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A Review of the Impact of E-health on Economic Growth in developed countries and developing countries

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Abstract
E-health is one of the most important assets a human being has. It permits us to fully develop our capacities. If this asset erodes or it is not developed completely, it can cause physical and emotional weakening, causing obstacles in the lives of people. E-health is relatively a new term in e-healthcare and has no clear definition to date. In this paper, we define e-health as consisting of all Information and Communication Technologies (ICT) tools and services in e-health care. This use of ICT in e-health care offers great potential in terms of benefits that range from improvements in quality and better access of all citizens to care to avoidance of unnecessary cost to the public purse. The results show that the *e-health services* determinant was of greater significance than the rest of the determinants, it is interesting to see that the *environment* determinant is rejected in most of the specifications compared with *lifestyles*. In addition, it is seen that *lifestyles,* which have an impact on e-health status, have a higher impact on economic growth.
Key words: E-health, Economic Growth, environment, GLS Model.

1. Introduction

E-health is one of the most important assets a human being has. It permits us to fully develop our capacities. If this asset erodes or it is not developed completely, it can cause physical and emotional weakening, causing obstacles in the lives of people. The previous connection can be seen as the relationship between income and e-health. Life cycle models have explained how one's e-health status can determine future income, wealth and consumption (Lilliard and Weiss 1997; Smith 1998; Smith 1999).

E- health is relatively a new term in e-healthcare and has no clear definition to date. It was first used in 1999 at the 7th International Congress on Telemedicine and Telecare in London by John Mitchell from Sidney, Australia who spoke about a national government study whose main result was the recognition that "cost-effectiveness of telemedicine and tele-health improves considerably when they are part of an integrated use of telecommunications and information technology in the e-health sector". Eysenbach (2001) asserts that this term was apparently first used well before 1999 by industry leaders and marketing people rather than academics. These industry and marketing people created and used this term in line with other "e" buzzwords such as e-commerce, e-business, e-solutions and many others, in an attempt to convey the promises, principles, excitement (and hype) around e-commerce (electronic commerce) to the e-health sector and to provide a picture of the new possibilities the Internet is opening up to the e-health care. In this paper, we define e- health as consisting of all Information and Communication Technologies (ICT) tools and services in e-health care that link or interface patients and providers of e-health services including e-health professionals and it covers the transmission of data related to e-health between institutions. Examples include e-prescriptions, e-referrals, e-health information networks, electronic e-health records, telemedicine services, wearable and portable devices, e-health portals used as informational infrastructures for research and clinical care and many other ICT-based tools that assist in disease prevention, diagnosis, treatment, e-health monitoring and lifestyle management (Europe's Information Society, 2010). E-health goes even further to include the use of Internet or other electronic media to disseminate or provide access to e-health and lifestyle information or services.

Nowadays, it is possible to say every person could expect to live a long and e-healthy life. We could say its economic value is huge and e-health gains had the economic consequences of widespread economic growth and an escape of ill-e-health traps in poverty (World E-health Organization, 1999). But also, e-health problems could be reflected as reductions and obstacles for economic progress. Ainsworth and Over (1994) have studied the impact of AIDS on African economic development, stating the disease is prevalent among young workers, affecting productivity and domestic savings rates.

Therefore, there has been a growing interest to extend the relationship between e-health and economic growth, catalyzed in considerable extent by a 1993 World Bank report on e-health (see World Bank 1993). Barro (1996) comments e-health is a capital productive asset and an engine of economic growth. Using this argument, we can consider e-health as a determinant of human capital. Likewise, Mushkin (1962) indicates human capital formation, with the help of e-health services, and education are based on the argument that people develop themselves when they invest in these assets and will earn a future return with them. Grossman (1972), Bloom and Canning (2000) explain e-healthy individuals are more efficient at assimilating knowledge and, in consequence, obtain higher productivity levels. Hamoudi and Sachs (1999) argue there is a cycle of simultaneous impact between e-health and wealth.

In an early empirical review of the impact of e-health on economic development, Sorkin (1977) concluded that e-health, seen through reductions in mortality, had an important impact on economic growth during the early twentieth century. However, he comments increases in the e-health status of the population of developed nations will have little impact on economic growth, but the impact could be different for developing nations. For this matter, he points out several ways how e-health programs could have an impact on economic development on developing nations.

