

The human capital endowment of Latin America and the Caribbean

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Although there are a great many theoretical and empirical studies which use the concept of human capital, there is no generally accepted definition of this term, and in many cases it is simply equated with formal education. This article will try to clarify the concept of human capital more precisely, with special reference to the ways in which it can be acquired. It will also provide an international indicator that takes account of all the shades of meaning of the definition proposed here, which are usually left out of the traditional indicators. Thus, the proposed indicator will take into account health, formal and informal education, and experience. Analysis of the human capital endowments of the Latin American and Caribbean countries reveals a certain backwardness with respect to other regions. It should be noted, however, that there are big differences between countries, although these have been reduced in the last few decades through a process of regional convergence.

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I

Introduction

The most diverse disciplines —such as political science, philosophy or sociology— have always attached great importance to the education of individuals, emphasizing the way in which this conditions the general functioning of societies. The impact of education has also been stressed by economic science from its inception. Nevertheless, the interest in studying human capital was shared by very few economists until the 1960s, when some crucial studies began to be published on the concept of human capital, such as those by Becker (1962 and 1964), Schultz (1960, 1961 and 1962) or Denison (1962 and 1964).

It was not until the appearance of the new endogenous growth models, however, that the economic literature began to show growing interest in human capital, which it saw as one of the factors responsible for growth. Some of the most important models may be found in Lucas (1988), Romer (1990), King and Rebelo (1990), Rebelo (1991), Stokey (1991), Young (1991), Lucas (1993) and Acemoglu (1997). In these, human capital is shown to make possible an increase in labour productivity or acts through the stimulation of technological change. As regards the empiric evidence, among the many recent studies which have shown the connection between human capital and economic growth are those by Azariadis and Drazen (1990), Barro (1991), Levine and Renelt (1992), Mankiw, Romer and Weil (1992), Kyriacou (1992), Barro and Lee (1994), Benhabib and Spiegel (1994 and 1997), de la Fuente and da Rocha (1996), Mingat and Tan (1996), Krueger and Lindahl (1999), or de la Fuente and Doménech (2001).

As well as being an outstanding growth factor, human capital is also extraordinarily important in many other areas. Thus, as the Organisation for Economic Cooperation and Development (OECD, 1999) notes, it

helps cultural and institutional development, increases social cohesion, makes it possible to reduce crime, enhances citizens' interest in protecting the environment, permits the improvement of health conditions, and strengthens participation in political life, among many other important contributions.

In view of the importance of human capital, it is easy to understand why it is necessary that both the definition of the concept and the indicators constructed in order to quantify it should reflect its underlying elements as accurately as possible. One of the objectives of this article is precisely to offer a more complete definition of human capital than that usually given by most of the studies to be found in the economic literature. In addition, on the basis of the proposed definition various indicators will be constructed which will bring us closer to accurate measurement of all the nuances that it contains, in order to subsequently combine this information into a single indicator. On this basis, an analysis will then be made of the human capital endowment of Latin America and the Caribbean, which highlights the differences within and between regions but also shows a process of convergence.

This study is therefore organized as follows: after the present introduction, section II goes more deeply into the concept of human capital and offers a broad proposed definition; section III constructs various indicators based on the different elements forming part of the proposed definition; in section IV, a global human capital indicator is constructed and its properties as compared with the traditional indicator based on average years of schooling are evaluated; section V makes a diagnosis of the situation in Latin America and the Caribbean on the basis of the human capital indicator thus developed, and finally section VI presents the conclusions of the study.

II

The concept of human capital

This section analyses the concept of human capital as reflected in the economic literature and proposes a broad definition on the basis of a synthesis of those findings, taking account of various aspects which are usually left out of the reckoning.

1. Regarding the concept of human capital

The differences separating some individuals from others can be observed in many fields, including the economic sphere. Consequently, the labour force is not homogeneous: people carry out different types of activities with different degrees of efficiency, so that workers display different levels of productivity when carrying out similar tasks. Each worker's capacity to adapt to the needs of the labour market will depend on his skills. The human capital he possesses will thus determine an individual's capacity to do a given job. It should be noted that we are taking a markedly economic attitude, distinguishing the concept of human capital from the traditional concept of education, which has a more social connotation.

The underlying idea of the concept of human capital is not new. Over 200 years ago, in 1776, Adam Smith recognized the importance of personal skills in determining the wealth of individuals and nations (Smith, 1904). The formal concept of human capital was not developed until the 1960s, however. Special mention may be made in this respect of the studies by Schultz (1961) and Becker (1964). In these studies, human capital is related to productivity and is defined as the sum of the investments in education, labour training, emigration or health, which result in an increase in the productivity of workers. Those studies conceive the training of individuals as an investment process in which more training will result in higher productivity and, hence, higher wages. Thus, the term "human capital" is explained by the fact that it is seen as a form of capital incorporated into persons. The association of the concept of capital with human beings caused much controversy among the economists of the time, but in spite of the initial criticisms, human capital soon became one of the most important economic concepts of the second half of the twentieth century.

More recently, the original concept has been expanded to include not only paid work but also that carried out outside the market, such as voluntary, community and domestic work: it thus covers all activities that directly or indirectly create income or wealth. Even so, economists have begun to recognize that these definitions of human capital are still too simple and leave out crucial aspects, so that they do little to help in the design of a proper training policy. Laroche, Merette and Ruggeri (1999, p.89) suggest that the traditional definition of human capital should be broadened to include the potential for obtaining human capital and the amount of such capital already possessed. In the work in question, they define human capital as the sum total of inborn capabilities, knowledge and skills that individuals acquire and develop in the course of their lives.

Along the same line of thinking, Ruggeri and Yu (2000) argue that human capital is a dynamic and many-sided concept. They consider that it should be analysed from a dynamic perspective covering a wide variety of purposes. Thus, they suggest that the concept of human capital should be expanded to include four dimensions: i) potential human capital; ii) the acquisition of human capital; iii) the availability of human capital, and iv) the effective use made of it. The concept would thus incorporate the use made and yields obtained, reflecting to some extent the demand side for human capital.

In short, as noted by Yu (2001), there are different definitions of human capital in the literature, but there is no generally accepted definition, even though human capital is considered to be one of the key production factors. The term "human capital" has traditionally been applied to academic education, and only recently has it been expanded to include a number of other aspects. The new definitions proposed reflect the present needs of the economy, while at the same time they present new challenges for quantifying human capital.

2. The definition of human capital

In the light of the foregoing, a definition of human capital is developed in this study which includes

various elements —some of them already covered in the existing literature— and is based on the ways in which human capital is acquired and accumulated. The proposed definition will be developed in line with the scheme shown in figure 1.

Thus, it is considered that human capital can be inborn or acquired. **Inborn human capital** comprises capabilities of a physical and intellectual nature, which may be modified by the individual's health and nutritional conditions. **Acquired human capital** will be built up in the course of life through formal education, informal education and accumulated experience. These three types of acquired training will condition the labour training and system of values of the individuals concerned, and these, together with their inborn aptitudes, will determine their performance at work.

Labour training will be determined by the skills obtained for carrying out a given task. In many cases, one single kind of training can be used for various jobs. For example, learning how to use a computer is a type of knowledge, obtained in school, at home or at work, which can be used in very different jobs. In other cases,

however, a given type of labour training will only be useful for a particular function, as in the case of learning to pilot an aircraft. In this latter case, it is difficult to replace employees with a specific type of training with others, and it is often necessary to make big investments in order to provide new employees with such knowledge.

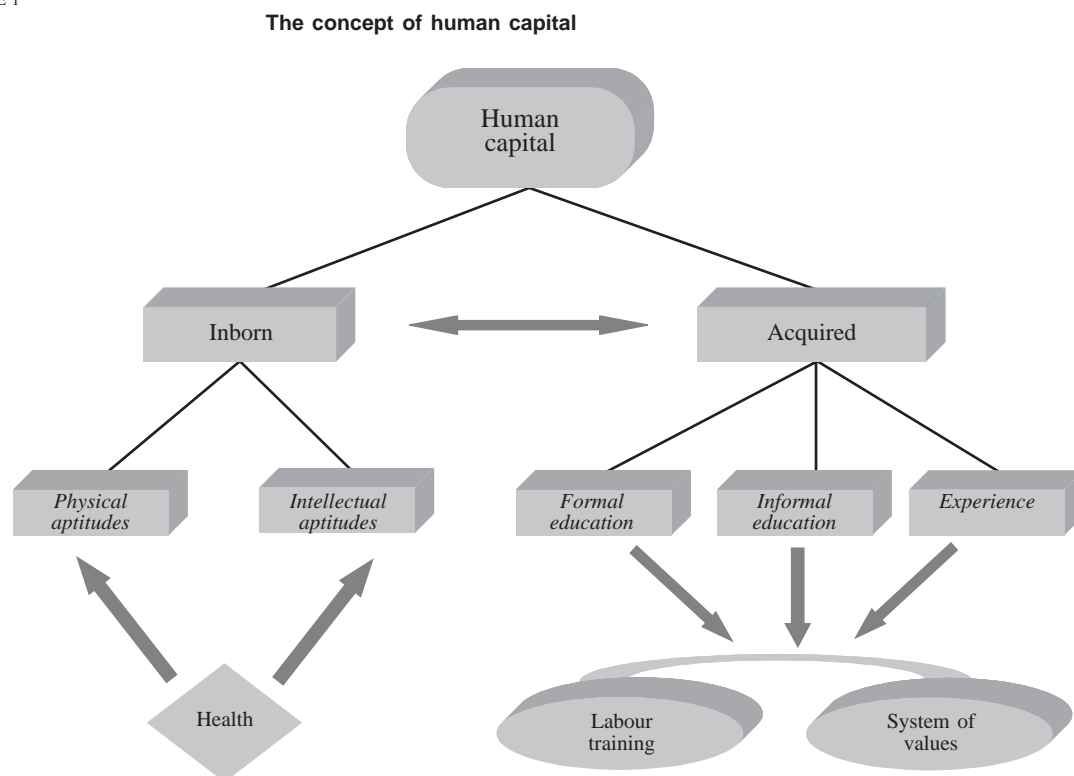
The system of values of an individual is also something which is acquired. These values will be a key element in the labour capabilities of employees. Employers attach great importance to these values, since they will condition the motivation, loyalty, integrity, diligence or reliability of a worker.

