Journal of Engineering and Applied Sciences 12 (11): 2966-2971, 2017
ISSN: 1816-949X


# Human Capital through a Prospective Method: A Study for Latin America

[1]Henry Laverde-Rojas, [1]Mercedes Gaitan-Angulo, [1]Jenny-Paola Lis-Gutierrez,
[2]Amelec Viloria and [1]Pilar Vega-Riano
[1]Fundacion Universitaria Konrad Lorenz , Bogota, Colombia
[2]Universidad de la Costa, Colombia, Barranquilla, Colombia

**Abstract:** This study aims to evaluate education as a component of human capital in comparison to other types of investments that relate to the formation of this stock. First, this study uses a nonparametric method known as prospective to estimate the value of human capital for a sample of ten Latin American countries from a returns perspective. Then, through partial decompositions examines the contribution of education in the volumes of human capital. The results indicate positive effects of education that however tend to run out in the long run.

**Key words:** Education, human capital, prospective method, Latin-American, long run

## INTRODUCTION

Since, the seminal works of Schultz (1961), Becker (1964), Mincer (1974), it has developed a solid theory on the determinants of human capital. Although, there are good reasons to assign to education a major role in determining the human capital, at the macro level it has not been empirically analyzed to what extent does characterizes this stock by itself. However, it has been tacitly established that this dimension brings the most important fraction of human capital relegating the role of other types of investments in the formation of this stock. The lack of studies is due in part to the emptiness of appropriate measures of human capital.

The purpose of this study is to address these two problems: consistently estimate a series of human capital and then, put into perspective the role of education compared to other investments in the formation of this. The literature has evaluated the dimensions of human capital in isolation and with the aim to determine their effect on other variables such as economic growth. This practice can turn over a partial view of the phenomenon. The dimensions of human capital play different roles in the formation of it and only their joint influence can ensure a consistent explanation. The health for example, provides a platform for better utilization of innate conditions of individuals and have catalytic effects on education. Hence, the formal education alone does not provide enough information on the better use of this form of human capital, given it is subject to health. Therefore, by establishing the relative importance of the determinants of human capital can confirm or not the appropriate use of educational variables as the only reliable element in the estimation of this stock.

The first obstacle in this effort is to have a measure of human capital that reflects comprehensively the concept and then link it to their determinants to evaluate the relative importance of each one of them. This study relies on a method known in the literature as lifetime labor income or prospective. Taking advantage of the characteristics of returns human capital, technique tries to overcome some limitations that are present in other methods, taking into account assessments made by market in key elements of this stock. When a company rents labor of a worker pays for a complete package of skills embodied in individuals, not by one them as the years of education. In this sense, wages reflect the valuation made by company for whole of abilities. Although, the measure has an extensive tradition, its implementation has been limited to developed countries. An exception is the research of Coremberg (2010) who implements the method of JF to Argentina for the period 1997-2004. This lack of literature is supplemented with the application to a sample of Latin American countries. The prospective method is a good alternative measurement of human capital and a valuable tool for assessing the relative importance of education.

## MATERIALS AND METHODS

Based on the way the physical capital is estimated, two approaches are used to achieve the monetary value of human capital; the first, based on production costs, it is calculated by taking into account the outlays made at each stage of investment. The second is an approach based on the incomes that will generate investment of this stock called prospective or

**Corresponding Author:** Henry Laverde-Rojas, Fundacion Universitaria Konrad Lorenz , Bogota, Colombia

lifetime labor income which was perfected in the last stage by Jorgenson and Fraumeni (1992) henceforth JF.

The latter approach estimates the monetary value of human capital from the perspective of returns, i.e., the yield generated by investments in human capital throughout the life cycle of individuals, resulting in a flow of income through their labor remuneration. This method relies heavily on the benefits of the market. It is assumed that in perfect competition and certainty where the remuneration of the factors reflects its marginal productivity, the market evaluates better the productivity of the workforce, taking into account many aspects in assessments including related with the skills, abilities, etc.

The methodology and assumptions in this study follows closely to Liu (2011) in order to make comparisons between OECD countries and those developing countries. Although, the approach is based on the original idea proposal by JF, it presents some modifications. In principle it departs from the valuation of the activities that are not included in the market. This is done by virtue not only of the difficulty in obtaining the data but because the market activities are considered as the most important for evaluating the productive capacity of the population.

