ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA

ANALYSIS OF PERFORMANCE AND ASSESSMENT OF GROWTH AND PRODUCTIVITY IN THE ESCWA REGION

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ABBREVIATIONS

CICUP	Center for International Comparisons at the University of Pennsylvania
GCC	Gulf Cooperation Council
GDI	gross domestic investment
GDP	gross domestic product
GFCF	gross fixed capital formation
FDI	foreign direct investment
ILO	International Labour Organization
ISS	import substitution strategy
MDE	more diversified economy
MENA	Middle East and North Africa
MFP	multifactor productivity
PIM	perpetual inventory method
PPP	purchasing power parity
PWT	Penn World Table
OCR	output-to-capital ratio
OECD	Organisation for Economic Co-Operation and Development
OLS	ordinary least squares
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
TFP	total factor productivity

Executive summary

The fifth issue of *Analysis of Performance and Assessment of Growth and Productivity in the ESCWA Region* seeks to identify the determinants of long-term growth and focuses on three sources of growth of selected ESCWA member countries, namely: physical capital, human capital and total factor productivity (TFP). While the analysis presented herein concentrates on the growth performances of Egypt, Jordan and the Syrian Arab Republic over the period 1975-2000, it is important to highlight that the ensuing policy recommendations are pertinent to the entire ESCWA region.

The main findings of the study can be summarized as follows:

(a) The above-mentioned sources of growth in the three countries under investigation were sorted over the entire period by degree of importance, namely, the accumulation of physical capital, followed by the increase of human capital and of TPF;

(b) The dramatic drop in the growth rate in the 1980s and 1990s relative to the 1970s is partly due to the decline of gross fixed capital formation (GFCF) that was not balanced by an equivalent increase in human capital. In fact, the sluggish growth of Egypt and the Syrian Arab Republic and the negative growth of Jordan in the 1980s can be largely attributed to declining stocks of human capital per worker in those three countries in the past two decades;

(c) While the growth rate of TFP was low in the three countries over the period 1975-2000, it was not negative throughout the whole period, revealing instead marked troughs during the 1980s and 1990s. Such a feature is reminiscent of the low rates that prevailed in industrialized countries during the 1970s, when productivity started to slow down.

In those three countries, TFP was not responsible for the high growth rate of the 1970s. Moreover, while it was responsible for the low growth rate in the 1980s and the 1990s, it was not the only factor behind the poor economic performance. In Jordan, for instance, the rate of growth in output per worker during the 1980s was negative mainly as a result of the negative rate of growth in physical capital, which was also the case of the Syrian Arab Republic during that decade. Furthermore, the decline in the growth rate of income per capita could be attributed to structural adjustment policies that skewed income in favour of the rich and lowered the domestic demand component.

There are two main policy recommendations deriving from this investigation. First, Egypt, Jordan, and especially the Syrian Arab Republic are best advised to increase funds for education and to promote critical thinking allowing for qualitative improvements. Making their share of gross domestic product (GDP) equal to that prevailing in the industrialized advanced countries will not be sufficient. Education has been relatively under funded and quality has been below expectations, and this has created an adverse path dependence that is detrimental for growth performance at present and even more for future prospects. Per capita expenditure should almost double the present rate in the three countries, until a new steady state with rising high human capital emerges. Nonetheless, increasing expenditures on education will not suffice unless accompanied by a comprehensive reform of the education system. Beyond raising educational standards, absorbing the educated becomes an issue of industrial capacity and the lack thereof. Negligible industrial integration suggests that few countries will be able to climb the productivity ladder by relying mostly on the private sector to undertake investment. Governments, therefore, can be instrumental to the development process through the allocation of credit programmes, loan and export guarantees, and other protections that help higher productivity sectors grow to face global competition. Without a targeted public sector role in the private economy, education expenditure is insufficient by itself to bring about growth of 'leading' sectors that generate income with higher value added in technologically advanced areas.

Moreover, the three countries under investigation are in urgent need of a new strategy aimed at improving social infrastructure, with two immediate goals, namely: (a) to create an institutional/legal environment that encourages productive activities and attracts foreign direct investment (FDI), while discouraging rent-seeking activities; and (b) to create a policy environment in which uncertainty and transaction costs are continuously reduced through macrostability and microefficiency.

Introduction

Countries of the ESCWA region achieved a high rate of economic growth during the 1970s.[1] Specifically, the rate of growth for the entire region in real GDP exceeded substantially that of population growth, thereby yielding a strong growth rate of per capita income during that decade, which measured 5 per cent. With continuing growth at such a momentum, real per capita GDP could have doubled by the mid-1980s compared to its level at the beginning of the 1970s.[2] However, in the event, the rate of growth in real per capita income became negative in the course of the 1980s and grew by less than 0.5 per cent during the 1990s, thereby indicating a clear slowdown in the region.[3] It is important to note that a similar pattern of growth was experienced to a certain degree by various developed and developing countries across the world, subsequent to the interruption of the post-war growth trend in the late 1970s and early 1980s.[4]

As expected, contractions in investment expenditures were brought about by significant declines in oil prices in the 1980s. Furthermore, in the 1980s and 1990s, the region's economic setback was largely due to disruptions caused by wars and political unrest. Within that context, capital accumulation collapsed in most developing economies after the debt crisis of 1982; and oil exporters, as a group, experienced the sharpest decline. It has been argued that such a fall was the natural result of a correction of excessively ambitious projects, particularly in the areas of petrochemicals and refineries, which had been initiated during the oil boom period. Accordingly, those were restructured in terms of scale and scope in the wake of deteriorating oil prices in 1982 and, in particular, following the collapse of the oil market in the summer of 1986.

A recent study by ESCWA examined the impact of oil revenues on economic activities and compared the region's economic circumstances of the past two decades to those of the 1970s.[5] It indicated that the high oil prices in the 1970s generated significant oil rents that promoted economic growth and, to a certain extent, insulated economic activities from pent-up political tensions in the region.[6] As a result, it allowed the allocation of financial resources to investment expenditures irrespective of the circumstances of the political cycle. However, the sharp fall in oil prices in the 1980s removed that shield and made investment very vulnerable to the volatility of both oil prices and political turmoil.[7]

While changes in oil prices have a direct effect on the countries of the Gulf Cooperation Council (GCC), more diversified economies (MDEs) are far from being isolated from the fate of oil exporters in the Gulf subregion given the role played by such indirect channels as workers' remittances, which are a source of capital inflows. In addition to the fall in oil prices, other factors contributed towards the sharp decline in the rate of growth of the 1980s and 1990s.[8]

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[1] The ESCWA region consists of two subregions, namely: (a) countries of the Gulf Cooperation Council (GCC), comprising Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates; and (b) countries and territories categorized as more diversified economies (MDEs), including Egypt, Iraq, Jordan, Lebanon, Palestine, Syrian Arab Republic and Yemen.

[2] Given that the rate of growth in real GDP per capita in the ESCWA region was 4.99 in the period 1971-1980, solving the equation $2Y(1971)=Y(1971)\,e^{.0499\,t}$ for t yields t=13.89 years.

[3] Specifically, the rate was an estimated 4.99 per cent in the 1970s, dropping to minus (-) 3.43 per cent during the 1980s, and registered a very modest 0.34 per cent during the 1990s. See ESCWA, *Analysis of Performances and Assessment of Growth and Productivity in the ESCWA Region*, First Issue (E/ESCWA/EAD/2003/3).

[4] See D. Ben-David and D.H. Papell, "Slowdowns and meltdowns: Postwar growth evidence from 74 countries", *Review of Economics and Statistics*, vol. 80, No. 4 (November 1998), pp. 561-571.

[5] See ESCWA, "Survey of Economic and Social Developments in the ESCWA Region 2006-2007", chapter V.

[6] The statement is only partially accurate given that political tension was already high in Lebanon before the outbreak of the civil war in 1975, and that the revolution in Iran occurred in 1979 within an environment of high oil prices.

[7] Within that context, the current challenge for the region relates to the creation of an economic environment that insulates economic activities from the intrinsic instability of oil prices in international markets. ESCWA, "Survey of Economic and Social Developments in the ESCWA Region 2006-2007".

[8] Cardoso and Galal indicated that a correlation between oil prices and growth for the period 1976-1999 was insignificant, thereby suggesting that other factors played prominent roles. E. Cardoso and A. Galal, "External environment, globalization and reform," which was presented at the Workshop on Understanding Reform (Cairo, 16-17 January 2002).

According to some analysts, the reversal of the growth in Egypt in those two decades owed primarily to the comprehensive system reform undertaken in the early 1980s. Specifically, the Government pursued a strategy aimed at converting the economy from a socialist system that was dominated by the public sector and based on an import substitution strategy (ISS), to a free market economic system led by the private sector. As a consequence of the transformation, and given that the private sector failed to fill the ensuing gap, public capital formation fell and resulted in a decline in total investment. Such a failure, which can be attributed to a lack of adequate business impetus needed for the successful transformation of the economy, continues to be marked by distortions that plague the economy, including macroeconomic imbalances, price rigidities and a repressed financial sector.[9]

However, the decline in investment expenditures in the 1980s provides only a partial explanation for the substantial fall in the growth rate of per capita income across the region. For example, the economic experience of Egypt, which retained a stable investment ratio to GDP, does not correlate with the case of Jordan and the Syrian Arab Republic. The relevant data show that the magnitude of the decline of the investment rate, measured as the ratio of investment to GDP, was not commensurate with the decline in the growth rate of per capita income. In the case of Egypt, for instance, the investment rate declined annually by a modest 2 per cent during the 1980s, while the annual decline in the per capita income growth rate was 40 per cent.

Additionally, other analysts have observed that the region's average investment rate over the period 1974-2000 was not particularly low. Rather, it reached 24.6 per cent, which is higher than the average rate registered over the same period by the member States of the Organisation for Economic Co-operation and Development (OECD), at 22.9 per cent; and only marginally less than that of the successful economies of East Asia, at 29.9 per cent.[10] The analysts explain the weakening in the growth rate entirely in terms of the decline in the rate of investment. That is particularly true for the early 1980s when regional investment increased while, at the same time, per capita income growth rate decreased, and even became negative. Convinced that the crucial variable was the efficiency of investment rather than the rate of accumulation of physical capital, they applied the growth accounting method over the period 1975-2000 for certain countries in the Middle East and North Africa (MENA). However, they found that TFP growth over the period was "staggeringly low", and actually negative.[11] The exceptions in the Arab region were Egypt, Oman, Syrian Arab Republic and Tunisia, which attributed their low productivity growth to a host of factors, including, most importantly, political instability, inadequate business environment and lack of human capital.

Consequently, identifying low productivity growth as the cause for the decline in per capita income growth during the 1980s and 1990s is misleading, particularly because it did not remain steadily low over the whole sample time period 1975-2000. Therefore, there is a need to understand what caused the high growth of the 1970s. It can be assumed that the answer does not lie in the growth of capital, given that it failed to stimulate growth in the early 1980s. Thus, it is vital to know whether productivity growth was high throughout the 1970s and declined in the following two decades in order to identify those factors that were responsible for growth in the 1970s and were absent subsequently. Put another way, there is a need to recognize those factors that are detrimental to growth and that were absent in the 1970s, but that appeared in the 1980s and 1990s.

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[9] See A. Bisat and M.A. el-Gamal, "Investment and growth in Egypt: 1970-1997 – Lessons from the past and guidelines for the future", which was presented to the Sixth Annual Conference of the Economic Research Forum (Cairo, 28-31 October 1999).

[10] See X. Sala-i-Martin and E.V. Artadi, "Economic growth and investment in the Arab world", which was prepared for *The Arab World Competitiveness Report* (World Economic Forum, October 2002), p. 25.

[11] Ibid., p. 29. Similar results have been reported more recently, with longer time series typically from 1960 to 2000. These include S.C. Baier, G.P. Dwyer and R. Tamura, "How important are capital and total factor productivity for economic growth", *Economic Inquiry*, vol. 44, No. 1 (January 2006); A.S. Abu-Qarn and S. Abu-Bader, "Sources of growth revisited: evidence from selected MENA countries", *World Development*, vol. 35, No. 5 (May 2007); and A. Isaksson, "Productivity and aggregate growth: a global picture", which is a forthcoming working paper by the United Nations Industrial Development Organization (UNIDO) Research and Statistics Branch.

This study is principally aimed at addressing the above questions and providing answers. Within that stated goal, the investigation presented herein extends the well-established growth accounting method in order to conduct dynamic comparative exercises. The objective is to analyse the response of the rate of output growth to changes in exogenous variables that are influenced by Government policies, including such investment in physical capital as increased spending in education that can enhance human capital stock. In addition, it seeks to make recommendations for policymakers in the ESCWA region aimed at reverting the low growth rates of per capita income that have plagued the region in the past decades, and ultimately at increasing the well-being of the entire population.

