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Economic Growth

A Review of the Theoretical and Empirical Literature

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Some countries have achieved rapid growth rates and caught up with wealthier countries while others have achieved little or no growth. Efforts to determine the reasons for these differences are an important theoretical and empirical task.

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This paper — a product of the Macroeconomic Adjustment and Growth Division, Country Economics Department — is part of a larger effort in PRE to analyze the policy determinants of economic growth. This research was part of the preparation of a research project "Do National Policies Affect Long-run Growth?" Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Raquel Luz, room N11-059, extension 34303 (42 pages).

In recent years, economists have developed new models of endogenous economic growth that consider policy influences on growth and divergent outcomes among countries. These models deal with such issues as growth, the operation of financial markets, trade policy, government expenditures, and taxation.

Using the standard neoclassical growth model as a point of departure, Renelt reviewed important recent developments in growth theory. He analyzed the methodology of several endogenous growth models and examined models aimed at particular policy issues.

One reason for the success of the standard neoclassical growth model, Renelt writes, is that it provided a convenient tool for organizing data on the sources of economic growth. The model left much of the growth unexplained, however.

Cross-sectional analysis has provided some useful insights into the growth process. More direct estimation of productivity growth and production functions in developing countries along the lines suggested by existing growth accounting studies could be very useful.

Economists working in this area should target their work directly to the analysis of policy options in developing countries. More work also is necessary at the sectoral level. The new models of growth have not adequately described the issues of structural transformation and disequilibrium in factors markets. The existence of spillovers and increasing returns probably is more important in the industrial sector of developing countries. Policymaking generally will benefit from empirical results generated from more carefully constructed structural economic models.

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This paper was completed while the author was a summer intern at the World Bank. It is being issued posthumously in respectful memory of the author. The paper was discussed with William Easterly, Ross Levine, and Sergio Rebelo, but the work remains entirely the author's.

I. Introduction

Economists have long been interested in the factors which cause different countries to grow at different rates and achieve different levels of wealth. This issue is especially relevant today. The 1990 World Bank World Development Report highlights the scale of global poverty and the importance of economic growth in alleviating poverty. The historical record shows a broad range of outcomes in achieving sustained economic growth. Some countries have achieved high incomes while many remain at lower levels. Recent history particularly highlights this fact with some countries, particularly East Asian, achieving very rapid rates of growth and catching up with already wealthy countries while others, particularly Sub-Saharan Africa, have achieved little or no growth. Determining the reasons for these differences remains an important theoretical and empirical task. We review recent theoretical advances in growth theory which are potentially relevant to development policymakers and the existing empirical literature on the determinants of economic growth.

Although neoclassical economic theory has become dominant in economic analysis, development economists have been reluctant to adopt neoclassical growth theory as it predicts stable growth independent of policy decisions Chenery (1986) makes the case for the inadequacy of the neoclassical equilibrium approach for developing countries as it does not take into account disequilibrium factors such as internal demand constraints, external market constraints, economies of scale, learning by doing, and imperfect factor markets. In recent years, economists working within neoclassical theory have provided models which address a number of issues raised by development economists.[1] In particular, new models of endogenous economic growth have been developed which allow for policy

[1]For example, see Murphy,Shleifer, and Vishny (1989a,b).

influences on growth and divergent outcomes among countries. These models deal with general issues of growth and important policies such as the operation of financial markets, trade policy, and government expenditure and taxation.

In the following section we present a review of the recent developments in growth theory. It begins with a discussion of the standard neoclassical growth model due to Solow (1956), followed by an analysis of the methodology of endogenous growth models and a review of models aimed at particular policy issues. Since the relevance of these models for development policymaking is ultimately an empirical issue, the available evidence on determinants of growth is also presented in Section III.[2] It will be apparent that there exists a relatively weak link between the theory and empirical reviews. This suggests the need for additional empirical work which will help development policymakers operationalize the insights provided by economic theory.

II. Theories of Economic Growth and Policy

A. Basic Neoclassical (Solow) Model

The workhorse model of traditional neoclassical growth theory is that due to Solow (1956). The general properties of this model are well known so the discussion here is quite limited (see also, section III.A). The major innovation introduced by Solow was to allow for factor substitutability so that stable equilibrium growth could be obtained. This model is consistent with a number of stylized facts related to economic growth such as the relative constancy over time of the capital-output ratio and factor income shares. The major difficulty with this model is that growth in per capita output converges to zero in the

[2]The review of growth theory draws on Romer (1989c) while the review of the empirical evidence draws on Chenery (1986) and Easterly and Wetzel (1989).

steady state. In order to have steady state growth exogenous technological change was introduced. A problem from the standpoint of policymaking in developing countries is that policies have no effect on growth in the steady state of the Solow model. For example, there is evidence of a positive correlation across countries between investment rates and growth, but in the Solow model this would affect the long-run level of output but not the growth rate[3].

A number of other empirical findings suggest problems with the Solow model. One implication of the model is that countries with similar technologies and preferences will converge to the same steady state output levels. This does appear to hold for some groups of economies.[4] However, De Long (1988), Quah (1989), and Romer (1989c) show that there is little evidence of convergence for a broad sample of countries. This is especially true for the developing countries, Easterly (1990a) demonstrates that many show little or no evidence of sustained economic growth. Explaining persistent differences in growth rates and income levels through exogenous differences in technology levels or growth is clearly inadequate.

Another piece of evidence suggests the inadequacy of the Solow model. Numerous researchers have found that GNP displays long-term persistence to shocks. Nelson and Plosser (1982) were the first to argue for the existence of a unit root in U.S. GNP as opposed to variation around a deterministic trend.

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[3]The growth rate would be affected along the transitional path but explaining historical growth rates with transitional dynamics may create other counterfactual implications as discussed by King and Rebelo (1989a). There may also be a positive association between growth and investment if technological change varies across countries which induces greater savings in countries with greater growth.

[4]See Baumol and Wolff (1988), Dowrick and Nguyen (1989) on productivity convergence in the OECD, and Barro and Sala-i-Martin (1989) on the U.S. states.

Campbell and Mankiw (1987) also present evidence of persistence while Blanchard and Quah (1989) find persistence of shocks identified as supply but not to demand shocks. Evidence provided by Campbell and Mankiw (1989) and Kormendi and Meguire (1990) suggest persistence also holds for a broader group of countries. This evidence is suggestive although the methodological and economic issues are still disputed.[5] King and Rebelo (1988) discuss the potential importance of this fact for alternative growth models. In the Solow model shocks will not be persistent with trend stationary technological change, though they may be if technology follows a random walk. Endogenous growth models are capable of generating random walk behavior of output even if shocks are trend stationary. This is important to development policymakers for understanding the potential long-term effects of shocks such as the debt crisis.

