ECONOMIC RESEARCH REPORTS

CROSS-COUNTRY GROWTH REGRESSIONS

by **Jess Benhabib**
and
Mark Spiegel

RR# 97-20 **April 1997**

C.V. STARR CENTER FOR APPLIED ECONOMICS

NEW YORK UNIVERSITY
FACULTY OF ARTS AND SCIENCE
DEPARTMENT OF ECONOMICS
WASHINGTON SQUARE
NEW YORK, NY 10003-6687

Preliminary

Cross-Country Growth Regressions

Jess Benhabib
New York University

and

Mark M. Spiegel[1]
Federal Reserve Bank of San Francisco

ABSTRACT

A large literature has identified a variety of "ancillary variables," such as political instability, income distribution, and financial development as important determinants of income growth in cross-sectional studies. This leaves open the question of whether these variables influence growth through their effect on rates of factor accumulation or their influence on total factor productivity growth. This paper addresses this question by examining whether "primitives," or rates of factor accumulation, are sufficient statistics for economic growth, and whether the ancillary variables found in the literature do enter in the determination of physical and human capital accumulation rates. Our results suggest that the primary influence of these ancillary variables on growth is through factor accumulation. However, the significance of many of these ancillary variables is not robust to the inclusion of country fixed effects. In addition, we find evidence that financial development is also an important determinant of total factor productivity growth.

Key words: Growth, Investment, Human Capital, Ancillary Variables

JEL Classification: N10; N30

---

[1]Warren Chiang and Laura Haworth provided excellent research assistance. Helpful comments were received from Tim Cogley. We are grateful to Adam Przeworski for valuable ideas and criticisms.This paper represents the opinions of the authors and not necessarily those of the Federal Reserve Board of Governors or the Federal Reserve Bank of San Francisco. Financial assistance from the C.V. Star Center for Applied Economics at New York University is gratefully acknowledged.

1. Introduction

In the years since Levine and Renelt (1992) reported that "A vast literature uses cross-country growth regressions to search for empirical linkages between long-run average growth rates and a variety of economic policy, political and institutional factors...," cross-sectional investigations into the determinants of economic growth have proliferated at an even faster pace. While there are indeed a large number of studies of these policy, political and institutional factors, or "ancillary variables" as they are commonly referred to in the literature, and indeed there is some consensus as to the types of variables which display more or less robustness in these investigations, there is not a complete understanding of the manner in which these variables influence growth.

One can distinguish between economic growth that follows from the enhancement of a nation's technology, that is from increases of total factor productivity in standard growth accounting exercises, and economic growth that arises from increases in the nation's factor stocks, or "primitives." This latter group would include standard factors of production, such as labor and capital, as well as human capital. The rate of their accumulation would be directly affected by ancillary variables like income distribution or redistributive government programs which can influence tax rates [Persson and Tabellini (1995), Alesina and Rodrik (1994), Perotti (1993)]; political variables like social unrest or rent-seeking activities that dilute rates of return on investment [Veneiris and Gupta (1986), Alesina and Perotti (1996), Benhabib and Rustichini (1996), Tornell and Velasco (1992)]; or imperfect financial markets that limit educational as well as economic opportunities for the talented and constrain their productivity [Galor and Zeira (1993), Banerjee and Newman (1991), Benabou (1996)].

Since underlying theories suggest that such ancillary factors influence growth essentially through their impact on factor accumulation, it would make sense to test their effects directly on investment rates. Furthermore, we should not expect them to appear in a standard growth accounting exercise that already incorporates rates of factor accumulation as explanatory variables, as also discussed in Benhabib and Spiegel (1994).

Recently some authors have pointed out that not all sources of economic growth are sustainable in the long run. For example, Young (1994) has suggested that the rapid economic growth enjoyed by East Asian NIC's is attributable to factor accumulation rather than total factor productivity growth. This observation sheds doubt on the sustainability of their high growth rates, since the high rates of factor accumulations are likely to subside once the marginal products of physical and human capital are driven down to levels consistent with a new steady state. In this vein, the identification of those ancillary variables which induce "dynamic," i.e. total factor productivity, gains as opposed to those variables which act towards enhancing factor accumulation rates has important policy implications.

To implement this test of the role of ancillary variables, we must first have a base model of growth accounting that captures the impact of technological progress and technology diffusion on economic growth. We can then ask whether ancillary variables affect growth directly, or whether they affect the growth of factor accumulation. If these ancillary variables directly affect growth, then they will enter into the growth accounting equations even after we have accounted for disparities in factor accumulation rates.

We also check whether ancillary variables have an impact on investment rates in physical and human capital after we have accounted for the more traditional determinants of savings and investment rates, mainly the structure of preferences, the level of wealth and the rates of return on capital. While rates of return are difficult to measure directly, the stock levels of physical and human capital together with labor supply will to a large extent capture and reflect the marginal products, as well as the wealth level[2]. The question then becomes whether there is any additional role is left for ancillary variables in explaining investment rates.

Our data set includes a panel of five-year growth periods from 92 countries over the period 1960 through 1985, which allows us to test for country-specific fixed effects. One difficulty with cross country regressions, such as those we ran in Benhabib and Spiegel (1994), is the possibility of omitting country-specific fixed effects, and thereby attributing explanatory power to other variables which act as proxies for unobservables. It is quite possible, for example, that fixed effects would usurp the role of educational attainment in the regressions, but it is also possible that educational attainment levels, which enter as a set of not too dissimilar numbers in the panel for each country, are nothing but proxies for omitted country characteristics.

The literature contains a variety of approaches to evaluate the robustness of ancillary variables. Levine and Renelt (1991) conducted the extreme bounds analysis method. Essentially, their method examined whether a right-hand side variable was robust to a large myriad of specifications. An ancillary variable was reported as "non-robust" if it failed to enter significantly in any of these specifications. Sala-i-Martin (1996) however suggested that such a test was misleading, since it failed to distinguish between ancillary variables which failed to

[2] See section 2.4 for a discussion.

enter in all specifications and those which had failed in only one of the specifications in the study.

In this paper we attempt to further scrutinize the explanatory power of ancillary variables from an additional perspective. We compare the performance of various ancillary variables with and without the presence of country-specific fixed effects. A fixed-effects specification should account for missing country characteristics which are constant over the sample. To the extent that fixed effects are important and significant, and that they eliminate the explanatory power of other variables, they reflect a further measure of our ignorance in the process of identifying the broad universal categories that account for economic growth.

Our panel specification also accommodates some response to the issue of simultaneity. As is well known, the potential endogeneity of factor accumulation rates, particularly physical capital accumulation rates, implies that an OLS treatment of the data may yield biased coefficient estimates [for example, see Benhabib and Jovanovic (1990)]. Moreover, Benhabib and Spiegel (1994), demonstrated that the coefficient estimate bias on physical as well as human capital accumulation is likely to be positive. This is of particular concern to our study here. If our physical capital coefficient estimate is biased, it is likely that some of the coefficient estimates on the ancillary variables in the growth regressions will also be biased.

To diminish such problems of simultaneity bias, we follow a number of recent studies [Barro and Lee (1994), Caselli, et al (1996), and Easterly, et al (1996)] in using lagged values of endogenous variables as instruments in our growth regressions. In particular, we use the generalized method of moments application advocated by Caselli, et al (1996) and Easterly et al

(1996) because this application does not rely on the presence of random individual effects, as the instrumental variables method used by Barro and Lee (1994) would.

