric approach for Guatemala

The amount of empirical literature on economic growth is enormous. Among innumerable contributions there are two important empirical approaches which model the impact of human capital on economic growth. One way is to incorporate human capital as an additional factor within the production function, for example by adapting the Solow (1956) model. Up to now, this approach has remained the workhorse of empirical research. Mankiw, Romer and Weil (1992) show that traditional growth theory can accommodate human capital and may provide a reasonable approximation of cross-country data.

Still, one of the key insights of the Solow model is that the factor accumulation per se is insufficient to achieve long-run growth, and that long-run growth particularly depends on growth in total factor productivity. Human capital accumulation may therefore have only a short-term impact on the rate of growth. However, rates of accumulation are expected to have explanatory power for growth rates during the transition to an eventual balanced growth path.

Consideration of transition could therefore open up the possibility of assessing the macroeconomic role of education for economic growth within this framework. In addition, since the "short run" in the context of growth theory is often thought of in terms of decades, even short-run effects could be worthwhile policy objectives.

An alternative way, to some extent associated with endogenous growth, is to model explicitly technological progress as a function of the level of human capital and other variables. In a rather influential study, Benhabib and Spiegel (1994) first use the structural form of the human capital augmented production function to estimate the role of education for a sample of industrialized and developing countries. In their analysis, the regression coefficient on the change in average schooling years turns out to be statistically insignificant and sometimes even enters with a negative sign. Benhabib and Spiegel then propose an empirical growth model in which human capital externalities can be considered to be embodied in subsequent advances in education and in new physical capital via technology import as proposed in the models of Lucas (1988) and Romer (1990). Their empirical results suggest that the level of schooling, which enters with a positive coefficient, indeed facilitates the adoption of technology from abroad and the creation of domestic technologies.

In a similar manner, Morales (1998) shows that the completion of secondary education proxied by enrollment ratios appears to have a significant and positive impact on total factor productivity within a time-series context for El Salvador. It is important to note that in such cases the estimated increase in productivity is not simply a phenomenon in the transitional period since an increase in the flow of education leads to a gradual increase in the human capital stock. Implicit in this concept is the claim that by increasing the average level of education the rate of economic growth will be permanently increased over time.

Taking the above mentioned studies into account and given the fact that cross-country growth regressions have often led to disappointing results, the next paragraphs provide the empirical specification for the two different channels through which education is assumed to influence economic growth. Model 1 treats human capital as an additional factor of production, while Model 2 hypothesizes that human capital levels directly affect the aggregate technology parameter.

2.1 Human Capital as a Factor of Production (Model 1)

The human capital augmented growth model considers human capital as an independent factor of production and can be represented in a Cobb-Douglas production function with constant returns to scale:

$$(1)\ Y_t = A_t \cdot K_t^{a} \cdot H_t^{ß} \cdot L_t^{(1-a-b)}$$

where *Y* represents output and *A* is the level of technology or total factor productivity. *K*, *H* and *L* are physical capital, human capital and labor. Multicollinearity between capital and labor is avoided by standardizing output and the capital stock by labor units, which also impose the restriction that the scale elasticity of the production factors is equal to unity. Converted into a logarithmic expression, the production function can be estimated in its structural form:

$$(2)\ \ln y_t = \ln A_t + a \cdot \ln k_t + b \cdot \ln h_t + u_t$$

where the lower case variables $y = Y/L$ and $k = K/L$ are output and physical capital in intensive terms and $h = H/L$ stands for average human capital.

At first glance, the formula already appears suitable for estimation. However, some problems arise since it is well known that most macroeconomic time-series contain unit roots and that regression of one non-stationary series on another is likely to yield spurious results. As reported in Table 1, the data for the case of Guatemala is no exception. By transforming the time-series to stationarity by first differencing, the estimation bias will be removed. However, in any case this will create its own problems, notably because of the risk of losing information on the long-run relationships of the variables.

