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Analysis of Human Capital Effects: A Systematic Review of the Literature

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Abstract

Economic theory presents human capital as playing a driving role in the process of economic and social development in the countries. Indeed, human capital is presented in several research works as a factor that promotes accelerated growth and sustainable development. Microeconomic analyzes also suggest that investments that improve the level of human capital contribute to improving the distribution of income, but also reduce poverty. However, these conclusions seem not to be shared by all researchers. This article aims to enlighten researchers and especially young researchers on the results of the analyzes of human capital's effects on economic growth, income inequality, poverty and welfare. In order to achieve this objective, we collected information through search engines. This strategy required the definition of four equations with Boolean operators linking the key words of the study, i.e., 'education' with 'economic growth', 'income inequality', 'poverty' and 'welfare'. Based on the results obtained, we note the existence of a consensus around the effects of human capital on poverty and welfare. However, the results obtained for agricultural productivity, economic growth and income inequality remain mixed. One observation made in the literature is the use of education quantity as a proxy of human capital. As the definition of human capital is broader, education quantity cannot be a good proxy. We suggest some avenues for new research based on a more global human capital index, because this one takes into account other dimensions such as stunting, mortality, average number of years of education and education quality,

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1. Introduction

Human capital plays an important role in the economic and social development process of nations. In the related literature, differences in investment efforts in human capital formation have generally been used to explain differences in the levels of economic development of countries (Schultz, 1961; Becker, 1964; Welch, 1970; Romer, 1986; Lucas, 1998, Kraay, 2018; Collin & Weil, 2020). In this literature, it can be noted, for example, that nations that have accumulated more wealth are those that have invested consistently in the education and health of their population. In doing so, they have a sufficient stock of human resources to innovate quickly and/or to adopt new technologies more easily. In contrast, poor nations, because they have not invested sufficiently in the education and health of their population at the outset, have difficulty getting off the ground economically, as their level of human capital does not allow them to take advantage of technological progress more quickly and thus to make productivity gains.

In the literature on the analysis of human capital effects, existing research has very often used the quantity of education (number of years) as a proxy. Also, in these researches, estimation results have been obtained using various techniques (Ordinary least square, instrumental variables, Triple least square, method of generalized moments, etc.) and data categories (time series, cross section and panel). From the analysis of the results of the different studies, we

note a lack of consensus. For example, for the same theme treated, the results vary substantially depending on the approach used, the nature of the data and the context of the study. This divergence in conclusions does not make it easy for young researchers and those not experienced in the subject to understand the orientations of the analysis of human capital effects. The aim of this article is to provide readers with an organized literature and relevant information on the effects of human capital from education on lot of key variables (productivity, economic growth, income inequality, poverty, and welfare).

In both empirical and theoretical work, a section is usually devoted to the literature review. Constructing a good literature review is often not an obvious exercise for young researchers. Very often, they simply present a compilation of abstracts of articles as a literature review. A good literature review requires a good knowledge of the related literature, but also synthesis skills. It should have an analytical structure that allows the researcher to specify his or her contribution very clearly in relation to existing work or to choose a method of analysis. It is with all these requirements in mind that this article is written to help researchers who are mainly taking their first steps in research to develop good writing approaches. This article also provides seasoned researchers with basic resources to start their research work. Finally, the article suggests new avenues of research around the analysis of human capital effects.

The rest of the article is organized as follows. Section 2 presents the methodology used to select the articles. Section 3 presents the analytical basis for the conclusions of the selected work. Section 4 presents the limitations of the previous work and proposes new avenues for research. Section 5 concludes the article.

2. Methodology

In this section, we present the methodology used to select the articles that were used to build the literature review discussed below. The selected works focus on studies linking human capital to variables such as agricultural productivity, income inequality, economic growth, poverty, and well-being. For each theme discussed, the works are organized according to the type of data and the similarity of the research results. For example, in presenting the work on the analysis of the effects of human capital on income inequality, we proceed as follows. First, we organize the selected articles into two groups, i.e., those that analyze the effects of educational variation on income inequality and those that focus on the analysis of the relationship between inequalities in access to education and income inequality. Secondly, we specify the type of data used (cross-section, panel, etc.) while discussing the nature of the relationship obtained, i.e., absence of effects of human capital on income inequality or presence of positive/negative effects of human capital on income inequality.

The articles are obtained via well-known search engines. These include Google Scholar, Sciences Direct and the online resources of the University of Sherbrooke. Some articles were downloaded directly from the sites of the journals where they were published. We also consulted methodological manuals, dissertations, and theses online and in the libraries of the University of Lomé, the University of Bamako, the Thomas Sankara University, the University of Sherbrooke, etc. Other relevant information was collected at conferences (Canadian Society of Economics, Canadian Economics Association, International Conference

of the Francophonie, etc.). The collection of information through search engines required the definition of four in order to determine the documentation that fits the objective of the article. These equations with Boolean operators link the key words of this study, i.e., 'education' with 'economic growth', 'income inequality', 'poverty' and 'welfare'.

A total of 201 articles were pre-selected. More concretely, the selection procedure was as follows. In a first step, we pre-selected works that analyze the effects of human capital on the productivity of agricultural firms, economic growth, income inequality, poverty, and well-being. Given the abundance of work on these topics, we established selection criteria to obtain the articles of interest. These criteria are based mainly on the title of the article, the rating of the journal in which it is published, the frequency with which the article is cited and the date of its publication. Based on the above criteria, we have selected those articles that provide relevant information in terms of research methodology and originality. In the following section, the conclusions of these findings are discussed.

3. Literature on the Effects of Human Capital

The objective of this article is to present in a structured way the conclusions of the studies on the analysis of the effects of human capital. Since the various studies we cite use education as a proxy for human capital, in the rest of the paper we will use the notion of education to refer to human capital. In what follows, we first present the conclusions of the work on the relationship between education and agricultural productivity. Then, we present successively those related to the effects of education on economic growth, income inequality, poverty, and well-being.