We first introduce a variety of specifications for "base" growth and investment equations. Our sample is a panel of five-year growth episodes for a large cross-country data set. We then introduce the ancillary variables into these base growth specifications and examine whether they enter into the growth regressions with and without accounting for country fixed effects. We also examine the robustness of the "primitives" to the inclusion of these ancillary variables. Finally, we examine whether the ancillary variables we consider enter directly into the determination of the rates of physical and human capital accumulation, again with and without accounting for country fixed effects.

We concentrate on a small set of ancillary variables which have received a large amount of attention in the literature. In particular, we concentrate on indicators of political instability, income distribution, and financial development. There are a variety of explanations why each of these might have an impact on growth rates.

In the case of political instability, Alesina, et al (1996) follow a long literature [for example, see Alesina and Perotti (1996), Barro (1996), and Easterly and Rebelo (1993)] in finding a negative relationship between measures of political instability and growth. Other authors, such as Cukierman, Edwards and Tabellini (1992) have identified the influence of political instability on a more focused policy variable, such as inflation rates.

Most of the arguments concerning the channel through which political instability influences growth stress its impact on factor accumulation rates. For example, Alesina, et al (1996) argue that "Political instability affects growth because it increases policy uncertainty, which has negative effects on productive economic decisions such as investment and saving." An alternative channel is stressed by Murphy Shleifer and Vishny (1991) and Grossman (1991) in which political instability leads to enhanced rent-seeking, or even revolutionary, activity.

Another ancillary variable which has been introduced into growth equations is income distribution. Perotti (1996) distinguishes between different channels of causation. The first is "endogenous fiscal policy," which would be associated with Alesina and Rodrik (1994), Perotti (1993), and Person and Tabellini (1994), among others. Under this channel, the distribution of income affects growth through its influence on the level of government expenditure and taxation. Holding all else equal, the greater the disparity of income in a society, the greater will be the amount of redistribution which takes place through the levying of distortionary taxation. An alternative channel is the role of income inequality and poverty as a source of political contention and instability. Under this argument, associated with Veneiris and Gupta (1986), Alesina and Perotti (1996), and Benhabib and Rustichini (1996), income disparities and poverty encourages groups to engage in rent-seeking activities which can both discourage investment and disrupt the allocation of factors.

A third set of ancillary variables introduced into the growth equations are variables that can capture the degree of financial development. A number of authors, including Greenwood and Jovanovic (1991), Bencivenga and Smith (1991), Galor and Zeira (1993), Banerjee and Newman (1991), Benabou (1996), Ljungqvist (1993) and King and Levine (1993b) have stressed the effect of market imperfections and borrowing constraints on investment rates of physical and human capital, especially in poor economies or in economies with skewed income distributions. To test such hypotheses we can use the extent of the development of financial markets as a proxy for market imperfections, and interact them with measures of wealth or income distribution to see if they influence either economic growth rates or investment rates in physical or human capital. Levine and Zervos (1993) have found that financial development is a uniquely robust argument in the determination of income growth.[3]

The studies mentioned above suggest that financial backwardness may hinder the ability of agents to engage in investment in capital. This would be particularly true, but not limited to, an agent's own human capital, as liquidity constraints can preclude an agent from investment in his own human capital at optimal levels. Such a phenomenon would presumably be most relevant for the poorest nations. As a result, this theory would suggest that an interactive term with GDP per worker and financial development levels would enter negatively in the determinants of the rates of physical and human accumulation. We add such an interactive term to our measure of financial development below.

Finally, the liquidity arguments concerning the importance of financial development in factor accumulation would seem to be particularly relevant for economies with a skewed distribution of income. The argument would simply be that the more skewed the distribution of income, the larger would be the share of the population in the lower "tail," where they would be more likely to find themselves unable to acquire financing for profitable investments in either physical or their own human capital. This would argue for the possibility of an interactive term with income distribution and the degree of financial development. To investigate this possibility,

[3] Previous empirical studies, such as King and Levine (1993) have found a positive role for levels of financial development in the determination of both the growth of the physical capital stock and income growth rates. However, their income growth regressions do not include physical capital accumulation as an argument on the right-hand side, so the primary channel through

we introduce a term representing the interaction of income distribution and financial development.

The remainder of this paper is divided into four sections. The following section discusses the specification of our "base" growth specifications and examines our results for these specifications with and without fixed effects. Section three introduces the ancillary variables into the two endogenous growth specifications. Section four examines the determinants of rates of physical and human capital accumulation. Section five concludes.

2. Base Growth and Investment Regressions

2.1 Specification of Growth Regressions

Benhabib and Spiegel (1994) consider two alternative specifications for growth accounting. The first type would be associated with the standard Solow (1956) neoclassical growth model with human capital added as a factor of production. Under a neoclassical model, the nominal income of country *i* in period *t*, Y_{it}, will be a function of labor, L_{it}, physical capital, K_{it}, and human capital, H_{it}. Adopting a Cobb-Douglas technology, $Y_{it} = A_{it}L^{\alpha}{}_{it}K^{\beta}{}_{it}H^{\gamma}{}_{\iota\tau}\varepsilon_{\iota\tau}$, where $\varepsilon_{\iota\tau}$ represents in i.i.d. disturbance term, and taking log differences, the specification follows:

$$(1) \qquad (\log Y_{it} - \log Y_{it-1}) = (\log A_{it} - \log A_{it-1}) + \alpha(\log L_{it} - \log L_{it-1}) + \beta(\log K_{it} - \log K_{it-1}) + \gamma(\log H_{it} - \log H_{it-1}) + e_{it}$$

where $e_{it} = log\ \varepsilon_{it} - log\ \varepsilon_{it-1}$.

---

which financial development affects growth i.e. through enhanced factor productivity or through factor accumulation rates, is unaddressed in their paper

Note that the above specification does not include initial income. The textbook neoclassical model only provides a role for initial income as a determinant of how far a nation is from its steady state. The greater the distance from the steady state, the greater the predicted growth of per capita income through enhanced rates of capital accumulation. Since our specification already incorporates capital accumulation rates, there is no additional role for initial income levels.

An alternative role for initial income may be found in a model which allows the possibility of "catch-up," or technology diffusion, across countries. Initial income may play a role in determining the rate at which countries can adopt the technologies of leader countries [Nelson and Phelps (1966)]. In particular, the farther behind is a nation's technology, the greater is the amount it can learn from others. Consequently, we would predict a greater rate of growth of A holding all else equal, and hence a greater overall growth rate.[4]

This is the role of initial income in the endogenous growth specification for income growth considered by Benhabib and Spiegel (1994). This specification allowed for endogenous growth to be based upon the level of human capital in a nation. Based on the argument that human capital levels facilitate the adoption of technology from abroad, they develop a model in which the growth rate of total factor productivity depends upon both the current level of human capital as well as an interactive term with the disparity of technology levels from the "leader country," i.e. that country which has the maximum level of initial total factor productivity. They adopt the Cobb-Douglas technology, $Y_{it} = A_{it}(H_{it}) K^{\alpha}_{it} L^{\beta}_{it} v_{it}$, where $A_{H_{it}} > 0$ and v_{it} represents

[4] Also, our reported rates of factor accumulation are likely to be measured with error, so initial income levels may be adding information to the sample in a non-trivial manner.

an i.i.d. disturbance term. They also adopt the following structural specification for the rate of total factor productivity growth

(2) $$(\log A_{it} - \log A_{it-1}) = c + g \log H_{it} + m(\log H_{it})\left[\frac{(y_{maxt} - y_{it})}{y_t}\right]$$

where y_{maxt} represents the total factor productivity of the "leader nation," approximated in our sample by output per worker in the country with the greatest level of output per worker.