This study comprises three chapters as follows:

(a) Chapter I presents a brief theoretical background of the investigation in the following sections: (i) the first section outlines the empirical approach that has been adopted in this study, namely, growth accounting, and presents a brief historical summary of the origin of the concept of TFP growth and its role within the neoclassical theory of production; (ii) the second section reviews the textbook version of the neoclassical growth model that was extended to include human capital, thereby allowing transitional dynamic analysis; and (iii) the last section of this chapter reviews the economic literature related to human capital and growth, which are highlighted by both the endogenous growth models and recent empirical literature. In addition, a didactic description of the term "productivity" is presented in order to clarify its dissimilar meanings, scopes and measures. Finally, the last section focuses on the controversy surrounding the weak relationship between human capital and growth that has been suggested by empirical analysis, and outlines some probable explanations that have been put forward over the past decade. Within that context, the chapter provides a brief yet accurate summary of the proxies that have been recently suggested for more accurately enhancing the stock of human capital;

(b) Chapter II is devoted to empirical analysis and consists of two sections, namely: (i) data issues, which depict periodicity (time period), data sources and variables used in the model, and briefly explains the adopted methods and approaches aimed at constructing some of the series given the absence of adequate empirical estimations; and (ii) empirical results, which present the growth experience profile over the sample time period 1975-2000 of the selected three ESCWA member countries. The model is used to qualitatively explain the profile and, more specifically, the theoretical apparatus of the model is used to explain the significant drop in the growth rate in the 1980s and 1990s. The second segment quantitatively analyses the same profile by simulating the model using the growth accounting method;

(c) Chapter III presents the conclusions and recommendations that are relevant both to the countries under investigation, in terms of assessing economic performance, and to ESCWA member countries more generally, in terms of underscoring economic policy decisions. The ultimate aim is to find an approach whereby the current situation, characterised by lack of investment, slow GDP per capita growth and insufficient human capital accumulation, can be reversed in order to take full advantage of the current oil boom and, consequently, increase the wellbeing of the population.

I. THEORETICAL BACKGROUND

Growth occurs when there is an increase in the factors of production and/or there is an improvement in the productivity of such factors. While the former causes a temporary increase in the growth rate of production, the latter has a permanent effect. It is important to note that while standard inputs have a less than proportional impact on growth given diminishing returns of scale, any TFP growth generates a proportional increase in the overall production. That is one of the reasons why growth accounting continues to be the centre of discussions regarding the long-term determinants of economics growth.

A. METHODOLOGY

The growth accounting framework provides a straightforward method for analysing the process of economic growth. It decomposes the rate of output growth into two separate sources, namely, contributions from factor accumulation and improvements in efficiency. While the first component owes to physical capital and labour, which are readily available from collected and published data, the second source is computed as a residual from an aggregate production function and corresponds to changes in national income, which are not described by changes in the standard factors of production. However, the residual captures any kind of technological change.[12] Moreover, it is nowadays considered as a measure of our ignorance regarding the real causes of growth in the long run (see box 1). This criticism was totally well-founded in the past and still carries some truth, given that TFP can pick up increases in productivity arising from innovations or efficiencies caused by corporate improvements.[13]

Additionally, TFP is occasionally labelled as multifactor productivity (MFP). While that is an indicator of productivity, it differs from other measures of productivity because it quantifies the combined effect of different factors of production (see box 2). The ratio usually takes account of total production in the numerator and of the main inputs of production in the denominator. Consequently, MFP could represent the total output per unit of, for example, combined labour and capital inputs of production. It is important to note that the traditional factors of production are weighted by their respective incomes. Moreover, it is worth drawing attention to the fact that "land" as an input is generally neglected in aggregate production functions because its inclusion could overstate the share of physical capital, thereby underestimating TFP growth.

During the past fifty years, the Solow residual has usually been attributed to technology in the broadest sense.[14] However, it has been repeatedly indicated that caution must be exercised when growth accounting is employed and that, in particular, results must not be considered as a pure measure of technological progress.

Moreover, estimates of TFP growth that emanate from the standard framework have a number of limitations, including the following:[15] (a) the method is not an authentic theoretical concept or a theory of growth because a complete theory of TFP does not yet exist;[16] (b) the method is only valid if countries have attained a steady state of balanced growth whereby output grows at the same rate as input; and (c) factor prices must coincide with marginal products.

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[12] See, for example, R.M. Solow, "Technical change and the aggregate production function", *Review of Economics and Statistics*, vol. 39, No. 3 (August 1957), pp. 312-320.

[13] Note that for shorter timespans, the results that emanate from growth accounting exercises have been employed to analyse the short-term effects of the business cycle on the overall economic performance of countries.

[14] R.M. Solow, "Technical change and the aggregate production function", *Review of Economics and Statistics*, vol. 39, No. 3 (August 1957), pp. 312-320.

[15] See, for example, Z. Griliches, "Productivity: measurement problems" in *The New Palgrave: A Dictionary of Economics*, J. Eatwell, M. Milgate and P. Newman (eds.), vol. 3 (Stockton Press, 1987), pp. 1010-1013; E.C. Prescott, "Lawrence R. Klein Lecture 1997: Needed: A theory of total factor productivity", *International Economic Review*, vol. 39, No. 3 (August 1998), pp. 525-551; and R.J. Barro, "Notes on growth accounting", *Journal of Economic Growth*, vol. 4, No. 2 (June 1999), pp. 119-137.

[16] The method provides a mechanical decomposition of the growth of output into growth of various inputs and growth of TFP. Specifically, it does not explain how TFP is related to such factors as preferences technology and research and development; and how changes in certain parameters that are influenced by Government policies affect the rate of output growth. Rather, it is an empirical method aimed at quantifying the impact that traditional factors of production have on aggregate output.

Box 1. A brief historical note on total factor productivity growth

Although the notion of total factor productivity (TFP) growth was comprehensively analyzed before the 1930s, the concept of "growth accounting" only started after historical data on inputs and output were assembled at a microlevel by, inter alia, Copeland (1936) and Copeland and Martin (1938). It increased as the national accounts were constructed by Kuznets in the United States of America and Stone in the United Kingdom of Great Britain and Northern Ireland, respectively, and became widely available in the 1940s. In fact, while the initial research papers were conducted by Tinbergen (1942) and Stigler (1947), the momentum grew in the 1950s with investigations by Schmookler (1952), Fabricant (1954), Kendrick (1955), Ruttan (1956) and Abramovitz (1956), among others. In view of the above, it is evident that such a type of analysis preceded the neoclassical theory of production as expounded in the Solow-Swan model (1956). Even so, it is viewed nowadays as a preliminary step to identify the long-term growth determinants.

However, the topic was decisively catapulted to the centre stage with the classic article of Solow (1957). The noticeable element of this empirical study was not only the magnitude of TFP growth, which had been already stated, but also the explicit integration of economic theory, namely, calculus, within a consistent empirical framework. The results indicated that only 12.5 per cent of growth in output per capita in the period 1909-1949 in the United States of America owed to accumulation of physical capital, which led Solow to conclude that the portion of the residual was nearly 88 per cent. The estimates indicated that the high rates of growth of the United States, which in fact had approximately doubled in the first half of the twentieth century, were, for the most part, the end result of increased overall productivity. Consequently, the accumulation of standard factors of production was essentially irrelevant for long-term economic growth. That remainder is commonly referred to as the Solow residual.

Subsequent studies during the 1960s by, inter alia, Kendrick (1961), Denison (1962), Abramovitz (1962), Griliches (1963) and Jorgenson and Griliches (1967) had included elements of input quality, namely, human capital and careful estimates of physical capital. Despite the fact that their inclusion had reduced the unexplained residual, it remained the major individual contributor to long-term growth. Similar growth-accounting exercises also started to be conducted by many countries in Western Europe, including France and the United Kingdom, and by Japan, which took the pioneering work of Denison (1967) as its starting point.

However, the topic of productivity as a whole largely disappeared from the economic literature of the 1970s. This phenomenon was triggered by the first oil shock beacuse higher international prices were thought to be the main culprit for the poor economic performance in industrialized economies, particularly the United States of America and Western Europe. As a direct consequence, such short-term issues as increasing rates of inflation and unemployment led to an acute period stagflation in the developed world that lasted until the 1980s. In turn, that generated an intense academic debate between the two main competing schools of thought at that time, namely, Keynesianism and monetarism, regarding how policymakers needed to adequately address such crucial issues.

As the short-term problems were resolved, concerns over long-term issues resurfaced. Consequently, enquiries into the long-term determinants of growth regained new momentum in the late 1980s. In fact, over the past two decades, an extensive body of models and empirical investigations have been carried out, thereby paving the way for the issue of productivity to take centre stage in the economic debate. In particular, Japan and the so-called Four Tigers in East Asia, namely, Hong Kong, the Republic of Korea, Singapore and Taiwan, were successful in returning to sustained economic growth within a short period of time.

The economic successes of the newly-industrialized countries in East Asia represented the heart of discussions in academic circles and among policymakers because, when compared to developed countries, they provided evidence that economic performance was indeed related to TFP. The theory obtained more impetus and has since led to heated debates, mostly in the mid 1990s, and particularly after Krugman (1994) and Young (1995) challenged the conventional wisdom regarding the so-called East Asian "miracle", which had been celebrated by such international organizations as the World Bank. Krugman and Young's estimates implied that the high rates of growth in those countries and territories could be largely attributed to accumulations of traditional inputs of production, thereby increasing labour force participation and improving labour quality, but not to TFP growth. Moreover, they claimed that overall productivity increases were negligible and the alleged "miracle" was a mere illusion. Their idea gained even more popularity after the Asian financial crisis of 1997. That explains, to a certain extent, why TFP growth has remained at the centre of attention in a debate that continues to attract many researchers.

Sources: The historical review draws to certain extent on papers by E. Denison, "Growth accounting", in *The New Palgrave: A Dictionary of Economics*, J. Eatwell, M. Milgate and P. Newman (eds.), vol. 2 (Stockton Press, 1987), pp. 571-574; A. Maddison, "Growth and slowdown in advanced capitalist economies: techniques of quantitative assessment", *Journal of Economic Literature*, vol. 25, No. 2 (June 1987), pp. 649-698; P. Krugman, "The myth of Asia's miracle", *Foreign Affairs*, vol. 73, No. 6 (November/December 1994), pp. 62-78; A. Young, "The tyranny of numbers: confronting the statistical realities of the East Asian growth experience", *The Quarterly Journal of Economics*, vol. 110, No. 3 (August 1995), pp. 641-680; and Z. Griliches, "The discovery of the residual: a historical note", *Journal of Economic Literature*, vol. 34, No. 3 (September 1996), pp. 1324-1330.

There is currently a broad consensus that maintains that growth accounting exercises seem to capture the impact of dissimilar aspects, including, inter alia, improvements in the organization of the economic system and institutions, and efficiencies in Government regulations and stock of knowledge. Additionally, while it has been claimed that growth accounting can capture the effects of investment in education and health, capturing their distinctive effects poses a daunting challenge.

Consequently, the well-established framework has been expanded by many researchers to include other variables that take into account the quality of inputs, including, inter alia, human capital, multiple sectors, changes in the capacity utilization and economies of scale.

It is important to note that the standard method of growth accounting is not suitable for analysing such rent-based economies as the oil-exporting countries of the Gulf subregion. The predominance of the oil factor in those economies requires a different theoretical approach in order to separate the oil industry from the rest of the economy.

Therefore, a suitable strategy for analysing the economies of oil-exporting countries employs a two-sector growth model, with separate production functions. The approach, which has been widely used by numerous researchers since the 1960s, focuses on the likelihood of non-optimal allocation of resources between the two sectors, namely: the domestic sector (N), which can be assumed to be essentially non-oil; and the export sector (X), which corresponds to the petroleum sector.[17]

The empirical analysis of this paper is confined to three MDEs in the ESCWA region in the period 1975-2000, namely, Egypt, Jordan and the Syrian Arab Republic, which were chosen purely for data considerations.

B. THE MODEL

This section outlines the one-sector growth model that is used throughout the paper.[18] Subsequent to a discussion on the neoclassical growth model and the extended model that includes human capital, the model is further broadened to allow for analysis of transition dynamics when the economy is out of steady state.

