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REVIEW OF ELHANAN HELPMAN'S BOOK: "THE MYSTERY OF ECONOMIC GROWTH"

ASSAF RAZIN*

This book, "**The Mystery of Economic Growth**," which was recently published in Hebrew, provides an excellent non-technical description of the developments of growth economics over the last half century. The story of the ideas and research of the theory and empirics of economic growth is organized around four themes. First, the importance of the accumulation of physical and human capital for the explanation of income levels and growth rates across countries. Second, the importance of knowledge creation and total factor productivity for economic growth. The discussion evolves around the impact of research and development, learning-by-doing, external effects (externalities) and increasing returns. To understand the determinants of knowledge accumulation one needs to investigate also the incentives for knowledge creation and diffusion. Third, the importance of various globalization trends and developments and the international transmission of technological innovation and knowledge for expansion of new techniques of production. Fourth, the role played by economic institutions on economic growth, and the growth effects of economic policy that these institutions help implement. Based on a large body of empirical research, the principal conclusion that emerges from the book "The Mystery of Economic Growth" is that long-term economic growth stems largely from economic institutions that facilitate technological innovation and adoption of new technologies. The solution to the puzzle of economic growth, according to Elhanan Helpman, could be found only if we understand the role played by the relevant economic and political institutions. I begin by describing the book's chapters in detail.

1. EMPIRICAL REGULARITIES

This chapter provides a description of key empirical facts and regularities, which are a benchmark through which we can usefully judge the power of economic growth theory. The chapter convincingly demonstrates that there are huge differences in per capita income among different countries. These differences are much greater today than at any time in the past. The relatively small income differences between countries before the early nineteenth century began to widen during the Industrial Revolution. Although the disparities in per capita income between the rich countries shrank during the period subsequent to the Second

* Department of Economics, Tel Aviv University.

World War, the gap between the rich and the poor countries has widened since the war. Moreover, the dwindling number of middle-income countries has resulted in polarization between the rich and poor countries; a bi-polar income distribution. But, notwithstanding this uneven global growth, during the course of the last hundred years the rate of growth has been truly exceptional. The post WWII period of rapid expansion is unparalleled in human history.

2. FACTORS' ACCUMULATION AND GROWTH

This chapter focuses on the effects of the accumulation of physical and human capital on economic growth. To highlight the role of factors' accumulation, the chapter makes the benchmark assumption that technological changes constitute an exogenous process. The endogeneity of technological change is the core of all of the following chapters.

The chapter opens with two questions:

1) Whether the factors' accumulation mechanisms are capable of explaining the stylized facts discussed in Chapter 1;

2) Why does the factors' accumulation mechanism benefit some countries but not others.

Important studies which the chapter reviews empirically examine the inverse relationship between the growth rate of output per capita and the initial capital-labor ratio, which appears in Solow's neo-classical growth model. The studies reviewed investigate the match with data of Solow's model transitional dynamics in the process of convergence to a steady rate of growth. Since income per capita is an increasing function of capital intensity and data on income per capita are more reliable than data on capital intensity, researchers examine the correlation between initial levels of output per capita and its subsequent growth. Controlling for variables which determine the steady state, they found a negative correlation which is consistent with the Solow model. This is called *conditional convergence*. The data supports *conditional convergence* but they do not support *unconditional convergence*; that is convergence which is not conditioned by steady state variables. Why are there forces of divergence? If income is driven only by capital accumulation and an underlying technological change process which is common to all economies why poor countries and rich countries would have not converged. Other factors must have played a role. Economists studied the role of human capital in this context. Another implication of the Solow model under the assumption of same technologies and same rate of technological change is for differences in income per capita. The cross-country variation in income per capita is a simple function of the cross-country variation in saving rate, population growth rate and the initial level of labor productivity. If every country is at its long run equilibrium and the initial levels of productivity are randomly distributed, then as shown by Mankiw, Romer and Weil (1992), the cross-country variation in income per capita regression, as a function of the saving rate, population growth rate and the initial level of labor productivity. The regression can explain 60 percent of the 1985 cross country income variation but the implied capital share in output is excessively large.

