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GROWTH: AN
INTERDISCIPLINARY
APPROACH**

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LONG-RUN ECONOMIC GROWTH: AN INTERDISCIPLINARY APPROACH *

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Abstract

Economic growth and development is a complicated process that falls into the domain of many disciplines in social sciences and humanities. It is natural then to study fundamental aspects of economic growth synthesizing research in relevant fields. In this short paper, we argue that this has rarely been the case in the economic growth literature. We briefly discuss past growth theories and empirics, and present a broad framework to compare and evaluate work on economic growth from an interdisciplinary perspective.

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1. Introduction

Economic growth implies increases in per-capita real gross domestic product (GDP), namely widening of the production scale in a country as a whole, or more efficient use of its economic resources to produce goods and services. Although development per se encompasses a wide range of phenomena ranging from indicators of “quality of life” to “human development,” the increase in per-capita GDP is a major component of economic and social development. Since the scale of production or productivity can only be increased in the long run, secular economic growth is considered a long run phenomenon.

Investigation of sources of long-run economic growth and development has always been an interesting topic for economists. After all, the observed pattern in economic growth across countries and time begs the question why some countries prospered and others did not. This intellectual challenge notwithstanding, the recent proliferation of a vast theoretical and empirical literature is partially due to improvements in the economists’ mathematical tools and the availability of comparable cross-country data on macroeconomic aggregates (the so-called Penn World Tables).

Most empirical studies in the literature, however, present only a set of exogenous factors influencing economic growth within the framework of single-equation regressions. These studies usually consider *one-way* causalities running from selected economic (and recently, non-economic) regressors to per-capita real output growth ignoring the possible endogeneity of most factors. Political scientists or sociologists behave no differently from economists when they try to explain the level of or improvements in democracy, institutions, culture etc. They assume, for example, that per-capita real income or the growth rate of real GDP matters for democracy with no reverse effects.

We believe that the nature of economic growth is too complex to be captured by estimating single-equation regressions. Therefore, in this paper, we stress the importance of an interdisciplinary approach. To that end, we propose a broader framework of a set of

linkages to capture most of the important interactions among economic growth, production factors, demographic characteristics, location, culture, institutions, income distribution, political and macroeconomic stability, and government policies.

The next section briefly reviews the economic growth literature with special reference to one-way and two-way causalities between a set of variables and economic growth. In Section 3, we discuss long-run economic growth and possible interactions with other processes. We then try to evaluate some current research in terms of a matrix of interactions and discuss the merits of an interdisciplinary approach. The last section concludes.

2. A Brief History of Growth Theories and Empirics

Adam Smith's (1776) *An Inquiry into the Nature and Causes of the Wealth of Nations* may be seen as a suitable starting point for economic growth theories. In Smith (1776), not only capital accumulation but also technological progress and institutional and social factors play a crucial role in the economic development process of a country (Kibritcioglu, 1997). Smith distinguished between three stages of economic growth. In his opinion, nations like China and Turkey were at "a low level equilibrium trap" because of "bad-governance" and an insufficiency in maintaining basic human rights and freedoms or "property rights" in modern parlance. This was due to cultural and institutional backwardness of these countries. Leading nations in his age were England and North America but they were only at the second stage of development. They were still in a "natural freedom" environment, and therefore, in an ongoing economic growth process.

Smith believed that no country in the 18th century was at the third stage of economic growth. According to Smith, the natural environment limits economic growth beyond a certain level. Falling profit rates along the growth path of an economy, changes in the relative factor scarcity and decreases in profitable investment opportunities all play a role in constraining economic growth. These limitations of nature arise from limited land endowment and lack of favorable conditions, climate and geographical location of the

country. Thus, every growing economy, had to slow down and stop at an upper limit of development. The notion of an upper limit to growth perhaps is related to the agrarian based society of Smith's age.

The idea of long-run steady state in Smith (1776) influenced many generations of economists, from David Ricardo to Roy Harrod. Harrod's (1939) and Domar's (1946) Keynesian growth models concede that factors of production are not substitutable and investment decisions are functions of expected demand for goods and services. An important aspect of the standard Keynesian growth model is that there is an unstable balanced growth path in a closed economy due to a fixed-coefficient production function and the existence of an independent investment function given investor expectations regarding future demand for goods and services. As a corollary of the model, government policies can affect the long-run growth rate of real output in the economy.

