Notes on Education and Economic Growth: Theory and Evidence

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Notes on Education and Growth: Theory and Evidence

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Abstract

An extensive literature indicates that a substantial proportion of the rate of growth of the economy can be attributed to increases in the educational level of the labor force. Recent theoretical advancements in the economic growth literature once again place human resource issues at the forefront of the debate on country economic growth. The new growth theories reaffirm the importance of education for promoting economic growth. The externalities associated with education are given prime importance in the new growth theories, which accommodate endogenous technical change and increasing returns to scale. This paper presents a review of the new growth theory literature, focusing on the importance of human capital.
Introduction

An extensive literature indicates that a substantial proportion of the rate of growth of the economy can be attributed to increases in the educational level of the labor force (for a review, see Psacharopoulos 1984; Tilak 1989). While the relationship between human resource development and economic growth has always been important in economics, it received considerable attention during the 1960s with the "human investment revolution in economic thought" (Bowman 1966).

Schultz (1961) and Denison (1967) tried to answer the question of how much education has contributed to economic growth. Denison used the production function in order to identify the contribution of different factors of production to the increase in the national income or gross national product of the United States between 1910 and 1960. Increases in the quantity of labor and physical capital did not explain the increase in gross national product. There was a large "residual factor." Denison suggested that improvements in the quality of the labor force, including increased education, were important, together with other factors such as technological progress and economies of scale. It is now generally recognized that education contributes to economic growth, but that it is very difficult to identify and measure the precise contribution of education relative to other factors.

The neo-classical view of economic growth states that as physical and human capital are accumulated, their incremental contribution to output diminishes. The implication for developing countries is that since they have smaller endowments of physical and human capital, they will grow faster than rich countries for the same level of investment in physical and human capital assets. Eventually, poor economies will catch up with rich economies and per capita incomes will converge. A central element of economic growth theories is technological change. In the basic neo-classical model, it is assumed that technological change is exogenous to the economic process (Solow 1956, 1957, 1970).

The evidence, however, does not appear to indicate that less developed countries are catching up to developed countries. Dissatisfaction with the neo-classical model led to a search for alternative explanations of divergent growth paths. "Old" neo-classical theory is not able to account for the diverging development of nations, and exogenous technical change is questioned.

New Growth Theory

New growth theories are differentiated from each other by the different accumulated factor which acts as the source of growth: physical capital (with learning by doing or complementarities), technology (research and development), human capital, or infrastructure and public services (see Table 1). Thus, growth is explained by endogenously driven technical change which in turn may be brought about by a variety of reasons: learning-by-doing (Romer 1986); external effects of human capital formation (Lucas 1988); production externalities of
public expenditures (Barro 1990); and quality improvements through the invention of new products (Grossman and Helpman 1991).

Table 1: New Growth Theories

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<thead>
<tr>
<th>Author</th>
<th>Component</th>
<th>Relevant Policy Implication</th>
</tr>
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<tbody>
<tr>
<td>Romer (1986)</td>
<td>learning-by-doing/ endogenous tech.</td>
<td>Invest in R&amp;D</td>
</tr>
<tr>
<td>Lucas (1988)</td>
<td>external effects (spillovers)</td>
<td>Invest in Human Capital</td>
</tr>
<tr>
<td>Azariadis and Drazen (1990)</td>
<td>threshold levels</td>
<td>Invest in Human Capital</td>
</tr>
<tr>
<td>Barro (1990)</td>
<td>production externalities</td>
<td>public expenditures</td>
</tr>
<tr>
<td>Young (1991)</td>
<td>invention/learning-by-doing</td>
<td>Research/Production experience</td>
</tr>
</tbody>
</table>

In the "old" neo-classical models it is not clear why innovation would occur if it is a public good. In the "new" theories, to endogenize innovation, externalities with the development of technical knowledge are considered. The existence of increasing returns to scale in the aggregate production function is a novelty in the new growth theories. Technological change is treated as a separate factor in the aggregate production function and interest in technological change as an endogenous economic phenomenon has increased dramatically in recent years.