The first way is through productivity gains and increasing man-hours of work. Jack (1999) explains productivity of labor depends on factors like physical and mental capabilities, investments in human capital and efficiency of labor organization and management, and emphasizes changes in e-health could affect labor productivity through the previous channels. Also, labor productivity could also be reduced by the need to care for sick relatives or by reducing years of schooling if parents are chronically ill. On the other hand, improvements in e-health could positively affect the experience level of the work force by increasing their life expectancy and good e-health status condition.

The second way is making feasible the development of previously unsettled regions. Sorkin (1977) mentions a major e-health program could initiate the development of areas where economic activity was deterred by unfavorable e-health matters. Bryant (1969) indicates e-health and e-health services can improve or retard economic development and social and economic changes within a region.

The third way is improving innovation and entrepreneurship by changing the attitudes of people. Malenbaum (1970) used a step wide regression equation with macroeconomic data of 22 poor countries, using agricultural output as the independent variable, with several social, economic and e-health data as dependent variables. With this, he showed how the influence of e-health factors on output seems to be larger compared with other economic and social variables. As a conclusion, Malenbaum (1970) suggests e-health programs could change the happenings of the lives of the poor by taking their own decisions and to have the feeling to influence the events on their everyday activities, which often accept them as pre-ordered.

In a theoretical basis, Mankiw et al. (1992), Barro (1996) and Grossman (1972) have developed models that include e-health capital as a significant variable for economic growth. Nevertheless, life expectancy is the most used variable to represent it. This variable is defined by the United Nations as the average number of life years since birth according to the expected rate of mortality by age. Jacobs and Rapaport (2002) show analysts prefer to focus on a survival time indicator, such life expectancy, because it emphasizes the duration of e-health status and places implicit importance on a person's well-being. However, under the classification of the European Commission of Public E-health, there are four determinants of e-health: genetics, lifestyles, environment and socioeconomics. It is not clear the definition of life expectancy is the best definition for e-health capital. Bhargava et al. (2001) mention life expectancy does not reflect the productivity of the labor force accurately and capital formation and innovation need the labor force to be active and e-healthy during most of its working life. Also, Evans et al. (1994) mention death and e-health factors could not be related. Thus, it is unsure whether life expectancy completely measures the impact of e-health on economic growth.

The problem is if the e-health variable is not well specified, it can lead to measurement errors or omitted variable bias that produce biased and inconsistent estimators, failing to have a true estimation and validity of the impact produced by e-health, and not demonstrating in detail the theoretical background developed in the past.

This paper presents an empirical study of the impact of e-health capital on economic growth, extending its definition to include the four determinants of e-health in order to find a more concise evidence of its impact. Furthermore, it takes into account the different determinants of e-health in the estimation and the possibility of analyzing separately the impact of each determinant, being this is distinctive contribution and what sets it apart from previous studies.

2. Literature Review

In 1992, Mankiw et al. extended the Solow model of growth by adding human capital, specifying this variable has a significant impact on economic growth. Later, other authors developed models that included human capital, specifically e-health capital. Barro (1996), following a Ramsey scheme, develops a growth model including physical capital inputs, level of education, e-health capital, and the quantity of hours worked. By obtaining first order conditions, he finds an increase in e-health indicators raises the incentives to invest in education and a raise in e-health capital lowers the rate of depreciation of e-health, adding there are diminishing marginal returns to investment in e-health (Gallego 2000).

Grossman (1972) develops a model that allows e-health capital formation, seen as a capital good, to be able to work, to earn money, and to produce domestic goods. He shows an increase in the quantity of e-health capital reduces the time lost of being sick. The model assumes people are born with initial endowments of e-health which depreciate with age and grow with investment in e-health. Among their principal findings, it can be mentioned the productive nature of e-health is produced when a good state of e-health allows a more effective performance in the job and study. Grossman also finds that the principal determinants of e-health capital accumulation and demand for medical services are wages, age and level of education.

In an empirical analysis, Bloom et al. (2001) follows the Solow model with human capital. Although they find that e-health capital is a significant variable for economic growth under the two-stage least squares method, key variables such as capital and schooling are not significant; therefore, the results are questionable. For Latin America, there is a series of technical research documents of public e-health developed by the Panamerican E-health Organization, which find a strong correlation between economic growth and the regional e-health, estimating regressions similar to Barro's (1996) where e-health is much more robust than schooling (Mayer et al. 2000).