The subsequent Neoclassical growth model is due to Ramsey (1928), Solow (1956), Swan (1956), Cass (1965), and Koopmans (1965). The basic assumptions of the one-sector neoclassical growth model are constant returns-to-scale, diminishing marginal productivity of capital, exogenous production technology, substitutability of capital and labor, and lack of an independent investment function. The standard neoclassical growth model implies that the steady state growth rate, aside from exogenous technological progress, is zero. That is, conventional macroeconomic policies such as government investment can affect the level of per-capita income but they have no effect on the long run growth rate of the economy. Moreover, improvements in the production technology are not explicitly modeled; they are reduced to a "black box" in the model. The exogenous technological improvements, if continuous, can compensate for the negative effect of decreasing marginal productivity of capital thereby leading to long run growth. Finally, the exogenously determined constant population growth rate is the main determinant of per-capita real income level in many neoclassical models.

The standard neoclassical growth model implies that countries with the same steady-state capital per-worker but different initial relative factor endowments and per-capita

incomes will grow at different rates to eventually reach the same per-capita income level. This so-called “absolute convergence” between fast-growing poor, and slow-growing rich countries is based on the assumption that technology, the saving rate, and population growth rate are all identical across countries, and that returns to capital are diminishing. The convergence hypothesis was to become a major point of disagreement with the subsequent endogenous-growth theory, in particular following Romer (1986) and Lucas (1988). Currently, it is generally accepted that there is more evidence in favor of a “conditional convergence”; e. g. Barro (1991), Mankiw et al. (1992) and Barro and Sala-i-Martin (1992). That is, countries with different parameters and different steady-state capital per-worker targets will grow at different rates but those with similar parameters will converge to reach the same per-capita output level.

P. Romer, R. Lucas and other proponents of endogenous growth theory argued that, unlike physical capital, human capital may be augmented by non-diminishing returns, which permits economic growth to continue indefinitely. Accordingly, technological progress occurs as a purposeful economic (R&D) activity when profit maximizing agents seek out newer and better products. Inventions are rewarded with an ex-post monopoly power through patents to cover the high cost of initial investments necessary to bring new products to the market. There is another dimension of the economics of new ideas or technology: innovations have a public component (externality) in that they raise the productivity of all subsequent innovators (knowledge spillover effect). Ultimately the growth rate of an economy depends on R&D technology, the degree of firms’ monopoly power (appropriability of new technologies) and time horizon of investors.

Endogenous growth models developed within the framework of inter-temporal optimizing behavior of rational agents represent different intellectual influences. Some models can be broadly considered as an extension of the Schumpeterian or the institutional tradition. Some others have strong neo-Smithian or still a neoclassical background. Some of these models are even called Harrod-type growth models.

First generation endogenous growth models achieve positive and constant steady state growth rates both by assuming *non-decreasing* returns-to-scale and by *endogenizing* technological improvements; e. g. Romer (1986, 1990), Lucas (1988) and Becker et al. (1990). That is, technological spillover effects resulting from investments in research & development, human capital or technological infrastructure ensure a self-feeding growth process in the economy. Another class of models known as the “AK type”, replace the assumption of diminishing marginal productivity of capital with the *non-diminishing* marginal productivity of the accumulable factor of production to achieve positive and sustainable steady state growth rate in the economy; e. g. Jones and Manuelli (1990) and Rebelo (1991).

Endogenous growth models, no matter whether they are “scale” or “AK-type” models, emphasize the important role of governments’ fiscal, technology, education and health policies in the process of economic development. They also leave some room to historical, cultural and sociological factors as determinants of long-run growth.

Nevertheless, empirical evidence does not strongly support either the absolute convergence idea of some neoclassical models or the existence of increasing returns-to-scale in endogenous growth models. The criticism of the latter has recently led to the development of non-scale growth models as in Turnovsky (2000), which is much closer to the neoclassical model. Jones (1995), for example, argues that the steady state growth rate is independent of traditional macroeconomic policies. However, because of slow convergence speeds in the transition process, these policies can lead to remarkable long-run effects on the *level* of per-capita income.