Recent theoretical advancements in the economic growth literature once again place human resource issues at the forefront of the debate on country economic growth. The importance of education for promoting economic growth is reaffirmed. The externalities associated with education are given prime importance in the new growth theories, which accommodate endogenous technical change and increasing returns to scale. Long run economic growth increases as a result of an increase in the rate of technological change. In turn, technological change increases when there are more highly educated workers. The importance of human capital accumulation, and specifically "knowledge," for facilitating the development of new technologies and as a source of endogenous growth is reaffirmed.

Comprehensive reviews of new growth theory have been provided elsewhere (see, for example, Amable and Guellec 1992; Brander 1992; Behrman 1990; Verspagen 1992; Sala-i-Martin 1990). Here the parameters of new growth theory are highlighted, and the implications for human resource development are suggested.

New growth theories emphasize the distinction between capital-based models and ideas-based models (Romer 1993a; 1993c). Capital-based models assert that growth is the result of
capital accumulation. Ideas-based models give emphasis to a factor that opens up new investment opportunities, alternatively known as innovation, invention or technological change. This represents a return to the neo-classical model with its emphasis on the importance of technological change. Ideas drive both growth in income and capital accumulation. The discovery of ideas is treated as being endogenous rather than exogenous in the new theories. Ideas are not the same as physical or human capital. But unlike neo-classical theory, ideas are something other than freely available public goods. In industrialized countries they come about as a result of intentional attempts to make discoveries. Ideas arrive in developing countries as a result of attempts to transfer them, to the extent that this is encouraged by market incentives.

In addition to the role of increasing returns to scale, new growth theory emphasizes the learning by doing effects of human capital in the production of technology-intensive products and the dynamic spillover effects of the growth of the export sector, which acts as a leading sector in the diffusion of modern technology across other sectors and industries.

New growth theorists use terms such as physical capital, knowledge, aggregate capital (physical capital plus knowledge) and human capital (which is different and beyond years of schooling or on-the-job training). Attempts are made to operationally define such terms and to build testable models. Growth theorists also distinguish between education (at the primary and secondary levels) and scientific knowledge (acquired in post-secondary education). In conventional theory, education, scientific knowledge, and man-hours on the job are bounded on a per capita basis; that is, they cannot exceed the length of life of people. But knowledge, understanding and science have grown per capita, and continue to do so. While cognitive skill or memory is tied to particular individuals, scientific knowledge is a different kind of intangible that is not tied to individuals (Romer 1993a). The main reason why human capital, and not physical capital, holds the key to persistent high growth in per capita income, is that people, unlike machines, can learn. Investments that increase people's skills and productivity yield not diminishing returns, but constant or even increasing returns. Of course, there exist significant gaps between classroom education and the effective utilization of knowledge in the production process.

In Romer's (1986) equilibrium growth model of endogenous technological change, long-run growth is driven primarily by the accumulation of knowledge. This theory postulates a positive externality in the production of knowledge because knowledge is assumed not to be perfectly patented or kept secret. The production of consumption goods as a function of the stock of knowledge and of other inputs has increasing returns, and the stock of knowledge may have an increasing marginal product. The major new assumption of this theory is that knowledge grows without bound.

The inability of neo-classical theory to adequately explain the diversity in growth experiences has led to the development of other theories. One adaptation adds human capital with externalities in the sense that the average level of human capital affects a worker's productivity in addition to the effect of her own human capital (Lucas 1988). In this sense
human capital is "twice blessed;" first, because of its inherent productivity and second, because interactions among well-educated people further increases their efficiency.

Other theorists emphasize labor-augmenting spillovers from human capital investments. Once a given level of knowledge is achieved, it is much easier to acquire further knowledge or a sharp change in production possibilities is induced so that there is a critical mass in human capital attainment. As a result of such threshold externalities, countries with high human capital investment relative to their per capita incomes can experience periods of high sustained growth. Therefore, there could be high payoffs in terms of growth to human resource investments at higher levels (Azariadis and Drazen 1990). Developing countries may experience low growth rates until a crucial (perhaps human capital level) threshold is passed (Tallman and Wang 1992).

Young (1993) combines two types of endogenous growth models: invention and learning by doing. He emphasizes the interdependence between research activity in the laboratory and production experience on the factory floor. Learning depends on invention, and the costs of production depend on cumulative learning experience.