Nevertheless, the study of human capital has been focused on the schooling factor. Despite the studies of Bloom et al., it has been assumed that schooling is a matter of great relevance. Recently, this concept has been extended to the variable of interest in this study, e-health. In this case, e-health differs from schooling in the sense that it varies through the course of life and is the result of elections based on behavior, primarily during childhood and older adulthood (Strauss and Thomas 1998). Likewise, Gallego (2000) mentions a theoretical solid structure integrating e-health and economic growth has not been developed. He attributes this to the lack of interaction between the contributions of e-health economics and economic growth theory, and the bias towards a major importance of schooling as a primary determinant, due to the difficulty to disaggregate the impact of the two variables on the product.

In addition, the relationship between e-health and labor has been deeply studied. Bloom and Canning (2000) describe how e-healthy populations tend to have higher productivity due to their greater physical energy and mental clearness. Likewise, Strauss and Thomas (1998) review the empirical evidence of the relationship between e-health and productivity, establishing correlations between physical productivity and some e-health indicators. They focus particularly on those related with nutrition or specific diseases.

In the field of e-health economics, the endogenous causality between e-health and income has been the topic of several studies whose purpose is to establish the direction of the causality. Luft (1978) gives an informal explanation of this causality: "a lot of people who otherwise wouldn't be poor are, simply because they are sick; however, few people who otherwise would be e-healthy are sick because they are poor" . In order to explain the direction of the causality of the impact of e-health over income, Smith (1999) uses life cycles models, which link e-health condition with future income, consumption and welfare. According to this, Bloom and Canning (2000) explain this direction of the causality with education, indicating e-healthy people live more and have higher incentives to invest in their abilities since the present value of the human capital formation is higher. The higher education creates higher productivity and, consequently, higher income.

Similarly, some empirical and historical studies have analyzed the relationship between e-health and economic growth. They establish an endogenous relationship between them and, at the same time, argue there are exogenous factors, which determine the e-health conditions of a person (Hamoudi and Sachs 1999).

One major problem in the empirical studies of the impact of e-health on economic growth consists in their use of life expectancy as a proxy variable of e-health. For example, Bloom and Canning (2000) point out recent economic analysis shows the significance of e-health conditions as a determinant of subsequent economic growth. However, they measure e-health as life expectancy, which does not consider all the dimensions of e-health. E-health, if its true value wants to be assessed, should be measured in all its dimensions: mortality, morbidity, disability and discomfort. Life expectancy takes into account mortality, but it is not perfectly correlated with the rest of the e-health dimensions (Evans et al. 1994). Moreover, life expectancy reveals only the lifetime of the stock of human capital, saying nothing about the time in the labor force of this capital or the problems caused by the population aging. This is a problem because, even though there is a solid connection between e-health, productivity and economic growth, e-health capital depreciates over time (Grossman 1972) and at one point the relationship stops being binding.

As a response to these problems, the purpose of this study is to extend the definition of e-health capital in the empirical analysis of the Solow growth model with human capital, using a variable that includes the four determinants of e-health defined by the European Commission of Public E-health: *e-health services*, *socioeconomic conditions*, *lifestyles*, and *environment*. This will more accurately define the impact of e-health capital on economic growth.

3. Empirical Evidence

The model is based on the specifications of Bloom et al. (2001), which use an incomplete specification of variables. This study tries to improve the specification of the e-health variable by incorporating a self-built ordinal e-health index as such a variable. In order to evaluate empirically the Solow model with human capital, the model is estimated through a panel data analysis, which includes the growth rates of physical capital, labor, schooling, and e-health indices, the latter being expressed in their absolute level, for the years 1970-80 and 1980-90 with the method of ordinary least squares.

The criterion used to create the sample was based upon the availability of data, where the countries candidates should have available data on capital, labor, schooling, and e-health for the years 1970, 1980 and 1990. For capital, the data was obtained from the Penn World Table (Heston et al. 2002), and it is measured using stock of capital series for each country using a method of perpetual inventory for the year 1970, which is the base year. For the following years, it is calculated by multiplying the capital of the previous year for one minus the depreciation rate (in this case, 5 percent) and adding the current investment. GDP and labor data were obtained from the same source, expressed in 1985 dollars and economically active population over 15 years, respectively. The schooling data was obtained from Barro and Lee (2000), where schooling is measured as the average school years of the population over a period of 15 years.