**Data:** The main data to estimate the value of the human capital stock comes from different household surveys of ten Latin American countries (in the case of Argentina the data come from the Permanent Household survey (EPH) collected by INDEC for the period 2003-2011. For Chile, the National Sociodemographic Characterization Survey (CASEN) of the Ministry of Planning for the period 1990-2011 is used. In Colombia the Continuous Household survey (ECH) of the DANE is used for the period 1997-2006. For Costa Rica, the new National Household Survey (ENAHO) of INEC for the period 2001-2010. For Ecuador the National Survey of Employment, Unemployment and Underemployment (ENEMDU) of the INEC 2002-2011. For Honduras, the Permanent Household Survey of Multiple Purposes (EPHPM) of INE for the period 2001-2009 is used. In Mexico the national survey of occupation and Employment (ENOE) of INEGI for the period 2000-2009. For Paraguay the Permanent Household Survey (EPH) of DGEEC for the period 1999-2008. In Peru the National Household Survey (ENAHO) of INEI for the period 2004-2012. Finally, for Uruguay, the Continuous Household Survey of INE for the period 2001-2010) with national coverage (Argentina, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, Paraguay, Honduras and Uruguay), collected by institutes or ministries of each country's national statistics (exceptions of this are Argentina and Uruguay that only have coverage for urban population, nevertheless, the sample is representative in relation to the total population. In other cases due to the change in methodologies in the surveys, it was preferred to limit the sample to urban areas and certain periods despite counting national information and longer periods this is the case of Colombia).

This study only takes into account people who are in the workforce. This includes those who are working or looking for a job. In addition, the age of individuals ranges between 16 and 62 years old, established according to, the average age of retirement between men and women in Latin America and to compare with the results obtained by the OECD international consortium whose range is between 15 and 64 years old.

To implementation of the algorithm is needed to organize individuals by educational levels. However, the classification of educational levels are not homogeneous between surveys. In some cases levels may include more or fewer years or more categories. In this way, it is subdivided to individuals according to their years of education into three broad categories: basic education, comprising those individuals in the range between 0 and 8 years of education, intermediate education, individuals in the range between 9 and 15 years of education and higher education, individuals with 16 or more years of education.

Employment rates in this study are defined as the ratio between individuals of certain age and educational level that are currently working over economically active population (the economically active population in this case will be defined on this subset of individuals with which there may be differences in relation to the estimated by the different national statistical institutes).

In applying the JF model an essential element is labor income of workers. In this study only considers monetary income of wage and salary from the main job (although, the inclusion of other types of income such as benefits, transfers, etc. could be considered in the estimation of human capital, the data are not homogeneous or are not available in the same categories between the surveys of the different countries with which was chosen to include only this type of income). The surveys used contain a significant portion of unreported income. Therefore, to correct the possible biases that can generate this problem an econometric model was implemented. In this case, an estimation by OLS to impute unreported income was used, through assigning income from a worker to another which it has the same characteristics (the imputation of missing data closely follows the research by Gasparini *et al.* (2001). On the other hand, the problem of underreporting of income is not addressed which is a weakness of the present document).

Enrollment rates for different levels of education are the most important indicators of educational dynamics. These rates are defined in this document as the ratio of individuals with education level e and age a who are currently registered as students to achieve a higher level $\bar{e}$, over all individuals in education level e and age a.

Some variables used in estimating the value of the human capital stock are taken from other sources. Survival rates derived from data United Nations Population Division. Liu (2011) points out, it is expected that education tends to decrease mortality rates however, data available only allow differentiate by gender and age so it is assumed that survival rates do not vary between educational levels. In this study for all countries the discount rate is the same used by the consortium of the OECD, set at 4.58% and average growth rate of real wages of CEPAL data (as a baseline, a medium-term criterion is used, taking as reference the period 1980-2010, based on the criteria of the OECD consortium. In the calculation, the series is smoothed to avoid fluctuations in the economic cycle. The literature around the JF methodology reveals the sensitivity in the choice of these rates which becomes one of the weaknesses of this model). The choice of these parameters can be easily relaxed and do a sensitivity analysis of the results.