Table 1. Guatemala: Stationarity of the Time Series, 1951-2000

Variables	ADF test statistic	Result
lny	-2.29	non-stationary
lnk	-2.01	non-stationary
lnh	1.17	non-stationary
IM/I	-2.86*	stationary
Δ lny	-4.79**	stationary
Δ lnk	-4.26**	stationary
Δ lnh	-2.62*	stationary
Δ IM/I	-7.22**	stationary

** (*) Rejects the hypothesis of a unit root at the 1 (10) percent level assuming one lag and a constant in the test equation. The lag length was determined using the Schwartz criterion.

One approach to dealing with this dilemma is to employ an error-correction model that combines long-run information with a short-run adjustment mechanism. This methodology has also been used successfully in alternative growth studies. Examples of this are Nehru and Dareshwar (1994), Morales (1998) and Bassanini and Scarpetta (2001). The error-correction model may be estimated in two ways. Banerjee et al. (1993) show that the generalized "one-step" error-correction model is a transformation of an autoregressive distributed lag model. As such, it can be used to estimate relationships among non-stationary processes. In order to estimate the human capital augmented production function, the error-correction model may be written as follows:

$$(3)\ \Delta \ln y_t = g_1 \cdot \Delta \ln k_t + g_2 \cdot \Delta \ln h_t - g_3 \cdot (\ln y_{t-1} - a \cdot \ln k_{t-1} - b \cdot \ln h_{t-1} - \ln A_t) + u_t$$

As it stands, this equation cannot be estimated by Ordinary Least Squares since the variables in parenthesis cannot be formed without knowledge of *a* and *b*. However, one can estimate the re-parameterized form:

$$(4)\ \Delta \ln y_t = \ln A_t + g_1 \cdot \Delta \ln k_t + g_2 \cdot \Delta \ln h_t + g_3 \cdot \ln y_{t-1} + g_4 \cdot \ln k_{t-1} + g_5 \cdot \ln h_{t-1} + g_6 \cdot Dummy_t + u_t$$

Estimates of the parameter g_3 can be used to calculate the required elasticities a and b. The coefficient g_3 contains additional information because it can be interpreted as a measure of the speed of adjustment in which the system moves towards its equilibrium on the average. In the case of Guatemala, it was found useful to include a dummy variable into the error-correction model in order to test and eventually correct for the deviations of the long-run trend on output growth stemming from the civil strife (the violent conflict dummy was coded as "1" for 1977-1986 and for 2000). Once the overall model fit has been found satisfactory, equation (3) is reformulated in order to incorporate an error-correction term. Engle and Granger (1987) suggest a "two-step" procedure, in which the error-correction term EC_{t-1} is derived from the lagged residuals u_t of the levels regression in equation (2) that can be used to estimate the model:

$$(5)\ \Delta \ln y_t = \ln A_t + g_1 \cdot \Delta \ln k_t + g_2 \cdot \Delta \ln h_t + g_3 \cdot EC_{t-1} + g_4 \cdot Dummy_t + u_t$$

Equations (4) and (5) should in principle produce similar results, because both formulations can be understood as a transformation of each other. They may therefore yield information about the robustness of the estimated coefficients.

2.2 Human Capital Affecting the Technology Parameter (Model 2)

The basic framework for the second specification is a standard Cobb-Douglas production function with constant returns to scale:

$$(6)\ Y_t = A_t \cdot K_t^{a} \cdot L_t^{(1-a)}$$

which is standardized by labor units in order to avoid multicollinearity between capital and labor. Converted into a logarithmic expression, the equation becomes:

$$(7)\ \ln y_t = \ln A_t + a \cdot \ln k_t + u_t$$

Combining the long-run information of the variables with a short-run adjustment mechanism, the equation can be represented in its error-correction form:

$$(8)\ \Delta \ln y_t = g_1 \cdot \Delta \ln k_t - g_2 \cdot (\ln y_{t-1} - a \ln k_{t-1} - \ln A_t)$$

In contrast to the human capital augmented growth model, however, total factor productivity is considered to be a function of exogenous variables, namely education and foreign inputs. Benhabib and Spiegel (1994) postulate that an educated labor force may play a key role in determining productivity rather than entering on its own as a production factor. In the interest of simplicity, they assume that human capital is exogenously given and that higher levels of human capital cause increased productivity.