3.1 Education and Agricultural Productivity

According to Douillet & Girard (2013), agricultural productivity measures the efficiency of the use of production factors (land, capital, labor) in a given agro-ecological environment and political and socio-economic context. In other words, agricultural productivity provides information on the efficiency with which inputs are transformed into outputs, i.e., the efficiency of the production process. There are several indicators of agricultural productivity. The most commonly used in the literature are: total factor productivity (TFP), land productivity, agricultural labor productivity, intermediate consumption productivity and capital productivity. TFP is more comprehensive and reflects the efficiency of the use of all factors of production (land, labor, physical and human capital). Other productivity concepts are partial and are calculated by dividing output by the quantity of the factor concerned. For example, labor productivity is obtained by dividing total output by the quantity of labor used. While TFP is the most suitable indicator for assessing the efficiency of the production process, as it provides information on the share of growth attributable to innovations; for practical reasons due to the difficulties in assessing it, the other indicators are the most widely used in the literature to discuss the concept of productivity in agriculture. In doing so, we focus on agricultural productivity arising from human capital investment. In other words, we are interested in the variation in the level of agricultural productivity induced by the variation in the level of education.

In the literature on the analysis of the effects of education on agricultural productivity, several studies have concluded that the level of agricultural productivity is higher when farmers are educated. In this vein, researchers such as Nguyen (1979), Lockheed et al., (1980), Kawagoe et al., (1985), Abegaz (1994), Besley et al., (1994), Foster & Rosenzweig (1995), Seyoum et al (1998), Foster & Rosenzweig (2004), Weir & Knight (2004), Munshi (2004), Jolliffe (2004), Kurosaki & Khan (2006), Alene et al., (2008), Githinji et al., (2011), Davis et al., (2012), Gille (2011), Reimers & Klasen (2013), Gille (2013), Mussa (2014); Okpachu et al., (2014) and Andrianarison et al., (2022) found in their study that education positively and significantly affects agricultural productivity. The reasons given for this result can be summarized in four points. These points are presented in the following.

First, education improves farmers' managerial skills. The acquisition of these skills promotes optimal allocation of available resources, such as precision in pesticide dosage and fertilizer use (Asadullah & Rahman, 2009; Reimers & Klasen, 2013). Second, education helps to correct the problem of information asymmetry that prevails in markets.

Educated farmers will, for example, pay better prices for inputs and receive better prices for their output (Nelson & Phelps, 1966; Welch, 1970; Lockheed et al., 1979; Schultz, 1975; Schultz & Schultz, 1982; Asfaw & Admassie, 2004; Salahuddin et al., 2020). This advantage held by educated farmers may allow them to make better profits from the marketing of their produce. The third point relates to the effect of education on technological adoption. Educated farmers are quicker to innovate or adopt new production techniques because they have the knowledge to distinguish between promising and unpromising technologies (Nelson & Phelps, 1966; Feder et al., 1985; Lin, 1991; Foster & Rosenzweig, 1995; Asfaw & Admassie, 2004; Weir & Knight, 2004; Myeni et al., 2019). For example, while educated farmers adopt the new technology, illiterate farmers will wait until it has proven itself in terms of yield before adopting it. Reimers & Klasen (2013) explain that rapid adoption of new technologies by educated farmers creates a first mover advantage. Finally, a fourth and related point concerns the impact of education on reducing farmers' risk aversion (Knight et al., 2003). Reducing risk perception accelerates the adoption of new technologies that are often risky but potentially very profitable (Asadullah & Rahman, 2009). Based on the results of the work presented above, we find that education mainly affects agricultural productivity through its effects on the adoption of new technologies, the improvement of farmers' managerial skills and the management of information asymmetry.

However, it should be noted that although there seems to be a broad consensus in the literature on the direction of the relationship between education and agricultural productivity, contradictory conclusions have been found in some studies. In terms of microeconomic analysis, the work of Battese & Coelli (1995) and Llewelyn & Williams (1996) concluded that the effect of improving the level of education of farmers on agricultural productivity was statistically insignificant. Using panel data, Vollrath (2007) also found no effect of education on agricultural productivity in his sample countries. Craig et al., (1997) found an enigmatic negative effect of improved education on farm productivity. Phillips (1994), Lockheed et al., (1979), Asadullah & Rahman (2009) and Panda (2015) rely on the nature of the technology used in agricultural production activities to explain the origin of the differences in results

found in studies linking education and agricultural productivity. They argue that the impact of education is greater in economies where agricultural production is modernizing as is the case in developed countries, while its effects on agricultural productivity are weaker in sub-Saharan Africa and Latin America where agriculture is still at the traditional stage. In addition to using differences in education levels to explain differences in agricultural yields, the less intensive use of labor on large farms relative to small ones, differences in land quality and caste group membership could also explain the observed differences in agricultural productivity levels (Panda, 2015).

3.2 Education and Economic Growth

The neoclassical growth model is the standard framework par excellence that guides economists' thinking on discussions related to economic growth (Ramsey, 1928; Solow, 1956; Koopmans et al., 1963; Cass, 1965). In this model, the long-term growth rate depends on the exogenous growth rate of technical progress, while the short-term growth rate is an inverse function of the difference between the initial level of income and its level in the stationary state. The notion of conditional convergence is derived from the evolution of the short-term growth rate. It is characterized by the fact that the economy grows faster the lower its initial per capita income level is relative to its long-term target. However, the speed with which the economy converges to its steady state depends on the speed with which diminishing returns to capital take hold. Clearly, if capital is considered in its restrictive form, i.e., it includes only machinery and buildings, and excludes human resources, then diminishing returns will set in more quickly and under these conditions the rate of convergence will be high. From this point of view, Kahn (1992) argues that the speed of convergence calculated on the basis of physical capital alone is not in line with the empirical evidence. By introducing, however, human resources into the definition of capital, he obtains results that are closer to reality. In view of the conclusions of Kahn's (1992) work, it is therefore inappropriate to limit the analysis to the measurement of physical capital without taking into account human resources. The discussions in this section aim to show the importance of the role played by human capital, approximated by education, in the economic growth process. Nevertheless, in some research works this catalytic effect of human capital on economic growth is not systematic, as it depends on the structure of the country's economy. In what follows, we present the arguments underlying the reasoning of each school of thought.

3.2.1 Positive Effects of Education on Economic Growth

Economic theory presents human capital as an engine of economic growth. This driving role attributed to human capital has been highlighted in both theoretical and empirical analyses. At the theoretical level, Nelson & Phelps (1966) were among the first to show the importance of the role played by human capital in economic growth. Indeed, Nelson & Phelps (1966) constructed a model in which a country's ability to adopt new technology depends on its human capital endowment. On the basis of this consideration, they show that improving the level of human capital increases the speed of innovation and adoption of new technologies, which in turn improves the level of productivity of the economy and thus its level of growth. Following the work of Nelson & Phelps (1966), other authors such as Lucas (1989), Becker

et al., (1990) and Rebelo (1998) have also emphasized in their analysis the importance of the role played by human capital in the growth and development process of countries. In all the above works, human capital is approximated by the level of education.