## RESULTS AND DISCUSSION

Equation 3 allowed to obtain the value of the human capital stock for ten Latin American countries. To observe the magnitude of this value is displayed in relation to nominal GDP and physical capital. First, Fig. 1a shows the ratios of the human capital stock to GDP. In general, it appears that the human capital value is several times nominal GDP. On average, ratios are about 4.6 although, the differences between extremes (Chile and Honduras) are almost 4 points. The differences between the human capital stock and GDP are explained because the stock is the sum of Current Labor Income (CLI) plus the present value of Labor Income Futures (LIF) while only the first incomes are part of GDP. Therefore, it seems clear that the human capital stock exceeds several times the GDP, although in the latter is also the Current Non-Labor Income (CNLI).

On the other hand, Fig. 1a shows that, on average, there is a positive relationship between the ratio HC/GDP and per capita income levels in selected countries. A possible explanation for this relationship may be given by the functional income distribution. Assuming a constant ratio between current and future income, namely these two magnitudes grow at the same rate in order to the ratio HC/GDP increases when per 1 capita income rises then the ILC has to grow at a higher rate than CNLI. Defining

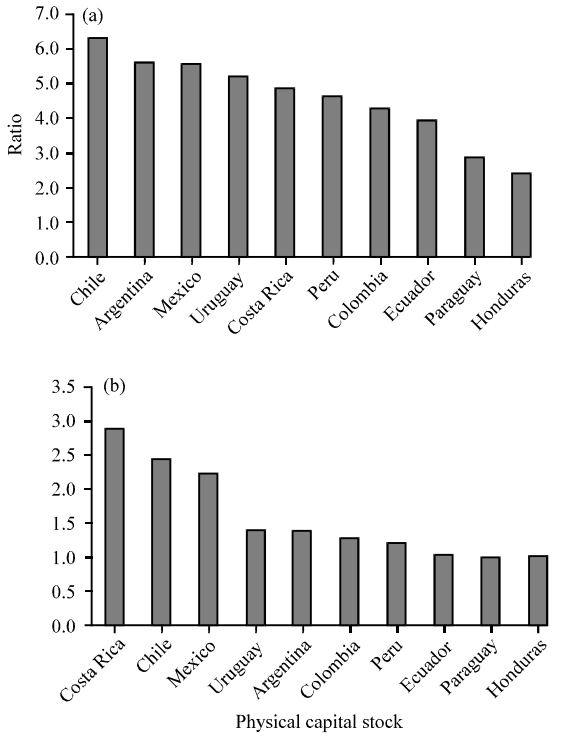


Fig. 1: a) Ratio human capital stock to nominal GDP and b) Ratio human to physical capital stock

Non-Labor Factorial Share (NLFS) as NLFS = rK/GDP and differentiating (dNLFS/dt)/NLFS = (dr/dt)/r+(dK/dt)/K-(dGDP/dt)/ GDP, then the condition for the HC/GDP rise is that (dNLFS/dt)/NLFS<0. If K grows at the same rate as GDP (stylized fact at least until 90) means that the rate of profit should be down. If not, what should happen is that the K grows at a slower rate than GDP, i.e., K/GDP was down which seems feasible with the growth of ICT. For example, Google generates enormous added value and invests relatively little in physical capital. However, Guerriero (2012) gives evidence that for developing countries the labor share of income has remained relatively stable since the seventies while for developed countries the trend is declining. The results are in line with those found by Piketty and Ganser (2014) (in order to verify this behavior in selected Latin American countries, it is calculated the factor shares using data based on employee remuneration, operating surplus and consumption of fixed capital at factor costs from CEPAL statistics. The results found the trend in shares for these countries seems to reinforce the findings by Guerriero (2012). Thus, the explanation via functional income distribution seems unsatisfactory).

However, if the rates at which are growing CLI and CNLI are relatively constant between these countries then