1. *The neoclassical growth model*

First, it is assumed that the economy has the following aggregate production function:

$$(1) \quad Y(t) = K(t)^{\alpha} H(t)^{\beta} [A(t) L(t)]^{1-\alpha-\beta}$$

$\alpha > 0$, $\beta > 0$, $\alpha + \beta < 1$. Where Y, K, H, L and A denote output, capital, human capital, labour and an index of technological progress, respectively. AL is referred to as effective labour, thus technological progress is of the labour-augmented or Harrod-neutral type.[19]

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[17] For a review of the literature and its advantages when oil-exporting countries are analysed see, for example, E.J. Medina-Smith, "Four essays on economic growth in Venezuela, 1950-1999" (University of Sussex, July 2003).

[18] The main equations of the neoclassical growth model were developed by Solow, and the extended model that includes human capital were developed by Mankiw, Romer and Weil and presented by Barro and Sala-i-Martin and by Romer. See R.M. Solow, "Technical change and the aggregate production function", *Review of Economics and Statistics*, vol. 39, No. 3 (August 1957); N.G. Mankiw, D. Romer and D. Weil, "A contribution to the empirics of growth", *The Quarterly Journal of Economics*, vol. 107, No. 2 (May 1992), pp. 407-437; R.J. Barro and X. Sala-i-Martin, *Economic Growth* (MIT Press, 1995); and D. Romer, *Advanced Macroeconomics*, second edition (McGraw–Hill, 2001).

[19] Several concepts of "neutral technological change" have been put forward, including, inter alia, the Harrod (1932), Hicks (1942) and Solow (1969) concepts, which are regarded as the most useful in economic growth models. While for Harrod, technological progress is neutral if the capital-output (K/Y) ratio carries on unaltered for a given rate of return of capital (profit). In the case of Hicks, neutrality in technological progress occurs as long as the capital-labour ratio remains unchanged at a constant ratio of factor prices. While those views differ in principle, Uzawa (1961) proved that they are equivalent in one sector growth model as long as the elasticity of substitutions between the two factors of production, namely, labour and capital, is unity (σ=1). Thus, only the Cobb-Douglas production function meets this condition. The reason for choosing the Harrod-neutral technical progress is because it is the only type of technical progress consistent with a stable steady-state ratio k*. Nonetheless, most of the literature on growth accounting assumes Hicks' neutral technological progress; see, for example, F.H. Hahn, "Neoclassical growth theory," in *The New Palgrave: A Dictionary of Economics*, J. Eatwell, M. Milgate and P. Newman (eds.), vol. 3 (Stockton Press, 1987), pp. 625-633; and R.J. Barro and X. Sala-i-Martin, *Economic Growth* (MIT Press, 1995), p. 33.

Moreover, it is assumed that K, H, L and A change over time according to the following equations:

(2) $K^{\bullet}(t) = s_K Y(t) - \delta K(t)$
(3) $H^{\bullet}(t) = s_H Y(t) - \delta H(t)$
(4) $L^{\bullet}(t) = nL(t)$
(5) $A^{\bullet}(t) = gL(t)$

Where s_K, s_H, δ, n and g are constants and, as usual, the dot over a variable denotes the derivative of that variable with respect to time, that is, time difference and thus the rate of growth.

Using the following definitions:

$y(t) = [Y(t)] / A(t) L(t)]$, as output per unit of effective labour;
$k(t) = [K(t) / A(t) L(t)]$, as capital per unit of effective labour;
$h(t) = [H(t) / A(t) L(t)]$, as human capital per unit of effective labour.

Equation (6) follows from these definitions:

(6) $y(t) = k^{\alpha} h^{\beta}$.

As a result, it is relatively straightforward to show that:

(7) $k^{\bullet} = s_K k^{\alpha} h^{\beta} - (n + g + s) k$
(8) $h^{\bullet} = s_H k^{\alpha} h^{\beta} - (n + g + s) h$

At steady state, this becomes:

(9) $k|_{k^{\bullet}=0} = [s_k / (n + g + \delta)]^{1/(1-\alpha)} h^{\beta/(1-\alpha)}$
(10) $k|_{h^{\bullet}=0} = [(n + g + \delta) / s_H]^{(1/\alpha)} h^{(1-\beta)/\alpha}$

Figure I. Steady-state configuration

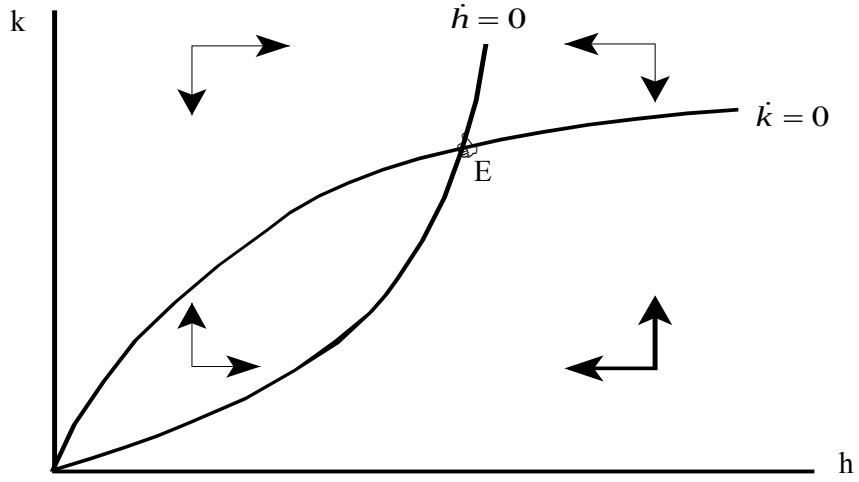

Figure I shows the dynamics of k and h together. Note that the two schedules, which are derived from equations (7) and (8) at $k^{\bullet} = 0$ and $h^{\bullet} = 0$, respectively, are upward-sloping owing to the positive productivity effects of physical and human capital. For instance, a higher endowment of human capital per worker raises the output per unit of effective labour [equation (6)] and stimulates the accumulation of physical capital [equation (7)]. Keeping k constant requires a higher physical capital-labour ratio and, therefore, the positive slope of $k^{\bullet} = 0$ locus. The figure shows that regardless of the initial conditions of k and h, the economy

moves to a stable steady state at point E. It is straightforward to show that if the economy is outside the steady state at E, it moves towards steady state with a speed equal to $\lambda = (1 - \alpha - \beta)(h + g + \delta)$ according to the equation:

(11) $\ln y(t) - \ln y(0) = (1 - e^{-\lambda t})[\ln y^{\wedge} - \ln y(0)]$, where $y^{\wedge}$ is the steady-state value.

2. *Transition dynamics*

Equations (6), (7), (8) and (11) yield the following:

(12) $y^{\wedge} = k^{\wedge \alpha} h^{\wedge \alpha}$
(13) $s_K k^{\wedge} = (n + g + \delta) k^{\wedge}$
(14) $s_H h^{\wedge} = (n + g + \delta) h^{\wedge}$
(15) $(1 / T) \ln [Y(T) / Y(0)] = (n + g + \delta) + [(1 - e^{-\lambda T}) / T] [\ln [y^{\wedge} / y(0)]$

Using these equations and defining Z, W and U as the rate of growth of output per worker, capital per worker and human capital per worker, respectively:

(16) $Z = g + [(1 - e^{-\lambda T}) / T] \ln [y^{\wedge} / y(0)]$

Equation (16) shows the growth of output per worker as the sum of two components, namely: (a) an exogenous one that is given by the rate of technological progress (g); and (b) a transitional one that is proportional to the gap between the initial and steady-state values of output per effective worker. It is important to note that in the case of $y^{\wedge} > y_0$, the second term in equation (16) is positive and the output per worker grows in the transitional period at a higher rate than the steady-state rate of g. That owes to capital deepening (physical and/or human); in other words, the capital-labour ratio increases. In the opposite case, that is, $y^{\wedge} < y(0)$, the second term becomes negative and the output per worker grows in the transitional period at a lower rate than g, owing to capital "shallowing", which refers to a more labour-intensive production process.

Finally:

(17) $\partial Z / \partial S_K = [\alpha (n + g + \delta)(1 - e^{-\lambda T})] / \lambda T s_{K,}$

with $\lim_{T \to 0} \partial Z / \partial s_K = \alpha (n + g + \delta) / s_K$
$\lim_{T \to \infty} \partial Z / \partial s_K = 0$

(18) $\partial Z / \partial s_H = [\beta(n + g + \delta)(1 - e^{-\lambda T})] / \lambda T s_H$

with $\lim_{T \to 0} \partial Z / \partial s_H = [\beta(n + g + \delta) / s_H$
$\lim_{T \to \infty} \partial Z / \partial s_H = 0$

Equation (17) gives the reaction of the rate of growth of output per worker to a change in s_K. The response starts at $[\alpha(n + g + \delta)] / s_K$ at the time of the change and declines until it becomes zero once the economy reaches its new steady state. Similarly, equation (18) gives the rate of change of the rate of growth of output per worker to a change in $s_{H.}$

C. BRIEF REVIEW OF THE LITERATURE

This section outlines the main reasons for the reappearance of the topic of growth in the literature and policy arena in the second half of the 1980s; examines the relationship between the concept of TFP and the growth accounting framework; and reviews recent empirical literature on the nexus between education and growth.

1. *Long-term economic growth*

Over the past 20 years, there has been a renewed interest in the long-term determinants of growth. While such a reassessment can be attributed to several factors, two stand out prominently, namely, debates at the levels of academia and policymaking, both of which are set forth below.

In the academic sphere, the rebirth of growth theory during the mid-1980s spurred the development of endogenous growth models, a trend set by the seminal studies of Romer and Lucas.[20] Special focus was placed on the roles played by technology in increasing returns to scale and externalities, which affect growth performance. In addition to the roles played by research, development and TFP growth in the growth process, those models hinge on the issue of productivity (see box 2).

Meanwhile, the theoretical literature also inspired and produced an outburst of investigations that were initially based on cross-country growth regressions but rapidly extended to time series analysis and, more recently, to the panel approach.[21] Other contributors developed different, yet nonetheless significant, lines of research, which were derived from the reappearance of the empirical convergence literature.[22]

However, it has been argued that the availability of several macroeconomic data sets for a significant number of countries has been one of the key differences between the current and the previous literature on growth (see box 4).[23] That has certainly allowed researchers to integrate theory and empiricism in a more consistent and clear-cut approach.[24]

In the policy arena, a move towards an economic strategy that places a significant emphasis on the role of the private sector started to occur during the late 1970s. At first, the alteration was limited to a small number of developing countries, including Chile and the newly-industrialized countries of South-East Asia. However, in the wake of the debt crisis of August 1982, there was a worldwide shift towards market-oriented policies, accompanied by an increasingly cautious attitude towards State intervention.

While that transformation initially occurred in such developed countries as the United States of America and the United Kingdom, it subsequently spread to many developing economies, mostly after the Washington Consensus of the late 1980s had developed into the dominant global view and been imposed by major international donors. Moreover, it became more visible in the 1990s when the economies of Eastern Europe that had hitherto been centrally planned also adopted market-oriented policies.

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[20] See P.M. Romer, "Endogenous technological change", *The Journal of Political Economy*, vol. 98, No. 5 (October 1990), pp. S71-S102; and R.E. Lucas, "On the mechanics of economic development", *Journal of Monetary Economics*, vol. 22, No. 1 (July 1988), pp. 3-42. For a comprehensive review of this literature see, for example, J. Temple, "The new growth evidence", *Journal of Economic Literature*, vol. 37, No. 1 (March 1999), pp. 112-156.

[21] The literature, which is related both to developed and developing countries, started with the classic article by R.J. Barro, "Economic growth in a cross section of countries", *The Quarterly Journal of Economics*, vol. 106, No. 2 (May 1991), pp. 407-443. This was followed by various studies, including, among others, N.G. Mankiw, D. Romer and D. Weil, "A contribution to the empirics of growth", *The Quarterly Journal of Economics*, vol. 107, No. 2 (May 1992), pp. 407-437; and R. Levine and D. Renelt, "A sensitivity analysis of cross-country growth regressions", *The American Economic Review*, vol. 82, No. 4 (September 1992), pp. 942-963.

[22] For an overview of the literature see, for example, J.R. Barro and X. Sala-i-Martin, *Economic Growth* (MIT Press, 1995); D. Romer, *Advanced Macroeconomics*, second edition (McGraw–Hill, 2001); and W.J. Baumol, "Entrepreneurship: productive, unproductive, and destructive," *Journal of Political Economy*, vol. 98, No. 5 (October 1990), part 1, pp. 893-921.