Empirical research on the relationship between human capital from education and economic growth confirms the results of the theoretical research presented above. This empirical work can be organized into two groups; the first using panel data and the second using cross-sectional data or time series. Among the works carried out using panel data, Barro (1991), Mankiw et al., (1992), Ashton & Green (1997), Blundell et al., (1999), Funke & Strulik (2000), Siggel & Ssemogerere (2000), Bils & Klenow (2000), Bassanini et al., (2001), De la Fuente & Doménech (2006), Kleynhans (2006), Cohen & Soto (2007), Maitra & Mukhopadhyay (2012), Riley (2014); Maitra (2016) and Mashamba et al., (2022) use average levels of education to show that improving the level of human capital is a necessary condition for achieving accelerated and sustained growth. In this literature, the role played by human capital in economic growth is explained by two distinct but complementary effects: the level effect and the rate effect. The level effect corresponds to the role of human capital in labor productivity, while the rate effect relates to the increase in competitive advantage induced by innovation and technological diffusion.

The results of the analysis of the effects of human capital on economic growth obtained from data collected at the level of a single country are consistent with those obtained with panel data. Indeed, Heckman (2005) used the case of China to show that the economic performance of this country has been improved over time thanks to substantial investments in human capital formation. Abbas & Nasir (2001) also analyzed the role of human capital in the economic growth of Pakistan and Sri Lanka. The results obtained from their analysis support the idea that human capital plays a fundamental role in the development process of a country through its positive effects on economic growth. Similar results are also obtained from the case of Saudi Arabia and are discussed in the article by Bokhari (2017).

3.2.2 Counter-Intuitive Effects of Education on Economic Growth

The traditional view that human capital is a major determinant of economic growth is not unanimous in the related literature. Indeed, statistical evidence on unemployment and economic growth from some developed and developing countries questions the systematic positive effect of human capital on economic growth. For example, the work of Čadil et al., (2014) shows that human capital must first reflect the economic structure of a country before improving its level can generate positive effects on economic growth. Otherwise, the expansion of education is likely to lead to higher unemployment rates due to crowding out and imbalances in the labor market. In the same vein, the work of Lindahl et al., (2001), López-Bazo & Motellón (2012), Ramos et al., (2012), and Cadil et al., (2013), based on the case of European Union countries, also shows the importance of the economic structure of the country in explaining the positive effects of human capital on economic growth.

Other analyses clearly conclude that investment in human capital formation has no systematic effect on economic growth. Using the case of East Asian countries, Li & Liang (2010) find that the effects of human capital on economic growth are statistically insignificant. Benhabib

& Spiegel (1994) used data from developed and developing countries to analyze the role of human capital in economic growth. In their analysis strategy, they construct a first model that estimates the effect of human capital on economic growth using a Cobb-Douglas function. The results obtained with this first method cast doubt on the driving role attributed to human capital in the growth process of nations. In an alternative model, they allow human capital to vary to directly influence total factor productivity. The results obtained with the latter model allow them to obtain positive effects of the improvement of the level of human capital on economic growth.

From the above, a few salient points need to be highlighted. First, human capital is approximated by the level of education, which is an imperfect proxy. Second, there is no consensus on the driving role of human capital in the economic growth process. Third, the results of estimates of the effects of human capital on economic growth depend on the nature of the data used, the structure of the economy under study and the model used.

3.3 Human Capital and Income Inequality

In the work cited in the following subsections, average years of education and inequalities in access to education are used respectively to approximate the level of human capital and inequalities in its distribution. In what follows, we first discuss the relationship between education and income inequality and secondly, we present the findings of the work linking inequalities in access to education and income inequalities.

3.3.1 Education and Income Inequality

In the literature linking human capital and income inequality, the average number of years of education has been used very often as a proxy for human capital. However, the findings of the work presented in this literature are mixed. Indeed, some show that education has a reducing effect on income inequality, some argue that there is no effect, and others point to enigmatic amplifying effects. In the following, we present a summary for each group followed by an interpretation of the counter-intuitive results.

Using panel data, Park (1996), Sylwester (2002), Gregorio & Lee (2002), Checchi & Van de Werfhorst (2014); Abdullah et al., (2015) and Sari & Purwono, (2021) conclude that an increase in the average number of years of education leads to a reduction in income inequality. The same result is obtained by Yang (2002) using the case of China. In his analysis, Yang (2002) shows that the regions of China that are highly endowed with qualified human resources have less income inequality, while those that are less endowed have high income inequality. The work of Bourguignon (1994), and Shahpari & Davoudi (2014) on the respective cases of Brazil and Iran also show that the improvement in the level of human capital from education has contributed to significantly reducing the level of income inequality in these two countries. Other studies, including those by Schultz (1963), Lustig et al., (2012), Jaumotte et al., (2013) and Campos et al., (2016) have concluded that a large part of the income gap between richer and poorer individuals can be reduced by improving the educational level of the population.

In contrast to the work that reports an inverse relationship between education and income

inequality, some have concluded that there are no effects and others that the effects are the opposite of those predicted by human capital theory. Focusing on the group of researchers whose findings point to an absence of effects, the work of Chiswick & Chiswick (1987) shows that labor market participation of highly educated individuals particularly leads to a change in the composition of the labor force, but the estimated effects of this participation on the distribution of income are statistically insignificant. Ram (1989) in his analysis also finds that improving the average number of years of education does not lead to statistically significant effects on the reduction of income inequality. Furthermore, Jallade (1982) finds from the case of Brazil that the improvement in the level of investment in education alone is not sufficient to bring about a significant reduction in the level of income inequality. He suggests that in addition to investment in education, policy makers need to put in place good income transfer policies in order to promote the achievement of greater equity in income distribution.

Addressing research that concludes that educational expansion has negative effects on income inequality, the work of Jimenez (1986) & Glomm and Ravikumar (2003) shows that investments that increase the average number of years of education and its expansion generate more income inequality. Furthermore, the study by Lustig et al., (2004) on the dynamics of income inequality in Asian and Latin American countries concluded that improvements in the average years of education have led to an increase in the level of income inequality in this part of the world. In the work of Checchi (2001), it is also stated that the improvement in the level of education in Indonesia has led to greater inequality in household income.