Now that we have made a first approximation to the elements that go to make up human capital, we will study them in greater detail in the following pages.

a) *Inborn human capital*

Human beings are distinguished from birth by genetic conditioning factors which will cause them to have different physical and intellectual aptitudes and will determine their efficiency in carrying out the jobs they do. Physical aptitudes include, among others,

FIGURE 1



Source: Prepared by the author.

strength, sense of balance, or manual dexterity, while intellectual aptitudes include intelligence and capacity of attention or concentration. These qualities can be cultivated throughout a worker's life through his acquired human capital.

Although each individual has different characteristics, it is reasonable to suppose that the initial average characteristics of the individuals of one country will be similar to those of the individuals of any other country. In other words, it is considered that geographical or racial differences do not exist. But although those qualities are initially similar, however, the use made of them will be subject to circumstances connected with the level of health of the environment in which the individuals live. Thus, if an individual suffers from malnutrition or unsuitable health conditions, this can reduce the possibility of making good use of his inborn aptitudes. It should be noted that this way of approaching the influence of health on the acquisition of human capital differs from the approaches traditionally adopted.¹ Thus, in most of the studies it is argued that an improvement in health conditions, measured through an increase in life expectancy, will affect human capital because of the longer active life of individuals, which will bring an increase in the return on human capital, and this will be reflected in greater economic growth. This argument is followed by Meltzer (1995), Kalemli-Ozcan, Ryder and Weil (2000) —who also offer an empirical study on the United Kingdom— and Rodríguez and Sachs (1999), who offer empirical results for Venezuela.

This reasoning must be viewed with caution, however, because —as argued by Echevarría (2004)— the proposed models assume an infinite time horizon, without taking account of the period of retirement. This latter factor must be taken into account, however, in order to achieve a correct explanation of the process of investment in human capital. Increases in life expectancy will not necessarily be accompanied by changes in decisions to invest in human capital unless there are changes in the period of retirement. Thus, in the great majority of countries life expectancy now exceeds the retirement age. Echevarría's study gives empirical results for the case of the United States which

confirm this proposal. It must also be added that, in the poorest countries with lower life expectancy, investment in human capital is conditioned by other factors which are much more important than the proposed time horizon of that investment. Examples of this are the need to start work at a very early age, or distance from training centres. These motives would support a change in the proposed approach.

b) *Acquired human capital*

Acquired human capital includes the formal and informal education received and the experience gained.

i) *Formal education.* Formal education includes pre-school, primary, secondary and higher education, and these academic levels form the conceptual basis traditionally used to quantify human capital, either through average years of schooling, the percentage of persons who have completed a given level of studies, or the indices of enrolment in each level of education.² Part of these levels of education will be compulsory and part voluntary.

In addition to the academic education regulated by law, formal education will also include the training given to unemployed persons by public bodies and the training courses for workers given by business firms and public bodies.

ii) *Informal education.* The concept of informal education began to be used in education sciences in the late 1960s and early 1970s, and covers all types of training received outside the institutionalized educational area. Thus, informal education consists of the instruction that individuals receive in their family and their closest social environment and all types of knowledge gained through self-teaching.³

On the one hand, the family and the circle of relations have always been of fundamental importance

¹ Even when the concept of human capital first appeared, Schultz (1961) and Mushkin (1962) already considered that improvements in health conditions could increase the endowment of human capital. Nevertheless, health has been left out of the reckoning in the great majority of theoretical and empirical studies dealing with the use of human capital. For an interesting analysis of health and human capital, see Bandrés and García Delgado (2000).

² For an analysis of indicators of formal academic education and quality of education, see Barro and Lee (1993, 1996 and 2001).

³ Coombs, Prosser and Ahmed (1973, p. 23) define informal education as the process carried out throughout a person's life whereby he acquires aptitudes, values and knowledge from everyday experience and the resources and influences of his closest surroundings, namely, the family and neighbours, work and play, the market, the local library, and the mass media. Tight (1996, p.68) assigns great importance to the education received through learning and training that takes place outside the formal institutions, distinguishing it explicitly from other types of education. The importance of this type of education in the training of individuals has been emphasized in many studies on education: for example, Torres (1990) analyses its importance in the educational policies implemented in Latin American countries, Foley (1999) focuses on the experiences of Australia, Brazil, Zimbabwe and the United States in this respect, while Youngman (2000) highlights its importance in the training of adults.

in the education of human beings. On the other hand, more and more importance is being assumed by the training which people receive from the various information media and which they all assimilate in their own way. Among these vehicles for informal education, books have long played a fundamental role. Other important means of informal education which have come on the scene more recently are the press, television, radio and the internet.⁴

III

The measurement of human capital: a new proposal

In this section, we will construct various indicators in order to come closer to the different aspects of the definition given above which are not usually taken into account in other indicators. The section will end with the formulation of a single indicator which will cover the different nuances of that definition.

Based on the concept of human capital formulated in section II above, various indicators will be proposed here which take account of all the nuances of that definition, i.e., **inborn human capital, formal education, informal education, and accumulated experience**. Using these indicators, a broad human capital index which corresponds to the concept in question has been prepared. The various indicators cover a period extending from 1960 to the present day and include the broadest sample of countries permitted by the available statistical information. The indicators taking account of each aspect of the definition are presented below.⁶

iii) Experience. Experience consists of all the situations experienced by an individual, which enable him to react to circumstances on the basis of previously acquired knowledge. Within this category, special mention may be made of work experience, which consists of all the knowledge gained in carrying out a particular task. Work experience is the most important type of experience from an economic point of view, since it is a decisive factor in a worker's productivity.⁵

1. Inborn human capital

As already noted, it would be logical to assume that the average individuals of one country would have the same inborn qualities as the average individuals of any other country. However, the use of those qualities is conditioned by the health situation prevailing in the environment where those individuals live. Thus, while starting from the assumption that the endowments of inborn human capital are the same for all countries, we will try to measure the consequences of disparities in health conditions for that human capital. This is done through the life expectancy indicator, which takes information on the health of the entire population spectrum and reflects the consequences of the general health conditions of individuals. This indicator also includes a considerable number of observations over time for a broad group of countries.

⁴ Leadbeater (2000) puts forward a number of arguments about the importance of the new technologies in the acquisition of knowledge.

⁵ For an analysis of learning by doing and its implications for productivity, see Arrow (1962). That study introduces this notion, which implies that the experience obtained from the use of new technologies in the production process will be accompanied by an increase in efficiency. Thus, there would be an increase in workers' productivity due to experience, at least until decreasing returns come into play. Various models based on human capital have stressed the importance that the process of learning by doing has in growth, due, among other factors, to the increasing use of new technologies. Some of these models are those by Romer (1986), Stokey (1991), Young (1991), Parente (1994) and Greenwood and Yorukoglu (1997).

⁶ The data on formal education are taken from Barro and Lee (2001), while the figures on paper consumption for cultural uses are from the Statistical Institute of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The rest of the data used in the preparation of the indicators come from *World Development Indicators* (World Bank, various years). The statistics on the use of newspapers, the radio, television and books were completed with data from the *Cross-National Time-Series Data Archive* of Arthur S. Banks, taken from the Social Indicators and Fixed Factors data base of the World Bank. All the sources used provide annual data from 1960 to the present for a broad sample of countries. The data taken from Barro and Lee refer to five-yearly figures. More exhaustive information on the definitions of the variables used and the availability of data can be obtained from the data bases mentioned.

2. Acquired human capital

Acquired human capital is the result of the formal and informal education received and the experience accumulated.

a) *Formal education*

The main effort made in the measurement of human capital has been in the collection of information on formal education. Out of all the indicators prepared in this respect, we will use the information on average years of schooling assembled by Barro and Lee (2001), since their indicator was constructed using the most rigorous procedures of any of the international studies made so far and provides information on the stock of human capital, in contrast with other indicators which only measure flows of education. This source provides five-yearly data from 1960 to 2000.