Benhabib and Spiegel (1994) then derive the following specification:

(3) $$(\log Y_{it} - \log Y_{it-1}) = c + (g - m)\log H_{it} + m(\log H_{it})\left[\frac{y_{maxt}}{y_{it}}\right]$$
$$+\alpha(\log L_{it} - \log L_{it-1}) + \beta(\log K_{it} - \log K_{it-1}) + u_{it}$$

where $u_{it} = \log v_{it} - \log v_{it-1}$.

m is predicted to be positive, reflecting the positive interaction between the amount of technology adoption a country can conduct, which is an increasing function of its degree of relative backwardness, and its capacity to adopt technology, which is an increasing function of its human capital stock. However, the coefficient on $\log H_{it}$ is of ambiguous sign, depending on the relative magnitudes of *g*, which reflects the importance of human capital as a source of technological innovation [Romer (1990)] and *m*.

Because of data limitations, the set of specifications above will be underspecified due to unobservable country-characteristics which also influence a nation's rate of technological progress. Recently, a number of studies have attempted to capitalize on the information available through the full panel of cross-country data by adjusting for country-specific characteristics which are constant across time through the use of fixed-effects [Knight, et al (1993), Islam

(1995), and Caselli, et al (1996)]. Below, we examine our results with and without fixed effect coefficients.

We therefore entertain both of the above specifications as potential "base regressions" for explaining economic growth in terms of the "primitives," or merely the levels of factor accumulation. In addition, we examine a less structural "endogenous growth" specification in which human capital enters in levels into technology and initial income is allowed to enter on its own to reflect the potential for technological "catch-up." We examine the performance of these specifications with and without fixed effect coefficients.[5] Finally, as in Mankiw, Romer and Weil (1992), we constrain the factor coefficients to levels consistent with constant returns to scale. In the case of the neoclassical model [equation (1)], this corresponds to the restriction $\alpha+\beta+\gamma=1$. In the case where human capital enters into technology rather than as a factor of production [equation (3) and the "reduced form" endogenous growth specification], this corresponds to the restriction $\alpha+\beta=1$.

As we indicated above, we estimate our growth regressions using generalized method of moments to account for the endogeneity of physical capital accumulation. This methodology has been used in a number of panel growth regressions, including Caselli, et al (1996) and Easterly, et al (1996), following techniques advanced by Holtz-Eakin, Newey and Rosen (1988) and Arellano and Bond (1991). Essentially, consistency of our estimators under generalized method of moments requires the assumption that all factors except physical capital accumulation are

[5] Note that introducing fixed effects in this form implies that country-specific characteristics influence the growth of a country's total factor productivity rather than its level.

strictly exogenous, while physical capital is only weakly exogenous. For example, for equation (1) we require $E(K_{it}e_{is}) = 0$ for all $s>t$.

Nevertheless, even after accounting for the endogeneity of physical capital accumulation, the assumptions required for our estimation method to be consistent are not innocuous. For example, there are a number of studies which have argued that the ancillary variables, such as political instability, will be dependent on rates of income growth [Londregan and Poole (1990), Alesina and Perotti (1996)]. The validity of these assumptions therefore need to be tested through a number of specification tests, including a test for serial correlation in the residuals and the Sargan test of the over-identifying restrictions suggested by Arellano and Bond (1991). While the results of such tests for our sample are not available at the time of this draft, they will be reported in the final version of the paper. Meanwhile, we note that both Caselli, et al (1996) and Easterly et al (1996) passed such tests for a similar panel growth study.

2.2 Data

Details concerning the data set are contained in the data appendix below. Our overall data set consists of a panel of 92 countries over five year periods of growth from 1960 through 1985. We also allow for fixed effects through country and time-specific dummy variables.[6] Data for PPP-adjusted income and labor force participation were obtained from the Summers-Heston Data set, version 5.6, which was released in 1995. Human capital is proxied by average years of

[6]The primary constraint on the number of countries in the sample is the Dhareshwar and Nehru (1993) capital stock data, which is available for 92 countries. The lower overall number reflects he small number of countries for which capital stock data is available, but some other base variable is not. As is the convention, we do not report the individual fixed-effect results in the paper. However, all of the original output is available upon request.

schooling in the population above 25 years of age, which was obtained from the updated version of the Barro-Lee (1993) data set, which was used in Barro and Sala-i-Martin (1995).

Constant dollar estimates of physical capital stocks were calculated by Dhareshwar and Nehru (1993) in local currencies based upon the assumption of a 4 percent decay rate. However, efforts to convert these estimates into common currency capital stocks yielded implausible results due to deviations from purchasing power parity, particularly during the early 1980's period of U.S. dollar appreciation. We used local currency GDP levels, also calculated by Dhareshwar and Nehru, to construct unit-free capital-output ratios. We then used PPP-adjusted estimates of output levels obtained from the Summers-Heston data set to construct "PPP-adjusted" capital stock estimates.

2.3 Growth Regression Results

The results for the base growth regressions obtained through generalized methods of moments estimation are displayed in Table 1.[7] Models 1, 2 and 3 display the neoclassical growth model from equation (1), the reduced form endogenous growth model and the structural endogenous model from equation (3) respectively without including fixed effects. Models 4,5, and 6 display the same specifications with country fixed effects included. All of the specifications also include time dummies to account for global shocks over time.

Looking over all of the specifciations, it can be seen that the significance of rates of accumulation of physical capital and labor are very robust, both with and without the inclusion of

[7] We also ran the reported specification under ordinary least squares. Although endogeneity would lead to biased estimates under OLS, these results were quite similar to the GMM results reported here. They are available upon request.

fixed effects. In addition, it appears that the model specification does not have a large influence on the estimates of factor shares across these two variables. However, the presence of fixed effects does influence our parameter values. Without fixed effects, physical capital accumulation yields a coefficient point estimate around 0.54, while with the inclusion of fixed effects, the coefficient rises to 0.68. Of course, our estimate for the labor share exhibits an opposite decline.

Looking at the different model specifications, it appears clear that the neoclassical specifications (Models 1 and 4) does most poorly. Besides labor growth failing to enter significantly, human capital accumulation enters insignificantly with a negative point estimate. This human capital result, initially pointed out in Benhabib and Spiegel (1994) and confirmed by others [Islam (1995)], does not indicate that education plays no role in growth. If we consider an endogenous growth specification, levels of education may have a far greater impact on growth rates than what would be indicated by the neoclassical hypothesis. In particular, levels of human capital accumulation may facilitate technological innovation or the adoption of technology from abroad.

Our current results suggest that the performance of human capital in levels in the endogenous growth specifications is dependent upon the inclusion or exclusion of fixed effects. In the reduced endogenous growth specifications (Models 2 and 5), human capital enters in levels with a positive, but not significant, coefficient when fixed effects are excluded, but a negative and significant coefficient estimate with the inclusion of fixed effects. On the other hand, the "catch-up" term in the structural endogenous growth specification enters positive and significant with the inclusion of fixed effects, but is insignificant when fixed effects are excluded.

The inclusion of fixed effects in our specification precludes human capital in levels over our five-year periods from reflecting long-term differences in human capital accumulation levels across countries. Nevertheless, this is consistent with either the hypothesis that human capital levels do enhance total factor productivity growth, or that the human capital measure in Model 3 is picking up other missing country-specific characteristics. In any event, the structural model in equation (3) reveals that the predicted coefficient estimate on human capital levels is ambiguous, depending on the relative importance of technological innovation and catch-up.