To evaluate the impact made by e-health on economic growth, an ordinal e-health index was built. This index includes, as best as it is possible, the four determinants of e-health. *Lifestyles* refer to the regular activities and habits a person has that could have an effect on its e-health. This determinant includes alcohol consumption in liters per person over 15 years, and percentage of urban population. *Environment* refers to the social, economic and physical environment that surrounds a person and can have an effect on its e-health. This determinant includes CO_2 emissions expressed in metric tons per person and children mortality rate for children under 5 years per each 1000 births. Finally, *e-health services* indicate the access, supply and use of medical care services. This determinant includes number of beds per each 1000 habitants, number of doctors for each 1000 habitants, life expectancy, and length of stay in a hospital. This data was obtained from the development database of the United Nations. It is important to mention the *socioeconomic conditions* determinant of e-health is not explicitly included in the index. Evans et al. (1994) argue economic conditions relate to *environment*, *lifestyles* and access to *e-health services*, so this determinant is implicit in the other three determinants and it makes possible the design of our index.

The use of these variables in the index can be justified with empirical evidence of their impact on e-health. In the case of *lifestyles*, high alcohol consumption brings e-health problems, causing diseases and even death. Thun et al. (1997) found the deaths associated with alcohol consumption in the United States are caused by mouth, esophagus, pharynx, larynx, liver and breast cancer. Pollack et al. (1984) found rectum and lung cancer. There are also differences between urban and rural life. In terms of e-health, the urban population spends more on e-health (Fisher et al. 2003). This is because the population is exposed to both higher risks due to pollution (Bolte et al 2004), and urban stress (Kalia 2003). Urban locations have different diseases than rural areas (Costa et al. 2003) and different *lifestyles* which generate different e-health and behavioral problems related to overall e-health (Elgar et al. 2003).

In the case of *environment*, this determinant includes both socioeconomic and physical environment. On one hand, as physical environment, Dockery et al. (1993) and Samet et al. (2000) have found evidence that air pollution has contributed to increase the mortality rates in different cities of the United States. There is consistent evidence the levels of particulate matter in the air are associated with the risk of death of all causes and of cardiovascular and respiratory diseases. On the other hand, in the socioeconomic aspect, the mortality rate for children under 5 years is used because it reflects the impact of e-health services and also reflects an indirect relationship between the parents' income and the e-health of children (Dooley and Stewart 2002). Moreover, Hamoudi and Sachs (1999) argue when a high proportion of children die, the net cost of raising the children that survive increases.

As it can be noted, there might be different relations among the same determinants. For example, the stress caused by urban life could be translated into subsequent increased alcohol consumption. De Wit et al. (2003) found people with high levels of stress consume more alcohol. Taken together, these variables take into consideration the four determinants of e-health, which is one of the purposes of this study. Other variables that could be used are the height and weight in relation to a measure of nutrition status, such as a corporal mass index, because there is empirical evidence of their importance in the link between e-health and productivity (Strauss and Thomas, 1998).

In short, once the countries that did not cover the whole data sections (human capital and production) were depurated, the initial sample was restricted from 72 countries to 52 countries. The sample is composed of 13 European countries: Austria, Cyprus, Denmark, Finland, Greece, Iceland, Italy, Netherlands, Portugal, Sweden, Turkey and the United Kingdom; 12 African countries: Benin, Cameroon, Central African Republic, Kenya, Mauritius, Mozambique, Nigeria, Rwanda, Togo, Tunisia and Uganda; 16 American countries: Bolivia, Canada, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Paraguay, Trinidad and Tobago, United States, Venezuela and Uruguay; and 11 Asian countries: India, Indonesia, Israel, Japan, Sri Lanka, Malaysia, Pakistan, Philippines, Singapore, Syria and Thailand. With this sample, it can be said there is, more or less, worldwide representation.

Afterwards, the e-health index was built for the years 1970, 1980 and 1990, being classified by its determinants and by the aggregated total, where the determinants are equally weighted inside the total index (see table 1).