Benhabib and Spiegel follow Romer (1990) and Nelson and Phelps (1966). In their empirical growth model human capital affects total factor productivity through two channels. First, higher levels of human capital directly influence productivity via its impact on domestic innovation. Second, higher levels of human capital cause improvements in total factor productivity by facilitating the adoption and implementation of foreign technology and therefore reducing the knowledge gap between the technologically leading nations and the developing world.

In addition, along with many other authors, Lee (1995) emphasizes that relatively cheaper foreign inputs are important determinants of growth since they provide a wider range of intermediate inputs (which in turn might enhance technological progress) and affect the efficiency of capital accumulation. Using cross-country data, Lee shows that the ratio of imports in investment has a significant positive effect on economic growth.

Taking into account these studies, the technology parameter is treated as a non-constant and is allowed to change over time:

$$\text{(9)}\quad \ln A_t = c + g_4 \cdot \ln h_t + g_5 \cdot \frac{IM_t}{I_t} + g_6 \cdot Dummy_t$$

where c is a constant or exogenous technological progress, h represents the level of human capital proxied by average years of schooling, and IM/I is the ratio of total imports to gross domestic investment. Moreover, the effects of civil strife and periods of high violence, assumed to have a negative impact on productivity and output growth, are tested by the dummy variable. Combining equations (8) and (9) yields the “one step” error-correction model in its re-parameterized form:

$$(10)\ \Delta \ln y_t = c + g_1 \cdot \Delta \ln k_t + g_2 \cdot \ln y_{t-1} + g_3 \cdot \ln k_{t-1} + g_4 \cdot \ln h_t + g_5 \cdot \frac{IM_t}{I_t} + g_6 \cdot Dummy_t + u_t$$

In analogy to the first empirical model, one can also apply a "two step" procedure using the lagged residuals of the level regression from equation (7) and incorporate an error-correction term into the specification:

$$(11)\ \Delta \ln y_t = c + g_1 \Delta \cdot \ln k_t + g_2 \cdot EC_{t-1} + g_3 \cdot \ln h_t + g_4 \cdot \frac{IM_t}{I_t} + g_5 \cdot Dummy_t + u_t$$

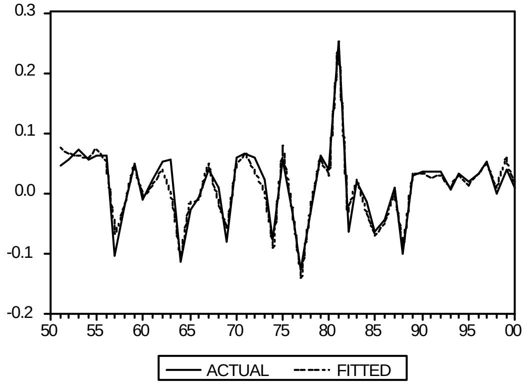
Notice that the final equations are quite similar when compared with the human capital augmented model. Therefore, it may be difficult to distinguish empirically between the two approaches. However, the implication of the alternative Model 2 is that the *level* of human capital rather than the *growth rates* now play a role in determining the growth of output per worker. Growth of output per worker now depends positively upon the average level of human capital through its impact on productivity. As Loening (2004) points out, despite some efforts in increasing average years of schooling, Guatemala's human capital base still remains far behind the Latin American average. If these equations are significant, they could yield information about the low performance of Guatemala's economy in terms of annual per capita growth.

3. Results of error-correction regressions

The following paragraphs present the econometric results of the two models; the original time series data and a detailed description of the procedures to come up with an estimate of the human capital stock for Guatemala are available in Loening (2005). Overall, the adjusted R^2 in all specifications of the error-correction model is rather high indicating a good fitting of the respective model to the data.

