

**EDUCATION, HEALTH AND ECONOMIC DEVELOPMENT:
A SURVEY OF QUANTITATIVE ECONOMIC STUDIES,
2001-2009**

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Abstract. We analyse the relationships of health, education and income per capita in developed and developing countries in year 2005, as well as the main conclusions of more than sixty studies published by our Association for the period 2001-2009, applied to OECD countries, Latin America, Africa, Asia and World comparisons. We analyse the relationship between Years of Potential Life Lost (YPLL) and health expenditure per capita in OECD countries and the conclusions show that the initiatives to increase coverage of health care to all the population in the United States is an important step to lower the relatively high value of YPLL in this country in comparison with other developed countries of Europe and other areas. Regarding developing countries we call attention to the role education to achieve the Millennium Development Goals (MDGs), and thus recommend to increase international cooperation. Keywords: Health Expenditure, Education and Development, YPLL JEL Codes: I0, I1, I2, O51, O52, O53, O54, O55, O56, O57

1. Introduction and World comparisons

In this section we present data and studies related with World comparisons. Section 2 present a comparison of OECD countries and sections 3 to 5 a summary of studies related with Latin America, Africa and Asia. Most of the cited articles are free downloadable at the journals Websites with links from the on line Annex.

Education and health expenditure are highly correlated because more educated population usually contributes to increase real Gross Domestic Product (GDP) per capita, through several causal relationships as those analysed in Guisan, Aguayo and Exposito (2001 a), Guisan and Neira(2007), Guisan(2009) and other studies. Other World comparisons which present interesting empirical evidence are, among others, the following ones:

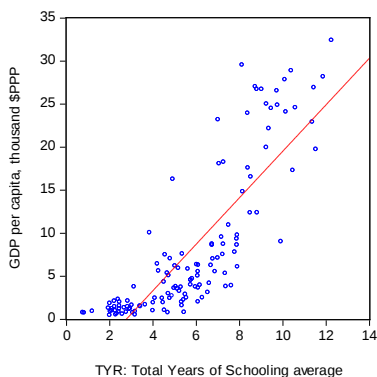
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Guisan, Aguayo, Exposito (2001 a) estimate cross-country models of Education, Industry and Fertility, which show the important impact that education has on the moderation of high fertility rates and for economic development. Guisan, Aguayo, and Exposito (2001 b) present a general view of the evolution of World education and development during the 20th century. Di Pietro (2006) analyses Income per capita, health and cross country IQ. Miles (2003) present a quantile regression approach to education and development.

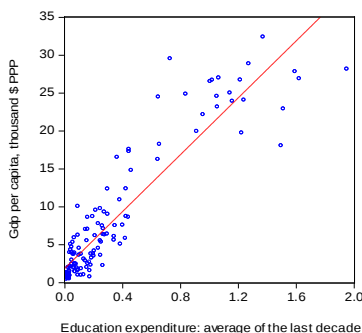
In the Annex we include a summary in English of some interesting studies published in Spanish, including: Guisan and Neira (2001) and Neira (2007).

Graphs 1 and 2 show the positive impact of education on GDP per capita and table A1, in the Annex, presents correlation coefficients between the stock of human capital and economic development, generally represented by Gross Domestic Product (GDP) per capita.

Graph 1. Years of Schooling and GDP per capita in 132 countries, year 2000



Graph 2. Past expenditure in Education and GDP per capita



2. Education, Health expenditure and YPLL in OECD countries

Table 2 presents education and health expenditure in OECD countries in year 2005, expressed in dollars at 2005 prices and PPP, and table 2 shows the percentage of health and education expenditure on real GDP together with some indicators of health assistance related with years of potential life lost (PYLL or YPLL) for male, female and general population (see definition in footnote of table 3).