The work of Abdullah et al., (2015) on the relationship between education spending and income inequality may help to better understand the origin of the counter-intuitive results presented above. Indeed, Abdullah et al., (2015) explain in their paper that, in general, increased public spending on education benefits children from richer classes more than those from poorer classes. This discrimination in investment decisions contributes to exacerbating the gaps between the educational attainment of children from the two social classes, which later leads to strong inequalities between their incomes, as the children of the rich will accumulate more years of good quality education and thus take up better-paid jobs, while the children of the poor, who do not have the same opportunities, will drop out of school very early and subsequently take up low-paid jobs.

3.3.2 Inequalities in Access to Education and Income Inequalities

Analyses of the effects of inequalities in access to education on income inequalities use the standard deviation in the distribution of education (Ram, 1990; Gregorio & Lee, 2002) and the Gini coefficient calculated for education (Lopez et al., 1998; Checchi, 2001) as proxies for inequalities in access to education. In this literature, a first group of researchers finds that inequalities in access to education underlie high income inequalities, while the second group concludes instead that the effects are statistically insignificant.

Building on the work of the first group, Becker & Chiswick (1966), Chiswick (1971), Park (1996), Checchi (2001), Gregorio & Lee (2002), Jenkins & Van Kerm (2006),

Rodríguez-Pose & Tselios (2009), Chani et al., (2014). Furthermore, Jamal & Khan (2003) also found from the case of Pakistan, the existence of a positive correlation between income inequalities and those related to access to education. Similar results were obtained by Yang (2002) in his analysis of the effects of inequalities in access to education on income inequalities in China. For the cases of the United States and the Organization for Economic Co-operation and Development (OECD) countries respectively, Becker & Chiswick (1966) and Földvári & Leeuwen (2010) also find a positive relationship between inequality in access to education and income inequality.

Focusing on the results of the second group, Chani et al., (2014) showed from the case of Pakistan that inequalities in access to education do not have statistically significant effects on income inequalities. Based on an analysis conducted using panel data, Castelló-Climent et al., (2014) also concluded in their analysis that high inequalities in the distribution of human capital around the world have hardly exacerbated differences in individuals' income. They explain this result by arguing that increasing returns to education and exogenous forces such as technological progress have offset the amplifying effects of inequalities in access to education on income inequality.

The differences in the nature of the results presented in this section can be clearly understood through the explanations provided in the work of Knight & Sabot (1983). The latter show that the expansion of education can affect the distribution of income through two effects: the composition effect and the compression effect. In explaining the two above-mentioned effects, they consider an economy composed of two groups of individuals: a first group composed of more educated individuals and another whose individuals are relatively less educated. The expansion of education in this case initially leads to a composition effect which results in an increase in the size of the group of better educated individuals, which initially tends to increase the level of income inequality. The compression effect occurs when the supply of labor exceeds the demand. This situation will lead to a decrease in the premium for better educated workers and thus cause a reduction in the income gap between individuals belonging to the two groups.

3.4 Human Capital, Poverty and Well-Being

In this section, we first discuss the relationship between education and poverty and secondly, we present the effects of education on well-being. As in the previous sections, education is used here also as a proxy for human capital.

3.4.1 Human Capital and Poverty

In poverty reduction strategies, human capital from education is presented as a fundamental determinant (Moyo et al., 2022; Rashid et al., 2022; Aref, 2011; Abdulahi, 2008; Echeverría, 1998). Indeed, education provides individuals with skills and abilities that enable them to take up better-paid jobs. The resulting increase in income levels naturally reduces poverty in both its absolute and relative dimensions. Throughout this section, the focus will be on the absolute dimension of poverty, which is defined as the lack of financial resources necessary to maintain a certain minimum standard of living in a society. In what follows, we first

present a synthesis of the findings of the work linking education and poverty based on information collected at the global country level. We then discuss the findings of the work on the effects of education on poverty based on data collected in rural areas, where poverty rates are highest.

In human capital theory, it is widely documented that nations cannot develop without substantial investment in education (Sen, 1998; Tilak, 2002). Indeed, education, by improving income levels, not only reduces poverty levels but also improves the quality of life of individuals. For example, Appleton (2001) used the case of Uganda to show that the improvement in the standard of living and the reduction of poverty in the 1990s was more rapid among educated people. He also points out that high poverty rates in African countries are due to low levels of investment in education. Similar results were also found by Bloom et al., (2006) in their analysis of the effects of education on poverty in sub-Saharan Africa. Other research studies including those conducted by Echeverr á (1998), Abdulahi (2008), Navaratnam (1986), Babatunde & Adefabi (2005) have also concluded that education plays an important role in the poverty reduction process in developing countries.

In addition to analyses at the broader country level, other studies have also looked at the relationship between education and poverty in rural areas. Among these studies, the work of Aref (2011) has highlighted the role of education in reducing poverty in rural areas. Furthermore, the analysis conducted by Chaudhry & Rahman (2009) based on the case of rural Pakistan also highlighted the importance of education in reducing poverty in rural households. Finally, the findings of Tilak (2002) & Ahmad et al., (2005) are consistent with those discussed above on the inverse relationship between education and poverty in rural areas. In all these studies, the effect of education on poverty is channeled through the positive effects of farmers' education on farm income.

3.4.2 Human Capital and Well-Being

In the previous sections, we have seen that education improves the income level of individuals. The increase in the level of induced income improves the level of well-being thanks to the possibility of financing more consumption expenditure on food and non-food goods. The work of Handa *et al.,* (2004), Angelopoulos *et al.,* (2007) and Bosi *et al.,* (2020) highlights this positive effect of education on welfare. Furthermore, studies conducted by Navaratnam (1986), Appleton (2001), Babatunde and Adefabi (2005), Abdulahi (2008), Cai *et al.,* (2008) ; Boncompte & Peredes (2020); Zhang (2021) also conclude that education is a necessary condition for the improvement of the well-being of the individual, the community and the all society. The positive effect of education on well-being in their work is mediated by the positive effects of education on income, health, political stability, equity in income distribution, reduction of unemployment and poverty.

4. Limitations and Research Perspectives

As mentioned above, this paper draws on work that uses education as a proxy for human capital. However, the World Bank defines human capital as the set of knowledge, skills and health conditions that individuals accumulate throughout their lives, and which enable them

to realize their full potential as productive members of society. In view of this definition, limiting human capital to the sole measure of education would be very restrictive; hence the need to use a composite index that takes into account several dimensions. Furthermore, in the above discussion, we have limited ourselves to analyses of the relationship between human capital and agricultural productivity, economic growth, income inequality, poverty and well-being. There is much other work that explores other aspects related to human capital. Work on the analysis of the effects of education on the productivity of non-agricultural firms, political stability, corruption, unemployment, etc. has not been included.