The construction of the index was made ranking data for which the higher the quantity more harmful the effect, such as higher alcohol consumption per capita and higher CO_2 emissions, the data was ranked upwards. On the other hand, in the *e-health services* section, such as hospital beds and physicians per 1000 inhabitants, the data was ranked downwards, placing the country with the highest services being at the top of the ranking. This is done so we can place the countries with desirable e-health characteristics and status at the top of the ranking. As a sum, the totals of each determinant were added to form the total e-health index, having 4 e-health indices: 3 of them where the sole e-health determinants and the other one was the total aggregated e-health index. So, these indices are ordinal indices, and as the level of the index decreases, the better e-health the country has. If we want to translate this relationship to the economic growth perspective, we expect that if the index is high, the economic growth is low.

4. Results

Initially, the model was estimated using growth rates in absolute levels with the method of ordinary least squares to measure their statistical significance. This can be seen on Table 2.

The variables used in the production function are capital, labor, schooling, *lifestyles*, *environment*, *e-health services* and the *total e-health index*. The reason to include them like this is to see the impact that the determinants of e-health can do separately, compared as if they were put together in a total index. Also, it would be interesting to see which determinant has the biggest impact on economic growth.

The first column includes the previously listed variables except the total e-health index, and it is seen that only the production inputs and *e-health services* are significant and have the expected signs: production inputs should be positive and the e-health determinants should be negative. The second column includes capital, labor, schooling and *e-health services* variables, being this last determinant the sole e-health variable considered. As a result, this and schooling are the only significant variables with the expected signs. The third column includes capital, labor, schooling and *lifestyles* and *environment* variables, being physical capital the only significant variable. Lastly, the fourth column includes capital, labor, schooling and the *total e-health index.* It is observed that all variables are significant at the five percent level of significance and have the expected signs, showing the impact that e-health has, with all its determinants, to economic growth. It can be noticed that among the determinants of e-health, *e-health services* resulted to be the most significant. Nonetheless, using the total e-health index, it is ostensible the aggregated e-health determinants have a significant impact on economic growth.

Now, the model was estimated again, but this time, using growth rates in per capita levels rather than in absolute levels. This can be seen in Table 3, which follows the same column structure developed in Table 3.

In the first column, with the inclusion of the e-health determinants separately, just physical capital and *e-health services* are significant. Again, these same variables are significant on the second column with a different variable composition. Just considering the *lifestyles* and *environment* determinants on the third column, none of the variables are significant, with the repeated exception of physical capital. Including the total e-health index as the e-health variable on the fourth column, it is seen that all variables are significant at the one percent level except schooling. This differs from the previous model with absolute levels where all variables were significant. It is interesting to see that schooling is not statistically significant, causing a disturbance in our model and having to pursue a better model.

Due to the possible presence of heteroskedasticity in the model using cross-section data, another panel data set was made with the same characteristics of the previous model, but this time, estimated with the method of generalized least squares (GLS). This can be seen in Table 4.

Using this model, the standard deviations of the coefficients are lower than the ones estimated by ordinary least squares and have a higher probability of statistical significance. Following the same methodology from the models previously used on Table 2, in the first column the model is estimated using e-health determinants separately, and it is seen variables are significant, with the exception of the variable *environment*. In the second column, e-health services are the only e-health determinant used, where all variables are significant at one percent level of significance. In the third column, just the *lifestyles* and *environment* determinants are used. In this case the variable physical capital is, again, the only significant variable. In the fourth column, the total e-health index is considered, showing all of the variables are significant at one percent level of significance. With this, the same conclusions from the previous model can be reached, but now these take into account a higher robustness and more efficient coefficients. Nevertheless, schooling is not statistically significant in some cases, showing the need to improve the model.

As before, the model was now estimated with per capita levels using the generalized least squares method. This can be seen on Table 5.

In the first and second column, all variables are significant, with the exception of *environment*. In the third column, as it has been seen in the previous specifications, the *lifestyles* and *environment* determinants are not significant. Including the total e-health index in the fourth column, all variables are significant at one percent level of significance, showing that generalized least squares method performed as a better estimation technique and the full impact of e-health on economic growth, taking other important variables in consideration as well.

As a comparison, the model was also estimated using life expectancy as the e-health variable, following the specification of Bloom et al. (2001). This was done in order to observe the statistical impacts made by the different e-health measures on economic growth. This can be seen on Table 6.