Elhanan Helpman concludes this chapter by noting that, in his opinion, Solow's model in itself is inadequate for analyzing growth data and data on differences in cross-country income.

3. PRODUCTIVITY

The chapter opens by defining various productivity concepts and explains the growth accounting approach (which was first suggested by Robert Solow). It then moves on to discuss the extent to which growth accounting helps us reveal the causes of economic growth. There is however a great difficulty in understanding the causal effects. Here is an example.

Consider the Mankiw, Romer and Weil (1992) case, in which equations were estimated that explain the variance in per capita income is based on the assumption that all countries enjoy the same productivity and on the further assumption that the initial levels of total factor productivity (TFP) differ between countries by a random factor only that is not correlated with investment. These assumptions were evidently made due to the lack of reliable data on the cross-country differences in productivity and on the relationship between productivity and investment. The conclusion from the findings was that a simple model such as the Solow model provides a satisfactory explanation of the cross-country differences in income per capita. However, the problem with this conclusion is the fact that the working assumptions systematically bias the estimates. Because the rates of TFP growth and investment-to-GDP ratio are positively correlated. This example leads the Elhanan Helpman to an interesting discussion of the cross-country differences in productivity. As productivity levels vary from one country to another, the impact of the differences in education must be taken into account to find reliable estimates of TFP. In fact, it was found that there is a positive relationship between total productivity and income per capita. Rich countries have an advantage in all the three main factors that determine per capita income: intensity of capital, education (human capital) and productivity.

Elhanan Helpman concludes with a quote from Hall and Jones (1999): "Income per worker is thirty-five times higher in the United States than in Niger. But the difference in capital intensity explains a ratio of only 1.5, while the difference in education levels explains a ratio of 3.1. It follows from this calculation that differences in inputs explain an output-per-worker ratio of about 4.7. TFP differences explain the residual ratio which equals 7.7. Evidently the difference in productivity is much more important than the differences in capital and education in explaining the poor performance of Niger relative to the United States." Elhanan helpman sums up by reiterating that there is convincing evidence that total factor productivity plays a major role in accounting for observed income variations across countries and rates of economic growth.

4. INNOVATION

As the growth rate of the world economy has accelerated over a long period, such acceleration cannot be explained by the forces of accumulation described by Solow, which predicts declining growth rates. To help reconcile the simple model with the concept of accelerated growth, technological change must grow over time. Theories that explain endogenous technological change were known as early as the 1960s , Arrow (1962) model of learning by doing, Uzawa (1965) model of human-capital-driven productivity improvements, and Shell (1967) model of inventive technological activity. These models are part of the "First Wave" of the literature on economic growth. Then, during the mid 1980s, Paul Romer 1986) show that historical data do not display declining growth rates. I contributed to developing the theory of the effect of the accumulation of human capital, in addition to the accumulation of physical capital, on growth, in my doctoral thesis from 1969, in Razin [1972, 1973]. Paul Romer (1986) worked out an explicit model of a growing economy that reconciled the opposing forces of increasing and diminishing returns, and did so in a way that generated sustained growth and was at the same time consistent with perfect competition. Output is produced with a single kind of capital and each producer's output depends on the stock held by all other producers, i.e., external economies of scale earlier uzawa construct an optimum growth model, centrally commanded, in which there are both physical and human capital but private returns depend on the ratio of these two stocks. This theory replaces the increasing returns and solves the problem to sustain permanent growth posed by diminishing returns, a la Solow. I noticed that in the Uzawa's model private and social returns coincide and applied the Uzawa model to the competitive economy. Years later this theory was extended by Lucas (1988).