A further problem for the Solow model, discussed by Lucas (1990), is that it predicts resource flows which are not observed. The basic model suggests that the returns to capital must be many times higher in the developing than in the developed countries. This would imply that most new investment would occur in the developing countries but this does not occur. Differential policies and political risk may dampen this effect, but the implied return differentials are probably too great to be explained by these factors alone. Even if it could be shown that returns to capital were roughly equal the Solow model suggests equalization of wages would also result (with similar technology equalized returns require that there is a similar amount of capital per worker which implies similar wages) which contradicts observed wage differentials and flows of workers. The understanding of international capital flows and immigration are also important in development policymaking.

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[5]See Cochrane (1988) and Christiano and Eichenbaum (1989).

B. Endogenous Growth Models

Given the empirical and policy difficulties associated with the Solow model a number of new models of economic growth have been proposed which attempt to endogenize the growth process. This section presents a review of the basic approaches underlying these models, following Romer (1989c), while the next presents policy applications. The two major approaches are to remove the fixed factor constraint of the Solow model by allowing constant returns to reproducible factors or to endogenize technological change by explicitly modeling the introduction of new technologies.

The simplest model which demonstrates the first approach is a model in which capital is linearly related to output as found in Rebelo (1987). In this model the production function takes the very simple form $Y=AK$ where K may be considered a composite of physical and human capital. It is easy to demonstrate that sustained per capita output growth is possible without resorting to exogenous technical change.[6] Assuming maximization of a utility function exhibiting constant relative risk aversion by an infinitely lived consumer yields a perpetual growth rate of $g=(A-\rho)/\sigma$, where ρ is the discount rate and $1/\sigma$ is the intertemporal elasticity of substitution. It is apparent that economies where consumers are more patient (low ρ) and more willing to substitute over time (low σ) will grow faster. However, it does not seem appealing to rely on differences in tastes to explain differences in growth. A more appealing explanation is that factors which affect the marginal product of capital will have sustained growth effects. This approach may be extended to multiple

[6]The view of Scott (1989) is similar since he argues all growth occurs through investment and changes in quality adjusted labor.

sectors. Rebelo shows that sustained growth is possible as long as a core of capital goods are able to be produced without fixed factors. Jones and Manuelli (1990a) demonstrate that technology need not be linear in capital for sustained growth, but that relaxing the Inada condition at infinity may be sufficient (i.e. $\lim_{k\to\infty} f'(k)=b$ and $b-\delta>$discount rate). A production function which may satisfy this condition is $Y=aK^{\alpha}L^{1-\alpha}+bK$ so their approach is similar to assuming linear production. A problem with the linear production approach is justifying the constant returns to reproducible factors when fixed factors are observed.[7]

Romer (1986) resolved this difficulty by adopting Arrow's (1962) learning-by-doing framework. The argument is that knowledge generation may be positively related to the scale of economic activity which is assumed to be proportional to capital accumulation. In order to have sustained growth there must be at least constant returns to reproducible factors. This implies increasing returns overall which would violate a condition for competitive behavior. Romer posits that there may be spillovers so that an individual firm faces constant returns (diminishing returns to capital) but there are increasing returns overall. The production function takes the form $y=Ak^{\alpha}l^{1-\alpha}K^{\epsilon}$ $(\alpha+\epsilon\geq 1)$ where y,k, and l represent firm level quantities and K is aggregate capital. Romer shows that stable growth paths are feasible in this model without relying on technological change. One implication of Romer's framework is that there will be too little capital accumulation in a private economy due to the external effect.

A similar set-up is employed by Lucas (1988) who utilizes Uzawa's (1965)

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[7]This may not represent a large problem for empirical and theoretical applications as getting near linear production generates steady state results of the Solow variety but the transition periods are quite long. See Mankiw, Romer, and Weil (1990) on human-capital augmented Solow model. Easterly (1990a) presents models in which the fixed factor constraint is endogenous.

model of human capital accumulation. Lucas proposes an aggregate production function of the form $Y=AK^{\alpha}(unh)^{1-\alpha}h^{\gamma}$ where h is average human capital, u is proportion of human capital used in final goods production, and n is population. This form allows for an externality to human capital which helps to explain observed international flows of capital and workers. In order to have sustained growth there must still be linear production in the human capital producing sector. The problem facing both the Romer and Lucas approaches is to find externalities which are empirically large enough to justify the functional forms employed. The additional problem facing the Lucas (and Rebelo) model is that human capital probably cannot be accumulated without bound.

A problem with the externality approach is that there appears to be little incentive to produce knowledge in this framework as technology is not compensated, but one observes firms actively undertaking research and development. Some of these problems are avoided by explicitly modelling the accumulation of knowledge. Romer (1990a,b) deals with this problem by recognizing the need to introduce non-competitive behavior in order to model the fixed cost nature of producing knowledge. He posits an aggregate production function of the form $Y=L^{1-\alpha}\int^{n} x_i^{\alpha}di$ where the x's are intermediate capital goods. At any one time a given range of the intermediate goods are produced. Each intermediate good requires a fixed outlay to invent so that an equilibrium with monopolistic competition exists. In this model, it is possible to have sustainable growth through the continued introduction of new intermediate products. Thus, policies which affect capital accumulation have growth effects. Policies which shift human capital to the research sector will cause higher growth but general investment incentives need not generate more growth as they raise returns in both sectors.

Another model which introduces endogenous technical change is a Schumpeterian model of growth through creative destruction by Aghion and Howitt (1989). They allow for learning-by-doing and the fact that new innovations may make old ones obsolete. Whereas in the Romer model the private equilibrium will generally have too little research there may be too much research in the Aghion and Howitt model. This approach can also be extended to account for copying of existing technologies by firms in developing countries.[8] These approaches seem preferable to relying on external effects which are difficult to observe and probably not of the magnitude necessary to generate sustained growth. A problem is that the empirical implications of these models are less clear as technological progress and the factors influencing it are difficult to measure.

C. Policy Applications of Growth Theory

The above models provide the basic framework for considering endogenous growth in a general equilibrium framework. However, given the broad nature of the results there is still little information for policymakers. A number of models have been developed along the above lines to deal with more specific policy and empirical issues. Many of these issues have also been of concern to developing countries.