a description could be that the rates at which grows CLI should be lower than LIF. The latter incomes depends on the life cycle of individuals and the expectations they form. In turn, these latter factors depend not only on the economic cycle and thus unemployment rates but also of the investment made in terms of experience and education. JFM Model weighs more future income when unemployment rates are lower and particularly when levels of education increase. Countries with higher per capita incomes are reporting higher levels of educational attainments. Worldwide, both the rates and high levels in terms of average years of schooling reached by South Korea for example have allowed to accumulate high levels of human capital stock. This same relationship is found in Latin American countries where it is seen that those with higher levels of human capital are also those with higher educational attainments. Low levels of human capital to GDP ratio can be explained by low levels of educational achievements. Additionally as Coremberg (2010) points out, the results are in agreement with the classical theory of economic growth in which countries with higher physical capital (as in the case of Argentina, Chile, Mexico, etc.) count with an average product of capital lesser (and hence, a larger capital-output ratio) than countries with more scarce capital resources (such as Honduras, Paraguay, etc.). As it would expect that ratio of human to physical capital is >1, the countries with lower average product of capital will also have greater human capital to GDP ratios. On the other hand as suggested by the author and quoting to Lucas (1990) another factor that could influence the ratio of human capital to GDP are positive externalities associated with this type of capital. It may be happening that people with higher human capital level are migrating to countries with higher income, since there can best take advantage of this stock (Feenstra *et al*., 2015).

In line with the foregoing and as an additional measure for comparing the size of human capital is confronted with its pair most traditional, physical capital (Fig. 1b). As already mentioned, this ratio shows that human capital is several times the physical capital. Although, there are some differences in the estimates of both stocks (Data for the physical capital stock comes from penn world (Feenstra *et al*., 2015). This suggests that the results shown should be taken with caution given that the sources and methodologies for estimating both human capital measures differ substantially. However, they can give a general idea of the dimensions of human capital) they correspond to the present value of the income stream in the investments made in these assets. The differences between the human and physical capital stock can be explained, first because the physical capital stock endures on average less than its counterpart, the human capital. Additionally, the flow of human capital income is more stable and persistent than investment in machines and equipment related to ICTs (Coremberg, 2010). Second, technological changes can depreciate the value of capital goods in the long term and favor wages of more skilled workers (Coremberg, 2010).

**Evolution of human capital:** To observe the evolution of human capital over time is necessary to do so in real terms. The literature on national accounts uses indices such as Laspeyres or Paasche to decompose components of prices and quantities. Regarding human capital (Gu and Wong, 2010) use the Tornqvist index. The price of human capital is associated with short-term changes in wages. However, the key is to observe the evolution of the components in the long-term associated with changes in volumes on the educational structure, experience, etc. Nonetheless, much of the growth in the volumes of human capital may correspond only to increases in population size which is necessary to discount this value to obtain a purer measure of the growth is due to increases in knowledge individuals. The difference between the growth human capital stock and the population give as result the growth rate of per capita human capital (For reasons of space, the results are only presented for Argentina and Chile, the estimates for the rest of countries have the same specifications although they are independently conducted. For each country the base year was set equal to 100. Note that Chile's values differ from other countries because the data are biannual between 1990-2000 and triennial for 2003-2011).

Figure 2 shows the results of the volume indices for the human capital stock, population and per capita human capital for ten Latin American countries.

With respect to the volume of the human capital stock it can be seen that the selected countries show increases in real terms compared to the base year, on average this stock rose a 3.8% per year. Much of the growth of human capital is explained by increases in population, on average grew at a rate of 2.7% (Table 1). Compared with OECD countries these growth rates become relatively high. By the thirteen OECD countries these values range between 0.27 and 1.3%.

None of the Latin American countries have negative rates of human capital per capita as opposed to OECD countries (Table 1). On average, Latin American countries showed growth of human capital per capita of 1.13% opposite to 0.10% for those OECD countries. These differences may be explained through decomposition of three characteristics of the population: gender, age and education. This is possible by using Tornqvist partial

Table 1: Components of human capital growth

| | Latin American countries | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Components | ARG | CHI | COL | COS | ECU | HON | MEX | PAR | PER | URU | Mean |
| Human capital | 2.51 | 7.62 | 3.99 | 3.85 | 3.19 | 3.59 | 3.09 | 4.53 | 4.23 | 1.49 | 3.81 |
| Population | 1.91 | 5.97 | 3.16 | 2.95 | 1.92 | 2.29 | 2.05 | 3.06 | 2.94 | 0.56 | 2.68 |
| Per capita HC | 0.61 | 1.65 | 0.84 | 0.90 | 1.27 | 1.30 | 1.04 | 1.47 | 1.29 | 0.94 | 1.13 |
| Gender | 0.04 | -0.15 | -0.01 | -0.05 | -0.08 | -0.04 | -0.05 | -0.02 | -0.03 | -0.01 | -0.04 |
| Age | -0.54 | -1.30 | -0.27 | -0.21 | -0.26 | -0.23 | -0.24 | -0.18 | -0.23 | -0.31 | -0.38 |
| Education | 1.11 | 3.10 | 1.12 | 1.15 | 1.61 | 1.57 | 1.33 | 1.67 | 1.55 | 1.25 | 1.55 |