Overall, the base growth regressions reveal remarkably stable coefficient estimates for both the rates of labor and physical capital growth. Both of these enter positively and significantly throughout the specifications introduced, with the exception of labor in Model 4. The role of human capital is less clear. Human capital fails to enter significantly when introduced as a factor of production in the neoclassical models 1 and 4. However, the structural endogenous growth specifications (Models 3 and 6) each have human capital either entering as a facilitator of technological progress, or through catch-up. Nevertheless, both of these results are dependent upon the inclusion or exclusion of fixed country effects.

3. Ancillary variables

3.1 Ancillary Variable Data

We examine three classes of ancillary variables: political instability, income distribution, financial development and government spending.

Data for political instability, referred to as *MJCHANGE* below, was obtained from Alesina et al (1996). Alesina et al identify a subset of the total government changes in the Jodice and Taylor (1983) data set which they consider "major changes" in government. They describe this subset as "... all irregular transfers of power such as coups, along with the subset of regular transfers that imply a substantial change in the party or coalition or parties in office." The political instability data is only available up to 1982, so our regressions below including this variable only encompass the four five-year periods from 1960 through 1980.

Income distribution data was obtained from the Deininger and Squire (1996) data set. Deininger and Squire report income quintiles from a wide variety of sources for a large set of countries.[8] We use the standard measure of income distribution, the Gini coefficient, referred to as *GINI* below, because it is available for a larger set of countries.

The indicators of financial development were obtained from King and Levine [(1993a) and (1993b)]. These include *LLY,* a measure of the ratio of liquid liabilities of the financial sector to GDP,[9] *BANK,* the ratio of deposit money bank assets over total assets which emphasizes the risk-sharing services banks are most likely to provide, and the share of credit funneled through the private sector through *PRIVATE,* the ratio of claims on the non-financial private sector to GDP.[10]

---

[8] Deininger and Squire (1996) identify a subset of their income distribution data set as "acceptable," based upon meeting a set of criteria. While we report the results for the full sample, we also ran the tests with the sample restricted to the Deininger and Squire "acceptable" sample. These results are very similar to those reported below and are available upon request.

[9] King and Levine (1993a) use M3 as a proxy for liquid liabilities when available, and M2 when M3 was unavailable. We chose to use M2 throughout, which is available for all countries in the sample.

[10] To check robustness, King and Levine also examine the ratio of claims on the nonfinancial private sector to total domestic credit. We also checked this indicator and obtained similar results which are available upon request.

3.2 Ancillary Variables in the Growth Regressions

In this section, we report the results of including the ancillary variables in the reduced form and structural endogenous growth specifications.[11] Because the ancillary variables considered in this study are highly collinear, we include them one at a time. Table 2 reports the results for the "reduced form" endogenous growth specification without the inclusion of fixed effects. It can be seen that the results obtained for the base growth regression are fairly robust to the inclusion of the ancillary variables. Physical capital labor force accumulation again enters positively and significant, although labor now receives a larger factor share than physical capital. Human capital again has a mixed performance. In most specifications it enters positive, but insignificant, with the exception of Model 7.

The financial variables appear to perform differently. The two non-financial variables, *MJCHANGE* and *GINI,* are insignificant in Models 1 and 2.[12] Similarly, income distribution interacted with financial development (Model 7) is also insignificant. However, many of the measures of financial development appear to enter with their predicted signs. In particular, *LLY* and *PRIVATE* enter significantly positive, while *BANK* does not. With the addition of the interactive terms, we see that *LLY* interacted with initial *GDP* is insignificant (Model 6) and the inclusion of this variable leaves *LLY* insignificant as well. *LLY* interacted with the Gini

[11] Because of space limitations and the poor performance of the neoclassical specification in the base growth regressions, we do not report the results from including the ancillary variables in the neoclassical specification. However, the qualitative results for this specification were similar and are available upon request.

[12] We obtained similar results for the alternative political instability indicator of the presence of a coup during the sample period and the alternative income distribution indicator "MID." These results are available upon request.

coefficient is also insignificant, but the *LLY* term is robust to its inclusion at a ten percent confidence level.

The inclusion of the ancillary variables into the structural specification without fixed effects are reported in Table 3. The results are very similar to the reduced form specification. The non-financial ancillary variables, *MJCHANGE* and *GINI*, are insignificant. The financial variables are also similar. *LLY* and *PRIVATE* are again positive and significant, while *BANK* fails to enter. *LLY* interacted with initial income again fails to enter significantly. Finally, *LLY* interacted with *GINI* is insignificant, but *LLY* is robust to its inclusion.

Tables 4 and 5 repeat the exercise with country-specific fixed effects included. The most striking implication of the inclusion of fixed effects is that the point estimates for the factor shares of physical capital and labor are very sensitive to our specification. The labor share goes from an implausibly high level of 0.891 in Model 1 to an implausibly low level of 0.065 in Model 4. The performance of human capital in levels, *LEDUC* is also mixed, with the coefficient entering significantly at a ten percent confidence level in about half of the specifications considered. The same is true for the catch-up term *LHYMAXY* in table 5. Physical capital accumulation consistently enters positively and significantly, but as with labor force growth, its point estimate fluctuates greatly.

The performance of the ancillary variables themselves is quite similar to those without fixed effects. The two non-financial ancillary variables, *MJCHANGE* and *GINI,* are insignificant. However, the financial ancillary variables perform relatively well, with *LLY* and *PRIVATE* again entering positive and significant in both regressions while *BANK* fails to enter.

LLY interacted with initial *GDP* is insignificant in both specifications, as is *LLY* interacted with *GINI.*

In summary, adding the ancillary variables to the growth regressions yields two results. First, the ancillary variables themselves tend to be insignificant once we account for factor accumulation levels, with the exception of two measures of financial development, *LLY* and *PRIVATE.* Second, the factor share estimates are very sensitive to specification choice in the presence of country fixed effects.

4. Determinants of Physical and Human Capital Accumulation

4.1. Base Investment Regressions

We next turn to the base specification for determinants of investment levels. If we focus on either infinitely-lived representative agent models or OLG models, the usual assumptions imply that investment levels increase with wealth. However standard assumptions imposed on theoretical models do not yield any restrictions on how investment rates, defined as the ratio of net investment to the stock of capital, varies with the level of wealth. Specifications that impose constant savings rates on the other hand, do imply that the investment to capital ratio is decreasing in capital, because the average product of capital is decreasing in capital under constant returns to scale. In such a case we expect a negative coefficient on existing capital stocks in the determination of physical capital accumulation, but a positive coefficient on the initial stocks of labor and human capital. Similarly, the rate of human capital accumulation should be increasing in initial physical capital stocks and labor, but decreasing in the initial stock of human capital.

Ordinary least square results for physical capital accumulation without country fixed effects are reported in Table 6. All the factor stock coefficients enter with their predicted signs and are significantly different from zero at a five percent level. In addition, the parameter estimates on these coefficients are very stable, although the capital share appears to be too large and the labor share too small for a standard neoclassical closed-economy model. Human capital enters positive and significant, and is robust to the inclusion of all of the various ancillary variables we consider.

Unlike the growth regressions, the ancillary variables perform relatively well as determinants of the rates of physical capital accumulation. Our political instability indicator, *MJCHANGE*, is negative and significant. In addition, all three indicators of financial development enter positive and significant, as would be predicted. However, *GINI* and the interactive specifications are insignificant.