1. Human Capital and Education

Development economists have long been concerned with human capital formation.[9] Endogenous growth models, such as Lucas (1988) above, allow for

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[8]A model of imitation and entrepreneurship is presented by Schmitz (1989). Models of trade and imitation are discussed by Grossman and Helpman (1989a,c) and Rivera-Batiz and Romer (1989).

[9]See Psacharopoulus (1984) and Schultz (1988).

significant effects of human capital accumulation on economic growth. Azariadis and Drazen (1990) posit a threshold externality for human capital. In their model human capital becomes more productive once a certain level of human capital accumulation is reached. They argue that growth rates will be positively correlated with the level of human capital relative the income level. This allows for the existence of multiple growth equilibria and an explanation for non-convergence. A model by Becker, Murphy, and Tamura (1989) allow for interactions between human capital accumulation and population growth. They show it is possible for countries to become trapped in an equilibrium with low human capital per worker and high rates of fertility as there exists lower returns to investing in human capital relative to more children. Stokey (1990) presents a model with heterogeneous labor and goods with growth driven by human capital accumulation. She claims the model helps explain the East Asian experience of growth in education, growth in trade, and changing composition of output. Arrau (1989) discusses human capital and growth in a life cycle model. He argues that if human capital is the engine of growth than tax policies which more heavily tax human than physical capital will adversely affect growth. Chamley (1990) discusses some implications of the tradeoff between human capital and physical capital accumulation in open economies. He argues that having a low level of physical capital at initial stages of development may lead to higher level of output on the balanced growth path as the returns to human capital will be higher, encouraging greater accumulation. Jones and Manuelli (1990b) discuss an overlapping generations model of endogenous growth and find that policies which redistribute income to the young, such as public education, may increase growth. These models suggest that government policies to promote education and human capital formation can have large impacts on long-run economic growth which should

be considered by policy makers in developing countries.

2. Government Spending and Taxation

Development economists have also been interested in the effects of government spending, taxation, and related distortions in developing countries. An obvious policy implication pointed out by Jones and Manuelli (1990a), Rebelo (1987), and Romer (1986) is that capital taxation (or subsidization) may have significant growth effects in the endogenous growth models whereas it would only have level effects in the Solow model.[10] King and Rebelo (1990) parameterize a model and show that fairly modest levels of taxation may be sufficient to totally stop growth. Rebelo (1990) discusses the importance of international capital markets for these results as differences in returns caused by taxation may cause capital flight which would allow GNP to grow even if GDP did not. Barro (1990) includes productive government spending in a model of endogenous growth. In this model growth is increasing for low levels of government expenditure (and taxation) and then decreasing when the government becomes too big relative to technical efficiency. This analysis also suggests that different types of government expenditure may have differing impacts on growth. His model also suggests that the relative efficiency of different governments will influence their relative growth rates.[11] Easterly (1990b) presents a model in which distortions between different types of capital causes growth effects which may be related in a nonlinear way to policy variables. This may be especially

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[10]In the Jones and Manuelli (1990) taxation may have either growth or level effects depending on the relative size of the tax distortion. A number of tax related issues in endogenous growth models are reviewed by Barro and Sala-i-Martin (1990).

[11]Reynolds (1983) also argues that a major cause of country variations in growth is the efficiency of governments in mobilizing resources.

important in developing countries which have narrower tax bases. It would be important for policymakers to understand the relative importance of these effects for long-term growth. Also, factors such as political instability and property rights may have effects similar to capital taxation by increasing the uncertainty associated with investment decisions.

3. Trade Policy

Given the success stories of the East Asian countries, development economists have been interested in the links between foreign trade and economic growth. Many developing countries have significant trade distortions through tariff or quota barriers which generate inefficient allocation of investment and rent-seeking behavior. Because trade distortions would have only level effects in the Solow model the discussion has moved to the relationship between trade policy and productivity growth.[12] A number of recent studies explore these issues within models of endogenous growth. Romer (1990a) notes a general implication of endogenous growth theories is that through increasing the scale of spillovers or available technologies openness to trade should increase growth.[13] Further research has suggested modifications to this result.

The work of Grossman and Helpman (1989a,b,c,1990b,1990a reviews major results) has focused on the application of models of endogenous technological change to trade issues. They find that quotas which generate rent-seeking behavior may have significant growth effects through the misallocation of resources. They also show that the impact of tariffs and trade policy on growth

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[12]See recent treatments by Edwards (1989) and De Melo and Robinson (1989). See Rodrik (1988) for skeptical view of trade policy and growth links.

[13]Backus, Kehoe, and Kehoe (1990) attempt to test for scale effects with fairly weak results.

depends on the sector which is targeted for protection. This is particularly relevant when differences in comparative advantage for research exist. If there is a research sector and final goods sector, then protection of the research sector by the country with comparative advantage in research may stimulate growth while protection of the final goods sector by this country will probably lower growth. They also discuss economic growth in North-South models of international trade. It is hard to generalize the potential impacts of trade policy on growth as the results depend on the specification of technological change and imitation. Models based on quality upgrading along the lines of Aghion and Howitt (1989) also show that research and development may be excessive. Further, they show that policies to increase growth in an open economy may not lead to welfare gains when there is imperfect competition.

Recent work by Rivera-Batiz and Romer (1989) also discusses trade policy and growth. They identify a number of channels through which international conditions can affect growth besides through expansion of market size. The knowledge spillover channel generally leads to greater growth although communications may be as important as direct trade. The redundancy effect suggests that freer trade will increase growth as less resources will be used reinventing existing technologies. Like in the Grossman-Helpman models, they find ambiguous effects of trade policy through the allocation effect. Basically, policies which encourage allocation of human capital to research may increase growth. They find there may exist a non-monotonic effect of tariffs on trade with low tariffs reducing growth and very high tariffs increasing growth. However, high protection generally has substantial negative level effects. Rivera-Batiz (1989) presents a North-South model of trade and growth in which trade openess in the South allows the poor country to escape a no growth trap.

He also shows that trade barriers in the South can lower the world growth rate.

It appears that even in very aggregative models that few strong conclusions can be drawn concerning the relationship between growth and trade policy. A major difficulty with these models is that it is hard to explain differences in growth rates among countries when they are open to trade. One could explain differences between countries open to trade and those completely closed but this does not seem satisfying as a complete theory of growth differentials between countries.

