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DO BETTER HEALTH AND EDUCATION ENHANCE ECONOMIC DEVELOPMENT?

***Abstract.** The major objective of this study is to show the importance of interdependencies between health, education and poverty in the context of South Mediterranean Countries (SMC) compared to the economies of the European Union (EU). Empirical assessments of interdependencies are pursued after reviewing the previous theories and applications. The results attained have revealed the existence of important links between different sources of wealth which are health, knowledge, monetary assets and social capital. Furthermore, the importance of non monetary assets appeared to be at least as important as the traditional economic and financial wealth. Given the extent and magnitude of education, health and socio-economic deficits in the SMC, the identification of the interdependencies generates new avenues for more integrated economic and social policies.*

***Keywords:** Interdependencies, Health, Education, Poverty, South Mediterranean Countries.*

JEL Classification D31-I1-I2-I3

1. INTRODUCTION

This study aims at analyzing the interdependencies existing between health, education and poverty as preliminary steps towards an analytical focus on human development policies. Previous research already demonstrated the role of knowledge and education in driving economic performance (Driouchi, A. et al, 2006). Yet, how do other variables, such as health, that are directly related to human development interact and affect economic and social development?

If empirical research has been accumulated globally and on different regions of the world, only limited evidence on the area of interdependencies exists for the South Mediterranean economies. The Arab human development reports (UNDP, 2002, 2003, 2004 and 2005) have shown large gaps in different aspects of human development in

the region. Health and knowledge have appeared to be among the major deficits in the region and occupy key positions in limiting access to better lives.

Insights into these inter-related issues have been building with the development of both theoretical and empirical studies, focusing on interdependencies with the development of new challenges facing policy-makers when accounting for the magnitude and level of sector inter-relations.

As developed in different empirical reports and studies, human development policies do have important interdependencies that should be better identified. These identifications help in refining the knowledge and the direction of policy actions that could enhance the level of attainment of the Millennium Development Goals (MDG's), as well as the enhancement of the living conditions of the populations.

This research has two inter-related objectives. The first one is to show how health, education, and income poverty are inter-related in the context of the South Mediterranean Countries compared to EU countries. The second objective is to relate health and education variables of the region and to identify how they can contribute to enhance economic development.

To achieve the above objectives, the most recent theoretical economic models are reviewed and used to support the empirical investigations that are pursued in the context of this study. Different databases from international organizations have provided the variables and indices included in the empirical investigations. Descriptive and regression analysis are used to assess and test for the existence of interdependencies between health, education and earnings.

2. LITERATURE REVIEW ON INTERDEPENDENCIES OF HEALTH, EDUCATION AND WEALTH

In an earlier contribution, Driouchi A. et al. (2006) presented the relationship between knowledge and economic performance using panel data on both developed and developing economies. Among the results attained, human capital and mainly education demonstrated promising roles in the determination of economic performance. However, other human capital related variables, such as health components, were not included given the methodological framework used in the study. Insights into the likely relationships of health, education and economic performance have been explicitly discussed in a series of social science and public health publications and reports. Different approaches have been used to tackle the extent and magnitude of these relationships. It is obvious that these linkages are well known, but their magnitude and extent of their usefulness for economic and social policies are not often emphasized. This review deals with the importance of interdependencies and the major findings accumulated in the socioeconomic literature. For Bernard et al. (2006), three basic sources of wealth (health, education, and economic resources) can be seen as interdependent causes and consequences of one another over the lifetime of an individual. The social capital could be considered as an important factor because individuals can accumulate other useful resources for themselves, their families and their communities through social networks.

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Adams et al. (2003) identified causal relationships between “socioeconomic status” and health conditions, with the empirical evidence established between socioeconomic factors and health but no clear causality found.

Lee and Kim (2007) conducted a longitudinal analysis to detect the long-term effect of health shocks on wealth and compared that with its short-term effect on the elderly, which is consistent with the previous studies including that of Adams et al. (2003). New health events appeared to have negative impacts on wealth but disappeared over time (Lee and Kim, 2007). The results also verified that severe health conditions (existing and new) significantly influenced wealth depletion mainly when shocks happen later in life. Furthermore, the study confirmed that health capital (existing severe chronic conditions) has a persistent negative impact on wealth changes over time. These results are subject to variation with the level of education, the family status, and other factors. Longer term effects were also investigated using panel data by P. Adams et al (2002) and by Cutler et al. (2007). However, limited evidence has been proven; the same results were found through the study of Cutler, Miller and Norton (2007). Mayer-Foulkes (2004) addressed the long-term impact of health by including the intergenerational and life-long dimensions. The relationships between health and each of the components that define the wealth of an individual, a group, and a country are examined below using a variety of publications.