Table 7 introduces country fixed effects into the physical capital accumulation specifications. The factor stock coefficients are still fairly robust with the physical capital share estimate again too high for a standard closed-economy neoclassical growth model. Human capital in levels actually obtains a higher point estimate in the presence of fixed effects, but it is less robust, only entering significantly different from zero in half of the specifications.

The performances of the ancillary variables are also poorer in the presence of country fixed effects. *MJCHANGE* is now insignificant, while *GINI* enters significantly with the incorrect sign. Of the three indicators of financial development, only *BANKS* is significantly positive. Similarly, the interactive terms are all insignificant or enter with the incorrect sign.

The results for human capital accumulation without country fixed effects are reported in Table 8. By and large, these results compare poorly to those for physical capital accumulation. *LEDUC* enters negative and significant, as would be predicted. Similarly, physical capital stocks are consistently positive, although not always significant. Labor stocks consistently enter with the incorrect negative sign, although usually not at significant levels.

Among the ancillary variables themselves, the non-financial variables do well, with *MJCHANGE* and *GINI* entering with their predicted negative signs at a five percent significance level. The performance of the financial variables is mixed, with only *BANK* entering at a significant level, although *LLY* is significantly positive with the inclusion of *LLY* interacted with *GINI*. This latter term, as well as the other interactive term, is insignificant.

Fixed country effects are added to the specifications in Table 9. *LEDUC* is still negative and generally significant, as predicted. However, *LLAB* now enters positively and usually significant, while the coefficient on *LCAP* is almost always insignificant. Among the ancillary variables, the only ancillary variable which is robust to the introduction of fixed effects is *MJCHANGE*, the indicator of political instability.

Taking these factor accumulation regressions as a group, we can make some general conclusions. First, among the non-financial variables in the absence of fixed effects, the level of our index of political instability, *MJCHANGE*, appears to hinder both physical and human capital accumulation. Our indicator of income distribution skewness, *GINI*, appears to negatively influence human capital accumulation, but not physical capital accumulation. However, these results are not very robust to controlling for country fixed effects. The only relationship which is robust to the inclusion of country fixed effects is the negative impact of political instability on physical capital accumulation.

Without fixed effects, all of the financial variables enter significantly into the determination of physical capital accumulation, while only *BANK* enters significantly into the determination of human capital accumulation. Here again, however, we see that the robustness of these results to the inclusion of fixed effects is quite limited. The only relationship which survives the inclusion of fixed effects is the positive role of *BANK* in the rate of physical capital accumulation. With fixed effects included, we find no relationship between financial development and the rate of human capital accumulation.

5. Conclusion

This paper investigates the role of ancillary variables in the determination of income growth. In particular, we investigate whether the relationship between the ancillary variables examined in the paper and national growth experiences identified in the literature stems primarily from the influence of these variables on the rates of physical and human capital accumulation, or whether these ancillary variables play an independent role in the determination of total factor productivity growth.

Our exercise yields three main findings: First, we find that the qualitative results obtained in Benhabib and Spiegel (1994) are robust to examination within a panel-GMM specification with and without the introduction of country fixed effects. In essence, we find that the data are more consistent with models in which human capital enters into total factor productivity rather than neoclassical specifications in which human capital is just a regular factor of production.

Second, we find that most of the non-financial ancillary variables in the study do not enter directly into the growth regressions, but instead enter as a determinant of physical capital accumulation. With country fixed effects excluded, political instability has its predicted negative impact on physical and human capital accumulation. Similarly, with country fixed effects excluded, the skewness of income distribution appears to be negatively related to the rate of human capital accumulation. However, neither of these non-financial ancillary variables enter into the growth regressions after accounting for rates of factor accumulation.

The financial development indices take different channels in influencing income growth. Two of the financial variables, the liquidity indicator and the ratio of financial assets of the private sector to GDP, enter into both the rate of income growth after accounting for rates of factor accumulation and the rate of physical capital accumulation. Moreover, these results are relatively robust to the inclusion of country fixed effects in the specification. The other measure, the share of assets intermediated by the commercial banking system, either fails to enter or enters with the incorrect sign in the growth regressions, but enters positively as a determinant of physical and human capital accumulation with fixed effects excluded.

Finally, we find that the introduction of country fixed effects hinders the performance of the ancillary variables in the determination of rates of factor accumulation. All of the ancillary variables with the exception of political instability either fail to enter or enter with the incorrect sign in the determination of physical capital accumulation rates when we include country fixed effects. The same is true for all of the ancillary variables with the exception of the share of assets intermediated through the commercial banking system in the determination of human capital accumulation rates. This latter finding sheds doubt on much of the piecemeal results which have been reported concerning various ancillary variables in the growth literature.

Data Appendix

$GGDP_t$: Average of annual growth rate of GDP from time t+1 to t+5.
GDP defined as RGDPW*POP. Source: PWT5.6

$GLAB_t$: Average of annual growth rate of the labor force from time t+1 to t+5.Labor force defined as RGDPW/RGDPCH*POP. Source: PWT5.6

$GCAP_t$: Average of annual growth rates of physical capital stock from time t+1 to t+5.Source: Nehru

$GEDUC_t$: Five year growth rate from t to t+5 of average years of schooling for adults over 25 years of age. Source: Barro-Lee

$LEDUC_t$: Log level of average years of schooling for adults over 25 years of age at time t.
Source: Barro-Lee

$LGDPL_t$: Log of GDP per worker (RGDPW). Source: PWT5.6

$LLAB_t$: Log of labor force at time t. Source: PWT5.6

$LCAP_t$: Log of physical capital stock at time t. Source: Nehru

$LEDUC_t$: Log level of average years of schooling for adults over 25 years of age at time t.
Source: Barro-Lee

$MJCHANGE_t$: Dummy variable that takes a value of 1 if a coup or major regular government transfer takes place between years t-4 to t, 0 otherwise. Source: Alesina, .et al.

$GINI_t$: 'Best' Gini coefficient from time t-4 to t. Source: Deininger and Squire

The following criteria order was used to identify the best available income distribution measure among those available in the Deininger Squire data set: 1. Quality (accept, cs, ps, nn); 2. Timeliness (closest to time t); 3. Most recent study; 4. National over rural/urban; 5. Household over person

LLY_t: Average from time t-4 to t of M2/GDP. Source: IFS. lines 34+35/line99b

$BANK_t$: Average from time t-4 to t of deposit money bank domestic assets divided by deposit money bank domestic assets plus central bank domestic assets. Source: IFS. lines 12a-f/(lines12a-f + lines22a-f)

$PRIVATE_t$: Average from time t-4 to t of credit issued to private enterprises divided by GDP.
Source: IFS. line 32d/line 99b.

Note: Financial Data for Taiwan is from Financial Statistics Monthly, Taiwan District.