It must unfortunately be noted that the international information available on other areas of formal education, such as training provided for the unemployed and training provided by enterprises themselves, is so scanty that it is not worth including in an international human capital indicator.

b) *Informal education*

The **family** plays a fundamental role in the education of individuals,⁷ although not all families will be capable of giving their children the same attention, nor will they possess the same resources for educating them. This circumstance will condition the training that children receive within the family unit. It will therefore be necessary to find an indicator to quantify the attention and resources devoted to the education of children, on average, in each country. In this study, we have chosen to use the fertility rate as an approximation to the education that children can receive from their parents. Thus, this rate will constitute a first indicator of the attention that parents give to each of their children. That attention will be less as the size of the family increases. Moreover, the number of children will limit the resources that can be devoted to each child, since it will be necessary to share the available resources among all of them. Furthermore, there is a strong negative correlation between fertility and per capita income, which is a further reason why the

fertility rate can serve as an approximation to the resources that each family can devote to the upbringing of its children.⁸

Another important element in the acquisition of informal education is **self-training through various information transmission media**.⁹ In order to capture this decisive factor in acquired human capital, an indicator of the media that make possible the acquisition of informal education has been prepared for the present study. Through this indicator, we will have an approximation to various possibilities of self-training that are available to the citizens of each country. We will then go on to explain how this media index was prepared.

⁸ The trade-off between the number of children and the quality of their education has been observed by Rosenzweig and Wolpin (1980), Behrman and Taubman (1986), and Hanushek (1992). These studies find that the size of the family unit will condition the investment in the education of their children, since each child will only be able to receive fewer resources. This idea has been accepted in various models and empirical studies. Thus, Becker, Murphy and Tamura (1990) develop a model which generates different stationary states according to the relations between fertility, education and growth, concluding that individuals must choose between the quantity and quality of the children they want to have. Lam and Duryea (1999) find a strong negative effect of female schooling on fertility and a strong positive effect of the schooling of the parents on the schooling of their children, arguing that the effects of education on fertility are reflected above all in greater investment in the education of children and an improvement in the quality of that education. Moav (2005) develops a model based on fertility and quality of education which offers an explanation of the persistence of poverty in some countries: that article finds that the quality of the education received by children is conditioned by the number of children, assuming that the productivity of the parents in educational matters increases with their own degree of training; as a consequence, poor countries have high levels of fertility and low investments in education, so that their future generations will also be poor. Similarly, Tamura and Sadler (2001) construct an overlapping generations model in which fertility appears as an endogenous variable which conditions the education received by the children. It should be noted, however, that the relation between fertility and human capital does not only show itself in the direction mentioned. Thus, human capital can also be one of the determinants of fertility rates, as shown by Becker, Murphy and Tamura (1990) or Lam and Duryea (1999), although there are also other factors that affect the reduction of that rate, such as lower mortality, the expansion of contraceptive use, the opportunity cost in wage terms of looking after children, or the lower degree of dependence of the aged.

⁹ The studies by Coombs, Prosser and Ahmed (1973) and Leadbeater (2000) already referred to earlier mention the importance of these means for acquiring informal education. The importance of these means of learning is shown by the fact that the Centre for Educational Research and Innovation of the Organisation for Economic Cooperation and Development (OECD) is developing a broad programme to study the impact of information and communication technologies on the quality of education. Various studies have already been published on learning through the internet, the consequences of the technology gap between countries, and the dramatic impact that the new opportunities have on learning.

⁷ Coombs and Ahmed (1974) argue that the examples and attitudes observed within the family circle will naturally form an essential part of the educational process.

Two periods were examined: one covering the period from 1960 to 1989, and the other covering the 1990s. The methodology used for each period is slightly different, the reason for this being the availability of data in each case and the appearance of new media.

The **media index for 1960-1989** was prepared in the light of the access of the population of each country to books, newspapers, radio and television. It is as follows:

$$IM_{it} = \frac{\frac{books_{it} \cdot N_t}{\sum_{i=1}^{N_t} books_{it}} + \frac{newspapers_{it} \cdot N_t}{\sum_{i=1}^{N_t} newspapers_{it}} + \frac{radio_{it} \cdot N_t}{\sum_{i=1}^{N_t} radio_{it}} + \frac{television_{it} \cdot N_t}{\sum_{i=1}^{N_t} television_{it}}}{Me_{it}} \quad (1)$$

where:

IM_{it} = media index of country i in year t .
 i = 1, 2, ... , N_t where t is the number of countries in the sample in year t .
 t = 1960, 1961, ... , 1989.
 $books_{it}$ = number of book titles per capita published in country i in year t . This includes all editions, children's books and textbooks. The figure refers to book titles, not the number of copies printed.

$newspapers_{it}$ = number of newspapers per capita circulating in country i in year t . Only includes daily newspapers.
 $radio_{it}$ = number of radio sets per capita in country i in year t .
 $television_{it}$ = number of television sets per capita in country i in year t .
 Me_{it} = media analysed in country i in year t .

In the **media index for 1990-2000**, the number of book titles published is replaced with the consumption of paper for cultural purposes, which provides more valuable information. The index also

includes the use made of personal computers, which have revolutionized access to information in the last decade through various programmes and internet. The index will thus be as follows:

$$IM_{it} = \frac{\frac{paper_{it} \cdot N_t}{\sum_{i=1}^{N_t} paper_{it}} + \frac{newspapers_{it} \cdot N_t}{\sum_{i=1}^{N_t} newspapers_{it}} + \frac{radio_{it} \cdot N_t}{\sum_{i=1}^{N_t} radio_{it}} + \frac{television_{it} \cdot N_t}{\sum_{i=1}^{N_t} television_{it}} + \frac{computers_{it} \cdot N_t}{\sum_{i=1}^{N_t} computers_{it}}}{Me_{it}} \quad (2)$$

where:

IM_{it} = media index of country i in year t .
 i = 1, 2, ... , N_t where t is the number of countries in the sample in year t .
 t = 1990, 1991, ... , 2000.
 $paper_{it}$ = kilogrammes of paper consumed for cultural purposes per thousand inhabitants in country i in year t .
 $newspapers_{it}$ = number of newspapers per thousand inhabitants circulating in country i in

year t . Only includes daily newspapers.
 $radio_{it}$ = number of radio sets per thousand inhabitants in country i in year t .
 $television_{it}$ = number of television sets per thousand inhabitants in country i in year t .
 $computers_{it}$ = number of personal computers per thousand inhabitants in country i in year t .
 Me_{it} = media analysed in country i in year t .

Of course, not all individuals will be able to make use of the media available in the same way. In order to make an approximation to the actual use made of these instruments, it will be assumed that only the literate inhabitants will be able to make full use of them, while the illiterates will not be able to make any use of them whatever. Although this assumption may seem arbitrary, the literacy index of each country does represent a good indicator of the advantage taken of the available educational media, so that by introducing this correction we will be coming closer to the real situation. Thus, the index of utilization of the available media will finally be as follows:

$$IUM_{it} = IM_{it} \cdot ALF_{it} \quad (3)$$

where:

IUM_{it} = index of utilization of available media in country i in year t .

IM_{it} = index of media in country i in year t .

ALF_{it} = literacy rate of country i in year t .

c) *Experience*

Few attempts have been made to try to measure experience, because of the difficulties involved in representing in the form of an indicator the knowledge accumulated through personal experiences or work. For the present study, we have opted to calculate the number of years that the average citizen of each country has been present in the labour market. The results obtained should be interpreted with caution, however. The problem is that the labour functions carried out by an individual usually change over the course of his working life. Furthermore, work is not homogeneous: there are jobs for which experience is more important than for others and takes longer to acquire.

The average number of years of work experience, that is to say, the number of years for which an individual has been in the labour market, has been calculated from the average age of the country's population, less the age at which the average citizen began to work.¹⁰ It has been assumed that the minimum age of entry into the labour market is 16, in line with the international conventions on this subject, although

unfortunately in some cases this age may be considerably lower. In order to take account of this circumstance, data have also been used on the work done by children between 10 and 14 years of age. Finally, the opposite situation should also be taken into account. Thus, in some countries the age of entry into the labour market is higher than 16, since the average individual has continued his education after the minimum age for starting work. A suitable correction was therefore made for the countries which were in this situation at some time in the period between 1960 and 2000, namely, Australia, Canada, the United States, Norway, New Zealand, South Korea, Sweden and Switzerland.

We thus have:

$$EXP_{it} = EMP_{it} - EIMT_{it} + AMTI_{it} \quad (4)$$

where:

EXP_{it} = the indicator of the work experience of country i in year t .

i = 1, 2, ... N_t , where N_t is the number of countries in the sample in year t .

t = 1960, 1961, ... 2000.

EMP_{it} = the average age of the population of country i in year t .

$EIMT_{it}$ = the average age of entry into the labour market in country i in year t .

$AMTI_{it}$ = the average number of years during which an inhabitant of country i in year t has been carrying out child labour.

Although the indicator thus prepared refers to the labour market, it should not be considered as relating solely to work experience, as it will also include the experience of life accumulated by individuals, which is one of the most important bases of knowledge. This is because life experience will grow in line with the average age of individuals, which is the key element in the preparation of the indicator.

To sum up, in line with the concept originally developed, inborn human capital—which is assumed to be equal, on average, for all individuals—can be affected by health conditions, as measured by life expectancy; formal education is reflected through an indicator of average years of schooling; informal education is taken into account through the fertility rate, which acts as a proxy for the possibilities of devoting resources and attention to the children's education, and through the preparation of an indicator of the use made of information transmission media; and

¹⁰ It would also be desirable to take account of the average period for which an average worker was unemployed, but this information has not been included because not enough data were available at the international level.

finally, an attempt is made to arrive at an approximation of accumulated experience through the preparation of another indicator, based on average

number of years of presence in the labour market. The tables with the values of the indices prepared are available from the author on request.