Table 2. Health and Education expenditure and GDP per capita, 2005

Country	Health Expend. per capita	Education Expend. per capita	Health & Education Exp. Per capital	GDP per capita
Australia	2999	1949	4948	33951
Austria	3397	1852	5249	33496
Belgium	3384	2030	5414	32063
Canada	3460	2086	5546	35002
Czech Rep.	1447	963	2410	20366
Denmark	3179	2944	6123	33196
Finland	2523	1836	4359	30695
France	3306	1863	5169	29759
Germany	3251	1673	4924	31380
Greece	2468	1311	3779	24928
Hungary	1440	926	2366	16958
Iceland	3371	2773	6144	35009
Ireland	2399	1764	4163	38693
Italy	2278	1465	3743	28122
Japan	2473	1746	4219	30310
Korea	1263	1596	2859	21342
Luxembourg	5389	4106	9495	68211
Mexico	696	772	1468	12432
Netherlands	3425	1847	5272	35111
New Zealand	2223	1662	3885	24916
Norway	4329	2702	7031	47319
Poland	843	848	1691	13786
Portugal	2029	1192	3221	20656
Slovakia	890	818	1708	16175
Spain	2260	1268	3528	27377
Sweden	3012	2080	5092	32298
Switzerland	4069	2193	6262	35839
Turkey	716	275	991	10841
UK	2387	2001	4388	32695
USA	6383	2933	9316	41718

Source: Elaboration from OECD and WB data. Note. Expenditure and Gross Domestic Product (GDP) per capita in \$ at 2005 purchasing power parities (PPP).

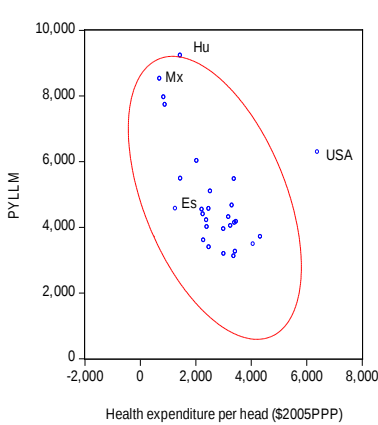
Table 3. Percentage (%) of Health and Education expenditure on GDP per capita, and YPLL (general, female and male), year 2005

Country	% Health	% Edu	% H+E	YPLL general	YPLL female	YPLL male
Australia	8.83	5.74	14.57	3228	2289	3946
Austria	10.14	5.53	15.67	3499	2068	4143
Belgium	10.55	6.33	16.89	4159	2848	5471
Canada	9.89	5.96	15.84	3487	2554	4168
Czech Rep.	7.10	4.73	11.83	4338	2430	5486
Denmark	9.58	8.87	18.44	3909	2493	4311
Finland	8.22	5.98	14.20	3974	2255	5094
France	11.11	6.26	17.37	3840	2252	4665
Germany	10.36	5.33	15.69	3360	2212	4044
Greece	9.90	5.26	15.16	3394	2017	4562
Hungary	8.49	5.46	13.95	6784	4032	9235
Iceland	9.63	7.92	17.55	2681	1744	3118
Ireland	6.20	4.56	10.76	3364	2289	4008
Italy	8.10	5.21	13.31	3185	1887	3605
Japan	8.16	5.76	13.92	2757	1831	3397
Korea	5.92	7.48	13.40	3842	2227	4568
Luxembourg	7.90	6.02	13.92	3427	2378	4080
Mexico	5.60	6.21	11.81	6777	5027	8528
Netherlands	9.75	5.26	15.02	3103	2266	3259
New Zealand	8.92	6.67	15.59	4041	2747	4540
Norway	9.15	5.71	14.86	3026	2118	3710
Poland	6.11	6.15	12.27	5638	3211	7962
Portugal	9.82	5.77	15.59	4411	2858	6024
Slovakia	5.50	5.06	10.56	5804	3343	7732
Spain	8.26	4.63	12.89	3304	2000	4399
Sweden	9.33	6.44	15.77	2825	2011	3191
Switzerland	11.35	6.12	17.47	2952	2100	3488
Turkey	6.60	2.54	9.14	na	na	na
UK	7.30	6.12	13.42	3549	2564	4220
USA	15.30	7.03	22.33	5066	3633	6291

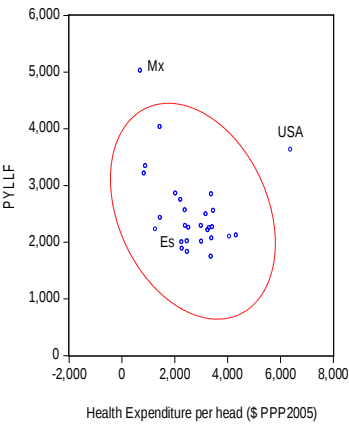
Source: Note: Data of years around 2005 for YPLL (years of potential life lost from OECD data, for people dying below 70 years old), except in Belgium 1999. Not available data for YPLL in Turkey (likely similar to those of Mexico). YPLLM (male), YPLLF (female). % H+E is the sum of % of Health and Education expenditure per capita on GDP per capita.