In order to fill the gap in the measurement of human capital through the quantity of education alone, new human capital indices are used in the recent literature. These indices combine, for example, information on health, quality and quantity of education, quantity of education, age and life expectancy (Kraay, 2018; Collin & Weil, 2020; Kafando, 2019; Kafando & Boccanfuso, 2020). It would therefore now be interesting to analyze the effects of human capital using an index that integrates quality-adjusted education, health, and skills acquired through work experience. Some work (Collin & Weil, 2020; Kafando, 2020) has already begun in this direction. These works use the new World Bank index (Kraay, 2018) to conduct an analysis of the effects of human capital from a normative approach. In this literature, Collin & Weil (2020), Kafando & Boccanfuso (2020), etc. have used a variant of the new World Bank index to predict economic growth and poverty dynamics. More concretely, these authors have tried to see how improving the level of human capital improves the level of economic growth and reduces the level of poverty over time. Research perspectives can be considered based on the new World Bank Human Capital Index. For example, it might be interesting to see how future changes in this new index or a variant of it affect the dynamics of income inequality or enable more inclusive growth.

5. Conclusion

The results of the research presented in this article allow us to conclude that an improvement in the level of education leads, ceteris paribus, to an increase in income. The increase in the level of income in turn reduces poverty and improves the wellbeing of individuals. The work presented has also allowed us to deduce that there is a lack of consensus on the analysis of the effects of education on economic growth and on income inequality. The origin of these contradictions is generally explained by differences in the structure of economies and in the quality of education received by individuals. In the body of work discussed, it also emerges that education is the measure used to approximate human capital. Since the human capital of an individual takes into account several other dimensions (health, acquired experience, quality and quantity of education, etc.), the sole measure of education cannot be a good proxy. In order to take this limitation into account, the recent literature relies on new composite indices to proxy human capital. Although this article is titled, Systematic Review of the Literature on Human Capital Effects, it does not take into account studies of the effects of education on agricultural productivity and many other economic aspects. This article presents some research perspectives to guide researchers interested in the subject. To this end, we propose, for example, to use the new World Bank index (or a variant) to analyze the effects of human capital on income inequality and inclusive growth using a normative approach.

References

Abbas, Q., & Nasir, Z. M. (2001). Endogenous growth and human capital: A comparative study of pakistan and sri lanka [with comments]. *The Pakistan Development Review*, pages 987-1007. https://doi.org/10.30541/v40i4IIpp.987-1007

Abdulahi, B. A. (2008). Education and rural development. *Pakistan Journal of Social Sciences, 5*(7), 655-662.

Abdullah, A., Doucouliagos, H., & Manning, E. (2015). Does education reduce income inequality? a meta-regression analysis. *Journal of Economic Surveys, 29*(2), 301-316. https://doi.org/10.1111/joes.12056

Abegaz, B. (1994). Essays on Ethiopian economic development. Avebury.

Ahmad, A., Hossain, M., & Bose, M. L., & al. (2005). Inequality in the access to secondary education and rural poverty in Bangladesh: An analysis of household and school level data. In Workshop on Equity and Development in South Asia, India, volume 2005.

Alene, A. D., Manyong, V. M., Omanya, G. O., Mignouna, H. D., Bokanga, M., & Odhiambo, G. D. (2008). Economic efficiency and supply response of women as farm managers: Comparative evidence from western kenya. *World Development, 36*(7), 1247- 1260. https://doi.org/10.1016/j.worlddev.2007.06.015

Andrianarison, F., Kamdem, C. B., & Che Kameni, B. (2022). Factors enhancing agricultural productivity under innovation technology: Insights from Cameroon. *African Journal of Science, Technology, Innovation and Development, 14*(5), 1173-1183. https://doi.org/10.1080/20421338.2021.1937816

Angelopoulos, K., Malley, J., & Philippopoulos, A. (2007). Public education expenditure, growth and welfare. https://doi.org/10.2139/ssrn.997802

Appleton, S. (2001). Education, incomes and poverty in uganda in the 1990s. Technical Report, CREDIT Research Paper.

Aref, A. (2011). Perceived impact of education on poverty reduction in rural areas of Iran. *Life Science Journal, 8*(2), 498-501.

Asadullah, M. N., & Rahman, S. (2009). Farm productivity and efficiency in rural bangladesh: the role of education revisited. *Applied Economics, 41*(1), 17-33. https://doi.org/10.1080/00036840601019125

Asfaw, A., & Admassie, A. (2004). The role of education on the adoption of chemical fertiliser under different socioeconomic environments in ethiopia. *Agricultural Economics, 30*(3), 215-228. https://doi.org/10.1111/j.1574-0862.2004.tb00190.x

Ashton, D., & Green, F. (1997). Human capital and economic growth. *Policy Options, 18*(6), 14-16.

Babatunde, M. A., & Adefabi, R. A. (2005). Long run relationship between education and

economic growth in Nigeria: Evidence from the Johansen? cointegration approach. In Regional Conference on Education in West Africa.

Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics, 106*(2), 407-443. https://doi.org/10.2307/2937943

Bassanini, A., Scarpetta, S., & Hemmings, P. (2001). Economic growth: the role of policies and institutions. panel data evidence from OECD countries. https://doi.org/10.2139/ssrn.265091

Battese, G. E., & Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics, 20*(2), 325- 332. https://doi.org/10.1007/BF01205442

Becker, G. S. (1964). Human Capital: A theoretical and empirical analysis, with special

Becker, G. S., & Chiswick, B. R. (1966). Education and the distribution of earnings. *The American Economic Review, 56*(1/2), 358-369.

Becker, G. S., Murphy, K. M., & Tamura, R. (1990). Human capital, fertility, and economic growth. *Journal of Political Economy, 98*(5, Part 2), S12-S37. https://doi.org/10.1086/261723

Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary Economics, 34*(2), 143-173. https://doi.org/10.1016/0304-3932(94)90047-7

Besley, T., & Case, A. (1994). Diffusion as a learning process: Evidence from hyv cotton. Technical report.

Bils, M., & Klenow, P. J. (2000). Does schooling cause growth? *American Economic Review, 90*(5), 1160-1183. https://doi.org/10.1257/aer.90.5.1160

Bloom, D. E., Canning, D., & Chan, K. (2006). Higher education and poverty in subsaharan africa. International Higher Education, (45).

Blundell, R., Dearden, L., Meghir, C., & Sianesi, B. (1999). Human capital investment: the returns from education and training to the individual, the firm and the economy. *Fiscal Studies, 20*(1), 1-23. https://doi.org/10.1111/j.1475-5890.1999.tb00001.x

Bokhari, A. A. (2017). Human capital investment and economic growth in saudi arabia: Error correction model. *International Journal of Economics and Financial Issues, 7*(4).