Table 1
Base Growth Regressions[13]

Dependent Variable: GGDP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.0053**	0.0080	-0.0028	0.0092	0.4911**	0.0693**
	(0.0026)	(0.0185)	(0.0073)	(0.0088)	(0.1102)	(0.0255)
GLAB	0.4417**	0.4690**	0.4690**	0.2583	0.3476**	0.3476**
	(0.0623)	(0.0611)	(0.0611)	(0.1878)	(0.1105)	(0.1105)
GCAP	0.5630**	0.5310**	0.5310**	0.7441**	0.6524**	0.6524**
	(0.0623)	(0.0611)	(0.0611)	(0.1893)	(0.1105)	(0.1105)
GEDUC	-0.0046			-0.0024		
	(0.0066)			(0.0152)		
LEDUC		0.0041	0.0030**		-0.0239**	-0.0642**
		(0.0029)	(0.0015)		(0.0099)	(0.0148)
LGDPL		-0.0010			-0.0403**	
		(0.0024)			(0.0100)	
LHYMAXY			0.0010			0.0403**
			(0.0024)			(0.0100)
# Observations	397	397	397	397	397	397
Degrees of Freedom	390	389	389	390	308	308

13 Estimated by generalized method of moments with GGDP and GCAP lagged one period used as instruments. All specifications include time dummies. Models 4, 5, and 6 also include country dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 2
"Reduced Form" Endogenous Growth Regressions with Ancillary Variables[14]

Dependent Variable: GGDP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.0338	0.0735**	0.0270	0.0111	0.0259	0.0088	0.0707**
	(0.0269)	(0.0276)	(0.0212)	(0.0221)	(0.0213)	(0.0328)	(0.0290)
GLAB	0.6642**	0.6104**	0.5153**	0.4089**	0.4568**	0.5028**	0.6364**
	(0.0937)	(0.0676)	(0.0645)	(0.0647)	(0.0647)	(0.0645)	(0.0746)
GCAP	0.3358**	0.3896**	0.4847**	0.5911**	0.5432**	0.4972**	0.3636**
	(0.0937)	(0.0676)	(0.0645)	(0.0647)	(0.0647)	(0.0645)	(0.0746)
LEDUC	0.0060*	0.0095**	0.0041	0.0038	0.0050	0.0037	0.0111 **
	(0.0036)	(0.0046)	(0.0032)	(0.0032)	(0.0032)	(0.0033)	(0.0051)
LGDPL	-0.0035	-0.0077**	-0.0041	-0.0013	-0.0038	-0.0020	-0.0094**
	(0.0032)	(0.0032)	(0.0028)	(0.0032)	(0.0028)	(0.0040)	(0.0038)
MJCHANGE	0.0033						
	(0.0033)						
GINI		-0.0002					
		(0.0002)					
LLY			0.0206**			0.0699	0.0329*
			(0.0060)			(0.0750)	(0.0194)
BANK				-0.0003			
				(0.0091)			
PRIVATE					0.0133**		
					(0.0066)		
LGDPL*LLY						-0.0055	
						(0.0079)	
GINI**LLY							-0.0005
							(0.0005)
# Obs.	237	224	357	353	358	357	210
DF	230	215	348	344	349	347	200

[14] Estimated by generalized method of moments with GGDP and GCAP lagged one period used as instruments. All specifications include time dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 3
"Structural" Endogenous Growth Regressions with Ancillary Variables[15]

Dependent Variable: GGDP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	-0.0027	-0.0067	-0.0163*	0.0007	-0.0148	-0.0122	-0.0275**
	(0.0083)	(0.0132)	(0.0091)	(0.0126)	(0.0091)	(0.0103)	(0.0135)
GLAB	0.6642**	0.6104**	0.5158**	0.4075**	0.4617**	0.5028**	0.6364**
	(0.0937)	(0.0676)	(0.0645)	(0.0650)	(0.0646)	(0.0645)	(0.0746)
GCAP	0.3358**	0.3896**	0.4842**	0.5925**	0.5383**	0.4972**	0.3636**
	(0.0937)	(0.0676)	(0.0645)	(0.0650)	(0.0646)	(0.0645)	(0.0746)
LEDUC	0.0025	0.0018	-0.0002	0.0029	0.0008	0.0017	0.0018
	(0.0019)	(0.0030)	(0.0018)	(0.0022)	(0.0018)	(0.0030)	(0.0034)
LHYMAXY	0.0035	0.0077**	0.0043	0.0006	0.0042	-0.0020	0.0094**
	(0.0032)	(0.0032)	(0.0028)	(0.0032)	(0.0028)	(0.0040)	(0.0038)
MJCHANGE	0.0033						
	(0.0032)						
GINI		-0.0002					
		(0.0002)					
LLY			0.0219**			0.0699	0.0329*
			(0.0062)			(0.0750)	(0.0194)
BANK				-0.0037			
				(0.0093)			
PRIVATE					0.0165**		
					(0.0069)		
LGDPL*LLY						-0.0055	
						(0.0079)	
GINI*LLY							-0.0005
							(0.0005)
# Obs.	237	249	357	353	358	357	210
DF	230	239	348	344	349	347	200

---

[15] Estimated by generalized method of moments with GGDP and GCAP lagged one period used as instruments. All specifications include time dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 4
"Reduced Form" Endogenous Growth Regressions with Ancillary Variables and Fixed Effects[16]

Dependent Variable: GGDP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.6229**	0.0343	0.1282	0.3297**	0.1427*	0.3151**	0.0127
	(0.2238)	(0.0646)	(0.0812)	(0.1274)	(0.0866)	(0.1027)	(0.0575)
GLAB	0.8908**	0.7645**	0.1958	0.0653	0.2046	0.1559	0.6470**
	(0.2581)	(0.1444)	(0.1428)	(0.1378)	(0.1531)	(0.1290)	(0.1881)
GCAP	0.1092	0.2355*	0.8042**	0.9347**	0.7954**	0.8441**	0.3530*
	(0.2581)	(0.1444)	(0.1428)	(0.1378)	(0.1531)	(0.1290)	(0.1881)
LEDUC	0.0421**	0.0196*	0.0010	-0.0202**	-0.0008	0.0083	0.0138
	(0.0172)	(0.0116)	(0.0112)	(0.0104)	(0.0114)	(0.0109)	(0.0099)
LGDPL	-0.0699**	-0.0075	-0.0150*	-0.0212*	-0.0162*	-0.0370**	-0.0066
	(0.0248)	(0.0084)	(0.0088)	(0.0120)	(0.0096)	(0.0116)	(0.0077)
MJCHANGE	0.0005						
	(0.0043)						
GINI		-0.0002					
		(0.0003)					
LLY			0.0384*			-0.3584**	0.0438
			(0.0226)			(0.1607)	(0.0382)
BANK				-0.0506**			
				(0.0203)			
PRIVATE					0.0430**		
					(0.0213)		
LGDPL*LLY						0.0421**	
						(0.0167)	
GINI*LLY							-0.0005
							(0.0010)
# Obs	237	224	357	353	358	357	210
DF	152	160	272	268	274	271	147

---

[16] Estimated by generalized method of moments with GGDP and GCAP lagged one period used as instruments. All specifications include time and country dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 5
"Structural" Endogenous Growth Regressions with Ancillary Variables and Fixed Effects[17]