Cutler David M, Adriana Lleras-Muney and Tom Vogl (2008) presented the existence of a clear link between socioeconomic status and health, which are identified by a number of studies covering both the United States and European Countries. For example, mortality risk rises when individuals do not reach upper secondary education in the United States and in some European Countries. Each of the measures of socioeconomic status influences health through different mechanisms. This has important implications for the choice of public policies aiming at improving the health of individuals under specific conditions.

Sommestad (2001) emphasized the role of investment in human capital, with health being the major engine of economic growth. Based on the empirical evidence, “a 5-year gain in life expectancy resulted in 0.3 to 0.5 per cent economic growth”. Poverty and poor health penalize economic growth (Bloom and Canning, 1999). In *The Health and Wealth of Nations*, Bloom & Canning (2000) acknowledged the relationship between health and income, which indicates that higher income leads to a longer life expectancy. A healthier population works more efficiently with higher chances of improving its skills, generates and attracts more investments, and benefits from a higher resource allocation. This causality between health and income lead to health improvement and, then to further income increase. Various examples of this “Virtual Spiral” are from East Asia and Ireland (Bloom & Canning, 2000). In another publication, the same authors (2004) stressed that investing in health leads to higher economic and social performance under sound macroeconomic policies and governance. The same study illustrated that initial beneficiaries of health improvements are often the most vulnerable groups (children),

with healthier children having better school attendance and improved performance. This shows how health and income have been identified to be highly related.

Hurd and Kapteyn (2005) also analyzed the relationship between health and income. They found that, in some countries, a large variation in wealth is associated with a large variation in health. Further techniques and analysis have shown the importance of the link between health and expenditures. Xu et al. (2003) demonstrated the existence of an overall positive relationship between the proportion of households with catastrophic health expenditures and the share of out-of-pocket payments in total health expenditures. Gerdtham and Thgren's (2002) found that health expenditure and GDP are co-integrated around linear trends.

Knapp (2007) dealt with the links between nutrition, labor productivity and a health variable, height. The net role of nutrition on labor productivity was shown to be highly significant. Muysken et al. (1999) showed that when physical capital, relative to health, is scarce, optimal expenditures for health and consumption are lower. Also, consumption is no longer likely to be negatively related to population growth because it enhances the percentage of health workers.

Wichmann (1995) investigated the nutrition-productivity relationship at low levels of income and showed the existence of a strong relationship between the state of nutrition or health and labor productivity. The dynamic version demonstrated that better nutrition increases the productivity of the learning by doing process. The empirical evidence gathered confirmed the above findings, but revealed that children with good nutrition and health start school at an earlier age, progress further, and repeat fewer grades (Yamauchi, 2006). However, the analysis of a long panel of data (11 years) suggests that good health may discourage further investments in schooling at the stage of transition from primary to secondary school and that better health status may reinforce incentives to go to work.

A further series of publications produced major inputs into how interdependencies could be used to support more realistic policies. Anderson et al. (2004) illustrated how to account for evidence about early childhood socioeconomic conditions, which have long-term health consequences on health disparities over the life course, in relation to early investments in education. Aging populations in the developed world are currently posing a serious threat to the cost of pensions and health care. Anderson et al. (2004) explained why countries cannot expect to grow themselves out of the problem using measures such as increasing immigration, raising the retirement age, and encouraging households to have more children.

According to Farrell et al. (2005), the only effective measures are for households and governments to increase their savings rates and to allocate capital more efficiently in order to earn higher returns on the assets they have.

Grimm and Harttgen (2007) looked at the role of the dependency ratio, in relation to population growth, in relation to health. They also found that a low life expectancy substantially reduces welfare, despite the related economic feedback effects.