Test statistics do not point out any evidence of serial correlation nor misspecification at conventional levels (e.g., a Breusch-Godfrey test finds no evidence for the presence of first, second or third order serial correlation, and the residuals have been found normally distributed following stationary patterns). Both specifications of the error-correction model lead to similar results although the "one step" procedure is the preferred one. Considering the distortions caused by the internal military conflict and the limited choice of explanatory variables, the results have been found acceptable.

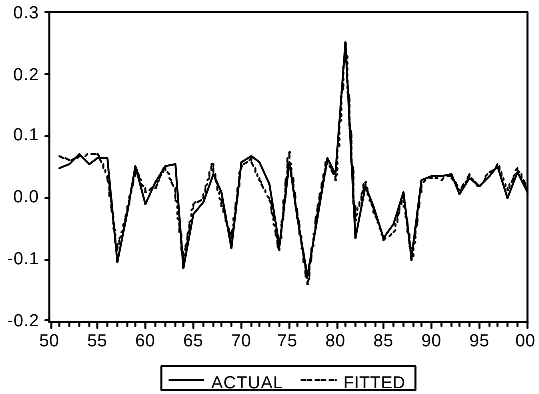
Figure 1. Guatemala: Actual versus Fitted Growth of GDP per Worker, Model 1, 1951-2000



Figures 1 and 2 show the fitness of equations (4) and (10). Gradually, the empirical specification that hypothesizes that human capital affects the technology parameter (Model 2) performs slightly better and its results have been found more robust concerning parameter stability than the human capital augmented production function (Model 1).

The error-correction coefficient in all specifications is statistically significant and suggests a moderate speed of adjustment towards the long-run growth path, equal to about 13 to 16 percent of the deviations per year. After a certain shock to the economy it would take on the average approximately 20 years to reach the level of output consistent with long-run growth (with differences to be less than 5 percent). The estimated capital share in output is approximately 1/2 to 3/5 and was found slightly too large while compared with the empirical evidence for developing countries. The most striking result for Guatemala is, however, that in both empirical models the average years of schooling appear to be strongly correlated with per capita growth.

Figure 2. Guatemala: Actual versus Fitted Growth of GDP per Worker, Model 2, 1951-2000



3.1 Human Capital as a Factor of Production (Model 1)

Human capital as a production factor, measured by average years of schooling, appears to have a positive and significant impact on the growth of output per worker (Table 2). The estimated long-run effect of a 1 percent increase of the average years schooling on GDP per unit of labor is approximately 0.16 percent. The schooling coefficient has been found robust concerning alternative assumptions about the physical and human capital stock. Employing alternative data would not change the magnitude or the significance of the variable.

The short-run elasticity of schooling is more difficult to explain. It is questionable whether or not that education has short-term effects on growth. A possible interpretation of this correlation could be that an increase in the average years of schooling partly behaves as a proxy for improved expectations, as emphasized by Morales (1998). Another possibility for the increase could be reverse causality effects. In other words, periods of increased enrollment in education are more favorable to higher rates of short-run growth. However, the short-term schooling coefficient was found to be sensitive to data issues. Consequently, its magnitude must be interpreted with care.

Table 2. Production Function for Guatemala: Human Capital as Factor Input, 1951-2000

Explanatory Variables	Dependent variable: percent change of GDP/worker	
	Equation (4)	Equation (5)
Constant	-0.038* (-2.12)	-0.002 (-0.26)
Percent change of capital/worker	0.900** (22.2)	0.904** (23.9)
Percent change of schooling/worker	0.483 (1.57)	0.486 (1.62)
ln GDP/worker [-1]	-0.132** (-2.90)	
ln capital/worker [-1]	0.072* (2.02)	
ln average schooling [-1]	0.022* (2.01)	
Violence conflict dummy	-0.032** (-4.95)	-0.032** (-5.34)
Error term [-1]		-0.131** (-2.95)
Long-run elasticity of capital	0.547	0.547
Long-run elasticity of schooling	0.163	0.163
Adjusted R^2	0.933	0.936
F-statistic	114.8	179.7
Durbin-Watson	1.942	1.931
S.E. of regression	0.016	0.016
Observations	50	50

t-statistics in parenthesis. ** Significant at 1%, * significant at 5%.