IV

Preparation of a global human capital indicator

Once we have indicators of the different elements that make up human capital, we can construct a global indicator encompassing all the aspects in question. This indicator will be constructed on a five-yearly basis for the period from 1960 to 2000. The reason why an annual basis was not used is that the data used in its preparation were taken from the study on formal education by Barro and Lee (2001), which cover five-year periods and thus condition the time periods used here.

In order to avoid scale effects due to the different definitions and units used in the variables, the latter were typified by subtracting the sample average from each item of data and dividing it by its standard deviation. The statistical procedure used to construct the indicator is factor analysis. Specifically, the method used is that of the main components. An important point is that in all cases a single main component can explain over 80% of the variation of the variables. Thus, a joint human capital indicator can be constructed which takes in the effect of each of the factors contemplated, condensed into a single figure for each country and year.¹¹ This makes it much easier and more intuitive to work with the results obtained. The

human capital indicators for each of the years in question may be found in the appendix at the end of this study. The total sample covers 106 countries, for the great majority of which information is available on a very high number of periods.

The indicator thus presented has the advantage of taking account of the effect of the multiple factors included in the definition of human capital, i.e., health, formal and informal education, and experience. Other indicators traditionally used were based on only one of these aspects. Consequently, from a theoretical point of view, it will make more sense to use it when considering a broader concept of human capital rather than the more restrictive concept of formal education. Furthermore, the time-span covered is considerable and the index has been constructed for a wide variety of countries, thus facilitating its use in empirical studies.

Although its theoretical justification is obvious, however (because it corresponds more closely to the concept), it must be noted that the measure of human capital made through the new indicator differs from that obtained with other, more traditional, indicators. For this reason, a comparison has been made between the indicator constructed here and the indicator traditionally used in empirical studies, i.e., average years of schooling of the population.¹² This comparison reveals appreciable differences in the periods analysed. Thus, although both indicators give homogeneous results, if we order the countries according to the values of the respective indicators, we observe appreciable changes of position depending on the index used. These changes are due to the inclusion of means of acquiring human capital other than the habitual means of academic education, which thus become just one more

¹¹ The equations obtained for each period by the main components method are:

$$\begin{aligned} H_{60} &= 0,92*ESV_{60} + 0,93*AME_{60} - 0,93*FEC_{60} + 0,85*IUM_{60} + 0,92*EXP_{60} \\ H_{65} &= 0,90*ESV_{65} + 0,94*AME_{65} - 0,94*FEC_{65} + 0,90*IUM_{65} + 0,91*EXP_{65} \\ H_{70} &= 0,90*ESV_{70} + 0,94*AME_{70} - 0,95*FEC_{70} + 0,91*IUM_{70} + 0,91*EXP_{70} \\ H_{75} &= 0,90*ESV_{75} + 0,95*AME_{75} - 0,96*FEC_{75} + 0,91*IUM_{75} + 0,92*EXP_{75} \\ H_{80} &= 0,88*ESV_{80} + 0,94*AME_{80} - 0,94*FEC_{80} + 0,91*IUM_{80} + 0,94*EXP_{80} \\ H_{85} &= 0,91*ESV_{85} + 0,95*AME_{85} - 0,95*FEC_{85} + 0,92*IUM_{85} + 0,94*EXP_{85} \\ H_{90} &= 0,91*ESV_{90} + 0,94*AME_{90} - 0,94*FEC_{90} + 0,87*IUM_{90} + 0,94*EXP_{90} \\ H_{95} &= 0,91*ESV_{95} + 0,92*AME_{95} - 0,93*FEC_{95} + 0,86*IUM_{95} + 0,93*EXP_{95} \\ H_{00} &= 0,89*ESV_{00} + 0,91*AME_{00} - 0,93*FEC_{00} + 0,85*IUM_{00} + 0,92*EXP_{00} \end{aligned}$$

where H is the human capital indicator constructed, ESV is life expectancy, AME is the average years of schooling, FEC is the fertility index, IUM is the indicator of use made of media, and EXP is the indicator of experience.

¹² Figures taken from the series prepared by Barro and Lee (2001).

way of obtaining training. Table 1 shows the absolute values of the differences between the place occupied by a country in terms of human capital according to the indicator constructed here, and the place it occupies according to the indicator based solely on average number of years of formal schooling.

Thus, use of the broader human capital index results in an average shift of seven places—a variation of 8% in the list—in absolute terms, compared with the place occupied by the same country when the average years of schooling are used. If we divide the countries into two groups—those with a high endowment of human capital and those with a low endowment—these variations do not imply

movements of countries from one group to the other, but they do show a change in the relative position among countries of the same group.

In addition to noting the differences in the amount of human capital according to each indicator, it is also important to take into account the differences in their statistical performance. To this end, we will analyse the statistical relation between the indices and a number of variables indicative of levels of economic and social development which can be correlated *a priori* with human capital. In order to determine the differences which exist between the two indicators in this respect, table 2 shows the correlation coefficients between those indicators and the variables in question.

TABLE 1

Total set of countries in the sample: Mean variations of places occupied by the countries according to their human capital indicators^a

Mean variation in place occupied (a)	5	6	7	7	8	7	8	9	8	7
Number of countries in sample (b)	71	84	92	101	100	101	102	100	93	94
Quotient between (a) and (b)	8%	8%	8%	7%	8%	7%	8%	9%	9%	8%

Source: Prepared by the author.

TABLE 2

Total set of countries in the sample: Correlation coefficients between human capital indicators and various variables, 2000^a

Variable	Average years of schooling	Human capital indicator	Number of observations
Per capita GDP, in purchasing power parity dollars	0.43	0.48	81
Population living on less than one dollar a day	–0.51	–0.61	43
Probability of living for more than 65 years (men)	0.57	0.54	82
Probability of living for more than 65 years (women)	0.59	0.76	82
Years lived with bad health (men)	–0.29	–0.31	82
Years lived with bad health (women)	–0.48	–0.63	82
Infant mortality rate (per thousand live births)	–0.35	–0.85	84
Infant mortality rate of children under 5 (per thousand live births)	–0.40	–0.91	84
Death rate in childbirth	–0.33	–0.47	82
Fertility rate between 15 and 19 years of age	–0.61	–0.42	82
Contraceptive use	0.59	0.93	49
Scientists and engineers engaged in R&D, per million inhabitants	0.99	0.65	55
Technicians engaged in R&D, per million inhabitants	0.65	0.98	51
Spending on R&D, as % of GDP	0.31	0.80	52
Articles in scientific and technical journals, per 100,000 inhabitants	0.77	0.98	84
Patent applications per 100,000 inhabitants	0.89	0.82	66
Women in ministerial-level decision-making posts (%)	0.29	0.31	78
Country risk: <i>Institutional Investor Credit Rating</i> (Institutional Investor, Inc.)	0.34	0.57	80
Country risk: <i>Euromoney Country Credit-worthiness Rating</i> (Euromoney Publications)	0.26	0.50	82

Source: Prepared by the author on the basis of data from *World Development Indicators* (World Bank, various years). See that source for a detailed definition of the variables. In the cases where no data were available for 2000, the nearest year was taken. In the country risk indicators, the higher the figure, the lower the risk.

^a Samples of homogeneous countries.

^b R&D = research and development.

Although the direction of the relation with the variables is the same in each case, there are considerable contrasts in the size of the correlation coefficient, depending on the indicator involved. The average difference between the coefficients obtained for each of the indicators in each case is 22 percentage points. This represents the differences in statistical performance between the two human capital measures. It may be noted that in 15 out of the 19 cases the new

indicator displays greater correlation with the variables analysed.

Consequently, the indicator prepared here uses a broader concept of human capital and differs from the traditional indicator based on average years of schooling in its statistical performance. In the following section, these properties will be used to analyse from a new perspective the human capital endowments of the Latin American and Caribbean countries.

V

Spatial and temporal analysis of human capital endowments in Latin America and the Caribbean

The following two subsections seek to go more deeply into the spatial and dynamic analysis of human capital endowments on the basis of the indicator prepared here.

1. Spatial analysis of human capital endowments

Table 3 was prepared in order to give a comparative analysis of the different human capital endowments of Latin America and the Caribbean compared with other world regions.

This comparison reveals that the differences between geographic areas are significant and, overall, are due to disparities in the five basic indicators used, although the contrasts are particularly marked in the case of formal and informal education but are less notable in the case of differences in health and experience.

Overall, Latin America and the Caribbean have a better endowment of human capital than Africa South of the Sahara, Southeast Asia, the Middle East and North Africa. Their situation in this respect is actually quite similar to that of the latter region, with indices of media utilization and health which are slightly lower (52% and 106% of the world average) but better endowments in terms of formal education received (99% of that average) and above all, greater experience (94% of the average) and better possibilities of acquiring informal education from the family (once again, 94% of the world average). East Asia and the Pacific, Eastern Europe and Central Asia, Western Europe and North America, however, have endowments superior to those of Latin America and the Caribbean in all the aspects covered.

In spite of the overall relative lag of Latin America and the Caribbean, a detailed analysis of the countries making up the region shows that there are big differences between them. Thus, it may be seen from table 4 that the countries with the best endowments of human capital are, in order, Barbados, Uruguay, Chile, Trinidad and Tobago, and Argentina. These countries have values of the global human capital indicator which are considerably above the world average and close to those of the countries with a medium-high endowment of human capital.