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3. EMPIRICAL INVESTIGATIONS

There are compelling reasons to believe that education and health positively contribute to economic growth. Yet, empirical studies show that this relationship is not always significant. Barro (1990) demonstrated that, for a given level of wealth, the economic growth rate was positively related to the initial level of human capital of a country; whereas, for a given level of human capital, the growth rate was negatively related to the initial level of GDP per capita. Azariadis and Drazen (1990) assumed that economic growth is not a linear process. Their results showed that literacy is correlated with the variation of growth in the least advanced countries, but it does not seem to be related to the growth of the most developed countries. Furthermore, they illustrated that the coefficient of human capital in the growth equation is about five times higher in the developing countries than in the developed countries. Therefore, one of the main conclusions of the analysis of the human capital-growth relationship is the absence of homogeneity across countries. If economic, social and cultural characteristics of each country modify the relationship between human capital and growth, then the estimation of this relationship must be regional and take into account the initial level of human capital. In order to include initial wealth of a country as factor in the econometric analysis, a dummy variable was created, which indicates if a country is poor (dummy=0) or not (dummy=1).

This analysis is based on datasets made of World Bank and United Nations. The first part uses descriptive statistic methods and simple regressions to make a comparative analysis between SMC and EU countries about the levels of education, health and economic wealth. The second part uses factorial methods to detect the interdependencies between education, health and economic development. Using these variables, three wealth patterns are observed and are analyzed for SMC and EU countries. The last part is an econometric analysis of the relationship between education, health and economic development using models with dummy variables.

3.1 Descriptive statistics

Per capita economic development in the SMC region in the past 20 years has been relatively low. This is partly because of high population growth rates, and partly because many countries still depend on oil exports, and oil prices remained relatively low during this period. Under this situation, human capital (health and education) and economic development are not expected to show meaningful relationships.

The South Mediterranean region is a medium wealthy region. During the period 1995-2007, the annual GDP growth was 3.87% for the region, with high variation between countries. Djibouti has the lowest annual GDP growth of 1.35% on average per year, and United Arab Emirates has the highest annual GDP growth of 6.75% on average per year.

Many scientists consider that literate people have better health and a higher socio-economic status. The general measure used to describe the educational level of a country is the literacy rate, which is calculated as the percentage of the population 15 years and older who are literate (can read and write). The variation of literacy

rate across countries is very high, from 52% for underdeveloped countries to 94% for developed ones.

The SMC region has invested heavily in education over the past few decades. As a consequence, the mean of the literacy rate increased from 68% in 1995 to 79% in 2004. However, disparities between countries are very high.

Life expectancy at birth is one of the most important indicators of health. For much of human history, life expectancy was between 20 to 35 years (Preston, 1995). In 2004, it was 72 years for the region under study, compared to 66 years worldwide. Life expectancy at birth has increased with the level of development, from 47 years for the underdeveloped countries to 77 years for the developed countries.

Recent studies argue that correlations of education with health and socio-economic status may have more to do with the effects of schooling rather than literacy in general. School life expectancy shows the overall level of development of an educational system in terms of the number of years of education that a child can expect to achieve. Special attention is required in the interpretation, as long as relatively higher school life expectancy indicates greater probability for children to spend more years in education but also higher overall retention within the education system. The overall mean of school life expectancy is 12 years, much higher in developed countries than in developing or underdeveloped countries (15 years in developed countries versus 7 years in underdeveloped countries). In the region, school life expectancy increased from 11 years, in 1995, to 12 years in 2004. Between countries, there are large disparities. For example, school life expectancy in Djibouti was 4 years in 2004, compared to Israel where it was 15 years.

3.2 How education, health and economic development are interrelated?

In order to have a suggestive representation of the interrelations between education, health and economic development, Principal Component Analysis (PCA) is applied. The variables used in this analysis are: GDP per capita PPP (current international dollars), life expectancy at birth (years), adult literacy rate, infant mortality rate (per 1,000 live births), and school life expectancy (years) - primary to tertiary, for SMC and EU countries, for three years 1995, 2000 and 2004. As long as adult literacy rate is available only for the year 2004, it has been considered constant for all these years. Most of the information is preserved (92%) by the projection of the variables on the plan determined by the first two principal components.