Boncompte, J. G., & Paredes, R. D. (2020). Human capital endowments and gender differences in subjective well-being in Chile. *Journal of Happiness Studies, 21*(1), 241-269. https://doi.org/10.1007/s10902-019-00085-y

Bosi, S., Camacho, C., & Desmarchelier, D. (2020). Human capital and welfare.

Bourguignon, F. (1994). Growth, distribution and human resources. Baltimore: John Hopkins University Press.

Čadil, J., Petkovová, L., & Blatná, D. (2014). Human capital, economic structure and growth. *Procedia Economics and Finance, 12*, 85-92. https://doi.org/10.1016/S2212-5671(14)00323-2

Cadil, J., Petkovova, L., Kaplanova, V., Loster, T., & Pavelka, T. (2013). Human capital and regional development-structural analysis. International Days of Statistics and Economics.

Cai, L., Mavromaras, K., Zakirova, R., & Fok, Y. K. (2008). Human capital and the patterns of employment and welfare receipt. Report prepared for the Australian Government Department of Employment and Workplace Relations under the Social Policy Research Services Agreement.

Campos, B. C., Ren, Y., & Petrick, M. (2016). The impact of education on income inequality between ethnic minorities and han in china. *China Economic Review, 41*, 253- 267. https://doi.org/10.1016/j.chieco.2016.10.007

Cass, D. (1965). Optimum growth in an aggregative model of capital accumulation. *The Review of Economic Studies, 32*(3), 233-240. https://doi.org/10.2307/2295827

Castelló-Climent, A., & Doménech, R. (2014). Human capital and income inequality: Some facts and some puzzles.

Chani, M. I., Jan, S. A., Pervaiz, Z., & Chaudhary, A. R. (2014). Human capital inequality and income inequality: testing for causality. *Quality & Quantity, 48*(1), 149-156. https://doi.org/10.1007/s11135-012-9755-7

Chaudhry, I. S., & Rahman, S. (2009). The impact of gender inequality in education on rural poverty in pakistan: an empirical analysis. *European Journal of Economics, Finance and Administrative Sciences, 15*(1), 174-188.

Checchi, D. (2001). Education, inequality and income inequality. LSE STICERD Research Paper, (52).

Checchi, D., & Van de Werfhorst, H. G. (2014). Educational policies and income in- equality. https://doi.org/10.2139/ssrn.2450413

Chiswick, B. R. (1971). Earnings inequality and economic development. The Quarterly Journal of Economics, pages 21-39. https://doi.org/10.2307/1881838

Chiswick, B., & Chiswick, C. (1987). Income distribution and education. In Economics of Education, pages 255-261. Elsevier. https://doi.org/10.1016/B978-0-08-033379-3.50051-6

Cohen, D., & Soto, M. (2007). Growth and human capital: good data, good results. *Journal of Economic Growth, 12*(1), 51-76. https://doi.org/10.1007/s10887-007-9011-5

Collin, M., & Weil, D. N. (2020). The effect of increasing human capital investment on economic growth and poverty: A simulation exercise. *Journal of Human Capital, 14*(1), 43-83. https://doi.org/10.1086/708195

Craig, B. J., Pardey, P. G., & Roseboom, J. (1997). International productivity patterns:

Accounting for input quality, infrastructure, and research. *American Journal of Agricultural Economics, 79*(4), 1064-1076. https://doi.org/10.2307/1244264

Davis, K., Nkonya, E., Kato, E., Mekonnen, D. A., Odendo, M., Miiro, R., & Nkuba, J. (2012). Impact of farmer field schools on agricultural productivity and poverty in east africa. *World Development, 40*(2), 402-413. https://doi.org/10.1016/j.worlddev.2011.05.019

De la Fuente, A., & Doménech, R. (2006). Human capital in growth regressions: how much difference does data quality make? *Journal of the European Economic Association, 4*(1), 1-36. https://doi.org/10.1162/jeea.2006.4.1.1

Douillet, M., & Girard, P. (2013). "Agricultural productivity; grounds for concern?" FARM, Issue 7.

Echeverría, R. G. (1998). Strategic elements for the reduction of rural poverty in Latin America and the Caribbean, volume 112. Citeseer.

Feder, G., Just, R. E., & Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. *Economic Development and Cultural Change, 33*(2), 255298. https://doi.org/10.1086/451461

Földvári, P., & Leeuwen, B. (2010). Educational inequality in europe, 1870-2000. In Workshop on human capital in economic history: measurement, determinants and implications, Tuebingen, Germany, pages 27-29.

Foster, A. D., & Rosenzweig, M. R. (1995). Learning by doing and learning from others:

Foster, A. D., & Rosenzweig, M. R. (2004). Agricultural productivity growth, rural economic diversity, and economic reforms: India, 1970-2000. *Economic Development and Cultural Change, 52*(3), 509-542. https://doi.org/10.1086/420968

Funke, M., & Strulik, H. (2000). On endogenous growth with physical capital, human capital and product variety. *European Economic Review, 44*(3), 491-515. https://doi.org/10.1016/S0014-2921(98)00072-5

Gille, V. (2011). Education spillovers in farm productivity: empirical evidence in rural India.

Gille, V. (2013). Education spillovers in farm productivity.

Githinji, M., Konstantinidis, C., & Barenberg, A. (2011). Small and as productive: Female-headed households and the inverse relationship between land size and output in kenya. Department of Economics Working Papers.

Glomm, G., & Ravikumar, B. (2003). Public education and income inequality. *European Journal of Political Economy, 19*(2), 289-300. https://doi.org/10.1016/S0176-2680(02)00178-7

Gregorio, J. D., & Lee, J.-W. (2002). Education and income inequality: new evidence from cross-country data. *Review of Income and Wealth, 48*(3), 395-416. https://doi.org/10.1111/1475-4991.00060

Handa, S., Simler, K., & Harrower, S. (2004). Human capital, household welfare, and children's schooling in Mozambique, volume 134. Intl Food Policy Res Inst.

Heckman, J. J. (2005). China's human capital investment. *China Economic Review, 16*(1), 50-70. https://doi.org/10.1016/j.chieco.2004.06.012

Human capital and technical change in agriculture. *Journal of Political Economy, 103*(6), 1176-1209.