He put forward a model that emphasized exogenous influences in knowledge accumulation, Paul Romer (1986) set off a "Second Wave" of the economic growth literature. Paul Romer's representative manufacturer has a production function in which output depends on the manufacturer's inputs of capital, labor and his own stock of knowledge. In addition, this productivity also depends on the aggregate stock of knowledge in the entire economy (this is the source of the externality effects). The result is that the growth rates may increase over time until they converge to a fixed long-term growth rate.

The empirical question in connection with the empirical implementation of Romer (1986) model is where are these externalities, and how large they are? Studies that address micro level and macro level data did not find externalities in the investment in education. Research therefore turned to concentrate on the external influences in knowledge accumulation through R&D. Griliches (1969) was one of the first to find that the social rate of return on R&D investment is much higher than the private rate of return. This provided important evidence of the existence of externalities. Grossman and Helpman provided the analytical framework for describing situations of acceleration in knowledge accumulation, based on R&D. The economic mechanism they put forth is: the greater the investment in R&D in the past, the greater the stock of knowledge accumulation; knowledge accumulation helps reduce the cost of R&D in the present. New models link the size of the market to the incentives for innovation. This link is due to the fact that profits from the

development of new products rise, the greater the size of the market in which these new products are sold.

5. INTERDEPENDENCE

This chapter places economic growth in the center of the globalization process and discusses the effects of globalization on economic growth. The main theme here is that globalization has a marked impact on economic growth, but it also unleashes forces of convergence to, and divergence from, equality of income per capita.

The book traditionally contends: "Capital accumulation raises income per capita. As the capital-labor ratio rises, however, the increasing capital stock contributes to output at a diminishing rate and the incentive to accumulate declines….. This argument takes a different form in an open economy that engages in international trade, because trade permits a country to specialize and specialization affects the return to capital. Small countries in particular can avoid the curse of diminishing returns because their terms of trade are not sensitive to the size of their capital stock.".

Terms of trade that improve or worsen as a result of openness account for just one channel of economic development. The flow of knowledge creates another channel. Grossman and Helpman (1995), who contribute to developing the theory of the international flow of knowledge, find that a country's productivity depends, in the long term, on the structure of demand between the knowledge development sectors and the traditional sectors, and the initial stock of knowledge. A typical economy will acquire knowledge through learning-by-doing, which may spill over from its international trade partner. In this case, the question of whether the learning by doing is at the national or the international level is important. If learning-by-doing is national in scope, Krugman (1987) shows that the growth rates of income per capita do not converge. Grossman and Helpman (1991) show that patterns of interdependence can generate a variety of outcomes regarding specialization, international trade, enhanced rates of growth and convergence Conversely, where learning-by-doing is international in scope,. In extreme cases, where other countries fully share the global stock of knowledge, R&D, the rates of increase in TFP equalize.

Empirical studies of the link between trade and growth must take into account the endogeneity of trade flows, To prevent biased estimates. Frankel and Romer (1996) employ gravity equations to describe trade relations between pairs of countries based on geographical and other characteristics, used as instrumental variables (IV) Predicted trade estimates obtained from using the instrumental variables were used to examine the link between income per capita and international trade. The trade estimated coefficient in the growth regressions for the instrumental variables was twice as high as the estimate obtained using the ordinary least squares (OLS) estimate. The latter evidently ignores the reversed (endogenous) growth impact on trade. The effect that trade has on income per capita through TFP is much stronger than other indirect effects through capital deepening and education.

Coe and Helpman (1995) estimate the effect of domestic and foreign R&D capital stocks on productivity level. For this purpose, a foreign R&D capital stock was computed

as a weighted average of the domestic R&D capital stocks of the trading partners, where trade shares of international products and services served are used as weights. This allows them to explain approximately 60% of the variation between countries at TFP levels. The evidence reviewed in this chapter regarding the effect of international trade policy on growth is however not clear cut. But this is hardly surprising as the theory of growth does not predict a simple relationship between international trading policy and growth.