On the first axis, the best represented variables are on one side: school life expectancy (years) - primary to tertiary and adult literacy rate, and on the other side: infant mortality rate (per 1,000 live births). The first axis summarizes the educational and health components of wealth. School life expectancy (years) - primary to tertiary and adult literacy rate are strongly positively correlated, and negatively correlated with infant mortality rate. The countries on the positive side of the first axis have values of educational indicators higher than the average, and the values of infant mortality rate lower than the average. The farther the country is from the center of the axis on the positive side, the wealthier in education and

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healthier the country is. The farther the country is from the center of the axis on the negative side, the poorer in education and the lower in health the country is. The SMC countries with the highest levels of education and lowest levels of infant mortality rates are Israel and Jordan, and the countries with the lowest levels of education and highest levels of infant mortality rates are Yemen and Morocco. Countries like Morocco, Yemen, Jordan and Tunisia became richer in education and health during the last ten years, while countries like Israel, Saudi Arabia, Iran, Oman and Kuwait became poorer in education and health during the last ten years.

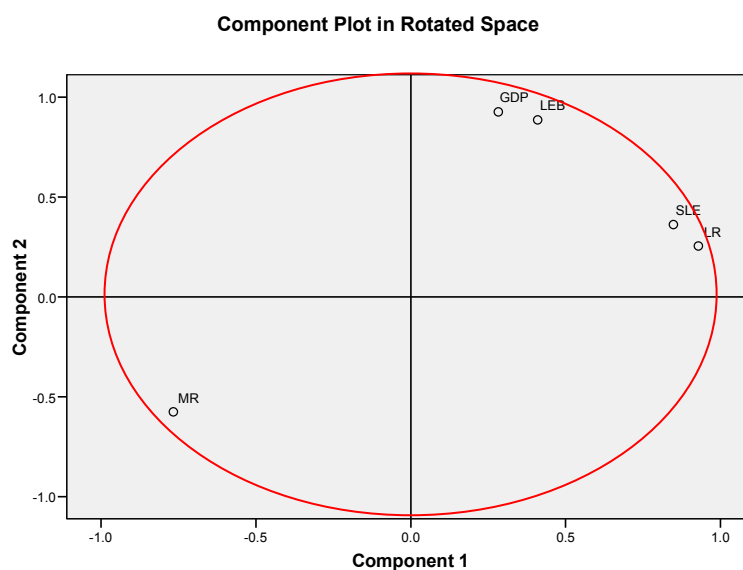


Figure 1 – Variable representation on factorial plan

On the second axis, the best represented variables are on one side: GDP per capita PPP (current international \$) and life expectancy at birth (years), and on the other side infant mortality rate (per 1,000 live births). The second axis summarizes the economic and health components of wealth. School GDP per capita and life expectancy at birth are strongly positively correlated, and negatively correlated with infant mortality rate. The countries on the positive side of the second axis have values of GDP per capita and life expectancy at birth higher than the average and the values of infant mortality rate lower than the average. The farther the country is from the center of the axis on the positive side, the richer and healthier the country is. The farther the country is from the center of the axis on the negative side, the poorer the country is. The richest and healthiest SMC countries are Israel and United Arab Emirates, and the poorest country is Yemen. During the last ten years, all of the countries became richer and healthier.