The long-run relationship of output with respect to its explanatory variables can be derived from equation (4) in Table 2. The results in terms of the human capital augmented Cobb-Douglas production function are the following:

$$(12)\qquad Y_t = A_t \cdot K_t^{0.547} \cdot H_t^{0.163} \cdot L_t^{0.290}$$

Overall, within the chosen framework, one can conclude that over the medium-term human capital accumulation plays an important role for economic growth in Guatemala. However, faster long-term growth would depend crucially on Guatemala's ability to increase productivity. In this respect, the results of the following empirical specification may provide useful insights.

3.2 Human Capital Affecting the Technology Parameter (Model 2)

The second empirical model emphasizes that the average level of schooling should not be treated as an extra input into the production function but may directly affect total factor productivity. Based on the regression results of equation (10) in Table 3, the following formulas in terms of the Cobb-Douglas production function can be obtained:

$$(13)\ Y_t = A_t \cdot K_t^{0.586} \cdot L_t^{0.414} \quad \Leftrightarrow \quad \ln y_t = \ln A_t + 0.586 \cdot k_t$$

$$(14)\ \ln A_t = -0.717 + 0.179 \cdot \ln h_t + 0.355 \cdot \frac{IM_t}{I_t} - 0.115 \cdot Dummy_t$$

$$(15)\ \Delta \ln y_t = 0.917 \cdot \Delta \ln k_t - 0.164 \cdot (\ln y_{t-1} - 0.586 \cdot \ln k_{t-1} - \ln A_t)$$

Equation (25) expresses the production function in the long run, equation (26) displays the variables that are thought to explain the evolution of total factor productivity and equation (27) shows the short-term dynamics of growth per labor unit. Notice that the estimated production elasticity of physical capital in the long-run equation is now larger than its factor share (as estimated in the human capital augmented production function) reflecting its correlation with human capital.

Taken at face value, Model 2 provides two mechanisms that govern the evolution of total factor productivity. First, the level of human capital, as measured by average years of schooling, appears to have a highly significant and positive impact on productivity growth in Guatemala.

Table 3. Production Function for Guatemala: Human Capital Affecting the Technology Parameter, 1951-2000

Explanatory Variables	Dependent variable: percent change of GDP/worker	
	Equation (10)	Equation (11)
Constant	-0.117** (-3.83)	-0.080** (-3.12)
Percent change of capital/worker	0.917** (25.8)	0.940** (28.0)
ln GDP/worker [-1]	-0.164** (-3.86)	
ln capital/worker [-1]	0.096** (2.89)	
ln average schooling	0.029** (2.92)	0.017* (2.30)
Ratio of imports/gross domestic investment	0.058** (3.45)	0.057** (3.28)
Violence conflict dummy	-0.019** (-3.10)	-0.020** (-3.25)
Error term [-1]		-0.130** (-3.37)
Long-run elasticity of capital	0.586	0.586
Adjusted R^2	0.945	0.942
F-statistic	140.7	160.8
Durbin-Watson	2.082	1.978
S.E. of regression	0.015	0.015
Observations	50	50

t-statistics in parenthesis. ** Significant at 1%, * significant at 5%.

Second, the empirical results imply that foreign technology inputs are important determinants for productivity growth (the ratio of total imports to domestic investment may hold as an indicator for the quality of investment). Almost obvious is the finding that periods of high violence or political instability, as proxied by the dummy variable, influence negatively the efficient use of factor inputs and economic growth.

Interestingly, the schooling variable and the ratio of imports to investment proved to have some joint effects. That is, the empirical specification works best when both variables are included within the equation. Employing the variables on their own would slightly reduce their significance. This effect could imply that there is an additional role for education in order to attract physical capital. Lucas (1990) suggested an alternative channel for human capital to growth. One reason why physical capital does not flow to poor countries may be the fact that these countries are typically poorly endowed with factors complementary to physical capital, thereby reducing its rate of return.