| Components | AUS | CAN | FRA | ISR | ITA | KOR | NZ | NOR | POL | SPA | UK | USA | HOL | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **OECD countries** | | | | | | | | | | | | | | |
| Per capita HC | 0.00 | 0.00 | 0.03 | -0.46 | 0.41 | -0.21 | 0.00 | -0.39 | 1.22 | 0.42 | 0.44 | -0.18 | -0.06 | 0.10 |
| Gender | 0.01 | 0.00 | 0.00 | 0.09 | 0.08 | 0.00 | -0.02 | 0.02 | 0.03 | 0.02 | 0.05 | 0 | -0.03 | 0.02 |
| Age | -0.42 | -0.49 | -0.48 | -0.78 | -0.39 | -0.47 | -0.44 | -0.71 | -0.09 | -0.37 | -0.38 | -0.58 | -0.65 | -0.48 |
| Education | 0.41 | 0.49 | 0.51 | 0.23 | 0.72 | 0.53 | 0.46 | 0.29 | 0.99 | 0.77 | 0.76 | 0.40 | 0.66 | 0.56 |

Estimates for all countries using Törnqvist index. The decomposition of gender, age and education correspond to partial indices which are first-order approximations. The calculations for the developed countries are taken from the OECD consortium estimates (Liu, 2011; Rensman, 2013). Note that the values of Chile differ from other countries because data are biennial into 1990-2000 and triennial into 2003-2011.

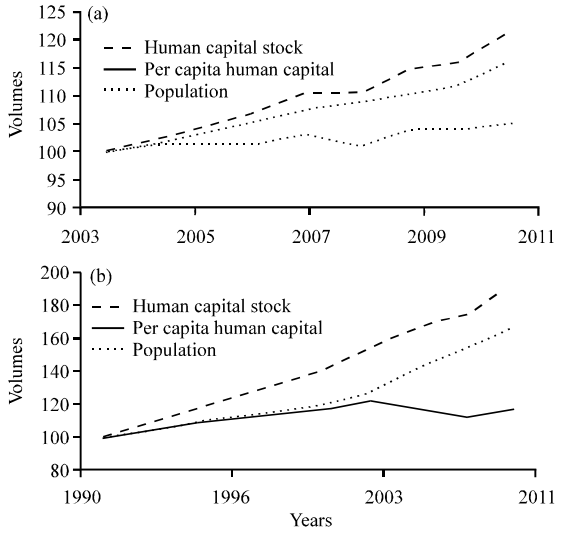


Fig. 2: Indices of volumes for human capital stock, population and per capita capital Human; Estimated by Tornqvist index, the difference between the growth human capital stock and the population give as result the growth rate of per capita human capital; a) Argentina; b) Chile

indices. The results show that most of the differences in growth rates of human capital per capita among those developed countries and Latin Americans have been due to the behavior of an aging population and average education levels. Although, for both blocks the aging population has been offset by higher levels of education, this trend is most marked in Latin American countries. To the JF method the increase in the age composition means a decrease in human capital because the older people have a higher annual income but a lower horizon in terms of life cycle therefore, the higher is the mean of population age a decrease in human capital is created. On the other hand, if the changes in population composition is carried out by greater educational levels will have a positive effect on human capital. Therefore, the net effect will depend on the growth rates of these two forces. As shown in Table 1, the positive effect of education has exceeded the negative effect of population aging. However, on average this compensation has been higher for Latin American countries, growing faster in the levels of education and to a slower aging rates than those OECD countries.

Moreover, the decomposition by gender shows that although, for both countries blocks, gender did not significantly influence in the determination of per capita human capital on average for Latin American countries the effect is negative indicating some wage discrimination. Thus, from the perspective of JF Method, increases in the mean of the females, reduces human capital.