Dependent Variable: GGDP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	-0.0980**	-0.0445	-0.0431	0.2269**	-0.0106	-0.0724**	-0.0561**
	(0.0367)	(0.0324)	(0.0287)	(0.0730)	(0.0373)	(0.0315)	(0.0275)
GLAB	0.8908**	0.7645**	0.1967	0.0955	0.2279	0.1559	0.6470**
	(0.2581)	(0.1444)	(0.1371)	(0.1549)	(0.1599)	(0.1290)	(0.1881)
GCAP	0.1092	0.2355*	0.8033**	0.9045**	0.7721**	0.8441**	0.3530*
	(0.2581)	(0.1444)	(0.1371)	(0.1549)	(0.1599)	(0.1290)	(0.1881)
LEDUC	-0.0278**	0.0121**	-0.0291**	0.0019	-0.0125	-0.0288**	0.0072
	(0.0119)	(0.0060)	(0.0128)	(0.0144)	(0.0131)	(0.0121)	(0.0082)
LHYMAXY	0.0699**	0.0075	0.0159*	-0.0263	0.0119	0.0370**	0.0066
	(0.0248)	(0.0084)	(0.0087)	(0.0169)	(0.0096)	(0.0116)	(0.0077)
MJCHANGE	0.0005						
	(0.0043)						
GINI		-0.0002					
		(0.0003)					
LLY			0.1085**			-0.3584**	0.0438
			(0.0360)			(0.1607)	(0.0382)
BANK				-0.1748**			
				(0.0574)			
PRIVATE					0.0170		
					(0.0362)		
LGDPL*LLY						0.0421**	
						(0.0167)	
GINI*LLY							-0.0005
							(0.0010)
# Obs.	237	224	357	353	358	357	210
DF	152	160	272	268	274	271	147

---

[17] Estimated by generalized method of moments with GGDP and GCAP lagged one period used as instruments. All specifications include time and country dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 6
Physical Capital Accumulation[18]

Dependent Variable: GCAP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	0.1489**	0.2133**	0.2564**	0.1533**	0.1555**	0.1551**	0.2080**	0.2828**
	(0.0259)	(0.0310)	(0.0418)	(0.0283)	(0.0259)	(0.0282)	(0.0356)	(0.0406)
LLAB	0.0157**	0.0169**	0.0218**	0.0197**	0.0233**	0.0182**	0.0236**	0.0272**
	(0.0020)	(0.0026)	(0.0030)	(0.0025)	(0.0024)	(0.0024)	(0.0029)	(0.0033)
LCAP	-0.0148**	-0.0167**	-0.0225**	-0.0177**	-0.0211**	-0.0169**	-0.0222**	-0.0279**
	(0.0020)	(0.0024)	(0.0030)	(0.0024)	(0.0024)	(0.0024)	(0.0030)	(0.0033)
LEDUC	0.0149**	0.0166**	0.0196**	0.0131**	0.0132**	0.0116**	0.0127**	0.0201**
	(0.0028)	(0.0031)	(0.0046)	(0.0035)	(0.0032)	(0.0034)	(0.0035)	(0.0053)
MJCHANGE		-0.0153**						
		(0.0039)						
GINI			-0.0001					
			(0.0003)					
LLY				0.0237**			-0.1653**	0.0174
				(0.0079)			(0.0759)	(0.0288)
BANK					0.0546**			
					(0.0092)			
PRIVATE						0.0323**		
						(0.0091)		
LGDPL*LLY							0.0224**	
							(0.0079)	
GINI*LLY							0.0009	
								(0.0008)
# Obs.	477	316	249	408	401	410	408	228
DF	468	308	239	398	391	400	397	217

18 Estimated by OLS. All specifications include time dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 7
Physical Capital Accumulation with Fixed Effects[19]

Dependent Variable: GCAP

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	0.5150*	-0.3877	0.9603**	0.7533**	0.6718**	0.7524**	0.7821**	0.9544**
	(0.2874)	(0.4954)	(0.3729)	(0.2977)	(0.2843)	(0.2955)	(0.3083)	(0.3682)
LLAB	0.0250	0.0995**	0.0279	0.0215**	0.0426**	0.0243**	0.0186	0.0385*
	(0.0157)	(0.0060)	(0.0214)	(0.0159)	(0.0158)	(0.0158)	(0.0179)	(0.0221)
LCAP	-0.0346**	-0.0498**	-0.0506**	-0.0388**	-0.0528**	-0.0405**	-0.0378**	-0.0553**
	(0.0052)	(0.0085)	(0.0068)	(0.0060)	(0.0063)	(0.0062)	(0.0066)	(0.0076)
LEDUC	0.0295**	0.0356**	0.0156	0.0189	0.0288**	0.0128	0.0183*	0.0090
	(0.0080)	(0.0116)	(0.0125)	(0.0101)	(0.0099)	(0.0097)	(0.0102)	(0.0150)
MJCHANGE		-0.0057						
		(0.0036)						
GINI			0.0007**					
			(0.0003)					
LLY				-0.0252			-0.0174	-0.0833*
				(0.0178)			(0.1176)	(0.0446)
BANK					0.0788**			
					(0.0130)			
PRIVATE						-0.0058		
						(0.0178)		
LGDPL*LLY							-0.0046	
							(0.0125)	
GINI**LLY								0.0021**
								(0.0009)
# Obs.	477	316	249	408	401	410	408	228
DF	386	228	169	319	315	322	318	149

[19] Estimated by OLS. All specifications include time and country dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 8
Human Capital Accumulation[20]

Dependent Variable: GEDUC

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	-0.0749	-0.0243	0.1717	-0.0089	0.0189	-0.0019	0.0582	0.1678
	(0.1069)	(0.1414)	(0.1514)	(0.1110)	(0.1117)	(0.1164)	(0.1405)	(0.1339)
LLAB	-0.0213**	-0.0247**	-0.0250**	-0.0139	-0.0113	-0.0162	-0.0089	-0.0115
	(0.0088)	(0.0119)	(0.0109)	(0.0098)	(0.0105)	(0.0099)	(0.0116)	(0.0108)
LCAP	0.0268**	0.0302**	0.0253**	0.0194**	0.0149	0.0205**	0.0138	0.0107
	(0.0084)	(0.0110)	(0.0108)	(0.0096)	(0.0103)	(0.0099)	(0.0120)	(0.0110)
LEDUC	-0.1246**	-0.1229**	-0.1556**	-0.1354**	-0.1256**	-0.1268**	-0.1358**	-0.1288**
	(0.0115)	(0.0142)	(0.0166)	(0.0139)	(0.0142)	(0.0142)	(0.0140)	(0.0174)
MJCHANGE		-0.0485**						
		(0.0178)						
GINI			-0.0022**					
			(0.0009)					
LLY				0.0437			-0.1906	0.1879**
				(0.0309)			(0.3016)	(0.950)
BANK					0.0664*			
					(0.0399)			
PRIVATE						0.0237		
						(0.0378)		
LGDPL*LLY							0.0250	
							(0.0320)	
GINI*LLY								-0.0029
								(0.0025)
# Obs.	483	316	249	413	405	415	413	228
DF	474	308	239	403	395	405	402	217

[20] Estimated by OLS. All specifications include time dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

Table 9
Human Capital Accumulation with Fixed Effects[21]

Dependent Variable: GEDUC

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	-1.5142	-0.1301	-3.1166*	-2.6166*	-2.9200*	-2.6582*	-2.3292	-3.3364*
	(2.5863)	(1.8529)	(1.5316)	(1.5570)	(1.5340)	(1.5791)	(1.7828)	
LLAB	0.1437*	0.2300*	0.2557**	0.1519**	0.1821**	0.1585**	0.1222	0.2177**
	(0.0773)	(0.1355)	(0.1064)	(0.0813)	(0.0861)	(0.0816)	(0.0904)	(0.1069)
LCAP	-0.0056	-0.0851**	-0.0122	0.0297	0.0230	0.0286	0.0403	0.0219
	(0.0256)	(0.0442)	(0.0337)	(0.0312)	(0.0345)	(0.0327)	(0.0342)	(0.0368)
LEDUC	-0.3662**	-0.5762**	-0.4845**	-0.4454**	-0.4684**	-0.4234**	-0.4529**	-0.5536**
	(0.0380)	(0.0607)	(0.0620)	(0.0504)	(0.0520)	(0.0492)	(0.0514)	(0.0725)
MJCHANGE		-0.0684**						
		(0.0187)						
GINI			0.0004					
			(0.0017)					
LLY				0.0900			0.5122	-0.1351
				(0.0904)			(0.5658)	(0.2158)
BANK					0.0810			
					(0.0709)			
PRIVATE						-0.0475		
						(0.0920)		
LGDPL*LLY							-0.0457	
							(0.0605)	
GINI*LLY								0.0065
								(0.0044)
# Obs.	483	316	249	413	405	415	413	228
DF	392	228	169	324	318	327	323	149

[21] Estimated by OLS. All specifications include time and country dummies. Dummy coefficient estimates are available upon request. ** indicates statistical significance at the five percent confidence level while * indicates statistical significance at the ten percent confidence level.