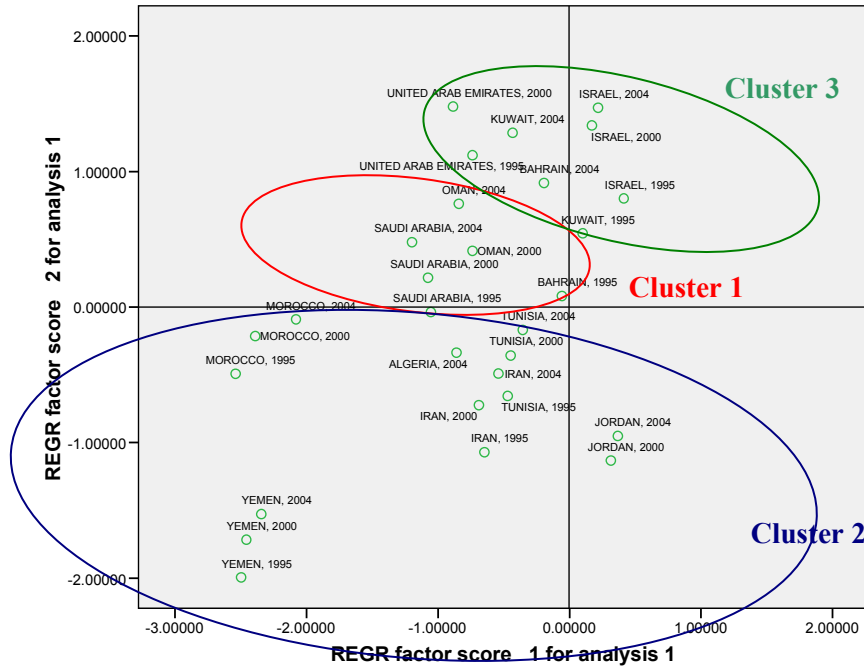


Figure 2 – SMC countries representation on factorial plan and wealth clusters

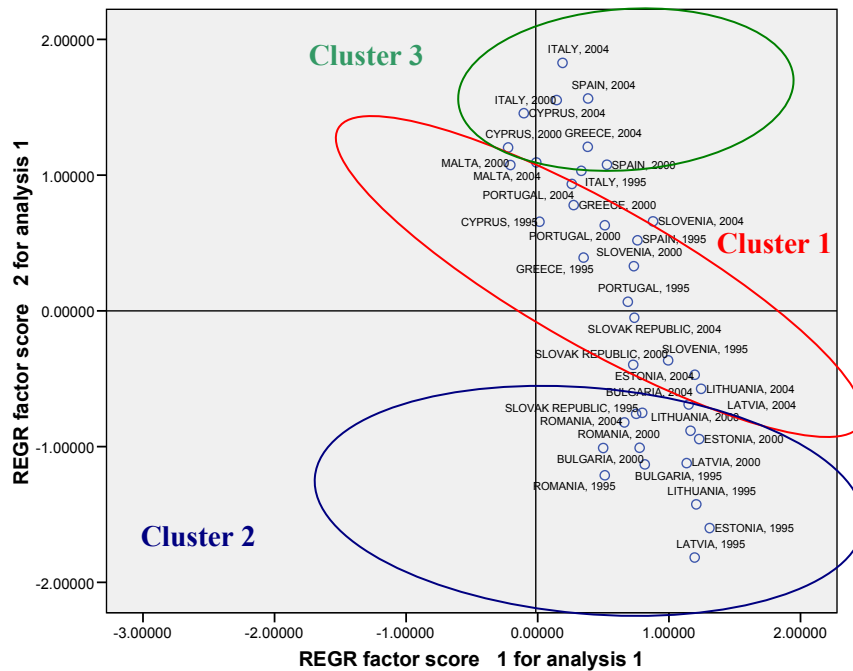


Figure 3 – EU countries representation on factorial plan and wealth clusters

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Taking into consideration all of the variables, the wealthiest countries in health, in education and economically will be represented in the first dial, far from the axis center, and the poorest will be represented in the third dial, far from the axis center. Thus, the richest SMC country from all points of view is Israel, and the poorest SMC country from all points of view is Yemen.

The main differences between SMC countries and EU countries are in education. Almost all SMC countries are on the negative side of the first axis, and almost all EU countries are on positive side of the first axis, which is determined by educational wealth and infant mortality rate. The general time trend is the translation of countries to higher values of education, health and GDP. For many of SMC countries, the improvement in education is more visible; for most of EU countries, the improvement in GDP per capita and health is more important. The homogeneity on the first axis is much higher for EU countries than for SMC countries; so, EU countries are much more homogenous in education and infant mortality rate compared to SMC countries.

3.3 Wealth patterns by education, health and economic development

This section applies data clustering methods in order to determine the wealth patterns by education, health and economic development for SMC countries compared to wealth patterns for EU countries. Data clustering means the classification of objects into different groups (clusters), so that the data in each cluster share some common attributes, often proximity according to some defined distance measure. In this case, the distance measure is the Euclidean distance, and the methods used are Ward method and k-means clustering method. Three groups are identified having the following characteristics:

- Cluster 1 includes countries with medium wealth: Bahrain, 1995; Kuwait, 1995; Saudi Arabia, 1995, 2000, 2004; and Oman, 2000, 2004. The school life expectancy (primary to tertiary) mean is 13.6 years, and the adult literacy rate mean is 92%. Hence, this group includes countries with average levels of education. The life expectancy at birth mean is 74.6 years, and the infant mortality rate mean is of 9.8 dead infants per 1,000 live births. Therefore, this cluster includes countries with an average level of health. The GDP per capita, PPP mean is 14,663 current international \$.
- Cluster 2 includes poor countries from all points of view: Algeria, 2004; Iran, 1995, 2000, 2004; Jordan, 2000, 2004; Morocco, 1995, 2000, 2004; Tunisia, 1995, 2000, 2004; and Yemen, 1995, 2000, 2004. The school life expectancy (primary to tertiary) mean is 12.13 years, and the adult literacy rate mean is 82%. Hence, the countries from this group have low levels of education. The life expectancy at birth mean is 69.2 years, and the infant mortality rate mean is 30.2 dead infants per 1,000 live births. Therefore, this cluster includes countries with low level of health. The GDP per capita, PPP mean is 5,649 current international \$.