[23] See, for example, R. Summers and A. Heston, "The Penn World Table (Mark 5): an expanded set of international comparisons, 1950-1988", *The Quarterly Journal of Economics*, vol. 106, No. 2 (May 1991), pp. 327-368; R.J. Barro and J.W. Lee, "International comparisons of educational attainment," Working Paper No. 4349 (National Bureau of Economic Research (NBER), April 1993); R.J. Barro and J.W. Lee, "International measures of schooling years and schooling quality", *The American Economic Review*, vol. 86, No. 2 (May 1996), pp. 218-223; and R.J. Barro and J.W. Lee, "International data on educational attainment: updates and implications," *Oxford Economic Papers*, vol. 53, No. 3, (July 2001), pp. 541-563.

[24] See X. Sala-i-Martin, "Fifteen years of new growth economics: what have we learned?" in *Economic Growth: Sources, Trends and Cycles*, N. Loayza and R. Soto eds. (2002), pp. 42-43.

Some empirical studies have shown that traditional inputs of production represent the most important determinant of economic performance. Furthermore, many such studies have found that the accumulation of physical capital is by far the most important source of growth in the long term.[25] In fact, a seminal cross-country empirical study suggested that the ratio of physical investment to GDP was the only variable that could be considered constant across countries and time.[26] However, the empirical evidence available to date has been far from conclusive and, therefore, the matter is still open to debate.

Box 2. Definition of productivity[a/]

The precise meaning of the term "productivity" has always remained elusive, owing partly to the disparate fields of research concerning that topic, including, inter alia, economics, engineering and administration. There is a general consensus that it implies the capacity to produce or the ability to make goods, products, agricultural crops or any particular commodity efficiently. In industrial activities, the efficiency of production is a crucial indicator of competitiveness.

Measuring productivity includes assessing a wide range of factors, including efficiency changes, technical change, economies of scale and capacity utilization. Furthermore, such measuring has been employed to detect production inefficiencies and identify bottlenecks in different areas of production, finance and management, with the explicit purpose of improving the production process.

Even so, analysts must proceed with prudence when productivity is interpretated, especially in cases that compare different countries and regions, given that the available statistics and the variety of measures at hand vary significantly with regard to their quality and scope.

While various approaches for measuring productivity have been suggested by the literature, they typically focus on calculating the rate of output per unit; in other words, the ratio of the production to the inputs that are required to fabricate a given product. The ratio is often represented as an average, which expresses the total amount of some categories of goods produced divided by the total input required, including, for example, labour, capital or raw materials. The term can refer to any standard factor of production individually (partial productivity), or to all the inputs of production combined (TFP or MFP) within a firm, a sector or an entire economy. Definitions for various productivity measurements are as follows:

(a) Labour productivity is typically measured as the production per worker or total output per labour-hour. Growth in labour productivity raises the quantity of goods and services available for consumption without an equivalent rise in the number of working hours. It is usually considered to be equal to the average product of labour. A crucial feature that must be highlighted is that output can be measured in physical terms, namely, in terms of units of production or price. Labour productivity represents the most common indicator for overall national productivity. Recently, it has become common place to compare the levels obtained by individual countries or regions to those registered by the economy of the United States of America;[b/]

(b) Land productivity, particularly for agricultural crops, is typically defined as the annual crop yield per acre, which is usually measured in tons per acre. It has become a standard indicator of efficiency in the agricultural sector and within the applied microeconomic literature. However, "land", as an aggregate input of production, is generally ignored within the macroeconomic literature;

(c) Capital productivity is generally referred to as the total output-to-capital ratio (OCR). It is measured as the output per unit of capital goods employed in the production process, usually regarded as capital services or capital utility. Consequently, it is the inverse of the capital/output ratio.

Notes:

a/ For a detailed review of different measures and approaches to productivity see, for example, Organisation for Economic Co-operation and Development (OECD), *Measuring Productivity OECD Manual: measurement of aggregate and industry-level productivity growth* (OECD, 2001).

b/ A recent report by the International Labour Organization (ILO) confirms that the United States of America still leads the world, with a value added per person employed in 2006 of $63,885. Moreover, ILO notes that, while the labour productivity gap between the United States and other developed economies keeps widening, the labour force in the United States of America works more hours per year than in most of the other countries. That implies that if labour productivity is measured as the value added per hour worked, Norway registers the highest level, at $37.99 in 2006. More information is available at: www.ilo.org/trends.

[25] See, for example, R.J. Barro, *Determinants of Economic Growth: A Cross-Country Empirical Study* (MIT Press, 1997).

[26] R. Levine and D. Renelt, "A sensitivity analysis of cross-country growth regressions", *The American Economic Review*, vol. 82, No. 4 (September 1992), pp. 942-963.

2. *Human capital and growth*[27]

It is widely believed that the standard of living of any individual depends, in the long run, on the capacity for increasing skills and competences. Equally, there is a general consensus regarding the numerous gains that the accumulation of human capital has on individual efficiencies, in other words, labour productivity (see box 2), and that is an option to provide opportunities for people in order to maximize their economic contribution. Those are frequently described as internal effects on individuals. At the aggregate level, that translates into the effect that increased investment in schooling and training can have on the rate of long-term economic growth. Consequently, the wellbeing of the population and the quality of life depend on the amount and quality of human capital that a society is able to accumulate. The economic literature therefore agrees that the accumulation of human capital has positive effects on output growth (see box 3).

However, there is still no empirical proof to confirm such an assertion. In fact, since the mid-1990s, several well-known empirical investigations have challenged the conventional wisdom that countries with greater levels of education can register higher rates of economic growth. The controversy began in the wake of a study undertaken by Benhabib and Spiegel (1994), who contested the conventional view that abundance of human capital boosts the national economy to such an extent that it provides a decisive advantage.[28] Their findings were the first to contradict the traditional belief in development circles concerning the importance of education for growth. Such findings gained impetus in 1990 when a seminal empirical study indicated that the estimated impact of growth of human capital on conventional, non-regressive growth accounting measures of TFP was large and strongly significant, albeit definitely negative.[29] Subsequently, many empirical studies have obtained meagre results. In effect, cross-country data and even panel data studies on growth have shown that the increase in human capital arising from improvements in the educational attainment of the labour force has had no positive impact on the growth rate of output per worker.

If proved accurate, those results could clearly present a major setback for developing economies in their quest to achieve an all-inclusive stage of development. There is a pressing need to explain the discouraging empirical results that suggest that improving education levels does not lead to faster economic growth. The intriguing issue has led analysts to search for possible explanations, including, inter alia, the quality of the data, measurement errors, the countries included in the sample and the methodology applied.

For example, Krueger and Lindahl stated that even in the presence of both micro and macro growth, the literature emphasizes the importance of education in the growth process.[30] Nonetheless, they called attention to the fact that macro evidence was more fragile than the results emanating from micro regressions at the national level. The researchers suggested that the imposition of linear restrictions and constant-coefficient could account for the poor results of cross-country regressions. Moreover, they highlighted the fact that errors in measuring education could negatively bias the estimated coefficients.

A special case relates to the standard proxies employed in empirical studies, including, inter alia, adult literacy, school enrolment rates and financial resource expenditures on education. It has been claimed that, at the empirical level, many of those variables do not provide a precise measure of human capital stock. In fact, some have argued that the quality of education is neglected by most of these proxies. Furthermore, other researchers argue that such health indicators as life expectancy can offer a more accurate measure of the stock of human capital (see box 3).

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[27] For a comprehensive assessment of the theoretical and empirical literature of human capital and growth see F. Schütt, "The importance of human capital for economic growth", Band 27 (Institute for World Economics and International Management (IWIM), 2003), which is available at: www.iwim.uni-bremen.de/publikationen/pdf/W027.pdf.

[28] Ibid., pp. 28-29.

[29] See L. Pritchett, "Where has all the education gone?", *The World Bank Economic Review*, vol. 15, No. 3 (March 2001), pp. 367-391, which was previously published as World Bank Policy Research Working Paper No. 1581 (National Bureau of Economic Research (NBER), March 1996).

[30] A.O. Krueger and M. Lindahl, "Education for growth: why and for whom?", *Journal of Economic Literature*, vol. 39, No. 4 (December 2001), pp. 1101-1137.

Box 3. Human capital[a/]

A. DEFINITION OF HUMAN CAPITAL

Human capital is a complex and ambiguous concept that has been consistently difficult to define from a theoretical standpoint. However, it is generally accepted that it refers to the skills, specific attributes and learned abilities that individuals possess. Indeed, it is usually considered as the stock of expertise that a given worker has accumulated and, therefore, that is available for productive activities.

Studies by Schultz and Becker in the 1960s triggered considerable interest in and research on the subject within and outside of economics. Over the years, many terms have been erroneously employed to describe the ability of workforce, staff and employees in enterprises, including such expressions as "instructional capital", "individual capital" and even "intellectual rights". That has occurred to the extent that terminologies like "personnel" and "human resources", and such phrases as "talent management", have also emerged. The most recent phrase to enter this field of study was "social capital", which has become popular in recent times. The confusion stems from the fact that the topic has been examined by experts from various branches, including, inter alia, economists, political scientists, psychologists, sociologists and information technologists. However, it must be stressed that the phrase "human capital" has remained the preferred term within specialized literature.

While human capital can appear a dehumanizing term, it was on the contrary coined to highlight the importance of investing in human beings. Specifically, individuals needed to be considered as assets rather than as sources of expenditure. Moreover, it was designed to illustrate the way in which financial investment in certain resources and services, including equipment, machinery, education and health, increases the stock of physical capital. Finally, national economy could be enhanced by accumulating human capital, encouraging a higher efficiency, and improving the organizational performance of companies and the overall productivity of a sector.

B. MEASUREMENT ISSUES AND STANDARD PROXIES FOR HUMAN CAPITAL

The measurement of human capital needs to "cover the range of investments that human beings make in themselves and in others, including formal and informal education, on-the-job-learning, health, nutrition, and social services".[b/] Given such a multidimensional aspect, it is unsurprising that there are as yet no definitive conclusions. That also explains why researchers in that area have still not been able to put together a comprehensive system of criteria for measurement of human capital.

One of the methods employed at the microlevel was to estimate the current based value of the sum of its income-earning future potentials through wage, salary or other compensations. They are normally measured and conceived of as private returns to the individual as the education level increases. Those estimates have been built around Mincer's approach. However, there can also be social returns from investment in education. In such a case, it is necessary to quantify the positive externalities that an individual's skill and increased expertise over time can have in the performance of the firm.

However, at the macrolevel, disagreements still persist regarding how to adequately, capture and compute an index of human capital for empirical purposes. This represents a daunting task that has eluded economists for the past decades, and has also been particularly challenging for the empirical literature of growth.

In its place, researchers have used a wide range of variables in empirical studies, including adult literacy, primary or secondary school enrolment rates, financial resources devoted to formal education and other proxies for human capital. The oldest method that has been employed is measuring the average years of schooling or education. The procedure consists of splitting up the population awarding to gender, participation in the labour force and level of education attained, whether elementary, secondary or tertiary. While the primary source is generally individual Governments, UNESCO, OECD and other international organizations regularly compile statistics on levels of formal education attained. It is important to note that such data use information on formal education and, therefore, do not take into account vocational training and other types of training outside the traditional educational system. Among the many researchers that have made use of this proxy are Romer, Barro, and de la Fuente and Domènech.[c/]

Box 3 (*continued*)

A second approach consists of evaluating the cognitive performances of students. For that purpose, scores on international comparable examinations in mathematics and science have been analysed. A similar method has been suggested by Hanushek and Kimko in order to surpass the limitations encountered when using such quantitative measures as average years of schooling.[d/] They point out that those measures do not capture the quality of the labour force, which is a crucial feature that can make a significant difference on long-term growth.

A third proxy that has been suggested and employed is a health indicator, particularly through available data related to the life expectancy of the population. Such statistics measure the index of mortality and morbidity. The rationale for using this variable is that a greater life expectancy is generally associated with higher levels of health services, which are directly linked to low levels of mortality and morbidity. Among some of the researchers who have highlighted the adequacy of those indicators are Strauss and Thomas at the microlevel, and Bloom, Canning and Sevilla at the macrolevel.[e/]

Notes:

a/ For a brief appraisal of this concept see, for example, S. Rosen, "Human capital", in *The New Palgrave: A Dictionary of Economics*, J. Eatwell, M. Milgate and P. Newman (eds.), vol. 2 (Stockton Press, 1987), pp. 681-690.

b/ V. Nehru, E. Swanson and A. Dubey, "A new database on human capital stock in developing and industrial countries: sources, methodology, and results", *Journal of Development Economics*, vol. 46, No. 2 (April 1995), p. 380.

c/ D. Romer, *Advanced Macroeconomics*, second edition (McGraw–Hill, 2001); R.J. Barro, "Human capital and growth", *American Economic Review: Papers and Proceedings*, vol. 91, No. 2 (May 2001), pp. 12-17; A. de la Fuente and R. Domènech, "Schooling data, technological diffusion, and the neoclassical model," *American Economic Review: Papers and Proceedings,* vol. 91, No. 2 (May 2001), pp. 323-327.

d/ E.A. Hanushek and D.D Kimko, "Schooling, labor-force quality, and the growth of nations", *American Economic Review: Papers and Proceedings*, vol. 90, No. 5 (December 2000), pp. 1184-1208.

e/ J. Strauss and D. Thomas, "Health, nutrition and economic development", *Journal of Economic Literature*, vol. 36, No. 2 (June 1998), pp. 766-817; and D.E. Bloom, D. Canning and J. Sevilla, "The effect of health on economic growth: a production function", *World Development*, vol. 32, No. 1 (January 2004), pp. 1-13.