In 'old' neo-classical theory, the production function is formulated in the following manner:

\[ Y = f(K, L) \]

where \( Y \) is output, \( K \) is capital, and \( L \) is labor. In 'new' neo-classical theory, models have been developed from the following basic formulation:

\[ Y = g(T, L, \bar{T}) \]

where \( L \) is a conventional production factor such as labor, \( T \) represents the stock of investment in technological change, and the bar indicates a general volume which is available to all firms in the economy. For Romer it indicates the sum of all individual \( T \)s, while in Lucas it is the average level of human capital (Verspagen 1992: 637).

One of the implications for developing countries is that since increments to physical and human capital make either the same contribution or an increasing contribution to output as economies become richer, stronger economies will fare better. Per capita incomes, therefore, will not converge. Richer economies may grow faster than the poorer economies indefinitely. And whether knowledge is a public good (Solow), or a public good privately provided by accident (Arrow, Lucas, Romer), the problem for development is that knowledge is not freely available to developing countries. Grossman and Helpman (1990: 90-1) write:
Casual observation and more systematic empirical research suggests that countries that have adopted an outward-oriented development strategy have grown faster and achieved a higher level of economic well-being than those that have chosen a more protectionist trade stance. The evidence on the efficacy of explicit policies to promote exports, including various forms of industrial targeting, is not yet conclusive. The approach to modeling endogenous innovation and endogenous human capital formation may provide a means for improving our understanding of the connection between the international trade environment including the trade policy regime and long-run growth performance. It seems clear that the less developed countries potentially stand the most to gain from their international relationships, since in principle these countries can draw upon the large stock of knowledge capital already accumulated in the industrialized world. But, it is equally clear from the poor growth experience of some of these countries, that the technology flows are anything but automatic. We need to learn more about the mechanisms by which knowledge and technology diffuse across international borders (including, for example, the role of multinational corporations in this regard), and the incentives that impinge upon the equilibrium rate of technology transfer.

One of the policy implications of new growth theory is precisely that, potentially, it is the less advanced economies that stand to gain the most from the freeing of international trade since by so doing, they can draw upon the stock of world knowledge. It would appear that trade policy has the potential for influencing long-run growth paths for the world economy (Shaw 1992).

Romer (1993b), in his analysis of trade and growth, emphasizes the importance of new goods. He invokes the turn of the century head of the patent office who recommended the abolition of the patent system because everything had already been invented (Romer 1993b: 17). The introduction of new goods into the economy implies both tangibles and intangibles. New goods, however, are associated with fixed costs. Fixed costs are important, and limit the introduction of new goods. Fixed costs are particularly important in developing countries, where the cost of technology transfer is high and impediments to business are great. Romer (1993b) refers to the difficulty in obtaining business permits in Peru (see also de Soto 1989).

Critique

Critics ask whether there is anything new about new growth theory. What is the value added of the literature, at least as far as policy implications are concerned? It is argued that no guidance is offered towards the identification of appropriate interventions (Selowsky 1993). d’Autumne and Michel (1993) point out that Arrow’s "learning by doing" model is a forerunner of recent models of endogenous growth, and that endogenous growth is possible in the original
Arrow framework. Also note that the notion of endogenous technological progress was present in the work of the classic school (Smith and Marx) and in Schumpeter (1934).

Most of the research in the new growth tradition is conducted using cross-country data. This involves problems of the quality of data and the differences across nations and cultures. It is not clear whether the externalities at the lower or higher schooling levels are more important for economic development. Psacharopoulos (1994) asks whether one can weigh two very elusive items: (a) the positive externalities associated with a university graduate discovering a new vaccine; and (b) the negative externalities associated with 30 percent of the population being illiterate for their entire lifetimes.

New growth theory, however, is preoccupied with a different question than is development theory: how to explain the persistence of growth rather than how to get it started. Development theory is intended as a guide to policy, while new growth theory is not. Paul Krugman stated: "The latter theorists try to explain the world, while their predecessors thought they could change it" (Krugman 1993: 31).