4. Conclusions

This paper analyzed two channels by which human capital is hypothesized to influence growth. First, a better-educated labor force appears to have a positive and significant impact on economic growth via factor accumulation. Over the medium run, a 1 percent increase of the average years of schooling would raise output per worker by about 0.16 percent. Second, the average level of human capital appears to have a strong impact on the evolution of total factor productivity. One reason for the low performance of the economy in terms of per capita growth may therefore be attributed to Guatemala's poorly developed human capital base, lagging far behind the Latin American average. However, it is empirically challenging to separate both approaches, and future research may control for potential endogeneity of schooling, the effect of the civil war and changes in the conditioning set of the variables.

The empirical results in this study have some policy implications. In particular, they underscore the need for further efforts in Guatemala to increase its level of human capital. Given the incomplete character of the average-years-of-schooling measure and the potential existence of threshold levels in education, as well as numerous non-monetary benefits of education, the contribution of human capital may be underestimated in its quantitative form. An additional finding is that the composition of investment appears to be an important factor behind productivity growth.

References

Banerjee, A., J. Dolado, J. Galbraith and D. F. Hendry (1993), *Cointegration, Error Correction, and the Econometric Analysis of Non-stationary Data*, Oxford: Oxford University Press.

Bassanini, A. and S. Scarpetta (2001), "Does Human Capital Matters for Growth in OECD Countries? Evidence from Pooled Meangroup Estimates" *OECD Working Paper* ECO/WKP 2001/8.

Benhabib, J. and M. Spiegel (1994), "The role of human capital in economic development: evidence from aggregate cross-country data", *Journal of Monetary Economics*, Vol. 34, No. 2, pp. 143-173.

Engle, Robert F. and C. W. J. Granger (1987), "Cointegration and Error Correction: Representation, Estimation, and Testing", *Econometrica*, Vol. 55, No. 2, pp. 251–276.

Lee, J.-W. (1995), "Capital Goods Import and Long-run Growth", *Journal of Development Economics*, Vol. 48, No. 1, pp. 91-110.

Loening, L. J. (2004), *Economic Growth, Biodiversity Conservation, and the Formation of Human Capital in a Developing Country: The Case of Guatemala*, Goettingen Studies in Development Economics, Vol. 13, Frankfurt: Peter Lang.

Loening, J. L. (2005). "Estimating Human and Physical Capital Stocks in a Data Scarce Environment: An Application to Guatemala, 1950-2002", *International Journal of Applied Econometrics and Quantitative Studies*, Vol.5-1, forthcoming.[2]

[2] Preliminary results for 1950-2000 are displayed in "The Impact of Education on Economic Growth in Guatemala", *Discussion Paper* 87, Ibero-America Institute for Economic Research, University of Goettingen, June 2002.

Lucas, R. E. (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics*, Vol. 22, No. 1, pp. 3-42.

Lucas, R. E. (1990), "Why Doesn't Capital Flow from Rich to Poor Countries?" *American Economic Review*, Vol. 80, No. 2, pp. 92-9

Mankiw, N. G., D. Romer and D. N. Weil (1992), "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics*, Vol. 107, No. 2, pp. 407-437.

Morales, R. A. (1998), "Determinants of Growth in an Error-correction Model for El Salvador", *IMF Working Paper* 98/104.

Nehru, V. and A. Dhareshwar (1994), "New Estimates of Total Factor Productivity Growth for Developing and Industrial Countries", *World Bank Policy Research Working Paper* 1313.

Nelson, R. and E. Phelps (1966), "Investments in Humans, Technological Diffusion, and Economic Growth", *American Economic Review*, Vol. 56, No. 1-2, pp. 69-75.

Romer, P. M. (1990), "Endogenous Technological Change", *Journal of Political Economy*, Vol. 98, No. 5, pp. S71-S102.

Solow, R. M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94.

World Bank (2003), *Poverty in Guatemala*, Report No. 24221-GU, Washington D.C.

Journal published by the Euro-American Association of Economic Development. http://www.usc.es/economet/eaa.htm