4. Financial Markets

Development economists have also been concerned about the role of financial factors in development. It has been argued by McKinnon (1973) and Shaw (1973) that financial repression (particularly depressed interest rates) slows growth through retarding savings and promoting inefficient investment allocation.[14] Recent studies have addressed the issue of financial markets and growth. Rather than focusing on the relationship between savings and interest rates (which is theoretically ambiguous) they focus on firm behavior in a risky environment with financial constraints. Greenwood and Jovanovic (1989) present a model in which growth and financial structure are both endogenous. In their model increased financial intermediation increases growth by raising the return to capital which promotes greater investment. Studies by Greenwald and Stiglitz (1989) and Greenwald, Salinger, and Stiglitz (1990) suggest that capital market

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[14]See recent reviews by Balassa (1989), Fry (1988), Gelb (1989), and World Bank (1989). The empirical evidence is mixed. Dornbusch and Reynoso (1989) argue that significant financial instability retards growth but not general financial repression.

imperfections may slow productivity growth. The main reason is that investments in productivity improvement may be more risky with financing constraints which can be alleviated with improved capital markets. Levine (1990) presents a model in which the functioning of a stock market affects the rate of growth and technological change. He shows that in addition to the usual tax effects on growth that taxation of financial market activity may lower growth rates. Bencivenga and Smith (1988) also present a model in which financial intermediation increases growth by increasing the quantity of savings in productive assets as opposed to more liquid but unproductive assets. This work may have implications for government policy to promote financial markets in developing countries.

III. Empirical Studies of Economic Growth and Policy

A. Issues and Methods

The above discussion highlights a number of ways in which policy choices may affect economic growth. One difficulty is that given the tools of endogenous growth theory almost any policy choice can be shown to have growth effects through its effect on the accumulation or allocation of physical or human capital. Empirical work is needed to identify the actual magnitudes of potential growth effects of policy. The methodology of studies is first reviewed and then results from studies based on growth accounting and cross-sectional analysis are presented.

A number of studies have attempted to study economic growth within a neoclassical framework. The normal methodology of these growth studies [following Chenery (1986)] is to begin with a neoclassical production function of the form:

(1) $$Y_t = A_t F(K_t, L_t)$$

Putting this in growth terms yields:

(2) $$G_Y = G_A + \beta_K G_K + \beta_L G_L$$

where $\beta_i=(\partial Y/\partial Z)(Z/Y)$ and G_i indicates percentage growth in variable Z. With constant returns to scale and perfect competition the β's will represent the factor share in output. The pioneering work of Solow (1957) used the observed shares and growth rates of capital and labor to decompose the contributions of capital and labor to output growth. The famous "Solow residual," representing growth which can not be explained by input growth, gives the growth in total factor productivity (TFP) which is assumed to come from exogenous technical change. Numerous researchers have followed Solow in attempting to account for economic growth for different countries and periods. Studies in this vein are reviewed below under growth accounting.

The growth accounting exercises usually work with time-series data for a single country. A number of studies have attempted to use this formulation to estimate the neoclassical model across countries. Since capital stock data is generally not available the equation usually estimated is:

(3) $$G_Y = \alpha_0 + \alpha_1(I/Y) + \alpha_2 G_L$$

With this formulation, and the assumption capital-output ratios and technology are the same across countries, α_1 should represent the marginal product of capital and α_2 the labor share. Most cross-sectional studies begin with this basic equation and then add other explanatory variables. Within a neoclassical, equilibrium framework there would appear to be little justification for this approach. Chenery (1986) argues that if disequilibrium effects are allowed then structural variables may be included in this formulation. For example, a number of studies include growth of exports as an additional variable under the

assumption that for developing countries exports (or imports) are an additional factor of production as there may be technological differences between home and foreign or tradeable and nontradeable goods.[15] These studies generally find growth of exports to be positively related to output growth, but there are obvious problems of reverse or common causality in this formulation.[16]

Another way of formulating the problem to allow for structural variables is to recognize that many developing countries may not be on the world production frontier. If (1) represents the world frontier, the production function for country i may be:

$$Y_t = (1-\theta_{it})A_t F(K_t, L_t) \tag{4}$$

where θ represents a measure of a countries productive technology relative to world technology (θ=0 indicates no gap). A number of factors could influence the level of θ in developing countries such as share of output in agriculture, share of exports, and educational attainment. A number of studies include changes in these types of variables to capture the effect of increasing productive efficiency. It could also be true that θ would be negatively correlated with initial income so that this variable may be important.[17]

Other sources of differences in growth may include differences in taxation, infrastructure, financial markets, trade distortions, and political stability. These factors would tend to affect the level and allocative efficiency of investment expenditures. However, within the basic neoclassical model these

[15]Examples include Balassa (1978,1985), Tyler (1981), Feder (1983), Ram (1985), and Moschos (1989).

[16]Jung and Marshall (1985) use Granger causality methodology and find little support for causation running from export growth to output growth. Rittenberg (1989) also discusses the problems of relating growth in any component of GDP to GDP growth.

[17]This should not be confused with the convergence predicted in the Solow model which is the result of different initial levels of capital per worker.

factors would tend to affect levels of output but not rates of growth in the steady state, although they may affect the speed of transition to the steady state and so yield growth effects. Endogenous growth models allow more scope for growth effects through these variables. A number of studies include variables to measure these factors and are reported below.

An obvious danger with the approach described here is that since the theory puts little restriction on possible relationships many variables can be found to be correlated with growth because there may exist common causality, reverse causality, or simply spurious correlation. One example demonstrating this problem is that of Scholing and Timmermann (1988) who include 118 independent variables in their study and find "almost all the socio-economic variables considered show significant direct and/or indirect growth effects." In the studies reported below about 50 separate independent variables are included in at least one study and most are shown to have statistically significant partial correlations with growth. This problem is further illustrated in Table 1 where nearly all the possible independent variables included in the Barro (1989b) data set are included in regressions explaining economic growth, growth controlling for investment level, and investment. The results show that it is possible to find a significant relationship between growth and many of the variables. This suggests that one should not put excessive emphasis on the growth effects for policy variables found in cross-section analysis. Particularly when the studies do not control for variables which may be closely related to the one being examined.[18] There exists a need to more explicitly model the potential impact of policy variables on growth in order to understand the true interactions.

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[18]Levine and Renelt (1990) conduct sensitivity analyses for a number of macroeconomic variables. They find few partial growth correlations are robust to the inclusion of alternate independent variables.

A further methodological problem is that the dynamic relationship between variables may not be adequately captured by a linear regression. A number of the theoretical works described non-linear relationships between independent variables and growth and the existence of threshold effects and low-level traps. This would again necessitate more detailed specification of the structural forms which must be estimated in order to account for policy influences on growth.