- Cluster 3 includes rich countries: Bahrain, 2004; Israel, 1995, 2000, 2004; Kuwait, 2004; and United Arab Emirates, 1995, 2000. The school life expectancy (primary to tertiary) mean is 14.46 years, and the adult literacy rate mean is 95%. Hence, the countries from this group have average levels of education. The life expectancy at birth mean is 78 years, and the infant mortality rate mean is 5.9 dead infants per 1,000 live births. Therefore, this cluster contains countries with an average level of health. The GDP per capita, PPP mean is 22,171 in current international dollars.

During the analyzed period, some translations could be observed from one cluster to another. Kuwait and Bahrain passed from cluster 1 to cluster 3, from medium wealthy countries to rich countries. Many of the new entrants in EU passed from cluster 2, countries with low level of wealth indicators, to cluster 1, countries with medium level of wealth indicators. The classification of countries and the changes in time confirm the interdependencies between the wealth components. The increase in GDP is correlated with the improvement in health and in education. SMC countries have lower education level and lower level of health compared to EU countries for the same level of GDP per capita.

3.4 What are the main determinants of wealth patterns?

In order to answer this question, a discriminant function analysis is used. The results obtained are significant, with a probability of 95%. Discriminant analysis determines some optimal combinations of variables (called discriminant functions) so that the first function provides the most overall discrimination between groups, the second provides second most, and so on. Moreover, the functions will be independent or orthogonal, that is, their contribution to the discrimination between groups will not overlap. In this case, the first function discriminates between the first cluster and the others, so between the medium wealth countries and the rest of the countries. The variables which contribute the most to this discrimination are GDP per capita and life expectancy at birth. This function is significant with a probability of 99%. The second function discriminates between the second and the third cluster, so between the rich and poor countries. The variables which contribute the most to this discrimination are school life expectancy, adult literacy rate and infant mortality rate. This function is significant with a probability of 90%.

Therefore, GDP per capita and life expectancy at birth determine the pattern of medium wealth countries. To be identified as a rich or as a poor country, the other variables, such as school life expectancy, adult literacy rate and infant mortality rate, are important. Thus, the economic and health components of wealth are used for the first time in identifying the wealth patterns of a country.

By using discriminant analysis, three classification functions are determined:

Cluster 1: $f_1 = -0.016 \cdot \text{GDP} + 41.518 \cdot \text{LExp} + 7.24 \cdot \text{LR} + 10.433 \cdot \text{MRI} + 2.375 \cdot \text{SLE} - 1832.509$

Cluster 2: $f_2 = -0.019 \cdot \text{GDP} + 42.559 \cdot \text{LExp} + 7.329 \cdot \text{LR} + 10.574 \cdot \text{MRI} + 3.54 \cdot \text{SLE} - 1903.387$

Cluster 3: $f_3 = -0.014 \cdot \text{GDP} + 41.157 \cdot \text{LExp} + 7.321 \cdot \text{LR} + 10.592 \cdot \text{MRI} + 1.564 \cdot \text{SLE} - 1849.568$

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One country is classified into the group with the highest value of the classification function. By using these classification functions, 100% of the cases used in the analysis are correctly classified.

Some simulations for the SMC countries are made in order to check the possibility of passing from one group of countries to another (from a medium wealthy country to a rich country or from a poor to a medium wealthy country), improving only one component of wealth. The simulation sought to find out if changing only one component of wealth could make a significant impact, or if it is necessary to improve more or less all components of wealth. For the four SMC countries (Kuwait, Jordan, United Arab Emirates, Morocco), the values for the classification functions were calculated, varying one by one the indicators from the minimum to the maximum observed value in the database and maintaining constant all the other indicators at the 2004 observed level. Improvements in GDP per capita involve the revision of country classification. The speed of change depends on the level of all the other wealth components. The higher the levels of health and education are, the faster the adjustment to a better group of countries is.