In the past decade, several investigations have attempted to explain why the initial wave of empirical studies failed to obtain undeniable positive results. For example, Temple employed a sample of 64 countries as a subset sample contained in the seminal research paper of Benhabib and Spiegel.[31] He obtained evidence from cross-country regressions to suggest that output growth was positively related to the variation in educational attainment, even after certain conditions of physical capital were taken into account. In view of those results, he argued that simple cross-country regressions that employed ordinary least squares (OLS) might be unable to detect the real effects that human capital has on growth, owing to a small number of unrepresentative countries.

A panel approach was undertaken by Barro with a sample of 100 countries for the period 1965-1995.[32] The results clearly demonstrated that the rate of economic growth was definitely related to the initial level of average years of formal education. However, he stressed that those empirical results were only valid for men at the secondary and higher levels of education. In fact, he indicated that years of schooling for women had no impact on growth, which is an outcome that he used in order to point out that well-educated women are being underutilized in many countries, particularly in developing countries. In 2001, Bassanini, Scarpetta and Hemmings obtained similar results using annual data for just 21 OECD member countries for the period 1971-1998.[33] The estimated growth equations confirm the microeconomic evidence available so far as to

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[31] J. Temple, "A positive effect of human capital on growth", *Economic Letters*, vol. 65, No. 1 (1999), pp. 131-134.

[32] R.J. Barro, "Human capital and growth", *American Economic Review: Papers and Proceedings*, vol. 91, No. 2 (May 2001), pp. 12-17.

[33] A. Bassanini, S. Scarpetta and P. Hemmings, "Economic growth: the role of policies and institutions. Panel data evidence from OECD countries", OECD Economics Department Working Paper No. 283 (2001).

suggest that the long-term elasticity of output to human capital measured as per working-age population to average years of education is significantly different from zero.

Another course of action has been to concentrate efforts in order to decrease data inconsistencies related to years of schooling. A study that is often cited in that context is that of de la Fuente and Domènech, which concluded that the quality of the data employed makes a significant difference in growth estimates.[34] Specifically, it challenged the view that emanated from some empirical studies, claiming that investment in education is not productive and that significant GDP has little to do with the stock of production factors.

Hojo adopted a different line, which consisted of a re-evaluation of a study conducted in the mid-1990s by Caselli et al.[35] Employing panel regression for 93 countries for the period 1960-1985, the results indicated that human capital proxied by secondary schooling and secondary enrolment ratio had a negative effect on growth, which confirmed the results of the original study. However, he was able to demonstrate that attainments in higher levels of education, regardless of the measure employed, were positively correlated with higher productivity levels. Hence, from the evidence obtained, he inferred that while education does in fact have a positive effect on growth, it is manifested indirectly through higher levels of productivity.

It is vital to note that increasing expenditure on education frequently leads to a rise in enrolment ratios in formal schooling. In fact, in some developing countries, the growth at different levels of education has been significantly impressive in the past decades. However, that does not translate into a higher stock of human capital of the labour force. Rather, it can be attributed to the following issues: (a) the increasing lag between investments and decisions in schooling is greater than that which prevails in physical capital; consequently, it takes longer for human capital stock to become available; (b) part of the investment is lost because of repeaters, dropouts and low quality of formal training; and (c) some graduates never participate in the labour force owing to restrictions, as in the case of women, or to the migration of trained and talented professionals in the form of human capital flight, the brain drain.[36]

There is a need to reiterate that the empirical literature on the relationship between human capital and growth in the long term has not yet reached a steady state. Consequently, caution is vital with regard to estimates of human capital as well as their interpretation, particularly when international comparisons among different countries and regions are conducted. That is because the available statistics and the variety of measures at hand, including, inter alia, adult literacy and primary and secondary school enrolment rates, vary significantly in terms of global quality and scope.

[34] A. de la Fuente and R. Domènech, "Schooling data, technological diffusion, and the neoclassical model," *American Economic Review: Papers and Proceedings,* vol. 91, No. 2 (May 2001), pp. 323-327.

[35] See M. Hojo, "An indirect effect on growth," *Economic Letters*, vol. 80, No. 1 (July 2003), pp. 31-34.

[36] See, for example, G. Psacharopoulos and A.M. Arriagada, "The educational composition of the labour force: An international comparison", *International Labour Review*, vol. 125, No. 5 (September-October 1986), pp. 561-574; and N.U. Haque and S.J. Kim, "Human capital flight: Impact of migration on income and growth", *IMF Staff Papers*, vol. 42, No. 3 (International Monetary Fund (IMF), September 1995), pp. 577-607.

II. EMPIRICAL ANALYSIS

A. DATA ISSUES

Simulation of the model described in chapter I requires time series data for the period 1975-2000 on Y, K, H and L, in addition to s_K, s_H, n, δ, α and β.[37] While data related to some of these variables are readily available from the national accounts of the countries under investigation, others, including capital stock, do not exist, which entailed the creation of proxies for them. A detailed explanation related to the sources and the methods used is set out below.

1. *Output and factors of production (Y, L, s_K and n)*

National accounts provide data on real output (Y), employment (L), the ratio of investment to GDP (s_K) and the rate of growth of L (*n*). However, for this investigation, the Penn World Table (PWT) was used, which constitutes an alternative source of macroeconomic variables.[38] It is important to highlight that major differences exist between data in PWT and those reported by most national accounts, which are usually in line with the data set of the World Bank. Such discrepancies are rarely mentioned in empirical studies. However, the data set used for this study has a major advantage given that it relates to real international United States dollars using purchasing power parity (PPP), thereby rendering the results internationally comparable.

2. *Stock of physical capital (K)*

Unfortunately, there is no official time series on capital stock series for any of the ESCWA member countries. Consequently, a proxy related to investment is often used, namely, gross domestic investment (GDI) and gross fixed capital formation (GFCF). It is important to note that the strategy has been widely used by researchers engaged in empirical studies for both cross-section and cross-country case studies of developing and even developed economies. It is considered a good proxy for the rate of growth of the stock of capital as long as the capital-output (K/Y) ratio remains comparatively stable, particularly in cross-section studies.[39] However, given that this investigation deals with time series data and in order to be consistent with neoclassical theory, other options were explored and evaluated.

For that reason, a series of capital stock was constructed using the perpetual inventory method (PIM), which consists in cumulating past investments flows over the years, while taking into consideration service life estimation and the rate of physical capital depreciation according to the following equation:

$$K(t) = \delta K(t-1) + I(t) ,$$

Where $K(0) = \Sigma^{\infty}_{i=0} \; I_{-i-1} (1 - \delta)^i = [I(0)] / (\alpha + \delta)$; and K(0), I(0) and γ denote the capital stock at the first year of the series, investment at the first year, and γ the rate of growth in investment in the first five years of the series. In that case, K(0) and I(0) are the stock of physical capital in 1975, which is the starting point of the empirical exercise, in other words K(1975) and I(1975), respectively.

3. *Human capital (H)*

In the past two decades, several aggregate data sets of the stock of human capital worldwide have been put together by different researchers (see box 4). However, for the purpose of this investigation, estimates of

[37] Note that the period 1975-2000 was chosen strictly in view of the availability of data.

[38] Within that context, version 6.1 was employed for the empirical estimations (2002). The dataset, which was first created in 1980, has been updated and is available through the Center for International Comparisons at the University of Pennsylvania (CICUP). See, for example, R. Summers and A. Heston, "The Penn World Table (Mark 5): An expanded set of international comparisons, 1950-1988", *The Quarterly Journal of Economics*, vol. 106, No. 2 (May 1991), pp. 327-368; and A. Heston, R. Summers and B. Aten, "Penn World Table Version 6.1" (CICUP, October 2002), which is available at: www.pwt.econ.upenn.edu.

[39] See, for example, R.J. Barro, *Determinants of Economic Growth: A Cross-Country Empirical Study* (MIT Press, 1997).

the stock of education were developed based on the mean years of formal education per working person in the market.[40]

The data set has several features that need to be highlighted, namely, (a) it includes the three countries under analysis, namely, Egypt, Jordan and the Syrian Arab Republic; and (b) it has been the most widely used in empirical studies of growth, including growth-accounting exercises, cross-section and panel regressions, despite obvious limitations. Its widespread use stems from the broad range of countries that it incorporates, both developed and developing economies, and from the long timespan that it covers.

4. *Investment rate in human capital (s_H)*

Theoretically, s_H is the ratio of total expenditure on education to GDP. The ratio of public expenditures on education to GDP is used given that it is the only available indicator that is readily available from the national accounts and UNESCO.

5. *Depreciation rate (δ)*

The depreciation rate can be calculated from the national accounts as a rate of GDP (D/Y) according to the equation $\delta = (D/Y)\ (Y/K)$; and (Y/K) was approximated as $(\Delta Y)/(\Delta K) = \Delta Y/ I$.

6. *Share of capital (α)*

The share of capital, α, or the elasticity of GDP with respect to the capital stock can be calculated from the national accounts as one minus the share of employees' compensation over GDP at factor cost. That is only correct, however, under two restrictive assumptions, namely: (a) factors of production are remunerated according to their marginal productivity; and (b) labour statistics encompass all labour value added.

Clearly, those two assumptions are unrealistic given the observed imperfection in the labour market and the under-accounting of real labour value added.[41] In order to address such shortcomings, values of α calculated from the national accounts were compared with other values for some developing countries, and sensitivity analyses for different values of α were undertaken, thereby yielding the most plausible values.

7. *Share of human capital (β)*

The lowest wage in each sector was assumed to be the rate for unskilled labour; and the average of those charges over all sectors yielded the wage for unskilled labour. Typically, that wage is between 0.5 and 0.6 of the average wage, which suggests that between 0.4 and 0.5 of total payment for labour represents returns to human capital. Using the estimate $0.4(1 - \alpha) < \beta < 0.5(1 - \alpha)$ and the values for α, the corresponding values for β are therefore calculated as the average of the lowest and the highest values.

Box 4. Data sets on human capital stocks

Psacharopoulos and Arriagada presented one of the pioneering studies in the field. They constructed an index of the mean years of schooling of the labour force for 99 countries, including seven ESCWA member countries, namely, Egypt, Jordan, Kuwait, Lebanon, Qatar, the Syrian Arab Republic, the United Arab Emirates and Yemen. It represents a weighted sum of enrolment ratios of different educational levels of the working population. One of their arguments was that educational attainment of the labour force gives a more accurate picture of the stock of human capital, while enrolment ratios only give a broad depiction of the efforts made in the educational sector. In fact, enrolment ratios alone do not provide any kind of information concerning the efficiency of investment in human capital. However, the main caveats of the data set are that no time series were available and that only 34 countries, two of which belong to the ESCWA region, possessed information for more than one year.[a/]

[40] Within that context, the data base built by Barro and Lee was used as a benchmark. See R.J. Barro and J.W. Lee, "International data on educational attainment: updates and implications," *Oxford Economic Papers*, vol. 53, No. 3, (July 2001), pp. 541-563.

[41] See, for example, A. Young, "The tyranny of numbers: confronting the statistical realities of the East Asian growth experience", *The Quarterly Journal of Economics*, vol. 110, No. 3 (August 1995), pp. 641-680.