B. Growth Accounting

Growth accounting has been a popular means of organizing data to describe economic growth. As discussed above the major task is to measure the growth contributions of factor inputs. This framework can be augmented by considering other factors which impact the efficiency of resource allocation. The results from such exercises can also provide insights into policy variables which vary across countries or time. In this section basic results from growth accounting are reviewed along with recent attempts to consider increasing returns and externalities.

A number of representative growth accounting studies are included in Table 1. A notable feature being the high share of TFP which is unexplained in the model. The variance in absolute level of TFP growth must also be considered significant since all countries should have access to similar technology. Chenery (1986) reviews a wide range of studies and reports that in developed countries labor growth averages 1.1% year, capital growth averages 5.2%, and output 5.4% with total factor productivity contributing 50% of total growth. For developing countries labor growth is higher (3.3%) and total factor productivity accounts for approximately 30% of growth. Nishimizu and Page (1990) compare industry level TFP growth in a number of countries. They find that within

countries TFP differentials among 2-digit industries decrease markedly with income level, and that within industry groups there is greater variability between countries than within countries suggesting the importance of country effects which may be influenced by policy. It would be useful to understand why TFP growth varies so widely among countries and particularly why it is lower in most developing countries.

Maddison (1987) performs a growth accounting exercise for six developed countries. He obtains similar results with the neoclassical methodology but also adds supplementary variables (in the spirit of Denison) which may be important for developing countries such as changes in economic structure, convergence, foreign trade, economies of scale, natural resource discoveries, government regulation, labor hoarding, and capacity utilization. Adding these variables reduces the average unexplained growth from 2.73% to 1.17% for the period 1950-73. However, the unexplained portion still ranges from 35 to 7 percent of total growth, and the residual ranges from 1.81 to .64.

One of the difficult issues in growth accounting is the precise measurement of capital input.[19] A recent study of the U.S. by Jorgenson, Gollop, and Fraumeni (1987) finds that the quality-adjusted capital can explain a major portion of post-war growth (46%) and that the residual can be reduced to 23% of total growth. This represents an improvement which may be important for other studies. Bailey and Schultze (1990) argue that these results differ from other studies primarily in the measurement of output as Jorgenson et. al. use gross output (including services from capital such as consumer durables) whereas other studies use net output.

The literature on endogenous growth with constant returns to reproducible

[19]See Jorgenson (1989) and Norsworthy (1984) for discussion.

factors suggests that the capital contribution to growth may be understated in traditional growth accounting exercises. Romer (1987) argues that growth accounting does not adequately explain the significant correlation between output and capital growth. He runs a regression with different countries and time periods and finds:

$$G_Y = \underset{(.003)}{.2} + \underset{(.08)}{.87*G_K} + \underset{(.18)}{.04*G_L}$$

He argues that externalities to capital accumulation are necessary to explain this finding. Benhabib and Jovanovic (1989) find this relationship does not hold in the U.S. time series. They also show that with added assumptions on the evolution of labor supply and technological change that the econometric estimates in Romer's regression are biased towards showing $^{H}\gamma_K=1$ and $^{H}\gamma_L=0$. They argue there is no strong evidence of increasing returns or capital externalities. Their results may be sensitive to the particular model they develop. In particular, they argue causality goes solely from knowledge to capital whereas the view of Romer (1986) and Scott (1989) is that knowledge is generated through investment. The Romer results may be consistent with the Solow model because in the Solow steady state capital and output will grow proportionately.

Since many of the new growth models focus on human capital it may be necessary to more adequately account for changes in this factor. Most studies which consider this issue assume wages reflect labor's marginal product and changes in human capital will show up in the changing composition of the labor force in which different types of labor are weighted by wages and labor share. This may be inadequate if there exist significant externality effects for human capital or labor markets are imperfect. Psacharopoulos (1984) discusses a number of problems which may cause the contribution of education to growth to be

understated in traditional studies, particularly in developing countries. He also reviews the evidence showing high rates of return to education which suggests the potential for a significant contribution of education to growth.[Psacharopoulos 1985]

Numerous researchers have shown that the Solow residual follows the business cycle in time series. Hall (1989) tests an invariance property of the Solow residual. Under constant returns and perfect competition, productivity growth should be uncorrelated with exogenous variables that induce output changes but do not shift the production function. He finds correlations with such instruments and the Solow residual. His proposed explanations include the existence of monopolistic competition with increasing returns, measurement error in labor input, and external market benefits. Caballero and Lyons (1989) test for the existence of increasing returns which are internal and external to industries. For U.S. data, they find no evidence of increasing returns within industries (elasticity of output to input of .8) but find aggregate increasing returns (elasticity of output to input of 1.3). Using instrumental variables yields industry returns close to constant returns to scale and aggregate increasing returns. These findings are suggestive that the assumptions of the basic neoclassical model are inadequate.

C. Growth in Cross-Sections

Given the paucity of long-run time series data for a wide range of countries many researchers have investigated determinants of economic growth using cross-sectional data. This section presents a summary of a large part of this work. Specific topics related to the theories presented above are reviewed below. Table 3 presents information on a number of empirical studies. It can

be seen that a wide variety of variables show some correlation to economic growth. Some of these appear to be relatively robust over a range of sample groups and periods whereas others appear to be sensitive to sample selection and choice of specification.

The most robust correlation across samples and time periods is the positive correlation between investment and output growth. It is important to remember that investment is itself endogenous and may depend the other independent variables and on previous growth performance.[20] Romer (1990b) discusses the interpretation of this coefficient in regards to technical change. He argues that the usual estimates of the effect of investment on growth show evidence of both exogenous changes in investment promoting growth and exogenous differences in technological growth promoting investment. Many of the studies reviewed here do not separate the effects of explanatory variables acting directly on growth as opposed to through investment. The results presented in Table 1 suggest that many variables may affect growth solely through their impact on the level of investment (significant in columns one and three). Easterly and Wetzel (1989) also emphasize that it is as important to understand the factors affecting the efficiency of investment and the level of investment, since countries with similar investment rates show wide variation in growth rates. A number of variables in Table 1 are significantly correlated with both investment and growth controlling for investment suggesting that they may act both on the level and efficiency of investment. Most of the studies reported in Table 3 include level of investment as an independent variable so that the reported results for other variables may be picking up efficiency effects. The results in Table 1 also

[20]Some of the studies, such as Barro (1989a,b) and Easterly and Wetzel (1989), recognize the importance of this issue.

indicate that few variables are correlated with growth and not investment which again suggests the importance of accounting for endogenous investment. A further topic of research which will not be addressed in depth here is savings in developing countries.[21] With imperfect capital mobility the quantity of savings (foreign and domestic) available for investment may be constrained and influenced by policy choices. Also, savings behavior in developing countries may not fit the infinite-horizon utility maximizing approach used in the endogenous growth models.