It was recognized, from early on, that many non-economic factors interact with the economic growth process. For example, institutional economics in the tradition of North and Thomas (1973) and North (1990) examine the link between economic development and institutions while there is a tradition in political science since Lipset (1959) that explains political institutions and democracy in terms of economic development.

In the standard neoclassical approach, history and institutions do not matter. The so-called growth-accounting techniques of the neoclassical tradition measure the relative significance of the capital stock, labor, and technology in the economic growth process. This usually is done within the framework of a macroeconomic production function; e. g. Denison (1962) and Barro (1999). However, modern institutional economists tell us another story. North (1994: 1), for example, argues that:

“Institutions are the incentive structure of a society and therefore the rules, norms, and enforcement characteristics that make up the institutional foundations of a society direct the allocation of resources of that society and economy. Economic growth throughout history could only be realized by creating an institutional and organizational structure that would induce productivity enhancing activity – a supply side argument; and equally that the consequent tensions induced by the resulting societal transformation have resulted (and are continuing to result) in politically-induced fundamental changes in the institutional structure to mitigate these tensions – a demand side argument. Both the supply side and demand side institutional changes have been and continue to be fundamental influences on productivity change.”

This rich streamline of the growth literature that relates economic growth both to macroeconomic variables and institutional variables / democracy is surveyed and evaluated by Sirowny and Inkeles (1990), Przeworski and Limongi (1993), Aron (1997, 2000) and Moers (1999).

Lipset (1959) is one of the earliest attempts to present a framework whereby economic development influences the political regime and democracy. Following Lipset (1959), many authors such as Rustow (1970), Pourgerami (1988) and Huntington (1991) investigated whether the degree of economic development is one of the major determinants of institutions and democracy. Nonetheless, from the standpoint of political scientists, economic growth and development are mostly exogenously determined. This clearly illustrates the importance of accounting for simultaneity / two-way causality between growth and democracy, which can be appropriately resolved by an interdisciplinary approach to growth, as we shall argue in the next section.

3. Interdisciplinary Aspects of Economic Growth

Before discussing the importance of an interdisciplinary approach, it is instructive to elaborate on what is meant by endogenous growth. Note that in our discussion, the endogeneity of factors influencing economic growth does not render long-run economic growth itself endogenous. The concept of “endogenous growth” as it is used in the economics literature refers to explicit modeling of factors that lead to sustainable long run growth, which is derived from optimal behavior of agents in the model. Although, at the theoretical level, endogenous growth models have improved our understanding of why growth rates differ across countries and over time, they cannot account for most of the observed variation in the data. The typical method in the growth literature is to estimate regressions with measured per-capita income growth as the dependent variable and a variety of ad hoc conditioning variables as explanatory variables. The inclusion of these wide ranging conditioning variables is aimed at explaining growth in productivity, the latter being largely responsible for economic growth. Even though the proliferation of this empirical literature and some of the results have been instructive in many ways, a good fraction of these regressions are hard to interpret, unstable, and involve what Durlauf and Quah (1999) called “a blaze of mediocre sociology”. For example, this latter study tabulates more than one hundred equations estimated in the literature.

In order to account for two-way linkages between economic growth and other factors, we propose a matrix of interactions as a frame of reference. In this matrix, it is possible to summarize all potential linkages and hypothesize their relative strength. This can be done, for example, using theoretical or empirical work in relevant fields. Due to the complexity of the processes involved, this may involve drawing conclusions with regards to hypothesized relationships from such distinct fields as anthropology, geography, history, political science, sociology, and economics. Only then, can one make certain that the explanatory variable in one field is not the dependent variable in other fields. Therefore, as a first attempt, we hypothesize two-way linkages between possible explanatory factors and




long-run growth as shown in Table 1. For clarity and compactness, we aggregate the set of factors interacting with economic growth into nine groups.