When life expectancy is used as the e-health capital variable, it is not statistically significant in any of the four specifications. This indicates, as stated above, that life expectancy is not a good representation of e-health capital.

5. Conclusions

From the previous empirical evaluation, e-health capital has a significant effect on economic growth, especially with a variable that captures all the determinants of e-health. This result is very important due to the ostensible importance of e-health as a determinant of growth and for the robustness shown with the growth model specification. Plus, even if it was expected that the *e-health services* determinant was of greater significance than the rest of the determinants, it is interesting to see that the *environment* determinant is rejected in most of the specifications compared with *lifestyles*. In addition, it is seen that *lifestyles,* which have an impact on e-health status, have a higher impact on economic growth.

It is important to add the implicit problem of endogeneity that the model could carry due to the arguments stated earlier, there is no single direction in the causality between income-health and e-health-growth. Further research could include a model estimated using instrumental variables for the e-health variable, breaking with the causality relationship with economic growth. One possible instrumental variable could be the percentage of land between the tropics or the distance from the equator (latitude), because it has been shown empirical evidence of its impact on growth and on its relationship with e-health with diseases such as malaria (see Hamoudi and Sachs 1999).

A higher awareness of the e-health of the people is necessary if sustainable growth is pursued, especially for the Third World. As demonstrated in this paper, factors like productivity and schooling are as important as e-health for the development of a country, where this last factor is sometimes not taken care of with the importance that it deserves. For policy implications, it is notorious how e-health can affect not just the economic e-health of a person, but of an entire nation. It is important to include investment in e-health as a tool of macroeconomic policy, due to the fact that differences in economic growth rates between countries have been significantly explained by e-health differences, showing that investment in e-health improves economic growth and is one of the few feasible options to destroy poverty traps (World E-health Organization 1999).

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Table 1. E-health Index

	LIFESTYLES			ENVIRONMENT			E-H. SERVICES			TOTAL		
	1970	1980	1990	1970	1980	1990	1970	1980	1990	1970	1980	1990
Austria	67	68	68	71	69	68	28	40	34	166	177	170
Benin	14	20	18	72	72	71	193	179	184	279	271	273
Bolivia	29	40	31	91	90	84	127	137	156	247	267	271
Cameroon	50	46	45	65	74	64	183	159	153	298	279	262
Canada	62	61	58	78	76	74	50	35	33	190	172	165
Chile	66	64	54	87	69	66	90	91	79	243	224	199
Cyprus	60	55	65	67	66	70	58	49	45	185	170	180
Colombia	35	43	49	75	68	67	115	126	121	225	237	237
Denmark	61	64	66	72	69	73	23	28	40	156	161	179
Ecuador	17	31	22	73	80	76	123	117	110	213	228	208
El Salvador	20	26	23	73	69	59	139	141	131	232	236	213
United States	64	59	59	81	80	83	32	41	48	177	180	190
Phillipines	28	29	35	63	65	66	156	149	153	247	243	254
Finland	46	52	60	65	65	68	33	30	32	144	147	160
Greece	55	65	63	71	68	74	31	28	30	157	161	167
Guatemala	21	21	30	77	81	68	135	134	141	233	236	239
Netherlands	60	63	63	68	68	72	20	23	27	148	154	162
Honduras	25	23	26	81	68	61	142	148	144	248	239	231
India	8	7	12	81	83	81	171	164	162	260	254	255
Indonesia	4	3	4	61	72	78	190	183	169	255	258	251
Iceland	38	39	42	62	62	61	14	13	14	114	114	117
Israel	42	25	22	61	63	59	25	31	28	128	119	109
Italy	71	66	64	70	68	69	28	21	18	169	155	151
Jamaica	36	39	32	76	74	71	88	88	103	200	201	206
Japan	54	53	57	66	62	63	25	25	23	145	140	143
Kenya	41	37	30	57	60	66	161	175	166	259	272	262
Malaysia	9	9	10	64	68	69	116	121	116	189	198	195
Mauritius	24	30	33	62	50	56	108	103	96	194	183	185
Mozambique	17	12	9	89	83	75	194	202	205	300	297	289
Nicaragua	39	28	28	82	76	68	120	127	129	241	231	225
Nigeria	45	54	48	87	91	95	200	188	161	332	333	304
Pakistan	2	2	3	69	74	83	170	167	169	241	243	255
Paraguay	43	51	51	50	53	51	108	116	139	201	220	241
Portugal	72	71	73	71	68	68	57	51	53	200	190	194
United Kingdom	57	58	62	74	72	75	38	44	51	169	174	188
Central African R.	31	25	27	73	67	74	189	191	202	293	283	303
Dominican Republic	27	35	40	76	77	78	111	108	104	214	220	222
Rwanda	59	51	51	60	72	69	189	193	186	308	316	306
Singapore	31	23	26	47	73	71	78	71	73	156	167	170
Syria	10	12	9	80	80	81	151	144	131	241	236	221
Sri Lanka	5	6	7	50	39	43	115	120	115	170	165	165
Sweden	58	46	48	66	61	56	12	15	17	136	122	121
Switzerland	68	67	69	63	60	63	11	8	12	142	135	144
Thailand	24	42	53	62	63	74	154	143	133	240	248	260
Togo	34	34	25	69	71	73	184	186	175	287	291	273
Trinidad and Tobago	38	47	42	89	97	96	85	82	91	212	226	229
Tunisia	18	13	17	96	82	76	136	132	115	250	227	208
Turkey	15	19	19	109	96	93	125	118	112	249	233	224
Uganda	74	70	72	57	64	62	163	186	199	294	320	333