We also found countries in the region, however, which have a very low endowment of human capital, with values well below the world average and close to the levels of other areas of the world with a lower degree of development. The most serious situation within the sample of 21 countries is that of Guatemala, followed by Honduras, Bolivia and Nicaragua. The countries with low endowments of human capital display shortcomings in all the indicators covered, but these deficiencies are most serious in the case of informal education, as measured through the fertility indicator and the media utilization index. The countries in the worst situation as regards the first indicator are Guatemala, Honduras and Bolivia, which also have serious shortcomings in terms of media utilization, while the cases of Colombia, Nicaragua and Ecuador are also noteworthy on account of their low levels in that index.

In general, the countries already mentioned above also display shortcomings in the indicators of experience, health and formal education. Special mention should be made of the deficit in formal

TABLE 3

Selected regions: Spatial analysis of human capital endowments, 2000

	Average years of schooling	Average years of schooling/ world average	Media utilization index	Media utilization index/ world average	Health	Health/ world average	Expe- rience	Experience/ world average	Ferti- lity	Fertility/ world average	Human capital indicator
Africa South of the Sahara	3.29	0.53	0.16	0.15	47.91	0.72	10.97	0.71	4.92	1.60	-4.57
Southeast Asia	3.38	0.54	0.08	0.08	61.21	0.92	12.99	0.85	3.99	1.29	-2.65
Middle East and North Africa	6.01	0.97	0.56	0.56	72.21	1.08	13.42	0.87	3.09	1.00	-0.04
Latin America and the Caribbean	6.13	0.99	0.52	0.52	70.81	1.06	14.52	0.94	2.89	0.94	0.19
East Asia and the Pacific	7.25	1.17	1.34	1.33	71.59	1.07	16.43	1.07	2.35	0.76	1.89
Eastern Europe and Central Asia	7.84	1.26	0.93	0.93	71.09	1.06	19.61	1.28	1.71	0.56	2.74
Western Europe	9.02	1.45	2.53	2.52	77.74	1.16	21.95	1.43	1.59	0.52	5.33
North America	11.84	1.91	3.71	3.70	77.97	1.17	18.57	1.21	1.80	0.58	6.30
<i>Average, all countries</i>	<i>6.21</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>66.77</i>	<i>1.00</i>	<i>15.37</i>	<i>1.00</i>	<i>3.08</i>	<i>1.00</i>	<i>0.33</i>

Source: Prepared by the author.

TABLE 4

Latin America and the Caribbean: Spatial analysis of human capital endowments, 2000

	Average years of schooling	Average years of schooling/ world average	Media utilization index	Media utilization index/ world average	Health	Health/ world average	Expe- rience	Experience/ world average	Ferti- lity	Fertility/ world average	Human capital indicator
Argentina	8.49	1.38	0.76	1.47	73.57	1.04	17.31	1.19	2.55	0.88	2.07
Barbados	9.11	1.49	0.82	1.58	75.66	1.07	20.72	1.43	1.75	0.61	3.61
Bolivia	5.54	0.90	0.20	0.39	62.06	0.88	11.79	0.81	4.02	1.39	-2.08
Brazil	4.56	0.74	0.66	1.28	67.15	0.95	15.62	1.08	2.24	0.78	0.12
Colombia	5.01	0.82	0.01	0.02	70.35	0.99	14.07	0.97	2.67	0.92	-0.53
Costa Rica	6.01	0.98	0.48	0.93	76.84	1.09	14.59	1.01	2.53	0.87	0.81
Chile	7.89	1.29	1.68	3.24	75.51	1.07	16.35	1.13	2.19	0.76	2.72
Ecuador	6.52	1.06	0.18	0.35	69.23	0.98	13.60	0.94	3.14	1.09	-0.38
El Salvador	4.50	0.73	0.42	0.81	69.53	0.98	13.66	0.94	3.20	1.11	-0.84
Guatemala	3.12	0.51	0.07	0.13	64.89	0.92	10.72	0.74	4.72	1.63	-3.34
Guyana	6.05	0.99	0.25	0.49	63.70	0.90	14.95	1.03	2.30	0.79	-0.14
Honduras	4.08	0.67	0.18	0.35	69.82	0.99	10.88	0.75	4.04	1.40	-2.16
Jamaica	5.22	0.85	0.45	0.87	75.16	1.06	15.29	1.05	2.54	0.88	0.54
Mexico	6.73	1.10	0.65	1.25	72.14	1.02	14.23	0.98	2.78	0.96	0.58
Nicaragua	4.42	0.72	0.12	0.23	68.63	0.97	10.94	0.75	3.61	1.25	-1.93
Panama	7.90	1.29	0.47	0.91	73.88	1.04	14.77	1.02	2.47	0.86	1.23
Paraguay	5.74	0.94	0.40	0.77	69.95	0.99	11.50	0.79	4.03	1.39	-1.33
Peru	7.33	1.20	0.40	0.78	68.74	0.97	13.71	0.94	3.05	1.06	0.08
Trinidad and Tobago	7.62	1.24	0.85	1.64	72.63	1.03	17.48	1.20	1.75	0.61	2.28
Uruguay	7.25	1.18	1.41	2.73	74.30	1.05	19.16	1.32	2.26	0.78	2.75
Venezuela	5.61	0.92	0.41	0.79	73.16	1.03	13.53	0.93	2.88	0.99	-0.06
<i>Average, all countries</i>	<i>6.13</i>	<i>1.00</i>	<i>0.52</i>	<i>1.00</i>	<i>70.81</i>	<i>1.00</i>	<i>14.52</i>	<i>1.00</i>	<i>2.89</i>	<i>1.00</i>	<i>0.19</i>

Source: Prepared by the author.

education displayed by the most backward Central American countries, while this deficit in education is also noteworthy in the case of Brazil, which, although

it has made a big effort in this field in recent years, still registers figures well below the average for the countries of the region.

To sum up, Latin America and the Caribbean are lagging behind the world average in relative terms and also register considerable disparities between countries within the region. Some of the countries show serious overall deficits in the indicators analysed, which reduce their possibilities of converging with other more developed countries of the region and adversely affect the possibilities of the global economic and social success of the region as a whole.

2. Evolution of the endowments of human capital

Table 5 has been prepared in order to show the evolution of the human capital endowments of the countries of Latin America and the Caribbean. It covers the 17 countries for which human capital indicators are available for all the five-year periods between 1960 and 2000. The overall picture given by the data is positive, because a total of 12 countries —Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, Mexico, Nicaragua, Panama, Peru and Venezuela— have appreciably improved their relative situations. In the cases of Chile, Costa Rica, El Salvador, Mexico and Peru, the effort made has been reflected in notable advances. In the case of Venezuela, however, although it registers a considerable improvement, which was especially noticeable up to the second half of the 1980s, since then there has been a decline.

Two countries which have stagnated as regards their relative position in terms of human capital with respect to the other countries of the region are Bolivia and Guatemala. This has helped to widen the gap in terms of development separating these nations from the rest of the countries of the region.

Finally, there are three countries —Argentina, Paraguay and Uruguay— which have suffered a gradual deterioration in their relative position, leading to a loss of competitiveness by the Southern Cone. This negatively affects the whole region, although some other countries in the area —especially the neighbouring countries of Brazil and Chile— have been able to derive advantages from it.

At all events, in spite of the relative lag of Argentina, Paraguay and Uruguay the region as a whole has registered a relative improvement in its world position, as may be seen from the evolution of the mean indicator for all the countries taken together. This is because there has been an upward trend in the human capital endowments shown by each indicator. But has this process of convergence with the situation at the world level been accompanied by real convergence at the regional level? In order to answer this question, Kernel density functions have been prepared for 1960 and 2000 and are shown in figure 2. This procedure reveals that there has indeed been convergence among the different nations, as reflected in the human capital index.

TABLE 5

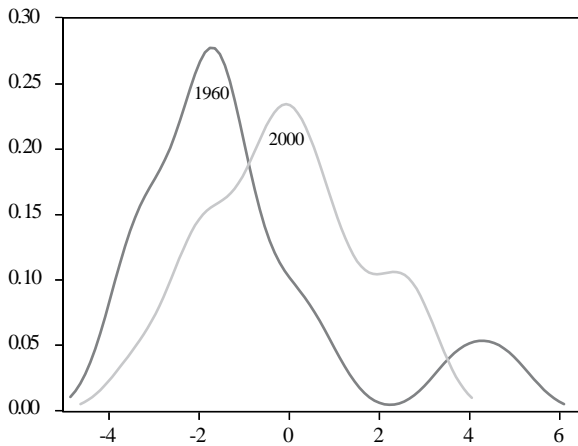
Latin America: Evolution of human capital indicator, 1960-2000