Table 1: Possible Interactions in the Economic Growth Process

	Capital and Labor	Technology	Demographic Factors	Geographical Factors and Climate	Cultural Factors	Institutional Factors and Democracy	Income Distribution	Government Policies	Macroeconomic Stability	Economic Growth
Capital and Labor	1									
Technology	2	11								
Demographic Factors	3	12	20							
Geographical Factors and Climate	4	13	21	28						
Cultural Factors	5	14	22	29	35					
Institutional Factors and Democracy	6	15	23	30	36	41				
Income Distribution	7	16	24	31	37	42	46			
Government Policies	8	17	25	32	38	43	47	50		
Macroeconomic Stability	9	18	26	33	39	44	48	51	53	
Economic Growth	10	19	27	34	40	45	49	52	54	55

The first set of explanatory factors includes supply-side variables like domestic capital accumulation, increases in the labor stock, foreign direct investment, and immigration. The technology block includes learning-by-doing, human capital formation, education, research & development efforts, and technological infrastructure in a country. Fertility rate, birth control, participation in the labor force, and age distribution in the country comprise the demographic set of influences. The fourth group includes geography, climate and hence, the location and natural resource endowment of a country. We count the role of religion, ethics and language within the boundary of cultural factors which forms group five. Group six includes the level of or improvements to institutions, the legal system, the financial

system, democracy, and political stability. The sixth group consists of the existence, deepening, and efficiency of markets (e. g. capital market) and related legal regulations. Income distribution constitutes the seventh group. Monetary, fiscal, trade, exchange-rate, education, technology, health, defense and other relevant policies of governments are one of the most important set of factors used by economists in explaining economic growth. Finally, the degree of macroeconomic stability (price stability or the stability of other macroeconomic indicators) is included in our framework of growth as the last group.

In this paper, we interpret long-run growth as a net result of multilateral interactions among these nine set of factors and economic growth itself. That is, there are 55 possible two-way direct linkages that form an intricate web of interactions. The direction of arrows in the numbered 55 cells of the table shows the expected direction of the influence between two sets of corresponding factors. A  sign, for example, denotes an expected causality running from the row factor to the corresponding column factor. A bi-directional arrow () , on the other hand, is an indication of a two-way causality. Moreover, solid black arrows show stronger anticipated effects in comparison to gray arrows. Finally, cells with a hollow circle  represent weak or negligible interactions. Note that these arrows represent direct two-way interactions; causal effects through third variables are possible as indicated by their relevant cells.

Smith (1776) is one of the earliest contributions to growth theory as mentioned in the previous section. His detailed considerations about growth and its sources present valuable insights in terms of numerous cells in Table 1. The Keynesian approach to growth can be viewed as limited to cells 8 and 10. The neoclassical theory, on the other hand, focuses on cells 1, 3, 19 and 10. Endogenous growth theories improve our understanding of growth through clarification of the linkages shown in cells 2, 6, 19, 8, 17 and 10. Institutional economists emphasize the role of institutions and democracy in the process of growth (cells 41 and 45). Lipset's (1959) approach where the causality is running from growth to democracy falls within cell 45. Almost all of these growth theories and related empirical studies, however, investigate *one*-way relations between selected factors and growth.

Recently, Helliwell (1992), Minier (1998), Hall and Jones (1999), Gallup et al. (1999) and Acemoglu et al. (2000) provide exceptions to the rule: these studies model complicated interactions between various factors to improve our understanding of growth. Helliwell (1992) detects a positive effect of growth on democracy and reports a negative, but insignificant reverse effect. In addition to these reciprocal effects within cell 45, he also considers a positive indirect effect of democracy on growth, flowing through effects of democracy on education and investment (cell 6) which compensates for the weak negative direct effect of democracy on economic growth. Helliwell concludes that it is difficult to identify any systematic net effects of democracy on long-run growth. Minier (1998) focuses on both direct effects of democracy on growth and indirect influences of democracy on growth through education and the rule of law. According to Minier, democratizing countries grow faster than a priori similar countries, while others that become less democratic grow slower than comparable ones.

Hall and Jones (1999) present one of the most detailed yet uncommon models in the growth literature. They argue that international differences in *levels* of output-per-worker are determined by differences in human and physical capital accumulation and productivity (cells 10 and 19) but this is not the whole story. Productivity is highly correlated with human capital accumulation and moderately correlated with the capital-output ratio (cells 1 and 2). Capital and factor productivity are determined primarily by social infrastructure defined by Hall and Jones as a combination of institutions and government policies that form the economic environment within which individuals accumulate skills, and firms accumulate capital and produce output (cells 45 and 52). Social infrastructure is in turn endogenized by assuming that institutions and government policies are a function of geographical and linguistic characteristics of a country (cells 30, 32, 36 and 38). The authors also consider the effects of real per-capita income on institutions and government policies and check the robustness of the results by allowing the differences in religion, population and political-economic systems of countries.