Variables relating to human capital accumulation do not show as strong of a positive effect on growth. This is certainly an area in which measurement problems are very important. A number of variables, including primary and secondary enrollment ratios, literacy rates, and educational spending, have been included to account for the role of human capital on growth. However, it is unclear whether any of these variables accurately accords with the theoretical concept and the theoretical discussion is itself unclear on the correct measurement of human capital in relation to growth. There may also be very long lags associated with education investments and economic growth.[22] Another problem is the definitions and measurement of these variables tends to vary across countries and time. An important task for further empirical work should be the construction of better human capital estimates.

A number of studies focus on the relation of growth and government spending and taxation.[23] The general finding is that there is a negative correlation

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[21]See Deaton (1990), Gersovitz (1988), and Williamson (1988).

[22]See discussion by Easterlin (1981).

[23]Barro (1989a), Khan and Reinhart (1990), Landau (1983,1986), Ram (1986), and Diamond (1989) on spending. Marsden (1983), Manas-Anton (1987), Koester and Kormendi (1989) and Skinner (1987) on taxation.

between growth and government consumption expenditures (as share of GDP).[24] This would also suggest a negative correlation between tax levels and growth. Skinner (1987) found that personal and corporate income taxes depressed growth in African countries while trade and sales taxes did not affect growth. Manas-Anton (1987) failed to find a stronger negative effect for income vs. other taxes and Koester and Kormendi (1989) did not find evidence of a negative impact of marginal vs. average taxes. This is an area where non-linearities between distortions and economic growth may be important. Also, the structure of the economy and taxation varies across countries so that similar taxes may have different effects across countries.[25] Theory suggests that there should be a tradeoff between higher provision of public goods and the distortionary impact of taxation. An implication is that it matters if government spending is for productive purposes. However, government capital expenditures tend to show little relation to growth.[26] Barro (1989a) finds a positive correlation between government capital expenditure and growth but the effect is weaker than for total investment. Diamond (1989) analyzes a detailed breakdown of current and capital expenditures. He finds overall government expenditure to be negatively correlated with growth with some significant positive growth effects for directly productive current expenditures and capital expenditures for education (which may proxy for human capital investment), but no strong effects for general

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[24]Levine and Renelt (1990) find that the results depend to some degree on the choice of data sets with government consumption expenditures being fairly strongly negatively related to growth with the Summers-Heston (1988) data set but not with a World Bank national accounts data set.

[25]See discussion of differential tax effects in Shah and Whalley (1990).

[26]Aschauer (1989) finds a strong relationship between government capital stock (particularly infrastructure) and productivity in the U.S. Shah (1988) finds that government capital in Mexico is productive but less so than private capital.

infrastructure expenditure.

International trade is an important issue in discussions of developing country growth.[27] As mentioned above, many studies find a positive correlation between export and output growth but this is subject to causality problems. A better measure of trade openness may be export share in GDP. This variable is in general positively related to growth but it is not as robust. A few studies use the change in export to GDP ratio over the sample period which captures growth in exports corrected for income growth. This variable is found to be significantly related to economic growth. Nishimizu and Robinson (1984) and Nishimizu and Page (1990) also find positive effects of export growth on productivity growth in a growth accounting framework. Levine and Renelt (1990) find that the trade measures are generally not robust in cross-country growth regressions. However, they find that trade openness measured by trade share of GDP is positively related to investment. A problem with studies using trade volume or growth is that they do not capture actual policy choices.

A major problem in testing the effect of policies on trade is finding good, internationally comparable measures of trade.[28] Edwards (1989) employs a measure of trade intervention calculated by Leamer (1988) based on deviations from factor endowment trade predictions and finds a significant negative relation to growth. However, this measure shows Hong Kong and Singapore as being the most interventionist and is negatively related to Leamer's other measure of trade openness. Dollar (1990) finds that real exchange rate distortions (based on prices in the Summers and Heston (1988) data set) and variability are negatively

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[27]See the studies by Bhagwati (1978) and Krueger (1978) and recent review by Edwards (1989).

[28]See Pritchett (1990) for discussion of the links between trade policy measurement and trade performance.

related to growth. Easterly and Wetzel (1989) find that outward oriented economies, based on a World Bank measure of trade orientation, grow faster than inward oriented economies. These findings suggest that trade policy may be important for growth, but these relationships need to be better defined.

Other issues have also been considered. There does exist some evidence of positive relation between financial liberalization and growth and a negative relation between inflation variability and growth.[29] These relate to the generally negative impact of distortions on growth.[30] Political instability has some negative correlation to growth while political freedoms appear to be somewhat positively related to growth.[31] These findings would be consistent with the theoretical view that increased uncertainty affects the accumulation of capital and growth. Numerous other variables have been included in cross-sectional studies, as seen in Table 3. An implication is that researchers should proceed with caution in simply adding additional independent variables in cross-section empirical work.

IV. Conclusion

One of the reasons for the success of the standard neoclassical growth model is that it provided a convenient tool for organizing data on the sources of economic growth, although much of the growth was left "unexplained." The models of endogenous economic growth have not yet been distilled into a standard

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[29]See Easterly and Wetzel (1989), Gelb (1989), Grier and Tullock (1989), Kormendi and Meguire (1985), and Manas-Anton (1986).

[30]See Agarwala (1983), Barro (1989b), Easterly and Wetzel (1989), and Gelb (1989).

[31]See Barro (1989a,b), Grier and Tullock (1989), Kormendi and Meguire (1985), Londregan and Poole (1989), and Scully (1988).

empirical framework. The existing empirical work has also failed to provide solid answers on the sources of variation in economic growth across countries. Cross-sectional analysis has provided some useful insights into the growth process, but there probably exists decreasing returns to continued investment in such work. More direct estimation of productivity growth and production functions in developing countries along the lines suggested by existing growth accounting studies could be very useful. This research should especially be addressed to the analysis of policy options in developing countries. More work also needs to be done at the sectoral level. The new models of growth have not adequately addressed the issues of structural transformation and disequilibria in factor markets which seem to be important parts of the development process and may make data analysis at an aggregate level less useful. The existence of spillovers and increasing returns are probably more important in the industrial sector of developing countries. In general, policymaking will benefit from empirical results generated from more carefully constructed structural economic models.