6. INEQUALITY

Kuznetz (1955) was the first to suggest that the personal distribution of income may change systematically along a country's development path: "Using a sample of low-income countries, income distribution was more unequal in the relatively richer countries; among the high-income countries, the distribution of income was more unequal in the relatively poorer countries in this group." The link between inequality and development can be described by a U-shaped function, which became known as the Kuznetz Curve. Bourguignon and Morrison (2002) study the evolution of inequality in the distribution of personal income worldwide, since 1820. During this long period, the average income of world inhabitants increased by a factor of 7.6, compared with a factor of 4 for the average income of the bottom sixty percent; and a factor of 10 for the income of the top decile. The literature on this subject shows that the factors that create the link between the index of inequality and growth have contrasting effects. Savings institutions, credit constraints, and political economic mechanisms work in complex ways in determining the link between distribution of income and growth.

Although research in this area is still in its infancy, Elhanan Helpman tentative conclusion is that inequality slows growth. Likewise, the effect of openness on inequality is also in dispute.

The education premium in the case of wage disparity is a widespread problem in the developed countries that can be explained by skill-biased in technological changes that rely heavily on professional labor, or due to international trade, as in the Heckscher-Ohlin international trade paradigm. Developing countries have a relatively large supply of unskilled workers and they therefore specialize in unskilled, labor-intensive industries. During the 1990s, the percentage increase in products manufactured using unskilled labor lowered their relative price, thus adversely affecting wages for unskilled labor in the developed countries. But many studies have shown that the growing wage disparity cannot be explained by the above foreign-trade mechanism, and it would appear that technological changes played a key role in explaining this disparity.

Elhanan Helpman concludes this chapter and presents evidence that, on average, growth has increased the income of the poor worldwide.

7. INSTITUTIONS AND POLITICS

The final chapter of the book, and the most thought provoking for future research, addresses the role of economic and political institutions that protect property rights on long-term growth. This discussion is critical to explaining the differences in income per capita across countries. Because, even after we take into account the accumulation of both physical and human capital, and the investment in R&D, large differences remain in cross-country growth rates.

Douglass North (1981), the economic historian, views the Industrial Revolution as a major institutional and organizational change. True, the accelerated pace of technological innovation began even before the Industrial Revolution. But, it was the institutional change that brought about improved protection of property rights, which in turn resulted in accelerated growth during and after the Industrial Revolution.

In this context, the differences between English common law and French civil law are extremely important. Through colonization, the civil law and common law systems were presumably transplanted to numerous countries. Law and law enforcement are stronger in countries that adopted the English common-law system, and weaker in countries that adopted French civil law. Some scholars believe that the political, legal and economic institutions created by the colonial countries in their colonies determined their long-term economic development. However, Engerman and Sokoloff (1997) study the hypothesis that the distribution of basic resources determined the patterns of development in the colonies. Some parts of South America that attracted migrants had land and climate that were suitable for growing commodities such as coffee and sugar and this activity created large inequalities in wealth and political power. These characteristics in turn helped create economic institutions that favored the plantation owners; thereby propagating inequality. In the same vein, other parts of Latin America were blessed with rich mineral resources. Here too large inequalities were formed based on favors allocated by the Spanish crown. In contrast, in the northern part of North America, where there were few native inhabitants and the smaller tracts of land were more suited to grains, large plantations did not develop as was the case in southern America. These conditions created fewer inequalities of wealth and political power, which better protected individual property rights. In turn these geographical-based circumstances promoting faster growth. However, the Engerman-Sokoloff hypothesis was not tested meticulously.