Box 4 (*continued*)

Barro and Lee constructed time series of educational attainment of the adult population aged over 25. The data was split by gender and different levels of schooling, namely, no formal education, primary, first cycle of secondary and higher education. The last three levels were separated even further into two components, namely, incomplete and complete studies, thereby setting up seven levels of instruction. All the series were constructed using the perpetual inventory method (PIM), which allowed them to transform accumulated flows of education, in other words, the enrolled population that increases with time, to stocks of human capital. The series were constructed at five-year intervals from 1960 to 1985 and comprised 129 countries.[b/]

Nehru, Swanson and Dubey constructed a time series of the stock of education for three schooling phases, namely, primary, secondary and tertiary, for 85 industrial and developing economies over the period 1960-1987, including nine countries in the Middle East and three in the ESCWA region, specifically Egypt, Jordan and the Syrian Arab Republic. The basic data included enrolment series related to the working age of the population and adjusted for mortality, grade repetitions among students and country-specific dropout rates. The series were constructed using the standard PIM. One of the main caveats of the data set is that the researchers did not make use of any information from censuses.[c/]

Barro and Lee offered an update of the data for the population aged 25 and over for the period 1960-1990. The new version also presented estimates of educational attainment for the population aged 15 and above for 126 countries, which could provide a better image of the labour force of developing countries, where the youth population enters the labour market earlier compared to counterparts in developed countries.[d/]

De la Fuente and Domènech assembled a revised version of Barro and Lee's 1996 data set, with an educational-attainment time series. However, it must be underlined that it only includes 21 member countries of OECD for the period 1960-2000.[e/]

In 2001, Barro and Lee presented the second, updated data set on educational attainment for a population aged 15-65 years. In the third version, the data were constructed for an interval of five years for the period 1960-1995, with projections for 2000. Among the new features was the distribution of educational attainment for seven levels of schooling, which were classified by gender for a population aged 15 and over. In fact, the researchers indicated that one of the advantages of the data set was that the population generally entered the labour force at around 15 years in most developing countries. Another important feature is that the series are built from enrolment data using PIM adjusted for mortality.[f/]

The most recent time series data were presented by Cohen and Soto in 2007. The data cover years of schooling for 95 countries, which are classified into major regional and economic groups worldwide. The data set includes four ESCWA member countries, namely, Egypt, Iraq, Jordan and the Syrian Arab Republic at the beginning of each decade in the period 1960-2000, with projections for 2010. The series were constructed from the OECD database on educational attainment and includes, among other interesting features, mortality heterogeneity among age groups; in other words, the fact that older citizens with a lower educational background tend to have a higher mortality rate. That last feature is incidentally one of the downward biases of the Barro and Lee data sets. In addition, historical information published by UNESCO and various censuses were drawn upon with regard to uncovered countries.[g/]

Notes:

a/ G. Psacharopoulos and A.M. Arriagada, "The educational composition of the labour force: an international comparison", *International Labour Review*, vol. 125, No. 5 (September-October 1986).

b/ R.J. Barro and J.W. Lee, "International comparisons of educational attainment", *Journal of Monetary Economics*, vol. 32, No. 3 (December 1993).

c/ V. Nehru, E. Swanson and A. Dubey, "A new database on human capital stock in developing and industrial countries: sources, methodology, and results", *Journal of Development Economics*, vol. 46, No. 2 (April 1995).

d/ R.J. Barro and J.W. Lee, "International measures of schooling years and schooling quality", *American Economic Review*, vol. 86, No. 2 (May 1996).

e/ A. de la Fuente and R. Domènech, "Schooling data, technological diffusion, and the neoclassical model," *American Economic Review: Papers and Proceedings,* vol. 91, No. 2 (May 2001), pp. 323-327.

f/ R.J. Barro and J.W. Lee, "International data on educational attainment: updates and implications", *Oxford Economic Papers*, vol. 53, No. 3 (July 2001).

g/ D. Cohen and M. Soto, "Growth and human capital: good data, good results", *Journal of Economic Growth*, vol. 12, No. 1 (March 2007).

B. EMPIRICAL RESULTS

This section applies the model that was presented in chapter I using the parameters that were established and calculated in section A of this chapter. The purpose is to analyse the growth process of three ESCWA member countries, namely, Egypt, Jordan and the Syrian Arab Republic, over the period 1975-2000.

In the first subsection, real per capita income of those three countries is compared to that of the Republic of Korea (see table 1). The aim is to assess the pattern exhibited by the standard of living of their populations in comparison to that of a developing country. The Republic of Korea has been chosen as a point of reference owing to that country's success in terms of achieving high rates of growth, thereby improving the standard of living of its population in a comparatively short period of time.

Moreover, details of the growth rate of GDP per worker (Y/L), the ratio of investment to GDP (s_K), the ratio of expenditures on public education to GDP (s_H), and the rate of growth of labour (n) are presented in tables 2 to 4. Such details enhance the qualitative analysis aimed at explaining the causes of the dramatic fall in the growth rates during the 1980s and 1990s. The second subsection employs the time series of capital stock and human capital that were developed above in order to quantify the results.

1. *Growth experience: a descriptive analysis*

This subsection begins by analysing the trajectory of GDP per capita of the three MDEs under investigation for the period 1975-2000. Table 1 shows the dramatic changes that occurred in the 1980s and 1990s. Specifically, the data indicate that in 1980 real per capita income of each country as a percentage of the benchmark provided by the Republic of Korea was equal to or above half that of the point of reference. However, 20 years later, it became approximately one quarter of the level achieved by the Republic of Korea. That represents the end result of the significant decrease of real per capita income of each country in the 1980s, which persisted throughout the 1990s, which implies that the gap between those ESCWA member countries and one of the most successful countries in South-East Asia has widened considerably since the mid-1970s.

TABLE 1. REAL PER CAPITA INCOME OF EGYPT, JORDAN AND THE SYRIAN ARAB REPUBLIC
(*Percentage of the Republic of Korea*)

Year	Republic of Korea (*United States dollars*)	Egypt (*Percentage*)	Syrian Arab Republic (*Percentage*)	Jordan (*Percentage*)
1975	3 719	0.45	0.68	0.64
1980	4 829	0.50	0.61	0.84
1990	9 958	0.33	0.31	0.35
2000	15 881	0.27	0.26	0.25

Source: Compiled by ESCWA, based on Penn World Table (version 6.1).
Note: Income is measured in internationally comparable United States dollars.

The downward trend was the end result of low growth rates in those countries, which has been experienced by the entire ESCWA region since the 1980s, accompanied by the fastest population growth rate in the world, growing at an average of 2.9 per cent each year.[42]

However, the recent economic growth of the region has created a significant revival from the lethargic outcome of the previous decades, resulting in an annual average growth rate of 5.8 per cent in the period 2003-2005. It must be stressed that GDP per capita annual growth had reached the modest averages of 2.9 to 3.8 per cent in the countries of the GCC and 1.9 per cent in MDEs. The region has therefore lagged behind

[42] See United Nations, *World Population Prospects: The 2006 Revision* (2007).

the developing world and, in the past few years, GDP per capita has grown at a lower pace than countries in sub-Saharan Africa.

A more individual description of growth performance for the three countries in the last quarter of the twentieth century (with sub-periods of time, for example 1981-1990) was achieved by breaking down the rates of growth in output per unit of labour (Y/L), ratio of investment to GDP (s_K), ratio of expenditures in education to GDP (s_H) and the growth of the labour force (n) (see tables 2 to 4).

TABLE 2. THE GROWTH RECORD OF EGYPT
(*Percentage*)

Period	Y/L	s_K	s_H	*N*
1975-1980	6.65	17.40	1.14	2.22
1981-1990	2.22	0.30	(7.60)	2.72
1991-2000	2.01	6.50	(1.43)	2.69
1975-2000	2.79	(0.50)	1.28	2.69

Source: Calculated by ESCWA.

Note: Figures within parentheses ( ) indicate negative growth rates.

Tables 2 to 4 indicate that, until 1990, the growth of output per unit of labour (Y/L) follows a similar pattern in all three ESCWA member countries under study. Each country experienced a relatively high growth rate in the period 1975-1980, which is associated with the first oil shock and the resulting spillover effects on those MDEs. Subsequently, a dramatic fall in growth occurred throughout the 1980s. By contrast, the three countries experienced different patterns in the 1990s. While Jordan experienced a modest recovery, both Egypt and the Syrian Arab Republic registered a slight fall of output per worker, thereby denoting a disappointing growth track record.

TABLE 3. THE GROWTH RECORD OF THE SYRIAN ARAB REPUBLIC
(*Percentage*)

Period	Y/L	s_K	s_H	*N*
1975-1980	4.17	2.78	3.30	2.93
1981-1990	2.00	(6.15)	(1.45)	3.30
1991-2000	1.80	(1.98)	(3.10)	3.50
1975-2000	1.90	(1.63)	(3.27)	3.30

Source: Calculated by ESCWA.

Note: Figures within parentheses ( ) indicate negative growth rates.

The theoretical framework outlined in chapter I can explain the dramatic change in growth that occurred in the 1980s and 1990s. Equations (9), (10) and the phase diagram of figure I allow us to examine the impact of changes of three main variables in consideration, namely, n, s_K and s_H on the growth rate in (Y/L).

TABLE 4. THE GROWTH RECORD OF JORDAN
(*Percentage*)

Period	Y/L	s_K	s_H	*N*
1975-1980	9.86	4.78	12.40	2.14
1981-1990	(2.60)	(1.13)	(1.45)	4.31
1991-2000	1.41	(2.72)	(3.10)	3.98
1975-2000	1.95	(0.63)	3.80	4.00

Source: Calculated by ESCWA.

Note: Figures within parentheses ( ) indicate negative growth rates.

Figure II shows the impact of an increase in the rate of growth of labour (*n*) on k and h. Assuming that the economy was in a steady state, that is at point E, with (Y/L) growing at the rate g, then equations (9) and (10) imply that an increase in (*n*) will move the economy to point E′, with less k and less h.

Since equation (12) implies $(Y/L) = Ak^{\alpha}h^{\beta}$, then the rate of growth of output per worker is given by Rate of growth in (Y/L) = g + α(rate of growth in k) + β(rate of growth in h).

Moreover, given that the growth rate in both k and h are negative between E and E′, the rate of growth in (Y/L) in E′ is less than E. Clearly, a decrease in (*n*) will have the opposite impact.

Figure II. Impact of an increase in the labour growth rate (*n*) on k and h

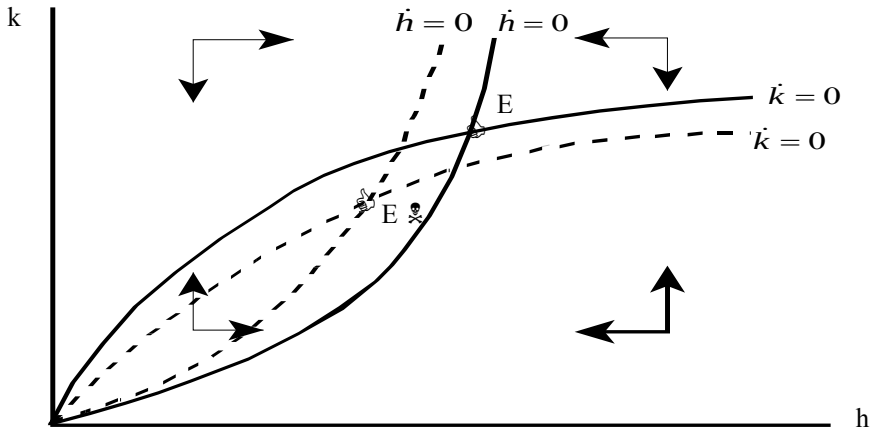
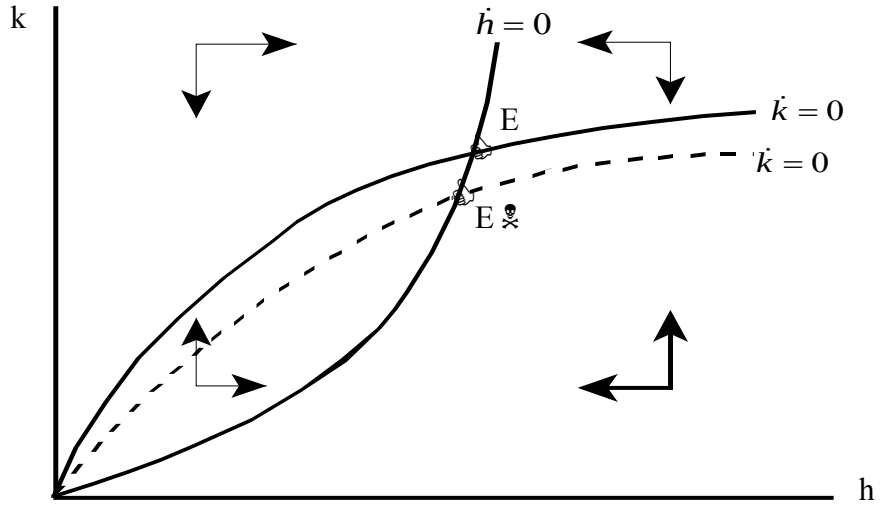


Figure II shows the impact of a reduction in the investment ratio, s_K, on k and h. Again, that leads to a decrease in both k and h and, subsequently, to a decline in the growth rate of output (Y/L). Finally, figure III shows the impact of a decrease in the ratio of expenditures on education to GDP on k and h. Note that that also leads to a drop in h and k and, therefore, to a decrease in the rate of growth of GDP per worker (Y/L).