	1960	1965	1970	1975	1980	1885	1990	1995	2000
Argentina	3.77	3.92	4.07	3.16	2.78	2.71	2.42	2.29	2.07
Bolivia	-2.02	-2.25	-2.64	-2.61	-2.49	-2.31	-2.02	-2.07	-2.08
Brazil	-1.31	-1.17	-0.84	-0.70	-0.61	-0.28	-0.18	-0.05	0.12
Colombia	-1.71	-1.68	-1.27	-0.46	-0.33	0.17	-0.30	-0.38	-0.53
Costa Rica	-1.35	-0.95	-0.09	0.77	0.83	1.16	0.80	0.91	0.81
Chile	0.67	0.79	1.40	1.69	2.15	2.33	2.24	2.32	2.72
Ecuador	-1.73	-1.77	-1.74	-1.36	-0.79	-0.36	-0.26	-0.30	-0.38
El Salvador	-2.78	-2.70	-2.30	-2.33	-2.10	-1.64	-1.32	-1.04	-0.84
Guatemala	-3.35	-3.26	-3.18	-3.27	-3.34	-3.60	-3.45	-3.46	-3.34
Honduras	-3.56	-3.60	-3.58	-3.31	-3.25	-2.34	-2.26	-2.24	-2.16
Mexico	-1.76	-1.65	-1.34	-1.06	-0.66	-0.31	0.37	0.55	0.58
Nicaragua	-3.38	-3.27	-2.97	-2.94	-3.12	-2.99	-2.52	-2.05	-1.93
Panama	0.06	0.35	0.28	0.55	0.97	1.35	1.47	1.31	1.23
Paraguay	-0.47	-0.77	-0.59	-0.60	-0.79	-1.10	-1.02	-1.28	-1.33
Peru	-2.34	-2.18	-1.71	-1.39	-0.80	-0.53	-0.47	-0.18	0.08
Uruguay	4.79	4.73	4.69	3.86	3.46	3.54	3.25	2.77	2.75
Venezuela	-1.40	-1.13	-0.73	-0.22	0.60	0.70	0.11	0.27	-0.06
<i>Average, all countries</i>	<i>-1.05</i>	<i>-0.98</i>	<i>-0.74</i>	<i>-0.60</i>	<i>-0.44</i>	<i>-0.21</i>	<i>-0.18</i>	<i>-0.15</i>	<i>-0.13</i>

Source: Prepared by the author.

FIGURE 2

**Latin America and the Caribbean: Kernel^a density function of
the human capital indicator, 1960 and 2000**



Source: Prepared by the author.

In 1960 there was more marked polarization between the countries with higher and lower human capital endowments, as may be seen from figure 2, where two peaks in the distribution may be observed. Thus, in 1960 the countries fell into two groups: one (the most numerous) consisted of the countries with lower human capital endowments, while the other

^a The Kernel density function makes it possible to smooth out the statistical distribution histogram and turn it into a continuous graph, by giving less weight to the observations furthest from the point being evaluated. The Kernel density of a series X at a given point x is estimated through the function:

$$f(x) = \frac{1}{N \cdot h} \sum_{i=1}^N K\left(\frac{x - X_i}{h}\right)$$

where N is the number of observations, h is the smoothing parameter selected, and $K(x)$ is the gaussian-type Kernel function used:

$$\frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}u^2\right)$$

where u is the argument of that Kernel function.

The smoothing parameter h used will have a value of 0.65. This parameter was obtained by applying the method proposed by Silverman (1986, equation 3.31) to the series of periods analysed.

contained those with more human capital. This polarization was gradually reduced over the years, however, until a more uniform and concentrated distribution was attained by the year 2000. It may therefore be concluded that the region has been undergoing a process of convergence as regards the endowments of human capital.

VI Conclusions

Human capital has far-reaching effects on the economy and life in society, as shown by many empirical studies. The definition of human capital and the indicators constructed to quantify it must therefore take account of all the elements included in the concept as accurately as possible.

A broad definition which distinguishes between inborn and acquired human capital has therefore been proposed in the present study. Inborn human capital includes both physical and intellectual aptitudes, which may be modified by nutrition and health conditions. Within acquired human capital, a distinction is made between formal education, informal education and experience. Formal education comprises legally regulated academic education, training within enterprises, and courses for the unemployed. Informal

education is imparted fundamentally within the family circle, but it can also be acquired through self-education by way of different means of transmission of information, such as books, the mass media or computers. Experience, for its part, consists of all the situations lived by an individual, which enable him to react to circumstances on the basis of the knowledge thus acquired. All these elements condition the labour training and system of values of the individual, thus determining his productivity.

After formulating this definition, we proceeded to propose different indicators which take account of each element contained in it.

- Inborn human capital, which is considered to be the same for all individuals in principle, can be altered by health conditions, as measured by life expectancy.

- Formal education is assumed to be represented by an indicator of average years of schooling. No consistent international information is available on other types of formal education.
- Informal education is measured indirectly by the fertility rate, which summarizes the possibility of devoting resources and attention to children's education, and by an indicator of the use made of means of transmission of information such as books, newspapers, radio, television and personal computers.
- Lastly, accumulated experience is taken into account through the preparation of another indicator: average number of years of presence in the labour market.

On the basis of the above indicators, and using the main components method of analysis, which makes possible the reduction of the data concerned, a global human capital indicator was prepared for the period from 1960 to 2000, presenting the data for five-year periods. The sample of countries used for each period numbered around one hundred. This indicator takes

account of more nuances than the international human capital indicators habitually used, which are based only on academic education received.

Analysis of the countries making up the Latin American and Caribbean region, using the indicator developed here, shows that the region is lagging behind in relative terms compared with East Asia and the Pacific, Eastern Europe and Central Asia, Western Europe and North America, although there are big differences in human capital endowment within the Latin American and Caribbean region as a whole.

At the same time, in spite of the declines suffered by Argentina, Paraguay and Uruguay in the last four decades, it has been observed that the region has registered a relative improvement in terms of human capital endowment, as well as a process of internal convergence in this respect. This is undoubtedly a *sine qua non* for there to be effective convergence in real terms at the intra-regional and inter-regional levels.

(Original: Spanish)

APPENDIX

Values of human capital indicator

	1960	1965	1970	1975	1980	1985	1990	1995	2000
Afghanistan	-4.2	-4.3	-4.8	-5.2	-5.5	-6.0	-6.4	-6.4	-6.5
Algeria	...	-3.9	-4.1	-3.9	-3.7	-3.0	-2.1	-1.5	-1.0
Argentina	3.8	3.9	4.1	3.2	2.8	2.7	2.4	2.3	2.1
Australia	7.1	7.4	7.3	7.1	7.1	6.9	6.7	6.3	6.2
Austria	6.8	6.8	6.6	6.5	6.8	6.9	6.6	5.5	5.7
Bahrein	...	...	...	-1.6	-0.5	0.6	0.5	0.3	0.5
Bangladesh	...	...	...	-4.3	-4.2	-4.1	-3.4	-3.0	-2.7
Barbados	...	...	4.3	5.2	0.8	5.1	4.3	3.9	3.6
Belgium	7.4	7.4	7.2	6.8	6.3	6.4	6.5	5.8	5.4
Benin	...	...	...	-4.6	-4.9	-5.4	-5.5	-5.4	-5.3
Bolivia	-2.0	-2.2	-2.6	-2.6	-2.5	-2.3	-2.0	-2.1	-2.1
Botswana	...	...	-3.7	-3.6	-3.4	-3.3	-3.2	-3.7	-4.3
Brazil	-1.3	-1.2	-0.8	-0.7	-0.6	-0.3	-0.2	-0.1	0.1
Burundi	...	...	...	...	...	...	-6.2	...	...
Cameroon	-2.6	-3.0	-3.4	-3.7	-4.0	-4.4	-4.4	-4.3	-4.6
Canada	7.0	6.5	7.0	7.5	8.1	8.1	6.9	6.7	6.3
Colombia	-1.7	-1.7	-1.3	-0.5	-0.3	0.2	-0.3	-0.4	-0.5
Congo, Dem. Rep.	-3.3	-3.4	-3.7	-4.0	-4.5	-5.0	-4.9	-5.3	-5.6
Congo, Rep.	...	...	...	...	...	...	-4.4	-4.8	-4.9
Costa Rica	-1.4	-1.0	-0.1	0.8	0.8	1.2	0.8	0.9	0.8
Cyprus	2.8	3.3	3.8	4.8	5.0	4.4	3.7	3.2	3.4
Chile	0.7	0.8	1.4	1.7	2.2	2.3	2.2	2.3	2.7
China	...	...	...	0.3	0.6	0.9	2.9	2.0	1.6
Denmark	8.6	8.8	8.3	8.0	7.8	7.8	7.2	6.4	5.8
Dominican Republic	-2.7	-2.5	-1.9	-1.4	-1.0	-0.6	-0.4	-0.4	...
Ecuador	-1.7	-1.8	-1.7	-1.4	-0.8	-0.4	-0.3	-0.3	-0.4
Egypt	...	...	...	-2.5	-2.5	-2.2	-1.7	-1.4	-1.1
El Salvador	-2.8	-2.7	-2.3	-2.3	-2.1	-1.6	-1.3	-1.0	-0.8
Fiji	...	...	0.5	1.1	1.3	1.4	0.9	0.8	1.4
Finland	5.2	6.6	7.1	7.1	7.3	7.5	7.6	7.7	5.9
France	6.1	6.2	6.1	6.0	5.8	6.0	5.8	5.6	5.0
Gambia	...	...	...	-4.7	-5.1	-5.4	-5.0	-5.0	-5.0
Germany	8.2	8.2	7.7	7.2	7.2	7.1	7.0	6.5	5.9
Ghana	-3.7	-3.7	-3.4	-3.5	-3.7	-4.0	-3.7	-3.3	-3.2
Greece	4.7	4.7	4.5	4.7	4.7	5.0	4.8	4.8	4.7
Guatemala	-3.3	-3.3	-3.2	-3.3	-3.3	-3.6	-3.4	-3.5	-3.3
Guyana	...	...	-1.2	-0.2	-0.1	0.0	0.1	0.0	-0.1
Haiti	-2.8	-2.8	-3.0	-3.2	-3.6	-3.9	-4.0	-4.0	...
Honduras	-3.6	-3.6	-3.6	-3.3	-3.2	-2.3	-2.3	-2.2	-2.2
Hong Kong	...	...	...	...	...	...	6.0	6.3	5.5
Hungary	6.2	6.7	6.8	6.3	5.8	5.6	4.4	4.0	3.9
Iceland	6.2	7.3	7.6	7.7	7.7	5.6	4.7	4.8	4.7
India	-2.7	-2.6	-2.4	-2.3	-2.3	-2.2	-1.8	-1.5	-1.4
Indonesia	-2.5	-2.7	-2.5	-2.4	-2.1	-1.5	-1.3	-0.9	-0.6
Iran	-3.4	-3.4	-3.2	-3.1	-3.3	-3.2	-2.3	-1.3	-0.5
Iraq	-3.8	-3.8	-3.6	-3.3	-3.2	-3.3	-3.5	-3.5	...
Ireland	4.8	4.7	4.3	4.1	3.9	4.3	4.4	4.5	4.7
Israel	4.1	4.1	4.3	4.0	4.0	3.8	3.7	3.4	3.1
Italy	5.3	5.2	5.1	4.6	4.4	4.5	5.3	5.0	4.8
Jamaica	...	-0.3	-0.1	0.2	0.5	0.8	0.8	0.6	0.5
Japan	6.0	7.0	6.9	6.6	6.8	6.7	7.4	7.2	6.4
Jordan	...	...	...	...	...	-2.5	-1.9	-1.1	-0.8
Kenya	...	-4.1	-4.2	-4.4	-4.4	-4.4	-4.0	-4.0	-4.2
Korea, Rep. of	-1.0	-0.2	0.3	1.7	2.6	3.7	...	...	...