Finally, Acemoglu et al. (2000) argue that current economic performance of former European colonies is mainly determined by current institutions (cell 45). They suppose that colonial institutions from the 17th to 19th century persisted even after their independence and that the feasibility of settlements influenced largely the colonization strategy of Europeans. The mortality rate faced by settlers like soldiers, bishops, and sailors stationed in colonies created different colonization strategies and hence, different institutions in different colonies. In places where the disease environment was not favorable to their settlement, Europeans preferred to form “extractive states” where they did not introduce institutions that are conducive to protecting private property. According to this study, roughly three-quarters of differences in per-capita income of former colonies can be explained by institutions, and one-quarter of differences in institutions is explained by the mortality rates of settlers. Although the authors ignore the possible effects of economic growth on institutions in the sense of Lipset (1959), it is encouraging to see that they check the robustness of their results related to mortality from diseases like malaria and yellow fever by investigating possible effects of climate, location, geography, religion, race composition and natural resources on institutions and growth (cells 30, 36, 34 and 40). In a follow-up study to Acemoglu et al. (2000), McArthur and Sachs (2001) recently extended the sample of countries used by the former study and concluded that both institutions and geographically-related variables such as malaria incidence or life expectancy at birth are strongly linked to per-capita GDP. Similarly, Gallup et al. (1999) investigate the link between geography and economic development through linkages in technology and institutions. Accordingly, geography reduces agricultural productivity and health, thereby hindering economic development. Adverse geography is also conducive to state predatory behavior which leads to predatory institutions and underdevelopment (cells 13, 19, 30, 15, 45).

It is evident that traditional empirical growth literature ignored interdisciplinary aspects of economic growth. However recent studies summarized above aim to exploit interactions and repercussions that had been previously ignored. Needless to say, these models provide steps in the right direction.

It is clear that estimating *all* of the numerous direct and indirect growth enhancing or hindering effects empirically is difficult if not impossible. First, there are data availability and measurement problems. Second, as in all simultaneous equation models, there has to be at least as many exogenous variables as there are equations. Moreover, establishing the direction of causality requires an empirically tested theoretical structure. However, by using such an interdisciplinary framework as a starting point, it is possible to understand and critically evaluate various growth theories and empirical studies. It is also possible to build models that draw upon research from various fields that can better account for observed variation in the data.

4. Concluding Discussion

Historical evidence provides diverse experience with regards to economic and social development. While a handful of countries achieved remarkable growth and prosperity, a good number of countries struggle in poverty with little or no trace of accelerated growth. P. Romer, R. Lucas and others provided an explanation: unlike physical capital, knowledge or human capital may be augmented by non-diminishing returns, which permits economic growth to continue indefinitely. This is the so-called “endogenous growth” theory. Accordingly, technological progress occurs as a purposeful economic (R&D) activity when profit-maximizing agents seek out newer and better products. There is another dimension of the economics of new ideas or technology: innovations have a public component (externality) in that they raise the productivity of all subsequent innovators (knowledge spillover effect). Ultimately the growth rate of an economy depends on R&D technology, the degree of firms’ monopoly power and the time horizon of investors. In addition to the interest generated by these recent theoretical models, the availability of comparable cross-country data on macroeconomic aggregates spurred a vast empirical literature on economic growth.

The typical method in the growth literature is to estimate regressions with measured per-capita income growth as the dependent variable and a variety of ad hoc conditioning variables as explanatory variables. A good fraction of these regressions are difficult to

interpret, unstable, and lack a coherent social science perspective. In this paper we argue that economic growth is a complex process that calls for a synthesis of various disciplines in social sciences. As a starting point, we propose a “matrix of interactions” of various factors that correlate with economic growth. This matrix can be used to gauge directional causalities of all possible two-way linkages. Using the matrix as a reference, it is possible to understand and critically evaluate various growth theories and empirical studies. It is also possible to account for plausible interactions drawing upon research from various disciplines in social sciences. It can be hoped that models built using an interdisciplinary approach can better account for observed variation in the data.

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