The main conclusion of this analysis is that all the wealth indicators are interdependent. Modifying or improving only one indicator is not sufficient for a country to become wealthier. However, a better health of population determines a better human capital, so more productivity, and in conclusion, a better economic result at country level. More educated people will determine an improvement in human capital, which leads to a greater level of GDP per capita. Furthermore, a richer country, from an economic point of view, will invest more in education and in the health of people, but the response is not as quick as for the other implications. The next two sections give some measurable results of these two statements.

3.5 Econometric models

In order to determine the impact of human capital on economic development, an econometric analysis with dummy variables is performed. The variables included in the analysis are: GDP growth (%), life expectancy at birth (years) and school life expectancy (years) - primary to tertiary, for SMC and EU countries, for years 1999, 2003 and 2005 or the last year available. In order to include initial wealth of a country as a factor in the econometric analysis, a dummy variable is created, which indicates if a country is poor (dummy=0) or not (dummy=1), using the previous results obtained by factorial analysis for the years 1995, 2000 and 2004.

The effect of Health on Economic Development

Regarding the relationship between health and GDP growth, there is a strong relationship between them. All of the models are very good with R^2 greater than 90% for both SMC countries and EU countries. The parameter coefficients are significant with a probability of at least 90%.

The parameter estimates of the regression models, which describe the relationship between health and GDP growth taking into account the initial level of wealth of a country, are provided in table 1. The main conclusion provided by these models is that the effect of improvements in health on GDP growth is more important for rich or medium wealthy SMC countries than for poor SMC countries.

An increase of 1 year in life expectancy at birth implies an increase of GDP growth 2 times higher for poor SMC countries than for the other SMC countries. The equation for poor countries goes through the origin and for the other countries there is a translation of the regression line with 4.441. Concerning poor EU countries, the impact of the increase in life expectancy at birth on GDP growth is much higher than for the poor SMC countries. In case of the not poor countries, there is an increase in GDP growth with life expectancy at birth for SMC countries, but not for EU countries, where there is an inverse dependency (Fig. 4).

Table 1 - Econometric models describing the effect of health on economic development

Variables**	N	R ²	F	Model
SMC countries				
Dependent variable: GDP Independent variables: LEB Dummy variable	29	0.998	3812	$\text{Ln}(\text{GDPg}) = 0.067 \cdot \text{LEB} + (76.81) + 4.441 \cdot \text{Dummy} - 0.065 \cdot \text{LEB} \cdot \text{Dummy} (2.54) \quad (-2.81)$
EU countries				
Dependent variable: GDP Independent variables: LEB Dummy variable	33	0.99	225305	$\text{Ln}(\text{GDPg}) = 0.065 \cdot \text{LEB} + (474.5) + 5.139 \cdot \text{Dummy} - 0.071 \cdot \text{LEB} \cdot \text{Dummy} (24.304) \quad (-26.023)$

*Under each regression coefficient, the corresponding t-value is written

** Dummy=0 if poor country and Dummy=1 if not poor country; GDPg = GDP growth+100%; LEB = Life expectancy at birth, total (years)

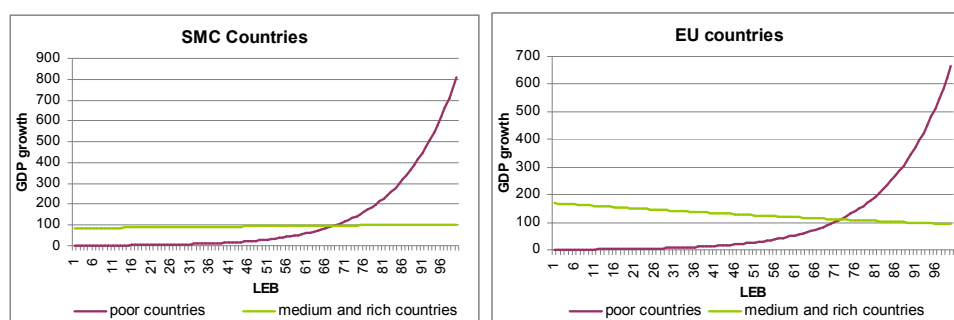


Figure 4 – Regression curves (GDP growth versus life expectancy at birth)

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The effect of Education on Economic Development

Concerning the relationship between education and GDP growth, there is a strong relationship between them. The models are good with R^2 greater than 98%. The parameter coefficients are significant with a probability of 99%.