The statistics can explain the performance of those three MDEs in the 1980s and 1990s. In the case of Egypt in the course of the 1980s, the rate of population growth, *n*, increased relative to the 1970s, and s_K and s_H decreased (see table 2). Those three changes led to a drop in the rate of growth of output per worker (Y/L), which in turn reduced capital per unit of effective labour and human capital per unit of effective labour. The decrease in the latter was significant, plummeting from 1.14 per cent in the 1970s to a negative rate of growth of minus (-) 7.6 per cent in the 1980s.

In fact, comparing the 1990s with the 1980s, it is evident that while the rate of growth of the workforce (*n*) decreased and recuperated (s_K), the percentage of financial resources devoted to education (s_H) continued to decline (see table 2). Consequently, two of the changes (in *n* and s_K) led to an increase in the rate of growth in (Y/L) and the third one (s_H) led to a decrease. Given the dominant latter, the overall rate of growth declined modestly. That implies that the substantial reduction in education expenditures clearly restricted the rate of growth, thereby recovering to the rate that had hitherto prevailed.

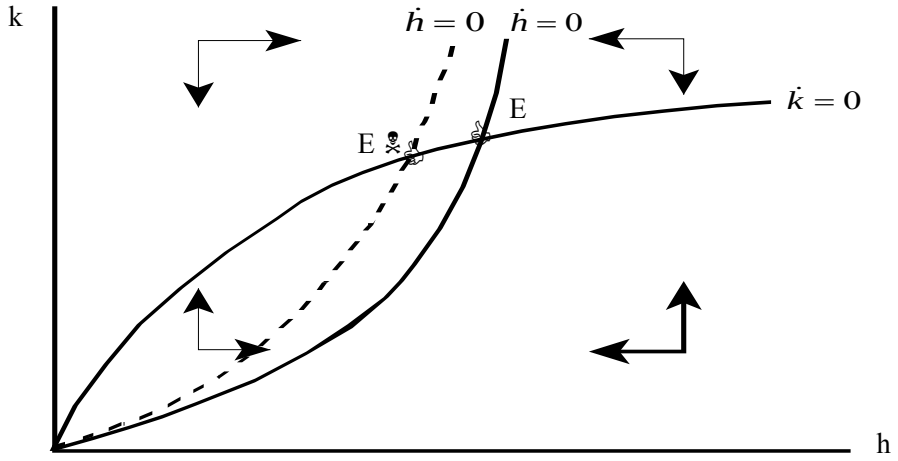
Figure III. Impact of a decrease in s_K on k and h



In the case of the Syrian Arab Republic during the 1980s, *n* increased, and both s_K and s_H declined relative to the 1970s, with negative rates of growth (see table 3). The three changes were simultaneously detrimental to growth, which can partly account for the unsatisfactory economic performance of the Syrian Arab Republic. The growth of output per worker (Y/L) dropped from 4.17 per cent in the second half of the 1970s to 2.00 per cent in the 1980s. The negative trend continued during the 1990s, when the rate of growth in (Y/L) dropped even further to a meagre 1.80 per cent.

In the case of Jordan, while *n* increased, s_K and s_H decreased throughout the 1980s and relative to the 1970s. The change was substantial; specifically, *n* increased by 70 per cent, which resulted in a decline in the growth rate of (Y/L) from the very high rate of 12.30 to minus (-) 2.6 per cent. In addition, the decline in s_K and s_H continued in the 1990s despite considerable falls of *n*, and dominated the outcome, thereby allowing an increase in the (Y/L) rate of growth (see table 4).

Figure IV. Impact of a decrease in s_H on k and h



2. Sources of growth: a quantitative analysis

While the above analysis provided a descriptive explanation for the dramatic changes in the economic performance between the golden era of the 1970s and the subsequent two decades, there remains a need to present a quantitative dimension. For that purpose, the standard growth accounting framework is used, which decomposes growth in output per worker into three sources of growth, namely, growth by capital and human capital per worker, and growth resulting from productivity that corresponds to TFP growth.[43]

Table 5 shows the TFP results over the period 1975-2000 in the last column for the three ESCWA member countries under investigation. Additionally, the table presents the results from five separate investigations that focus on the Middle East and were published in the past decade.

It must be clarified that judgments are not being made regarding the quality of the data, the results obtained or the countries included in the samples. In straightforward terms, the aim consists of comparing the estimates arising from this study with those published recently. Furthermore, this study provides an overall picture of the region. Indeed, the resulting image is so distinctive that some comments relating to the overall situation are necessary, namely:

(a) All the estimates presented in table 5 indicate that the rates of growth of TFP are low in nearly all the countries in the region, with most studies indicating negative TFP for some countries. While the estimates that stem from this research are not as negative as those indicated by some past studies, they are certainly significantly low and, in some cases, very similar to those reported by Sala-i-Martin and Artadi;[44]

(b) Egypt is the only ESCWA member country that registered a positive, albeit very low, rate of growth of TFP in four out of the five previous investigations. Within that context, the results of this investigation are similar to those reported by Bisat and El-Gamal;[45]

(c) Only half of the studies were able to include the GCC countries, owing most likely to data restrictions, particularly insufficiently long time series data sets. However, the estimations indicate negative TFP growth, which has hampered growth and certainly decreased the benefits accrued from oil rents. A degree of caution is needed when analysing those results, as indicated by the case of Oman, with results from the various studies at opposite poles and therefore contradictory.[46]

Finally, it must be emphasised that the estimates for individual countries within the region are clearly lower than the rate for the successful countries in East Asia. Nevertheless, they are in line with prevailing rates in OECD countries, which clearly suggests that the low growth in the three countries does not entirely stem from low productivity growth. In effect, other factors were certainly responsible for the poor economic performance in the 1980s and 1990s.

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[43] This is achieved by taking the log of the production function in equation (1) in section B of chapter I, taking the derivative with respect to time and subtracting $L^{\bullet}/L$ from the two sides. This yields: $(Y^{\bullet}/L) = \alpha (K^{\bullet}/L) + \beta (H^{\bullet}/L) + TFP$.

[44] It must be emphasised that the sample size for this study starts in 1975, compared to some studies that have a time series that starts in 1960 or even 1953. See X. Sala-i-Martin and E.V. Artadi, "Economic growth and investment in the Arab world", which was prepared for *The Arab World Competitiveness Report* (World Economic Forum, October 2002).

[45] See A. Bisat and M.A. el-Gamal, "Investment and growth in Egypt: 1970-1997 – lessons from the past and guidelines for the future", which was presented to the Sixth Annual Conference of the Economic Research Forum (Cairo, 28-31 October 1999).

[46] For example, Bisat, El-Erian and Helbling, as well as Sala-i-Martin and Artadi, suggested a positive rate of TFP in the last quarter of the twentieth century, while a very recent investigation by Baier, Dwyer and Tamura suggested exactly the opposite, namely, a negative growth rate of TFP (see table 5).

TABLE 5. TFP GROWTH IN THE MIDDLE EAST

Country	Bisat, El-Erian and Helbling (1971-1996)[a/]	Sala-i-Martin and Artadi (1975-2000)[a/]	Baier, Dwyer and Tamura (-1999)[b/]	Abu-Qarn and Abu-Bader (1960-1998)[c/]	Isaksson (1960-2000)[a/]	ESCWA (1975-2000)[a/]
ESCWA: GCC subregion						
Bahrain	-0.75	-0.80				
Kuwait	-0.30	-2.05	-0.26 (1980)[b/]			
Oman	2.00	1.40	-1.85 (1970)[b/]			
Qatar	-1.00	-2.35				
Saudi Arabia	-3.40	-1.10	-2.28 (1960)[b/]			
United Arab Emirates	-0.25	-2.05	-4.37 (1980)[b/]			
ESCWA: selected MDEs						
Egypt	-0.50	0.60	0.58 (1960)[b]	1.07	0.30	0.68
Iraq			-2.01 (1950)[b/]			
Jordan	-3.60	-2.00	-1.24 (1960)[b/]	-1.20	-1.30	0.80
Lebanon	-1.25	-2.30				
Syrian Arab Republic	2.00	1.40	-1.64 (1953)[b/]	-0.67	0.60	0.14
Yemen			-7.84 (1970)[b/]			
Countries neighbouring ESCWA						
Algeria	-3.00	-2.00	0.67 (1948)[b/]	-0.74	0.90	
Iran			-1.37 (1956)[b/]	-1.95	0.00	
Morocco	-1.00	-0.25	-0.02 (1951)[b/]	0.35	0.80	
Sudan				-0.26		
Tunisia	0.75	1.80	0.54 (1956)[b/]	0.03	1.00	
Turkey				-1.13	-0.60	

Sources: Compiled by ESCWA and based on the following studies: A. Bisat, M.A. El-Erian and T. Helbling, "Growth, investment and saving in Arab economies", *IMF Working Paper* WP/97/85 (IMF, 1997); X. Sala-i-Martin and E.V. Artadi, "Economic growth and investment in the Arab world", which was prepared for *The Arab World Competitiveness Report* (World Economic Forum, October 2002); S.C. Baier, G.P. Dwyer and R. Tamura, "How important are capital and total factor productivity for economic growth", *Economic Inquiry*, vol. 44, No. 1 (January 2006); A.S. Abu-Qarn and S. Abu-Bader, "Sources of growth revisited: evidence from selected MENA countries", *World Development*, vol. 35, No. 5 (May 2007); and A. Isaksson, "Productivity and aggregate growth: a global picture", which is a forthcoming working paper by the United Nations Industrial Development Organization (UNIDO) Research and Statistics Branch.

Notes:

a/ The Standard National Account Approach (SNAA) was employed.

b/ The first year in the data set of Baier, Dwyer and Tamura is provided in parenthesis for each country.

c/ Co-integration and panel data approaches were employed.

(a) *Egypt*

In the case of Egypt, the main source of growth was capital accumulation, in other words growth that was mainly driven by investment in physical capital over the entire period 1975-2000 (see table 6). During the high growth period of the 1970s, TFP did not contribute significantly to growth, and its contribution remained almost level in the 1980s and throughout the 1990s. Consequently, the dramatic decline in the rate of growth can certainly be attributed to the substantial drop in both the growth rate of capital per worker and human capital per worker.

Simulations of the model from equations (16), (17) and (18) in section B of chapter I reveal that the economy of Egypt is very much in transition and far from its steady state. In fact, it is moving very slowly towards a balanced growth path, given that the convergence speed is marginally below 2 per cent a year.[47] It is estimated that the steady-state level of output per worker almost doubled its level in 2000. Given that growth is more responsive to investment in capital than in human capital, the elasticity of the former is 1.22 and that of the latter is 0.73.

TABLE 6. DECOMPOSITION OF GROWTH IN EGYPT, 1975-2000
(*Percentages*)

		Y/L	K/L	H/L	TFP
1975-2000	Rate of growth	2.79	3.35	5.10	0.68
	Contribution to growth		48.00	43.90	8.10
1975-1980	Rate of growth	6.65	8.27	8.20	1.87
	Contribution to growth		56.00	37.00	(1.95)
1980-2000	Rate of growth	1.83	2.30	4.28	1.20
	Contribution to growth		56.60	70.10	(26.7)

Source: Compiled by ESCWA.

Notes: The calculation is based on $\alpha = 0.40$, $\beta = 0.24$.

Parentheses ( ) indicate negative values.

(b) *Jordan*

It must be emphasised that while Jordan has the highest stock of human capital per worker among the three countries under analysis, its rate of growth is lower during the whole period. Investment in physical capital also became insufficient in the 1980s and 1990s and was responsible for the dramatic drop in the growth rate of GDP per worker.

Growth can be greatly enhanced by increasing expenditures in education, which in turn raises the stock of human capital. That is because the elasticity of the growth rate to investment in human capital is significantly high, at 3.97, which represents more than three times the value in the Syrian Arab Republic and five times the value in Egypt. The economy is moving comparatively slowly towards its balanced growth path at a speed of convergence equal to 2.5 per cent. Consequently, the steady-state level of output per worker is set to be greater than its level in 2000 by a factor of 1.15.

TABLE 7. DECOMPOSITION OF GROWTH IN JORDAN, 1975-2000
(*Percentages*)

		Y/L	K/L	H/L	TFP
1975-2000	Rate of growth	1.95	2.46	2.42	0.80
	Contribution to growth		50.5	37.2	12.3
1975-1980	Rate of growth	9.86	17.83	2.54	3.90
	Contribution to growth		79.57	8.49	11.93
1980-2000	Rate of growth	(0.64)	(0.66)	2.39	(4.95)
	Contribution to growth		(45.30)	123.4	(178.12)

Source: Compiled by ESCWA.