REFERENCES

Alesina, Alberto, Sule Özler, Nouriel Roubini, and Phillip Swagel, "Political Instability and Economic Growth," Journal of Economic Growth, Vol. 1, (1996), 189-211.

Alesina, Alberto and Roberto Perotti. "Income Distribution, Political Instability and Investment," European Economic Review, (1996), forthcoming.

Alesina, Alberto and Dani Rodrik. "Distributive Politics and Economic Growth," Quarterly Journal of Economics, Vol. 109, (1994), 465-490.

Barro, Robert J. "Determinants of Economic Growth: A Cross-Country Empirical Study," NBER Working Paper no. 5698, (1996).

Barro, Robert J. and Jong Wha Lee. "International Comparisons of Educational Attainment," Journal of Monetary Economics, Vol. 32, (1993) 363-394.

Barro, Robert J. and Xavier Sala-i-Martin, Economic Growth, (McGraw Hill: New York), (1995).

Banerjee, A. and A. Newman. "Risk Bearing and the Theory of Income Distribution," Review of Economic Studies, Vol. 58, (1991), 211-265.

Benabou, Roland. "Equity and Efficiency in Human Capital Investment: The Local Connection," Review of Economic Studies, Vol. 63, (1996), 237-264.

Bencivenga, Valerie R. and Bruce D. Smith. "Financial Intermediation and Endogenous Growth," Review of Economic Studies, Vol. 58, (1991), 195-209.

Benhabib, Jess and Boyan Jovanovic. "Externalities and Growth Accounting," American Economic Review, Vol. 81, (1991), 82-113.

Benhabib, Jess and Mark M. Spiegel. "The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data," Journal of Monetary Economics, Vol. 34, (1994), 143-173.

Benhabib, Jess and Aldo Rustichini. "Social Conflict, Growth and Income Distribution," Journal of Economic Growth, Vol. 1, (1996), 125-142.

Caselli, Francesco, Gerardo Esquivel, and Fernando Lefort, "Reopening the Convergence Debate: A New Look at Cross-Country Growth Empirics," Journal of Economic Growth, Vol. 1, No. 3, (1996), 363-390.

Cukierman, Alex, Sebastian Edwards and Guido Tabellini. "Seigniorage and Political Instability," American Economic Review, Vol. 82, (1992), 537-555.

Deininger, Klaus and Lyn Squire. "A New Data Set Measuring Income Inequality," World Bank Economic Review, Vol. 10, no. 3, (1996) 565-591.

Dhareshwar, Ashok and Vikram Nehru. "A New Database on Physical Capital Stock: Sources, Methodology and Results," Revista de Analisis Economico, Vol. 8, No. 1, (1993), 37-59.

Easterly, William and Sergio Rebelo "Fiscal Policy and Economic Growth: An Empirical Investigation," Journalof Monetary Economics, Vol. 32, (1993), 417-458.

Easterly, William, Norman Loayza, and Peter Montiel, "Has Latin America's Post-Reform Growth Been Disappointing?," World Bank mimeo, August (1996).

Galor, Oded and Joseph Zeira. "Income Distribution and Macroeconomics," Review of Economic Studies, Vol. 60, (1993), 35-52.

Greenwood, Jeremy and Boyan Jovanovic. "Financial Development, Growth, and the Distribution of Income," Journal of Political Economy, Vol. 98, (1990), 1076-1107.

Grossman, Herschel. "A General Equilibrium Theory of Insurrections," American Economic Review, Vol. 81, (1991), 912-921.

Islam, Nazrul. "Growth Empirics: A Panel Data Approach," Quarterly Journal of Economics, Vol. 110, (1995), 1127-1170.

Jodice, D., and D. L. Taylor. World Handbook of Social and Political Indicators, (New Haven: Yale University Press), (1983).

King, Robert G., and Ross Levine. "Finance and Growth: Schumpeter Might Be Right," Quarterly Journal of Economics, Vol. 108, (1993a), 717-738.

———, "Finance, Entrepreneurship, and Growth," Journal of Monetary Economics, Vol. 32, (1993b), 513-542.

Levine, Ross and David Renelt. "A Sensitivity Analysis of Cross-Country Growth Regressions," American Economic Review, Vol. 82, no. 4, (1992), 942-964.

Levine, Ross and Sara J. Zervos. "What Have We Learned About Policy and Growth from Cross-Country Regressions?," American Economic Review, Vol. 83, no. 2, (1993), 426-430.

Ljungqvist, Lars. "Economic Underdevelopment: The Case of a Missing Market for Human Capital," Journal of Development Economics, vol. 40, no. 2, (1993), 219-239.

Londregan, John B. and Keith T. Poole, "Poverty, the Coup Trap, and the Seizure of Executive Power," World Politics, Vol. 42, no. 2, 151-183.

Mankiw, N. Gregory, David Romer, and David N. Weil. "A Contribution to the Empirics of Economic Growth,"Quarterly Journal of Economics, Vol. 106, (1992), 407-437.

Murphy, Kevin M., Andrei Shleifer and Robert W. Vishny. "The Allocation of Talent: Implications for Growth," Quarterly Journal of Economics, Vol. 105, (1991), 503-530.

Nelson, Richard R. and Edmund S. Phelps. "Investment in Humans, Technological Diffusion, and Economic Growth," American Economic Review, Vol. 56, (1966), 69-75.

Perotti, Roberto. "Political Equilibrium, Income Distribution, and Growth," Review of Economic Studies, (1993)

Perotti, Roberto. "Growth, Income Distribution, and Democracy: What the Data Say," Journal of Economic Growth, Vol. 1, (1996), 149-187.

Persson, Torsten, and Guido Tabellini. "Is Inequality Harmful For Growth?" American Economic Review, Vol. 84, no. 3. (1995), 600-621.

Romer, Paul M. "Endogenous Technological Change," Journal of Political Economy, Vol. 98, part II, (1990), S71-S102.

Solow, Robert M. "A Contribution to the Empirics of Economic Growth," Quarterly Journal of Economics, Vol.70, (1956), 65-94.

Tornell, Aaron and Andres Velasco. "The Tragedy of the Commons and Economic Growth: Why Does Capital Flow from Poor to Rich Countries?," Journal of Political Economy, Vol. 100, (1992), 1208-1231.

Veneiris, Y. and D. Gupta. "Income Distribution and Socio-Political Instability as Determinants of Savings: A Cross-Sectional Model," Journal of Political Economy, Vol. 96, (1986), 873-883.

Young, Alwyn. "Lessons from the East Asian NICs: A Contrarian View," European Economic Review, Vol. 38, no. 3-4, (1994), 964-973.