Acemoglu, Johnson and Robinson (2001) were the first to present arguments that local conditions rather than the identity of the colonial power, determined the development of the economic institutions that protected individual property rights. Using the difference in local conditions, they tested and partially explained the development of economic institutions and through them the difference in cross-country growth rates. Their theory consists of three building blocks. First, the colonizers were able to choose between forming economic institutions that would immediately help exploit the natural resources, or replicating the institutions of their country of origin; thereby facilitating the stable development of the colonized economy. Second, the choice between the exploitation or non exploitatation strategies depended on whether local conditions were or were not favorable to a long-term stay by the colonizers: A short stay was unlikely to encourage the development of Western

European institutions in the colony. Third, once the economic institutions that formed a framework for economic development were established, did they survive after the colonized countries gained their independence. They use a standard econometric technique of instrumental variables to neutralize the endogenous effect (the endogeneity has to do with reversed causality; from the institutions to growth and from growth to the economic institutions). The instrumental variable is the settler mortality rates. These are taken as indicators of colonial planned stay in the settlement. Settler mortality is presumably a powerful instrument because it strongly correlates with the local conditions faced by the early settlers, but is uncorrelated with economic growth, as it developed hundreds of years later.

Which of the two, geography or the quality of the institutions that protect private property rights, plays the primary role in economic development? Sachs and Warner (1995), who emphasize the importance of international trade for growth, attribute this role to geographical location and as evidence present the fact that countries with a temperate climate or that have easy access to trade have a significant advantage over regions that are tropical or landlocked.

Hall and Jones (1999) use the index of Western European influence and distance from the equator as instrumental variables for institutions in the first stage estimation. In the second stage, they examine the effect of the institutions on output per worker. Their study lends support to their conclusion that development takes place through institutions. Acemoglu, Johnson and Robinson re-entered the debate (2002) when they find that countries or regions that were relatively rich in the year 1500 were relatively poor in the year 1995, and also the reverse is true. They thereby convincingly demonstrate that geography cannot explain this pattern of "reversal of fortune".

The book concludes with a review of the role of economic and political interests in shaping economic development. There is a political-economy argument as to whether democratic regimes grow at a different rate from autocratic regimes. Elhanan Helpman review of the political effect of the democracy or autocracy on growth points to a dispute on the issue of whether democracy brings about development or development brings about democracy. The causal track cannot be identified in the data. It is therefore im [possible at this stage to draw straightforward conclusions on the direction of the effect.

With this the book concludes: "The study of institutions and their relation to economic growth is an enormous task on which only limited progress has been made so far. Nevertheless, renewed interest in this subject has produced new theoretical and empirical methods, new data sets and new insights. We are now therefore better equipped to face this task.".

8. SUMMARY AND ASSESSMENT

Elhanan Helpman is gifted with the rare skill that helps him combine an in-depth view with a broad perspective. This book is an excellent expression of this unique ability. He manages to find a way to tell a fascinating story, emphasizing both the theoretical and empirical implications and findings in the development of economic thought about economic growth.

We should remember that such a synthesis is based on a huge body of literature that has developed over more than fifty years, since Robert Solow broke the ice, so to speak. In composing this survey, Elhanan Helpman had to identify those important scientific contributions that have an on-going scientific value many years after they were made in some cases, and bring them together with the cutting edge current research, in logical order as a single integrative framework.

The story of the “mystery of economic growth” concentrates on analyzing only the "numerator", which appears in the income per capita ratio. But this is just one element of the story of economic growth. The other element relates to the "denominator", which appears in the income per capita ratio, which the book does not address at all (and Elhanan explicitly acknowledge this in the introduction). The literature that deals with the development of the interactions between the “numerator” and the “Denominator”, that is between population growth, productivity and income per capita, begins in the days of Malthus. In modern times it was re-developed by Becker (1961), Razin and Ben Zion (1975), and a new wave has recently been taken by Galor and Weil (1999) and Galor and Moav (2002).

One other thing is missing from the more complete account of the mystery-of economic-growth subject is the role played by institutions of the welfare state. The development of institutions of the welfare state (such as Social Security) which have an important role in reducing income inequality affected also the determinants of savings and birth rates, mortality and thereby growth.

The story of the mystery of economic growth will continue to preoccupy economists in future generations. Elhanan Helpman provides us with progress report that can influence further research on this fascinating subject.

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