The parameter estimates of the regression models, which describe the relationship between education and GDP growth taking into account the initial level of wealth of a country, are provided in table 2. The impact of the increase in school life expectancy on GDP growth is much higher for poor SMC countries than for the poor EU countries. In case of the not poor countries, GDP growth decreases faster with school life expectancy increases for SMC countries than for EU countries (Fig. 5).

Table 2 - Econometric models describing the effect of education on economic development

Variables**	N	R ²	F	Model
SMC countries				
Dependent variable: GDP	25	0.982	404.3	$\ln(\text{GDPg}) = 0.396 \cdot \text{LEB} +$ (25.866)
Independent variables: LEB				$+ 4.711 \cdot \text{Dummy} - 0.401 \cdot \text{LEB} \cdot \text{Dummy}$
Dummy variable				(3.038) (-3.41)
EU countries				
Dependent variable: GDP	33	0.998	4615.6	$\ln(\text{GDPg}) = 0.337 \cdot \text{SLE} +$ (67.77)
Independent variables: SLE				$+ 4.663 \cdot \text{Dummy} - 0.338 \cdot \text{SLE} \cdot \text{Dummy}$
Dummy variable				(7.197) (-7.897)

*Under each regression coefficient, the corresponding t-value is written

** Dummy=0 if poor country and Dummy=1 if not poor country; GDPg = GDP growth+100%; SLE = School life expectancy (years). Primary to tertiary. Total

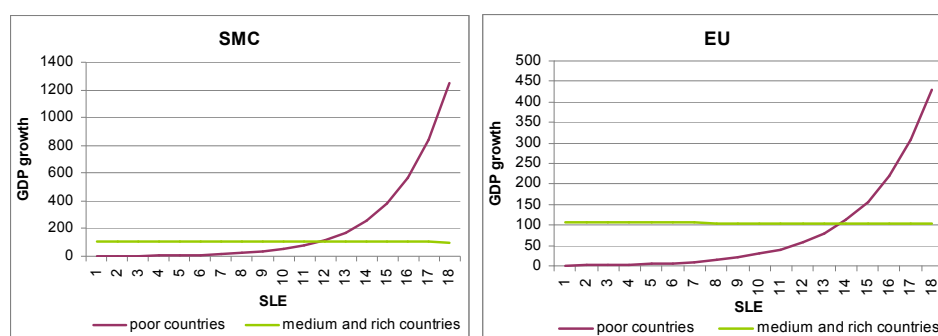


Figure 5 – Regression curves (GDP growth versus school life expectancy)

4. CONCLUSION

The regression analysis of different clusters, concerning the potential relationships between education, health and income measurements, helps to come up with the following conclusions.

First, the use of aggregate data, such as the “world cluster”, to illustrate relationships, without taking care of the different economic, social, regional, and development specificities, leads to contradictory findings. The example of the regression analysis of children out of primary school illustrates the ineffectiveness of aggregate data, because the results on world data contradict completely the results of the five sub-clusters. Data from sub-clusters, in contrast, improve the efficiency and help detect the level of significance existing between the GDP per capita and both health and education.

Second, the GDP per capita impact on improving education is not very significant. In fact, the overall conclusion that could be drawn from the regression analysis of the education and income indicators is that the relationship significance of GDP per capita is not considerable. In other words, the improvement of education within different clusters does not necessarily require an economic involvement or an increase in the income of the population. The single argument in favor of the importance of the GDP per capita for ameliorating the level of education concerns the literacy rates in middle income countries (mainly SMC, major oil net exporters, and high and medium human development). In general, other arguments besides income should be studied in order to enhance the contribution of education.

Third, in contrast to education, the interpretations of regression tables for health and income indicators show that GDP per capita is the key for most clusters. The enhancement of health in different clusters can only occur if it is accompanied by an improvement of the income level of the population. Alternatively, low human development countries need to focus on other measures besides GDP per capita to determine a significant relationship with health issues. The main point of the low human development countries’ health indicators is that the relationship significance varies from year to year. This “instability” can be explained by the rise of new factors that alter health, more than the GDP per capita would do, within a particular period.

Fourth, the economic development depends significantly on improvements in education and health. The impact of human development on GDP growth depends on the initial wealth of the country and on region (SMC or EU).

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