Table 1

Partial Correlations With Growth and Investment

	Per Capita GDP Growth 1960-85				Investment/GDP	
	Variable Alone		with Investment			
	β	t	β	t	β	t
AFRICA	-.017	(4.91)*	-.008	(2.66)*	-.062	(4.49)*
ASSASS	-.003	(.64)	.000	(.03)	-.017	(1.01)
AVAGE60	.003	(5.16)*	.001	(1.38)	.019	(7.49)*
CIVLIB	-.004	(4.06)*	-.001	(.71)	-.021	(6.28)*
CONSTCH	-.058	(3.57)*	-.015	(1.04)	-.288	(4.66)*
COUP	-.055	(2.14)*	-.005	(.24)	-.316	(3.26)*
CRISIS	-.003	(.45)	-.004	(.67)	.005	(.15)
GDE	.011	(.19)	-.037	(.81)	.179	(.94)
GDP60	.001	(1.48)	-.002	(2.29)*	.020	(5.46)*
GEECUR	-.001	(2.81)*	-.000	(2.22)*	-.002	(1.67)
GEETOT	.131	(1.10)	-.228	(2.20)*	2.150	(5.05)*
GGCFD	.233	(1.96)	-.107	(.91)	2.350	(5.22)*
GTRAN	.053	(2.10)*	-.008	(.32)	.452	(4.81)*
HSGOV	-.098	(3.85)*	-.078	(3.87)*	-.127	(1.24)
HSGVXDXE	-.128	(3.90)*	-.072	(2.53)*	-.426	(3.09)*
HSINV	.157	(8.46)*	---		---	
LAAMER	-.006	(1.44)	-.004	(1.27)	-.011	(.63)
LIT60	.020	(4.17)*	.003	(.65)	.119	(6.73)*
MIXED	.004	(1.10)	.003	(1.18)	.006	(.39)
POLRIGHT	-.004	(4.36)*	-.001	(.77)	-.020	(6.61)*
PPIDEV60	-.012	(2.14)*	.001	(.32)	-.085	(4.00)*
PPPY60	.025	(2.62)*	-.003	(.37)	.167	(4.69)*
PRIM60	.029	(6.43)*	.013	(2.58)*	.125	(7.47)*
PRIM70	.035	(6.80)*	.019	(3.52)*	.122	(6.38)*
REVCOUP	-.033	(5.02)*	-.014	(2.19)*	-.137	(5.49)*
REVOL	-.042	(5.38)*	-.019	(2.59)*	-.167	(5.50)*
RIOT	.001	(.52)	.000	(.21)	.004	(.65)
SEC60	.034	(4.20)*	.001	(.16)	.209	(7.38)*
SEC70	.033	(5.25)*	.009	(1.23)	.171	(7.66)*
SOC	-.018	(3.67)*	-.013	(3.21)*	-.036	(1.84)
SOCSEC	.049	(1.39)	-.014	(.44)	.476	(3.46)*
STRATPRI	-.000	(2.94)*	-.000	(.81)	-.002	(3.71)*
STRATSEC	.000	(1.32)	.000	(.95)	.001	(.85)
STRIKE	.001	(.08)	-.002	(.30)	.017	(.59)

* indicates significant at 5% level

Source of data: Data appendix to Barro (1989b)
All variables as defined in Barro (1989b)

Table 2

Representative Growth Accounting Studies

	Growth of Value Added	Share of Factor Inputs	Share of TFP
Christensen,Cummings & Jorgenson (80) 1960-73			
Canada	5.1	65	35
France	5.9	49	51
Germany	5.4	44	56
Italy	4.8	35	65
Japan	10.9	59	41
Korea	4.2	53	47
Netherlands	5.6	54	46
United Kingdom	3.8	45	55
United States	4.3	70	30
Elias (1978) 1960-74			
Argentina	4.1	83	17
Brazil	7.3	78	22
Chile	4.4	73	27
Colombia	5.6	63	37
Mexico	5.6	63	37
Peru (1960-70)	5.3	72	28
Venezuela	5.1	88	12
McCarthy,Hanson,Kwon(85)			
Colombia (1963-80)	5.7	72	28
Elias (82)			
Argentina (1970-80)	2.8	117	-17
Lampman (67)			
Philippines (1955-65)	4.5	80	20
Chen (77) 1955-70			
Hong Kong	9.3	54	46
Singapore (1957-70)	6.6	45	55
Korea	8.8	44	56
Japan	10.1	45	55
Taiwan	8.0	46	54

Table 3

Cross-Section Studies of Economic Growth

Study	Period	#C	D.V.	Independent Variables* IS	LG	HK	IY	XG	XS	GC	GK	TX	FL	IN	PI	PF	OV
Balassa (85)	1973-89	43d	GY	+	0		-	+									Y
Barro (89a)	1960-85	72	GYP	+	-	0	-			-	+/0				-	+/0	Y
Barro (89b)	1960-85	94	GYP	+		+	-			-					-		Y
Cardoso & Fishlow (89)	1950-80P	18d	GY	+	+			+									N
De Long (88)	1870-79	22	GYP				-										Y
De Long & Summers (90)	1960-85	42	GYP	+/0	0		-/0										Y
Diamond (89)	1980-85	38d	GY	+	0	+/0		+	0	0	+/0						N
Dollar (90)	1976-85	95d	GYP	+													Y
Easterly & Wetzel (89)	1960-85	70d	GY	+	+/0				+	-			+				Y
Edwards (89)	1960-82	28d	GY	+	+	0											Y
Feder (83)	1964-73	31d	GY	+	+			+									N
Gelb (89)	1965-85	34d	GY										+				Y
Grier & Tullock (89)	1950-81P	24D	GYP		+		-			-				-			Y
	1960-81P	89d	GYP		+		+			-				-		+	Y
Gupta & Islam (83)	1965-73	52d	GY	+	+												Y
Hicks (80)	1960-77	65d	GYP	+		+		+									Y

*+ (-) indicates found significantly positive (negative), 0 indicates insignificant, +/0 ndicates significant in some regressions, blank indicates variable not included in study

eriod: Time period of cross section analyzed, P indicates panel used
C: Number of countries, d indicates limited to developing countries,D to developed
.V.: GY=Growth of GDP, GYP=Growth of per capita GDP
.V.: IS=Investment share of GDP, LG=Labor growth, HK=Human capital variable, IY=Initial eriod income, XG=Growth of exports, XS=Export share, GC=Government consumption share, K=Government capital share, TX=Tax variable, FL=Financial liberalization, IN=Inflation ariable, PI=Political instability, PF=Political freedom, OV=Other variables used (Y/N) these re reviewed on the following page. Variable content and definitions may vary across studies.