These results reveal the importance that for the formation of human capital has played the educational levels (Lee *et al*., 2017) to offset the negative effects of an aging population and the gender wage gap. Nevertheless, these compensatory effects could be exhausted in the long-term. In fact while the rates of aging population increases, the growth rates of education, measured by average years of schooling are doomed to be diminishing due to the nature of the index. This latter phenomenon is already being observed in developed countries, where rates of growth the average years of schooling are very low (Lee and Chen, 2016). Meanwhile, the long-term trend is being replicated for Latin American countries. This would lead to that human capital per capita tends to levels near to zero or even to a path of long-term unsustainability.

## CONCLUSION

The first important fact of this study is that although the dimensions of the stock of human capital for Latin American countries are large (on average, the ratio is almost five times relative to GDP and two in reference to

physical capital) they become modest when it is compared to those of the OECD countries. The evidence presented is in line with the classical theory of economic growth which it is stated that countries with higher levels of per capita income exhibit higher CH/GDP ratios because they would have lower average capital productivities as well as a better use of the positive externalities of capital Human, among others.

The empirical results show that the evolution of human capital growth rates for Latin American countries have been on average positive and in per capita terms, higher than those of the OECD. However, the results also reveal that in general these rates are decreasing smaller as their growth slow down over time. For the more developed countries, per capita human capital growth rates are close to 0. By partial decompositions of the Törnqvist index it was possible to establish that the average positive rates of human capital per capita in the Latin American countries are explained to a great extent by the positive effects of education which have been able to compensate for the negative effects of population aging. However, due to the own dynamics of educational attainment, this compensatory effect tends to run out over time. For developed countries, levels in terms of educational attainment have reached such a point that it will be difficult to experience significant increases in this indicator given the expected returns to compensate for marginal increases in schooling. In the meantime, although developing countries grow at higher rates, their long term trend seems to approximate those more developed. In this way, increases in human capital via educational attainment seem doomed to be depleted in the long run.

## REFERENCES


Becker, G., 1964. Human Capital. Columbia University Press, New York, USA.

Coremberg, A., 2010. The economic value of human capital and education in an unstable economy: The case of Argentina. Proceedings of the 3rd International General Conference on International Association for Research in Income and Wealth, August 22-28, 2010, ECLAC, St. Gallen, Switzerland, pp: 1-77.

Feenstra, R.C., R. Inklaar and M.P. Timmer, 2015. The next generation of the Penn World Table. Am. Econ. Rev., 105: 3150-3182.

Gasparini, L., M. Marchionni and W. Sosa, 2001. [The distribution of income in Argentina and the Province of Buenos Aires]. Ministerio de Economía, La Plata, Argentina. (In Spanish)

Gu, W. and A. Wong, 2010. Estimates of Human Capital in Canada: The Lifetime Income Approach. Public Works & Government Services Canada, Ottawa, Canada, ISBN:9781100149974, Pages: 46.

Guerriero, M., 2012. The labour share of income around the world: Evidence from a panel dataset. Master Thesis, University of Manchester, Manchester, England, UK.

Jorgenson, D.W. and B.M. Fraumeni, 1992. The Output of the Education Sector. In: Output Measurement in the Services Sector, Griliches, Z. (Ed.). University of Chicago Press, Chicago, Illinois, pp: 303-338.

Lee, J., J. Ihm and D. Ryu, 2017. Human capital measures and stock return predictability: Macroeconomic versus microeconomic approaches. Finance Res. Lett., 21: 53-56.

Lee, K.S. and W. Chen, 2016. A long shadow: Cultural capital, techno-capital and networking skills of college students. Comput. Hum. Behav., 70: 67-73.

Liu, G., 2011. Measuring the stock of human capital for comparative analysis: An application of the lifetime income approach to selected countries. OECD. Stat. Working Pap., 2011: 1-1.

Lucas, Jr. R.E., 1990. Why doesnt capital flow from rich to poor countries. Am. Econ. Rev., 80: 92-96.

Mincer, J., 1974. Schooling, Experience and Earnings. Columbia University Press, New York.

Piketty, T. and L.J. Ganser, 2014. Capital in the Twenty-First Century. Harvard University Press, Cambridge, Massachusetts, ISBN:9780674430006, Pages: 696.

Rensman, M., 2013. Human capital in the Netherlands. Organization for Economic Cooperation and Development, Netherlands.

Schultz, T., 1961. Investment in human capital. Am. Econ. Rev., 51: 1-17.