Notes: The calculation is based on $\alpha = 0.40$, $\beta = 0.30$.

Parentheses ( ) indicate negative values.

[47] The calculation implies that, annually, the economy is moving marginally less than 2 per cent of the distance to its steady state.

(c) *Syrian Arab Republic*

The Syrian economy suffers from insufficient expenditures in education. The rate of growth in human capital per worker declined in the 1980s and 1990s by more than half its rate in the 1970s. In addition, investment in physical capital displayed a very volatile behaviour. Moreover, the economy is on a transitional path and far from its balanced growth path. The speed of convergence, however, is faster than that of Egypt, at 4.74 per cent a year. It is estimated that the steady-state level of output per worker will be higher than its level in 2000 by a factor of 1.66. The elasticity of growth to investment in human capital is much higher than that related to investment in physical capital, at 0.90 and 0.47, respectively, which owes merely to the fact that the economy is operating at a low level of human capital.

TABLE 8. DECOMPOSITION OF GROWTH IN THE SYRIAN ARAB REPUBLIC, 1975-2000
(*Percentages*)

		Y/L	K/L	H/L	TFP
1975-2000	Rate of growth	1.90	3.18	2.83	0.14
	Contribution to growth		66.90	32.8	0.30
1975-1980	Rate of growth	4.17	9.70	5.00	(2.10)
	Contribution to growth		93.00	26.40	(19.40)
1980-2000	Rate of growth	1.18	1.59	2.20	(0.20)
	Contribution to growth		53.90	46.60	(0.51)

Source: Compiled by ESCWA.
Notes: The calculation is based on $\alpha = 0.40$, $\beta = 0.25$.
Parentheses ( ) indicate negative values.

III. CONCLUSIONS AND POLICY RECOMMENDATIONS

Chapters I and II provided an in-depth analysis of the growth performance over the period 1975-2000 of selected ESCWA member countries, namely, Egypt, Jordan and the Syrian Arab Republic. The analysis decomposed growth into its three sources of physical capital, human capital and TFP. This final chapter highlights the main results of the empirical analysis related to each of the three sources and several of their policy implications.

A. PHYSICAL CAPITAL

The decomposition of growth in chapter II illustrated that the accumulation of physical capital was the major source of growth in the three countries under study over the entire period 1975-2000. Additionally, table 9 shows that while the investment ratio to GDP was higher in the three countries than the average of developing countries in 1980, it decreased systematically in the subsequent two decades and became less than that average in 2000 for those countries. While those figures are substantially below the successful newly-industrialized countries in South-East Asia, which registered approximately 30 per cent, they do bear a resemblance to those achieved by OECD member countries during the same time period.[48] However, it must be noted that developing economies require a higher rate of investment, particularly public investment, because market imperfections often create bottlenecks of resources and services, thereby hindering the creation and full development of private investments.

TABLE 9. THE INVESTMENT RATIO, 1980-2000

	1980	1990	1995	2000
Egypt	28	29	17	24
Jordan	37	32	33	20
Syrian Arab Republic	30	17	27	21
Developing countries	26	25	28	25

Source: United Nations Conference on Trade and Development (UNCTAD), *Handbook of Statistics* (UNCTAD, 2002).
Note: The investment ratio is measured as the ratio of total investment to GDP.

Another indicator that is very much related to the trend of aggregate capital formation is the rate of FDI inflow into the countries (see table 10). In Egypt, while the ratio of FDI to total investment was higher than the average for developing economies in the first seven years of the 1990s, it became less than the average in the subsequent three years of that decade. The FDI ratio in the Syrian Arab Republic was extremely low and declined further; specifically, it was approximately one third of the average for developing countries in the first half of the 1990s and became less than one tenth of that average in 2000. In Jordan, FDI showed a steady increase until 1997 and a steady decline thereafter.

TABLE 10. THE FDI RATIO, 1990-2000

	1990-1995[a/]	1996	1997	1998	1999	2000
Egypt	5.80	5.10	6.10	6.10	15.40	5.80
Jordan	0.70	0.80	19.30	18.50	10.30	2.30
Syrian Arab Republic	1.20	0.60	0.60	0.60	1.90	1.90
Developing countries	3.60	4.80	6.00	10.70	17.40	25.00

Source: United Nations Conference on Trade and Development (UNCTAD), *Handbook of Statistics* (UNCTAD, 2002).
Notes: The FDI ratio is measured as the ratio of FDI inflow to total investment.
a/ These percentages represent averages over the period 1990-1995.

[48] See X. Sala-i-Martin and E.V. Artadi, "Economic growth and investment in the Arab world", which was prepared for *The Arab World Competitiveness Report* (World Economic Forum, October 2002).

Equally, that trend is underscored by the Inward FDI Performance Index of UNCTAD (see table 11). The Index measures a country's share of global FDI flows to its share in GDP.[49] While political instability in the region could account for some of the drops in domestic and foreign investment, it cannot account for the whole decline. In fact, the bulk of the reduction is a response to changes in the regulatory business regimes, which is briefly described below.

TABLE 11. INWARD FDI PERFORMANCE INDEX, 1988-2000

Country	1988-1990	1998-2000
Egypt	2.8 (21)	0.5 (91)
Jordan	0.4 (97)	0.6 (88)
Syrian Arab Republic	0.5 (92)	0.3 (105)

Source: UNCTAD, *Handbook of Statistics* (UNCTAD, 2002).
Note: The figures in parentheses ( ) indicate the rank out of 139 countries.

B. HUMAN CAPITAL

In order of importance, the second largest contributor to growth is the accumulation of human capital. One of the main reasons for the dramatic decline in the rate of growth in the 1980s and 1990s in the three countries under investigation is the inadequate situation of human capital. That does not come as a surprise, given that the countries have a deficient record of investment in education. Table 12 shows the average years of school, which are a proxy to capture human capital stock (see box 3).[50] The statistics clearly indicate that, in the three countries under study, the average years of formal education were below the world average over the period 1970-1990. In fact, only Jordan reached the average global level and was slightly above that average in 2000.

TABLE 12. AVERAGE YEARS OF SCHOOLING FOR THE TOTAL POPULATION AGED 15 AND OVER, 1970-2000

Year	World	MENA	Egypt	Syrian Arab Republic	Jordan
1970	5.08	1.51	1.55[a/]	2.15	3.25
1980	5.77	2.47	2.34	3.65	4.28
1990	6.43	3.77	4.26	5.11	5.95
1995	6.44	4.46	4.98	5.48	6.47
2000	6.72	5.08	5.51	5.77	6.91

Source: R.J. Barro and J.W. Lee, "International data on educational attainment: updates and implications", *Oxford Economic Papers*, vol. 53, No. 3 (July 2001).

Note: a/ This figure for Egypt relates to 1975.

In the particular case of the Syrian Arab Republic, the situation is alarming, given that the enrolment ratio for both secondary and tertiary levels of education declined between 1990 and 1997 (see table 13). That drop is set to have dire consequences for future growth prospects. In the absence of dramatic reforms of public expenditures aimed at making public education a priority for policymakers, the situation could create an adverse path dependence that weighs heavily on future economic prospects.

[49] Within that context, countries with an index of one receive FDI exactly in line with their relative economic size. Countries with an index value greater than one attract more FDI than expected on the basis of relative GDP; and, conversely, countries with an index below one attract less than expected.

[50] The average years of school have been widely employed in the empirical literature on growth.

In fact, public expenditures on education over the years have ranged between 3 to 8 per cent of GDP in the three countries. That is a startling figure, given that it is more than 10 per cent in industrialized countries. For that reason, there is an urgent need to increase public spending on education in ESCWA member countries in order to raise that ratio to that which prevails in developed countries.

However, it must be underscored that matching the ratio that prevails in developed countries is insufficient in terms of promoting and sustaining robust and long-term rates of growth. In fact, for a transitional period, the increase in expenditure needs to exceed that prevailing ratio in order enable a considerable increase in expenditures per student. Such expansion is indispensable if the countries are to jump from lower trails of growth to higher paths of development. Maintaining current levels of expenditures on education or increasing them only marginally will only keep those MDEs trapped on a path of economic dependence.

A simulation of the model presented in this study highlights the power of the adverse path dependence. Assuming that the rate of increase in the accumulation of human capital had continued during the 1980s and 1990s at the rate achieved in the second half of the 1970s, then, by 2000, per capita income in the Syrian Arab Republic would have been more than double the current level; and in Jordan and Egypt, the increase would have been in the range of 1.4-1.5.[51]

TABLE 13. ENROLMENT OF SECONDARY AND TERTIARY EDUCATION, 1990 AND 1997
(*Percentage of relevant population*)

	Secondary		Tertiary	
Country	1990	1997	1990	1997
Egypt	76.2	78.3	15.8	20.20[a/]
Jordan	44.6	57.4	16.1	17.90[b/]
Syrian Arab Republic	51.9	42.5	18.2	15.40

Source: World Bank, *World Bank Development Report 2000/2001: Attacking Poverty* (World Bank, 2001).
Notes: a/ Data for 1995.
b/ Data for 1996.

There is a need to stress that future growth in the three countries depends on the extent to which a major reallocation of resources is undertaken in favour of public education, which represents a vital, albeit insufficient, condition for improving the human capital situation.

Specifically, the increase in resources devoted to schooling must be accompanied by major reforms in the education systems of the three countries, whose quality is comparatively low and removed from labour market requirements. In part, such analysis explains the high unemployment rate among educated people and the low return to human capital in the three countries.[52] A comprehensive reform in education needs to emphasize the acquisition of practical skills and the capacity for critical thinking, which is a prerequisite aimed at matching vocational and technical training. For that reason, the curriculum of the education system needs to be continuously upgraded in order to keep abreast of the global technological revolution, thereby boosting the chances of success for strategies that encourage self-employment and entrepreneurship, especially among youth and women.

[51] The numbers are approximations given that the simulation was carried out using the assumption that TFP rate of growth remained constant in the two scenarios, which is technically incorrect.

[52] See A. Ali, "On the relationship between education, the labour market and the measurement of returns to human capital", in *Enhancing links between education and labour markets in Arab countries*, A. al-Kawaz ed. (2002), pp. 8-26; and World Bank, *Unlocking the employment potential in the Middle East and North Africa: Toward a new social contract* (World Bank, 2004).

C. TFP AND SOCIAL INFRASTRUCTURE

The inability of Egypt, Jordan and the Syrian Arab Republic to increase the rate of capital accumulation, both physical and human, in line with the increase in the labour force, their failure to attract FDI and their low TFP levels cannot be explained by external factors. Rather, they stem from regulatory business regimes that are unable to constantly sustain increasing factors of production or increases in productivity. Such a failure owes directly to the weak social infrastructures of the countries.[53]

Three important functions of those institutions and policies are identified in the economic literature as follows:[54]

(a) To protect the output of individual production units from diversion. Specifically, private agents involved in theft, squatting and mafia protection rackets could execute such diversions. More often, however, the diversions are undertaken by Governments engaged in expropriation, confiscatory taxation and corruption;

(b) To attract the most talented individuals in the society and use their ability, endowments and aptitudes in productive activities, thereby creating new wealth, rather than engaging in rent-seeking activities that only capture existing wealth. Well-defined "property rights" make much of an economy's wealth invulnerable to expropriation and discourage rent-seeking activities. Similarly, well-functioning capital markets that allow firms to expand rapidly tend to promote production activities over rent-seeking;

(c) To pursue policies that ensure macrostability and microefficiency. The former is essential for reducing uncertainty with regard to the future while the latter is necessary for reducing transaction costs, both of which are prerequisites for creating a hospitable environment for domestic capital formation and FDI.

[53] Within that context, social infrastructure refers to those institutions and Government policies that determine the economic environment within which individuals accumulate skills and produce outputs. R.E. Hall and C.I. Jones, "Why do some countries produce so much more output per worker than others?", *The Quarterly Journal of Economics*, vol. 114, No. 1 (February 1999), p. 84.

[54] See A.O. Krueger, "The political economy of the rent-seeking society", *The American Economic Review*, vol. 64, No. 3 (June 1974), pp. 291-303; W.J. Baumol, "Entrepreneurship: productive, unproductive, and destructive," *Journal of Political Economy*, vol. 98, No. 5 (October 1990), part 1, pp. 893-921; and D. Romer, *Advanced Macroeconomics*, second edition (McGraw–Hill, 2001).