Jallade, J.-P. (1982). Basic education and income inequality in Brazil. World Development, 10(3), 187-197. https://doi.org/10.1016/0305-750X(82)90009-2

Jamal, H., & Khan, A. J. (2003). The changing profile of regional inequality. The Pakistan Development Review, pages 113-123. https://doi.org/10.30541/v42i2pp.113-123

Jaumotte, F., Lall, S., & Papageorgiou, C. (2013). Rising income inequality: technology, or trade and financial globalization? *IMF Economic Review, 61*(2), 271-309. https://doi.org/10.1057/imfer.2013.7

Jenkins, S. P., & Van Kerm, P. (2006). Trends in income inequality, pro-poor income growth, and income mobility. *Oxford Economic Papers, 58*(3), 531-548. https://doi.org/10.1093/oep/gpl014

Jimenez, E. (1986). The public subsidization of education and health in developing countries: A review of equity and efficiency. *The World Bank Research Observer, 1*(1), 111-129. https://doi.org/10.1093/wbro/1.1.111

Jolliffe, D. (2004). The impact of education in rural ghana: examining household labor allocation and returns on and off the farm. *Journal of Development Economics, 73*(1), 287-314. https://doi.org/10.1016/j.jdeveco.2003.02.002

Kafando, B. (2019). Human capital in developing countries: an estimation of the effects of education quality on income inequality https://ideas.repec.org/p/shr/wpaper/19-04.html

Kafando, B., & Boccanfuso, D. (2020) Are we investing enough in the education of today's children for a way out of poverty tomorrow? Evidence from Sub-Saharan Africa. https://ofe.umontreal.ca/statistiques-et-publications/rapports-de-webinaires-et-actes-deconferences/actes-de-la-deuxieme-conference-internationale-sur-la-francophonieeconomique-2020/

Kahn, G. A. (1992). Policies for long-rim economic growth: A summary of the bank's 1992 symposium. Economic, page 31.

Kawagoe, T., Hayami, Y., & Ruttan, V. W. (1985). The intercountry agricultural production function and productivity differences among countries. *Journal of Development Economics, 19*(1-2), 113-132. https://doi.org/10.1016/0304-3878(85)90041-0

Kleynhans, E. (2006). The role of human capital in the competitive platform of south african industries. SA *Journal of Human Resource Management, 4*(3), 55-63. https://doi.org/10.4102/sajhrm.v4i3.100

Knight, J. B., & Sabot, R. H. (1983). Educational expansion and the kuznets effect. *The American Economic Review, 73*(5), 1132-1136.

Knight, J., Weir, S., & Woldehanna, T. (2003). The role of education in facilitating risk-taking and innovation in agriculture. *The Journal of Development Studies, 39*(6), 1–22. https://doi.org/10.1080/0022038031233129356 7

Koopmans, T. C. (1963). On the concept of optimal economic growth. Technical Report, Cowles Foundation for Research in Economics, Yale University.

Kraay, A. (2018). Methodology for a World Bank human capital index. World Bank Policy Research Working Paper, (8593). https://doi.org/10.1596/1813-9450-8593

Kurosaki, T., & Khan, H. (2006). Human capital, productivity, and stratification in rural pakistan. *Review of Development Economics, 10*(1), 116-134. https://doi.org/10.1111/j.1467-9361.2005.00305.x

Li, H., & Liang, H. (2010). Health, education, and economic growth in east asia. Journal of Chinese Economic and Foreign Trade Studies. https://doi.org/10.1108/17544401011052267

Lin, J. Y. (1991). Education and innovation adoption in agriculture: evidence from hybrid rice in china. *American Journal of Agricultural Economics, 73*(3), 713-723. https://doi.org/10.2307/1242823

Lindahl, M., & Krueger, A. B. (2001). Education for growth: Why and for whom? *Journal of Economic Literature, 39*(4), 1101-1136. https://doi.org/10.1257/jel.39.4.1101

Llewelyn, R. V., & Williams, J. R. (1996). Nonparametric analysis of technical, pure technical, and scale efficiencies for food crop production in east java, Indonesia. *Agricultural Economics, 15*(2), 113-126. https://doi.org/10.1111/j.1574-0862.1996.tb00425.x

Lockheed, M. E., Jamison, D. T., & Lau, L. J. (1979). Farmer education and farm efficiency: A survey. ETS Research Report Series, 1979(2). https://doi.org/10.1002/j.2333-8504.1979.tb01182.x

Lockheed, M. E., Jamison, T., & Lau, L. J. (1980). Farmer education and farm efficiency: A survey. *Economic Development and Cultural Change, 29*(1), 37-76. https://doi.org/10.1086/451231

Lopez, R., Thomas, V., & Wang, Y. (1998). Addressing the education puzzle. The Distribution of Education and Economic Reform. World Bank Policy Research Working Paper, (2031). https://doi.org/10.1596/1813-9450-2031

López-Bazo, E., & Motellón, E. (2012). Human capital and regional wage gaps. *Regional Studies, 46*(10), 1347-1365. https://doi.org/10.1080/00343404.2011.579092

Lucas, R. E. (1989). On the mechanics of economic development. NBER Working Paper, (R1176).

Lucas, R. E. (1998). On the mechanics of economic development. Econometric Society

Lustig, N., Bourguignon, F., & Ferreira, F. H. (2004). The microeconomics of income distribution dynamics in East Asia and Latin America. The World Bank. https://doi.org/10.1596/0-8213-5861-8

Lustig, N., Lopez-Calva, L. F., & Ortiz-Juarez, E. (2012). *Declining inequality in Latin America in the 2000s: the cases of Argentina, Brazil, and Mexico*. The World Bank. https://doi.org/10.1596/1813-9450-6248

Maitra, B. (2016). Investment in human capital and economic growth in singapore. *Global Business Review, 17*(2), 425-437. https://doi.org/10.1177/0972150915619819

Maitra, B., & Mukhopadhyay, C. K. (2012). Public spending on education, health care and economic growth in selected countries of asia and the pacific. Health Care and Economic Growth in Selected Countries of Asia and the Pacific. https://doi.org/10.18356/e7c7bcb7-en

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics, 107*(2), 407-437. https://doi.org/10.2307/2118477

Mashamba, T., Magweva, R., & Gani, S. (2022). The Impact of Education on Economic Growth in Zimbabwe. *Journal of Educational Studies, 21*(1), 167-185.