"New" models are neo-classical since they contain the equilibrium notion and the rational behavior assumption of economic agents. Dissent from the mainstream position, however, comes from other perspectives, such as the Science Policy Research Unit at the University of Sussex, and MERIT at the University of Limburg in the Netherlands, and the evolutionary approach to economic analysis that requires neither price-taking nor explicit maximization in its description of market outcomes. These approaches place ideas at the center of the analytical framework (see, for example, Bell and Pavitt 1993). And, of course, neo-Schumpeterian models of growth are different from other new growth theories (see, for example, Cheng and Dinopoulos 1992).

Many of the specific claims of new growth theory have roots that go back at least 150 years. Romer remarks that the larger issues go all the way back to Plato. The term new growth theory has a different meaning, unplanned but very relevant: new growth theory is not new, but it is about the unlimited potential for newness that the world makes possible (Romer 1993b: 49).

Evidence

Most of the empirical work conducted to validate new growth theory thus far has relied on cross-country evidence (see, for example, Romer 1989; 1990; Barro 1991; Lau, Jamison and Louat 1991; Scott 1991; Benhabib and Spiegel 1992; Barro and Lee 1993; Gundlach 1993; Knight, Loayza and Villanueva 1993; Baffes and Shah 1993). Among other factors, these studies show the importance of investment in human capital for economic growth. For example, Azariadis and Drazen (1990) estimate that the threshold level of human capital accumulation beyond which a country may experience accelerating growth is a literacy rate of 40 percent. These cross-country studies, however, may be plagued with measurement problems associated
with the use of cross-sections of data (Tallman and Wang 1992). In many cases it is not known how the data was collected, how reliable it is, or how consistent it may be. A more intensive examination of specific case studies may be a promising path toward understanding the role of human capital in economic development. Some interesting work using new growth theory has examined the determinants of the within-country economic growth experience (see Table 2).

<table>
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<tr>
<th>Country</th>
<th>Theoretical Concept</th>
<th>Result</th>
<th>Author(s)</th>
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<tbody>
<tr>
<td>Austria</td>
<td>external effects of human capital</td>
<td>consistent</td>
<td>Winter-Ebmer (1992)</td>
</tr>
<tr>
<td>China</td>
<td>external effects of human capital</td>
<td>consistent</td>
<td>Wang and Mody (1993)</td>
</tr>
<tr>
<td>Korea</td>
<td>spillovers of human capital</td>
<td>consistent</td>
<td>Sengupta (1991)</td>
</tr>
<tr>
<td>Taiwan</td>
<td>endogenous technological growth</td>
<td>consistent</td>
<td>Tallman and Wang (1990)</td>
</tr>
<tr>
<td>Brazil</td>
<td>threshold levels of education</td>
<td>consistent</td>
<td>Lau, Jamison, Liu and Rivkin (1993)</td>
</tr>
<tr>
<td>Israel</td>
<td>knowledge</td>
<td>consistent</td>
<td>Bregman and Marom (1993)</td>
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The World Bank’s recently published study of economic growth in East Asia, *The East Asian Miracle* (World Bank 1993), emphasizes the importance of education. The report contains cross-country analyses of the determinants of economic growth. However, most interesting are the within-country analyses. Evidence is presented on eight East Asian economies (Hong Kong, Indonesia, Japan, Korea, Malaysia, Taiwan, Singapore and Thailand). By far the single largest contributor is primary education. Between 58 percent (Japan) and 87 percent (Thailand) of predicted growth is due to primary school enrollment.

A different conclusion is reached by Kim and Lau (1992). In their investigation of the sources of growth for four Asian countries (Hong Kong, Korea, Singapore and Taiwan) and five OECD countries (France, German, Japan, the United Kingdom and the United States), they find that technical progress (or increase in efficiency) does not account for any of the growth in the Asian NICs, but does account for a very high proportion of the growth in the OECD sample (45-71 percent). Capital accumulation accounts for most of the growth in the Asian NICs (82-88 percent). This study, however, is flawed, in that it does not account for education. But as the authors state, the Asian NICs are among the most educated societies after the OECD. The authors rightly conclude that further research is warranted with data that incorporates human capital.