(Continued)

Appendix (concluded)

	1960	1965	1970	1975	1980	1985	1990	1995	2000
Kuwait	...	-1.0	-1.4	-1.1	-0.2	0.6	0.9	0.8	0.9
Lesotho	...	...	-2.1	-2.3	-2.5	-2.8	-2.8	-3.5	-4.2
Liberia	-3.3	-3.5	-3.8	-4.0	-4.3	-4.8	-6.0	-6.1	...
Malawi	...	-3.9	-4.5	-4.7	-5.1	-5.5	-5.8	-6.1	-6.6
Malaysia	-2.2	-1.8	-1.2	-0.4	0.0	0.4	0.2	0.8	0.6
Mali	-4.2	-4.6	-4.9	-5.2	-5.5	-6.0	...	-6.7	-6.8
Malta	...	4.7	5.0	4.9	4.7	5.0	...	...	...
Mauritania	...	...	...	...	...	...	-4.9	...	...
Mauritius	...	...	0.0	0.4	0.9	1.2	1.2	1.1	1.2
Mexico	-1.8	-1.7	-1.3	-1.1	-0.7	-0.3	0.4	0.5	0.6
Mozambique	...	...	...	-4.5	-4.9	-5.7	-6.1	-6.1	-6.0
Myanmar	-2.7	-2.8	-2.9	-3.0	-3.0	-2.9	-2.4	-2.1	-2.0
Nepal	-2.9	-3.2	-3.7	-4.1	-4.2	-4.6	-4.3	-3.9	-3.8
Netherlands	5.9	6.2	6.7	7.0	6.7	6.7	6.5	5.9	5.6
New Zealand	5.9	6.9	6.8	7.4	7.2	7.2	5.8	5.3	5.0
Nicaragua	-3.4	-3.3	-3.0	-2.9	-3.1	-3.0	-2.5	-2.0	-1.9
Niger	-4.5	-4.8	-5.0	-5.3	-5.8	-6.5	-6.7	-7.1	-7.3
Norway	6.7	7.1	7.5	7.4	7.0	7.2	6.9	6.8	6.5
Pakistan	-3.6	-3.8	-3.7	-3.8	-4.0	-4.1	-3.8	-3.8	-3.7
Panama	0.1	0.3	0.3	0.5	1.0	1.3	1.5	1.3	1.2
Papua New Guinea	...	...	...	-3.4	-3.9	-4.2	-4.1	-3.7	-3.5
Paraguay	-0.5	-0.8	-0.6	-0.6	-0.8	-1.1	-1.0	-1.3	-1.3
Peru	-2.3	-2.2	-1.7	-1.4	-0.8	-0.5	-0.5	-0.2	0.1
Philippines	-1.7	-1.4	-1.2	-0.8	-0.8	-0.7	-0.3	-0.2	-0.2
Poland	4.3	5.0	5.5	5.4	4.9	4.2	3.8	3.9	4.0
Portugal	2.7	2.7	2.6	2.5	2.6	3.4	3.2	3.3	3.2
Rwanda	...	...	-5.0	-5.5	-5.8	-5.9	-6.5	-6.8	...
Senegal	-3.5	-3.9	-4.2	-4.3	-4.6	-5.1	-5.1	-5.1	-5.1
Sierra Leone	...	-4.3	-4.7	-5.2	-5.6	-6.3	-6.8	-7.1	...
Singapore	...	-0.4	0.9	1.9	2.2	2.3	2.7	2.8	3.0
South Africa	-1.5	-1.5	-1.3	-1.3	-1.1	-0.7	-0.8	-0.3	-1.3
Spain	3.9	4.2	4.4	3.9	4.0	4.5	4.6	4.6	4.7
Sri Lanka	0.0	0.2	0.3	0.2	0.7	0.9	0.8	0.9	1.0
Sudan	-4.0	-4.1	-4.3	-4.5	-4.6	-4.6	-4.5	-4.2	-4.0
Swaziland	...	...	-3.6	-3.4	-3.5	-3.4	-3.2	-2.8	...
Sweden	9.4	9.3	8.8	8.7	8.2	8.2	7.2	7.1	7.8
Switzerland	7.5	7.4	7.7	8.0	8.1	8.0	7.4	6.9	6.5
Syria	...	-3.6	-3.5	-3.4	-3.5	-3.3	-2.6	-1.8	-1.5
Thailand	-1.5	-1.6	-1.3	-1.0	-0.3	0.5	1.0	1.2	1.2
Togo	-3.7	-3.8	-4.0	-4.2	-4.3	-4.8	-5.1	-5.0	-5.0
Trinidad and Tabago	...	1.1	1.5	1.5	2.5	2.5	2.1	2.0	2.3
Tunisia	-3.4	-3.6	-3.3	-2.7	-2.2	-1.8	-1.1	-0.4	0.0
Turkey	-1.8	-1.6	-1.4	-1.2	-1.1	-0.8	-0.3	0.1	0.4
Uganda	...	-3.6	-3.8	-4.2	-4.8	-5.5	-5.7	-6.2	-6.4
United Arab Emirates	...	...	...	-0.5	...	...	...	...	...
United Kingdom	8.9	7.8	7.5	7.6	7.1	7.2	6.6	6.2	5.5
United States	8.9	8.8	8.7	9.2	9.4	9.5	8.0	7.0	6.3
Uruguay	4.8	4.7	4.7	3.9	3.5	3.5	3.2	2.8	2.8
Venezuela	-1.4	-1.1	-0.7	-0.2	0.6	0.7	0.1	0.3	-0.1
Yugoslavia, Fed. Rep. (Serbia/Montenegro)	3.7	4.0	4.2	4.1	3.7	3.4	3.0	...	...
Zambia	...	-3.5	-3.7	-4.1	-4.3	-4.6	-4.9	-4.8	-5.2
Zimbabwe	...	-3.7	-3.7	-3.6	-3.5	-3.5	-3.0	-3.5	-3.7

Source: Prepared by the author.