Moyo, C., Mishi, S., & Ncwadi, R. (2022). Human capital development, poverty and income inequality in the Eastern Cape province. *Development Studies Research, 9*(1), 36-47. https://doi.org/10.1080/21665095.2022.2032236

Munshi, K. (2004). Social learning in a heterogeneous population: technology diffusion in the indian green revolution. *Journal of Development Economics, 73*(1), 185-213. https://doi.org/10.1016/j.jdeveco.2003.03.003

Mussa, R. (2014). Externalities of education on productivity, efficiency, and production uncertainty of maize in rural malawi.

Myeni, L., Moeletsi, M., Thavhana, M., Randela, M., & Mokoena, L. (2019). Barriers affecting sustainable agricultural productivity of smallholder farmers in the Eastern Free State of South Africa. *Sustainability, 11*(11), 3003. https://doi.org/10.3390/su11113003

Navaratnam, K. K. (1986). Role of education in rural development: A key factor for developing countries.

Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *The American Economic Review, 56(*1/2), 69-75.

Nguyen, D. (1979). On agricultural productivity differences among countries. *American Journal of Agricultural Economics, 61*(3), 565-570. https://doi.org/10.2307/1239449

Okpachu, A., Okpachu, O., & Obijesi, I. (2014). The impact of education on agricultural productivity of small scale rural female maize farmers in potiskum local government, yobe state: A panacea for rural economic development in nigeria. *International Journal of Research in Agriculture and Food Sciences, 2*(4), 26-33.

Panda, S. (2015). Farmer education and household agricultural income in rural india. *International Journal of Social Economics, 42*(6), 514-529. https://doi.org/10.1108/IJSE-12-2013-0278

Park, K. H. (1996). Educational expansion and educational inequality on income distribution. *Economics of Education Review, 15*(1), 51-58. https://doi.org/10.1016/0272-7757(95)00000-3

Phillips, J. M. (1994). Farmer education and farmer efficiency: A meta-analysis. *Economic Development and Cultural Change, 43*(1), 149-165. https://doi.org/10.1086/452139

Ram, R. (1989). Can educational expansion reduce income inequality in less-developed countries? *Economics of Education Review, 8*(2), 185-195. https://doi.org/10.1016/0272-7757(89)90006-X

Ram, R. (1990). Educational expansion and schooling inequality: International evidence and some implications. The Review of Economics and Statistics, pages 266-274. https://doi.org/10.2307/2109716

Ramos, R., Surinach, J., & Artís, M. (2012). Regional economic growth and human capital: the role of over-education. *Regional Studies, 46*(10), 1389-1400. https://doi.org/10.1080/00343404.2012.675140

Ramsey, F. P. (1928). A mathematical theory of saving. *The Economic Journal, 38*(152), 543-559. https://doi.org/10.2307/2224098

Rashid, R. N., Saeed, M. K., & Ali, H. (2022). Impact of Human Capital on Poverty Reduction in Pakistan. *iRASD Journal of Economics, 4*(3), 419-428. https://doi.org/10.52131/joe.2022.0403.0089

Rebelo, S. (1998). The role of knowledge and capital in economic growth. Reference to education. National Bureau of Economic Research.

Reimers, M., & Klasen, S. (2013). Revisiting the role of education for agricultural productivity. *American Journal of Agricultural Economics, 95*(1), 131-152. https://doi.org/10.1093/ajae/aas118

Riley, G. (2014). Economic growth-the role of human & social capital, competition & innovation. Macroeconomic-growth-capital. Accessed, 16.

Rodríguez-Pose, A., & Tselios, V. (2009). Education and income inequality in the regions of the european union. *Journal of Regional Science, 49*(3), 411-437. https://doi.org/10.1111/j.1467-9787.2008.00602.x

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy, 94*(5), 1002-1037. https://doi.org/10.1086/261420

Salahuddin, M., Gow, J., & Vink, N. (2020). Effects of environmental quality on agricultural productivity in sub Saharan African countries: A second generation panel based empirical assessment. *Science of the Total Environment, 741*, 140520.

https://doi.org/10.1016/j.scitotenv.2020.140520

Schultz, T. W. (1961). Investment in human capital. *The American economic review, 51*(1), 1-17.

Schultz, T. W. (1963). The economic value of education. Columbia University Press.

Schultz, T. W. (1975). The value of the ability to deal with disequilibria. Journal of Economic Literature, 13(3), 827-846.

Schultz, T. W., & Schultz, T. W. (1982). Investing in people: The economics of population quality. Univ of California Press. https://doi.org/10.1525/9780520318540

Sen, A. (1998). Human development and financial conservatism. *World Development, 26*(4), 733-742. https://doi.org/10.1016/S0305-750X(98)00002-3

Seyoum, E., Battese, G. E., & Fleming, E. (1998). Technical efficiency and productivity of maize producers in eastern ethiopia: a study of farmers within and outside the sasakawaglobal 2000 project. *Agricultural Economics, 19*(3), 341-348. https://doi.org/10.1111/j.1574-0862.1998.tb00536.x

Shahpari, G., & Davoudi, P. (2014). Studying effects of human capital on income inequality in iran. *Procedia-Social and Behavioral Sciences, 109*(1), 1386-1389. https://doi.org/10.1016/j.sbspro.2013.12.641

Siggel, E., & Ssemogerere, C. G. (2000). Uganda?s policy reforms, industry competitiveness and regional integration: A comparison with kenya.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70*(1), 65-94. https://doi.org/10.2307/1884513

Sylwester, K. (2002). Can education expenditures reduce income inequality? *Economics of Education Review, 21*(1), 43-52. https://doi.org/10.1016/S0272-7757(00)00038-8

Tilak, J. B. (2002). Education and poverty. *Journal of Human Development, 3*(2), 191-207. https://doi.org/10.1080/14649880220147301

Vollrath, D. (2007). Land distribution and international agricultural productivity. *American Journal of Agricultural Economics, 89*(1), 202-216. https://doi.org/10.1111/j.1467-8276.2007.00973.x

Weir, S., & Knight, J. (2004). Externality effects of education: dynamics of the adoption and diffusion of an innovation in rural Ethiopia. *Economic Development and Cultural Change, 53*(1), 93-113. https://doi.org/10.1086/423254

Welch, F. (1970). Education in production. *Journal of Political Economy, 78*(1), 35-59. https://doi.org/10.1086/259599

Yang, D. T. (2002). What has caused regional inequality in china? *China Economic Review, 13*(4), 331-334. https://doi.org/10.1016/S1043-951X(02)00088-3

Zhang, W. (2021). Maternal human capital accumulation and children's well-being. *Advances in Life Course Research, 49*, 100406. https://doi.org/10.1016/j.alcr.2021.100406