A case study of Singapore and Hong Kong — two similar and dissimilar countries — is used to develop some insights into the growth process and to evaluate the empirical validity of
existing models of endogenous growth. Young (1992) finds that both capital and (human capital
adjusted) labor have grown considerably faster in Singapore, and that while technical change has
contributed substantially to economic growth in Hong Kong, its contribution to growth in
Singapore is next to nil. Singapore, the author concludes, is a victim of its own targeting
policies, which are increasingly driving the economy ahead of its learning maturity into the
production of goods in which it has lower and lower productivity; factor accumulation and
industrial transformation is too rapid. The difference in initial conditions is also important;
Hong Kong had a better-educated labor and industrial elite, and this is significant in explaining
subsequent differences in the performance of the two economies. Using Total Factor
Productivity (TFP) analysis, Young finds that in Hong Kong, technical change has contributed
to a substantial 30 to 50 percent of output growth between 1971 and 1990; in Singapore, it is
a negative 1 percent of output growth. These findings are explained using Young’s (1991)
theory, which is a model of invention and bounded learning by doing, which links the
productivity of new technologies to a society’s learning maturity. New technology is at first
costly, but with time and learning by doing, costs are reduced and productivity increases. Hong
Kong’s superior labor force in terms of education and higher rate of TFP growth, supports
endogenous technical change models which emphasize the supply of human capital as
determining the ability of an economy to absorb new technologies.

The East Asian NICs and Japan experience high growth due in large part to their
openness in trade and outward looking policy measures. An examination of the growth process
in Korea over time (1967-86) was recently undertaken using new growth theory. The growth
of human capital and the diffusion of skills across the board, which are strongly emphasized in
new growth models, have proved to be very significant in the growth process of Korea. Human
capital makes scale economies more persistent in the manufacturing sector and generates
dynamic resource allocation from the nonexport to export sectors, augmenting the overall
productivity of labor. The externality effect of the export sector on the rest of the economy
represents technical progress and its diffusion over the rest of the economy (Sengupta 1991).

Juoro (1993), using endogenous growth theory, and the model developed in Murphy,
Shleifer and Vishny (1991) that shows that countries with higher proportions of engineering
college majors grow faster while countries with a higher proportion of law majors grow more
slowly, investigates the allocation of human resources in Indonesia. Empirical evidence for the
period 1971-1990 shows that primary and secondary schooling have very important effects on
overall growth. A 1 percent increase in the ratio between enrollment in secondary school to
total enrollment (primary and secondary schools) would contribute to the increase in real GDP
per capita by 0.52 percent. The author also verifies that engineering graduates influence growth
positively, while law graduates have a negative effect. The policy conclusion is that increasing
the level of the workforce with secondary education is warranted.

Tallman and Wang (1990) investigate an open economy model with endogenous growth
through human capital accumulation. The labor quality measurement they use to gauge the level
of human capital incorporates a labor skill index into the labor input measure, which improves
the performance of the model. They use annual data for Taiwan covering the period 1965 to
1986. The evidence supports the theoretical suggestion that labor skill is a useful augmentation of the raw labor input measure commonly used in growth accounting studies. The labor skill level, the index of the higher educated population (university level schooling and technically oriented colleges), is not a true measure of human capital so the authors transform the index with years of schooling. The explicit inclusion of a human capital measure in the labor input variable is empirically justified. It provides a backdrop to analyze the empirical implications of innovation in the labor input measure to help reduce dependence upon an exogenous technology shock to explain economic growth. In one specification, the authors estimate the factor shares for labor and capital at 0.524 and 0.476 of output. Hay Woo (1991) finds that successful education planning contributed to economic growth in Taiwan. First, the foundations of a basic education infrastructure were laid. The system was constantly changed to match the changing requirements of growing economy. While education is found to have had an initially small direct impact, with time education contributed significantly to economic growth. Also of importance is Taiwan's openness to foreign trade, which means that technical change is very important, no doubt prompted by education.