Uruguay	64	49	57	70	72	56	54	56	48	188	177	161
Venezuela	52	58	56	85	82	84	116	122	80	253	262	220
Zimbabwe	48	42	37	82	78	86	138	138	183	268	258	306

Table 2. Production Function in Growth Form, Common Long-Run TFP Across Countries Dependent variable: Growth rate of absolute GDP; Ordinary Least Squares

	1	2	3	4
Constant	0.41	0.11	0.28	0.35
Capital	0.26	0.30	0.27	0.27
Labor	0.45	0.49	0.22	0.49
Schooling	0.22	0.24	0.15	0.23
Lifestyles	0.001		0.00	
Environment	0.002		0.00	
E-health services	0.001			0.001
Total				0.001
N	104	104	104	104
Adjusted-$\bar{R}$	0.69	0.65	0.63	0.66

Table 3. Production Function in Growth Form, Common Long-Run TFP across Countries Dependent variable: Growth rate of GDP per capita; Ordinary Least Squares

	1	**2**	**3**	**4**
Constant	0.27	0.09	0.12	0.28
Capital	0.28	0.28	0.29	0.28
Schooling	0.16	0.18	0.17	0.16
Lifestyles	0.002		0.000	
Environment	0.002		0.003	
E-health services	0.002			0.002
Total				0.002
N	104	104	104	104
Adjusted-$\bar{R}$	0.67	0.64	0.59	0.63

Table 4. Production Function in Growth Form, Common Long-Run TFP across Countries Dependent variable: Growth rate of absolute GDP; Generalized Least Squares

	1	**2**	**3**	**4**
Constant	0.26	0.09	0.12	0.28
Capital	0.27	0.28	0.28	0.28
Schooling	0.16	0.17	0.08	0.17
Lifestyles	0.002		0.000	
Environment	0.001		0.002	
E-health services	0.001			0.001
Total				0.002
N	104	104	104	104
Adjusted-R^2	0.62	0.63	0.60	0.67

Table 5. Production Function in Growth Form, Common Long-Run TFP across Countries Dependent variable: Growth rate of GDP per capita; Generalized Least Squares

	1	2	3	4
Constant	0.22	0.06	0.06	0.29
Capital	0.28	0.29	0.28	0.28
Schooling	0.18	0.17	0.02	0.20
Lifestyles	0.002		0.00	
Environment	0.000		0.001	
E-health services	0.001	0.001		
Total				0.002
N	104	104	104	104
Adjusted-R^2	0.95	0.94	0.87	0.94

Table 6. Production Function In Growth Form, Common Long-Run TFP Across Countries

	1	2	3	4
Constant	0.07	0.0011	0.10	0.002
Capital	0.28	0.2652	0.26	0.28
Labor	0.21		0.21	
Schooling	0.13	0.02	0.09	0.02
Life Expectancy	0.25	0.42	0.17	0.42
N	104	104	104	104
Adjusted-R^2	0.57	0.76	0.90	0.76