Table 3: Cross-Section Studies of Economic Growth Continued

Study	Period	#C	D.V.	Independent Variables* IS	LG	ED	IY	XG	XS	GC	GK	TX	FL	IN	PI	PF	OV
Hwa (83)	1970-79	87	GY	+	+			+						-			Y
Khan & Reinhart (90)	1970-79	24d	GY	+	+/0			+			0						N
Koester & Kormendi (89)	1970-79	63	GY	+	+		-					0					Y
Kormendi,Lavy, & Meguire (88)	1968-81	62d	GY	0	0		-		+								Y
Kormendi & Meguire (85)	1950-77	47	GY	+	+		-		+/0	0				-		+	Y
Landau (83)	1961-76	96	GYP			+	-			-							Y
Landau (86)	1960-80P	65d	GYP	+	0	+	-			-	0						Y
Levy (88)	1968-82	22d	GY	+	+/0			0									Y
Londregan & Poole (90)	1950-82P	121	GY				-								-/0		Y
Manas-Anton(86)	1973-82	39d	GY		+		0		+	0	0	-/0		-			N
Mankiw,Romer & Weil (90)	1960-85	98	GYP	+	0	+	-										N
Marsden (83)	1970-79	20d	GY	+	+							-					N
Martin & Farmanesh (90)	1972-81	76	GY	+	+					+		-					Y
Moschos (89)	1970-80	71d	GY	+	0			+									N
Murphy,Shleifer & Vishny (90)	1970-85	91	GYP	+		+/0	-			-/0					-		Y

*+ (-) indicates found significantly positive (negative), 0 indicates insignificant, +/0 indicates significant in some regressions, blank indicates variable not included in study

Period: Time period of cross section analyzed, P indicates panel used
#C: Number of countries, d indicates limited to developing countries,D to developed
D.V.: GY=Growth of GDP, GYP=Growth of per capita GDP
I.V.: IS=Investment share of GDP, LG=Labor growth, HK=Human capital variable, IY=Initial period income, XG=Growth of exports, XS=Export share, GC=Government consumption share, GK=Government capital share, TX=Tax variable, FL=Financial liberalization, IN=Inflation variable, PI=Political instability, PF=Political freedom, OV=Other variables used (Y/N) these are reviewed on the following page. Variable content and definitions may vary across studies.

Table 3: Cross-Section Studies of Economic Growth Continued

Study	Period	#C	D.V.	Independent Variables* IS	LG	ED	IY	XG	XS	GC	GK	TX	FL	IN	PI	PF	OV
Otani & Villanueva (90)	1970-85	55d	GYP	+	-/0	+/0		+									Y
lam (86)	1960-80	115	GY	+	+					+/0							N
ittenberger(89)	70-82	57d	GY	+	+/0			+									Y
Robinson (71)	1958-66	39d	GY	+	0												Y
omer (89a)	1960-85	94	GYP	+		+/0	-/0			-							Y
omer (89b)	1960-85	90	GYP	+			+/0		+	-							Y
ully (88)	1960-80	115	GYP													+	N
Skinner (87)	1965-82	29d	GY	0	0					-	+	-			-		Y
ler (81)	1960-77	41d	GY	+	+			+									N
ede (83)	1960-79	94	GYP	+		+	0										Y
Wheeler (80)	1960-77	43d	GY	+	+	+											Y

(-) indicates found significantly positive (negative), 0 indicates insignificant, +/0 dicates significant in some regressions, blank indicates variable not included in study

riod: Time period of cross section analyzed, P indicates panel used
: Number of countries, d indicates limited to developing countries,D to developed
).V.: GY=Growth of GDP, GYP=Growth of per capita GDP
I.V.: IS=Investment share of GDP, LG=Labor growth, HK=Human capital variable, IY=Initial period income, XG=Growth of exports, XS=Export share, GC=Government consumption share, GK=Government capital share, TX=Tax variable, FL=Financial liberalization, IN=Inflation variable, PI=Political instability, PF=Political freedom, OV=Other variables used (Y/N) these are reviewed on the following page. Variable content and definitions may vary across studies.

Table 3: Other Variables Included and Results

Balassa (85)	Outward Orientation (+), Manuf. Share Exports (+)
Barro (89a,b)	Socialist economy (-/0), Mixed economy (-/0)
	Invest. Price deviation (-), Africa (-), Latin America (-)
De Long (88)	Protestant religion (+)
De Long & Summers (90)	Investment durables price and share (+)
Dollar (90)	Real exchange rate distortion (-) & variability (-)
Easterly & Wetzel (89)	Inward trade orientation (-), Africa (-), Latin America (-)
Edwards (89)	Trade intervention (-)
Gelb (89)	Distortion index [Agarwala,1983] (-)
Grier & Tullock (89)	Variation in output growth (+)
Gupta & Islam (83)	Foreign Aid(+/0),Foreign Investment(0), Other Foreign Capital
Hicks (80)	Life expectancy (+)
Hwa (83)	Agriculture growth (+)
Koester & Kormendi (89)	Marginal tax (-/0)
Kormendi, Lavy & Meguire (88)	Money growth (0), Variation in output (0), Foreign aid (+/0)
Kormendi & Meguire (85)	Variation in output (+)
Landau (83)	Climate dummies (+/0)
Landau (86)	Population (-),Transfers from abroad (+), Distance to seaport(
Levy (88)	Terms of trade (-/0)
Londregan & Poole (90)	Africa (-), Europe & North America (+)
Martin & Farmanesh (90)	Government deficit (-)
Murphy, Shleifer, & Vishny (90)	Engineering students (+/0),Law students (-/0)
Otani & Villanueva (90)	Interest rate on external debt (0)
Rittenberger (89)	Agriculture Growth (+/0), Manufacturing growth (+/0)
	Services growth (+)
Robinson (71)	Net foreign balances (+), Change in agriculture share (+)
	Change in city share of population (+)
Romer (89a,b)	Africa (-), Latin America (-)
Skinner (87)	Terms of trade (+), Oil (+/0)
Weede (83)	Political democracy (-/0), Military (+)
Wheeler (80)	Change in nutrition (+)

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