The endogenous growth theory literature is used to specify a model of economic growth for Israel. The empirical analysis goes beyond neo-classical models to include physical infrastructure, human capital and the degree of openness of the economy. An aggregate production function is set up, and the returns to physical infrastructure (54-63 percent) and human capital (15-24 percent) are estimated. Both of these are greater than the returns to business capital (14 percent). Also, greater openness to foreign trade leads to a positive contribution to productivity. Increasing returns to scale in the business sector are detected, in conformity with endogenous growth theory. Openness in foreign trade leads to greater growth because of increased competition, enhanced efficiency, and the exchange of ideas and technology, thus promoting the accumulation of knowledge and human capital (Bregman and Marom 1993).

An empirical examination of economic growth over time in Brazil using state-level information has recently been published. The analysis covers the 1970s, a rapid growth period. It is estimated that education explains about 20 percent of growth. Among the reasons that the authors put forward to explain such a high contribution is that there is a threshold level of minimum average education somewhere between three and four years of schooling in order for education to begin to have an impact. (Lau, Jamison and Louat 1991 also find a threshold of four years of schooling before primary school has an effect, using cross-country data.) Thus there is a range where there are increasing returns in intangible capital as proposed by Romer. The authors caution, however, that it may be a long time before education has an effect on output (Lau, Jamison, Liu and Rivkin 1993).

Lucas' (1988) model of the external effects of human capital formation is taken as a starting point for examining the impact of human capital on wages in Austria (Winter-Ebmer 1992). In the Lucas model the human capital investment of an individual person is said to have external effects upon her co-workers. This impact on productivity should in turn have an impact on wages. A microeconomic approach is used in order to test Lucas' basic assumption of the
external effects of human capital. External effects are specific microeconomic phenomena and cannot easily be tested using cross-sections or time-series of countries. This procedure obviously has the advantage that — especially relevant for the study of human capital effects — years of schooling are comparable across industries within one country but not across different countries all over the world (see above). The approach is two-step: internal effects of human capital on pay are controlled for using wage regressions for individual data. External effects upon pay are present if the average amount of human capital of a reference group (industries, for example) is determining average wages in this group (or more precisely interindustry wage differentials) over and above the effect of individual characteristics on individual pay. In the first step internal effects of education are filtered out using wage functions for individuals. In the second step the resulting industry wage premiums are regressed on industry-specific characteristics and, above all, on average human capital in the industry to account for external effects of human capital. The author tries to separate internal returns to education from external ones. The results are not inconsistent with the Lucas model. Estimating a number of different regressions, the author finds that the only consistently significant variable explaining industry wage premiums is average years of schooling, with coefficients ranging from 0.04 to 0.11.

Azam (1993) provides a single country analysis (Côte d'Ivoire) using growth theories, but no tests with data are given.

In an analysis of industrial growth in Coastal China, Wang and Mody (1993) examine the external effects of human capital. They argue that foreign investment and exposure to foreign knowledge has stimulated industrial growth in coastal China. Education is shown to have an important impact, although more so in tandem with knowledge acquired through international links.

Crafts (1993) uses new growth theories to examine growth in Britain over a very long time period. Using many different specifications, he finds that new growth theory is not readily able to explain changes over time in the rate of economic growth. He concludes that learning spillovers were not sustained in Britain.

Discussion

Different roles for the market and the government are specified in the new growth models. The need for government intervention is justified and a role for monopoly power to promote innovation is provided. Amable and Guellec's (1992) review of new growth theory shows that most models provide a basis for public intervention in order to reach the optimal equilibrium. The implication from Lucas' model is that human capital investment are likely to be below the socially optimal level unless there is market intervention in the form of a subsidy for accumulating additional human capital (Tallman and Wang 1992). Individuals do not take external effects into account, making subsidies for human capital accumulation necessary.
Tallman and Wang (1992) argue that this may help explain the rapid development of the Newly Industrialized Countries.

Technological change is a powerful engine for economic growth, but it is necessary that the proper conditions be stimulated. Fundamentally, these conditions are set at the national level. For developed as well as developing countries, promoting these conditions will allow for the accumulation of technology; that is, knowledge and ideas.

There is no magic recipe for economic growth. Staying competitive means different things in different national contexts. In fact, technological change comes from many sources, but in any case it demands a certain technological capability in order to decide whether to absorb or to develop a technology.