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Bibliography

- Acemoglu, D. (1997): *Why Do New Technologies Complement Skills? Directed Technical Change and Wage Inequality*, working document, No. 97-14, Cambridge, Massachusetts, Massachusetts Institute of Technology.
- Arrow, K. (1962): The economic implications of learning by doing, *The Review of Economic Studies*, vol. 29, No. 3, Oxford, United Kingdom, University of Oxford.
- Azariadis, C. and A. Drazen (1990): Threshold externalities in economic development, *The Quarterly Journal of Economics*, vol. 105, No. 2, Cambridge, Massachusetts, The MIT Press, May.
- Bandrés, E. and J.L. García Delgado (2000): Estado de bienestar y crecimiento económico, in S. Muñoz Machado, J.L. García Delgado and L. González Seare (dirs.), *Las estructuras del bienestar en Europa*, Madrid, Escuela Libre Editorial/Civitas.
- Barro, R. (1991): Economic growth in a cross-section of countries, *The Quarterly Journal of Economics*, vol. 106, No. 2, Cambridge, Massachusetts, The MIT Press, May.
- Barro, R. and J.W. Lee (1993): International comparisons of educational attainment, *Journal of Monetary Economics*, vol. 32, No. 3, Amsterdam, Elsevier.
- _____ (1994): Sources of economic growth, *Carnegie-Rochester Conference Series on Public Policy*, vol. 40, Amsterdam, Elsevier.
- _____ (1996): International measures of schooling years and schooling quality, *The American Economic Review*, vol. 86, No. 2, Nashville, Tennessee, American Economic Association.
- _____ (2001): International data on educational attainment updates and implications, *Oxford Economic Papers*, vol. 53, No. 3, Oxford, United Kingdom, Oxford University Press.
- Becker, G.S. (1962): Investment in human capital: a theoretical analysis, *The Journal of Political Economy*, vol. 70, No. 5, part 2, Chicago, The University of Chicago Press.
- _____ (1964): *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, first edition, New York, National Bureau of Economic Research.
- _____ (1975): *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, second edition, New York, National Bureau of Economic Research.
- _____ (1993): *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, third edition, New York, National Bureau of Economic Research.
- Becker, G., K. Murphy and R. Tamura (1990): Human capital, fertility and economic growth, *The Journal of Political Economy*, vol. 98, Chicago, Illinois, The University of Chicago Press.
- Behrman, J.R. and P. Taubman (1986): Birth order, schooling, and earnings, *The Journal of Labor Economics*, vol. 4, No. 3, part 2, Chicago, Illinois, The University of Chicago Press.
- Benhabib, J. and M. Spiegel (1994): The role of human capital in economic development: evidence from aggregate cross-country data, *Journal of Monetary Economics*, vol. 34, No. 2, Amsterdam, Elsevier.
- _____ (1997): *Cross-country Growth Regressions*, Working Paper, No. 97-20, New York, CV Starr Center for Applied Economics, New York University.
- Coombs, P. and M. Ahmed (1974): *Attacking Rural Poverty. How Non-formal Education Can Help*, Baltimore, John Hopkins University Press.
- Coombs, P., C. Prosser and M. Ahmed (1973): *New Paths to Learning for Rural Children and Youth*, New York, International Council for Educational Development (ICED).
- De la Fuente, A. and J.M. da Rocha (1996): Capital humano y crecimiento: un panorama de la evidencia empírica y algunos resultados para la OCDE, *Moneda y crédito*, No. 203, Madrid, Fundación Santander Central Hispano.
- De la Fuente, A. and R. Doménech (2001): Schooling data, technological diffusion and the neoclassical model, *The American Economic Review*, vol. 91, No. 2, Nashville, Tennessee, American Economic Association.
- Denison, E. (1962): *Sources of Economic Growth in the United States and the Alternatives Before Us*, New York, Committee for Economic Development.
- _____ (1964): Measuring the contribution of education (and the residual) to economic growth, *The Residual Factor and Economic Growth*, Paris, Organisation for Economic Co-operation and Development (OECD).
- Echevarría, C. (2004): Life expectancy, retirement and endogenous growth, *Economic Modelling*, vol. 21, No. 1, Amsterdam, Elsevier.
- Foley, G. (1999): *Learning in Social Action. A Contribution to Understanding Informal Education*, London, NIACE/Zed Books.
- Greenwood, J. and M. Yorukoglu (1997): 1974, *Carnegie-Rochester Conference Series on Public Policy*, vol. 46, Amsterdam, Elsevier.
- Hanushek, E.A. (1992): The trade-off between child quantity and quality, *The Journal of Political Economy*, vol. 100, No. 1, Chicago, Illinois, The University of Chicago Press.
- Kalemli-Ozcan, S., H. Ryder and D. Weil (2000): Mortality decline, human capital investment, and economic growth, *Journal of Development Economics*, vol. 62, No. 1, Amsterdam, Elsevier.
- King, R. and S. Rebelo (1990): Public policy and economic growth: developing neoclassical implications, *Journal of Political Economy*, vol. 98, No. 5, part 2, Chicago, Illinois, The University of Chicago Press.
- Krueger, A.B. and M. Lindahl (1999): Education for growth in Sweden and the world, *Swedish Economic Policy Review*, vol. 6, No. 2, Stockholm, The Economic Council.
- Kyriacou, G. (1992): *Level and Growth Effects of Human Capital: A Cross-country Study of the Convergence Hypothesis*, Working Paper, No. 91-26, New York, CV Starr Center for Applied Economics, New York University.
- Lam, D. and S. Duryea (1999): Effects of schooling on fertility, labor supply and investments in children, with evidence from Brazil, *The Journal of Human Resources*, vol. 34, No. 1, Madison, Wisconsin, The University of Wisconsin Press.
- Laroche, M., M. Merette and G.C. Ruggeri (1999): On the concept and dimensions of human capital in a knowledge-based economy context, *Canadian Public Policy*, vol. 25, No. 1, Calgary, Alberta, University of Calgary.
- Leadbeater, C. (2000): *Living on Thin Air. The New Economy*, London, Penguin.
- Levine, R. and D. Renelt (1992): A sensitivity analysis of cross-country growth regressions, *The American Economic Review*, vol. 82, No. 4, Nashville, Tennessee, American Economic Association, September.
- Lucas, R. (1988): On the mechanics of economic development, *Journal of Monetary Economics*, vol. 22, No. 1, Amsterdam, Elsevier.
- _____ (1993): Making a miracle, *Econometrica*, vol. 61, No. 2, Evanston, Illinois, The Econometric Society, March.
- Mankiw, N.G., D. Romer and D. Weil (1992): A contribution to the empirics of economic growth, *The Quarterly Journal of Economics*, vol. 107, No. 2, Cambridge, Massachusetts, The MIT Press, May.
- Meltzer, D. (1995): *Mortality Decline, the Demographic Transition and Economic Growth*, Cambridge, Massachusetts, Brigham and Women's Hospital/National Bureau of Economic Research, unpublished.
- Mingat, A. and J. Tan (1996): *The Full Social Returns to Education: Estimates Based on Countries' Economic Growth Performance*, Human Capital Development Working Papers, No. 73, Washington, D.C., World Bank.

- Moav, O. (2005): Cheap children and the persistence of poverty, *The Economic Journal*, vol. 115, No. 500, Oxford, United Kingdom, Blackwell Publishing.
- Mushkin, S. (1962): Health and investment, *The Journal of Political Economy*, vol. 70, No. 5, Chicago, Illinois, The University of Chicago Press.
- OECD (Organisation for Economic Co-operation and Development) (1999): *Human Capital Investment. An International Comparison*, Paris.
- Parente, S. (1994): Technology adoption, learning-by-doing, and economic growth, *Journal of Economic Theory*, vol. 63, No. 2, Amsterdam, Elsevier.
- Rebelo, S. (1991): Long-run policy analysis and long-run growth, *The Journal of Political Economy*, vol. 99, No. 3, Chicago, Illinois, The University of Chicago Press, June.
- Rodríguez, F. and J. Sachs (1999): Why do resource-abundant economies grow more slowly?, *Journal of Economic Growth*, vol. 4, Norwell, Massachusetts, Springer.
- Romer, P. (1986): Increasing returns and long-run growth, *The Journal of Political Economy*, vol. 94, No. 5, Chicago, Illinois, The University of Chicago Press, October.
- _____ (1990): Endogenous technological change, *The Journal of Political Economy*, vol. 98, No. 5, part 2, Chicago, Illinois, The University of Chicago Press, October.
- Rosenzweig, M. and K. Wolpin (1980): Testing the quantity-quality fertility model: the use of twins as a natural experiment, *Econometrica*, vol. 48, No. 1, Evanston, Illinois, The Econometric Society.
- Ruggeri, G.C. and W. Yu (2000): On the dimensions of human capital: an analytical framework, *Atlantic Canada Economics Association Papers*, vol. 29, Sackville, New Brunswick.
- Schultz, T. (1960): Capital formation by education, *The Journal of Political Economy*, vol. 69, Chicago, Illinois, The University of Chicago Press.
- _____ (1961): Investment in human capital, *The American Economic Review*, vol. 51, No. 1, Nashville, Tennessee, American Economic Association.
- _____ (1962): Reflections on investment in man, *The Journal of Political Economy*, vol. 70, Chicago, Illinois, The University of Chicago Press.
- Silverman, B.W. (1986): *Density Estimation for Statistics and Data Analysis*, London, Chapman and Hall.
- Smith, A. (1904): *An Inquiry into the Nature and Causes of the Wealth of Nations*, fifth edition, edited by Edwin Cannan. London, Methuen and Co., Ltd. (first published in 1776).
- Stokey, N. (1991): Human capital, product quality and growth, *The Quarterly Journal of Economics*, vol. 106, No. 2, Cambridge, Massachusetts, The MIT Press.
- Tamura, R. and M. Sadler (2001): *Specialized Human Capital Investment, Growth and Convergence*, Clemson, Clemson University, unpublished.
- Tight, M. (1996), *Key Concepts in Adult Education and Training*, Routledge, London.
- Torres, C.A. (1990): *The Politics of Nonformal Education in Latin America*, New York, Praeger Publishers.
- Young, A. (1991): Learning-by-doing and the dynamic effects of international trade, *The Quarterly Journal of Economics*, vol. 106, No. 2, Cambridge, Massachusetts, The MIT Press.
- Youngman, F. (2000): *The Political Economy of Adult Education*, London, Zed Books.
- Yu, W. (2001): *A Survey of Existing Indicators for Human Capital*, Ottawa, National Round Table on the Environment and the Economy.