The modelling of technological change is still very stylized, which makes the use of these ideas in more realistic models and for policy analysis very difficult. One may add that endogenous growth models may be ahead of the measurement technology. More research is needed in order to make new growth models more useful for policy guidance with respect to the poorest countries.

In accordance with "old" and "new" theories, it can safely be said that human and physical capital complement each other: a higher stock of human capital enhances the rental value of machines; an increasing stock of physical capital boosts the efficiency of educational investment; and general investment plays a weak role in economic growth when not supported by education. One of the prime indirect ways in which education contributes to economic growth is that it enhances the adoption and efficient use of new inputs: the allocative efficiency of farmers and the more general ability to "deal with disequilibria." It was argued much earlier that education is more productive the more volatile the state of technology (see, for example, Nelson and Phelps 1966; Welch 1970; Bowman 1991). Educated labor ("skill") is more complementary with capital than is unskilled or "raw" labor (Griliches 1969). Schultz (1975) wrote about people's allocative abilities; that is, their ability to deal with economic disequilibria. This ability, it was argued, is enhanced by education. Extending the argument from Nelson and Phelps and others to its logical conclusion, increased growth can take place only if educational investment is increased now that the economy may be technologically progressive.

Solow (1992), commenting on old and new growth theories, writes that the "old" growth theory of the 1950s led to certain conclusions about the sorts of economic policies that would promote economic growth and also about their limitations. The "new" growth theory of the 1980s makes much stronger assumptions and leads to correspondingly stronger conclusions about the scope of growth-promoting policy. And while empirical work so far has neither confirmed nor denied the strong assumptions underlying the new theory, the theory is worth pursuing because of its intrinsic interest and the possibilities it opens up. Whatever the final verdict on the new theory, both theory and evidence support the belief that significant long-run gains, even if not permanent changes in the growth rate, can be achieved by increased investment in the
broadest sense, including human capital, technological knowledge, and industrial plant and equipment.

Theodore Schultz, in a recent paper, also specifically refers to new growth theory and the possibilities of experiencing increasing returns. Commenting on Lucas' external effects of human capital, he argues that "specialization, specialized human capital, increasing returns and economic growth go hand in hand" (Schultz 1989: 222). He also calls for greater investment in education, especially at the primary level.

In their excellent review of the literature, Tallman and Wang (1992) point out that Becker (1975) hinted at endogenous growth in his argument that the gains from college education are not fully quantified by earnings analysis because graduates are only partially compensated for their effect on development and the spread of knowledge. The accumulation of education by individuals is separate from the growth in knowledge, because of the external effect of education. This goes beyond primary positive effect on an individual when choosing a desired education level.

Also, Easterlin (1981) argues that widespread public education increases growth with the diffusion and advancement of knowledge. He makes the distinction between the spread of mass education, which is separate from the growth of science and technology.

This has further implications for public policy. While overinvestment is possible, or that investments may be skewed towards higher education (Psacharopoulos), this does not take into account external effects. However, the benefits of mass education are separate from science and technology. Therefore, due to the external effects that individuals do not take into account, the public subsidization of education may be justified in order for society to reap benefits. Overeducation, therefore, is a temporal phenomenon.

Issues

- What interventions are suggested by the new literature that are required to achieve maximum growth?
- If there is a threshold level of average education of the labor force, then what is its optimal distribution? Using the Brazilian example, should half the labor force possess six years and the other half only two? Also, what is the optimal distribution in terms of levels (primary, secondary, higher)? Widespread public education at the basic level may provide a threshold for development. It may be appropriate for economies at early stages of development, when primary education is a priority.
• Is there a relationship between the externalities of schooling and the distribution of educated labor in society? That is, do educated workers require other educated workers with which to interact?

• The debate has highlighted the importance of investment in human and physical capital. However, the accumulation of physical and human capital does not account for all economic growth. Intangible factors play a role: economic organization, innovation, absorption of technology. What is the implication for efficient educational investment?

• If the new theories emphasize "learning by doing," then what are the implications for basic education?
References


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<tr>
<th>Title</th>
<th>Author</th>
<th>Date</th>
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<tr>
<td>Poverty and Structural Adjustment: The African Case</td>
<td>Ishrat Husain</td>
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