Graphs 3 and 4 show the important impact of health expenditure in the diminution of both male and female values of YPLL per one hundred thousand inhabitants, elaborated from OECD data.

Graph 3. Health expenditure and years of live lost in OECD: YPLLM



Graph 4. Health expenditure and years of life lost in OECD: YPLLF



Graph 5 shows the positive relationship between Health Expenditure and real GDP per capita of OECD countries in year 2005

Graph 5. Health expenditure and GDP per head, OECD countries, 2005

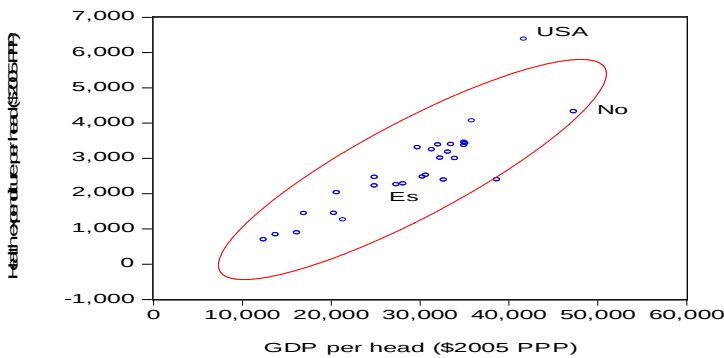


Table A2, in the Annex present the correlations between the variables and table A3 to A5 estimated econometric models.

GDP per head is in the range 10000 to 50000 dollars, and health expenditure between 500 and 7000 dollars. The most outstanding countries in both variables were Norway (No) and the United States.

The United States has reached very high standards of health average expenditure and quality but YPLL and other indicators do not perform as well as in other developed countries, due to the limitations in coverage of health assistance to poorest social groups. There are positive initiatives from Government to develop a mix of public and private policies for health assistance of all social sectors.

Other interesting studies published in English by our Association related with the positive role of education are the following ones:

Cosar and Bilidirici(2005), presents a comparison between Turkey and other OECD countries for the period 1960-2000, and recommend increase of expenditure in education in Turkey in order to reach a higher degree of convergence with economically more developed countries. Crespo and Fontoura (2006) analyze the relation between human capital and development in Portugal. Caruso and Palano (2005) analyse the positive effect of regions with higher degrees of support to universities and research in several European countries, including Italy, Spain and Germany.

Guisan (2009) presents a synthesis of the main factors of economic development and an analysis of European Countries in Comparison with the United States and Canada, 2000-2007. Guisan (2004) presents an inter-Sector Econometric Model of 151 European Regions, 1995-2000. Guisan and Aguayo (2002), (2003) analyse the evolution of education and development in the United States, Canada, Mexico, Europe and other countries in 1980-99. Guisan and Arranz (2003) present the estimation of econometric models of health expenditure in OECD countries, 1970-96.

Korres, Chionis, and Staikouras, (2004) present an analysis of . Regional Systems of Innovation and Regional Policy in Europe. Vieira, Vazquez-Rozas and Neira (2008), analyse the Innovation Factor in the Productive Process: Comparative Study of European Nuts, II 1995-2002, and Guisan (2005) analyses Universities and Research Expenditure in Europe and the USA, 1993-2003. Pereira, Martins, and Martins (2007), present an interesting analysis, based

on surveys, about the important question of Ethics and Wellbeing in Institutions, in Universities of Portugal, Cape Verde and the UK.

2. Education, health and development in Latin America

Some interesting studies published in English are the following ones:

Guisan, and Aguayo (2001) and (2002) relating educational level with fertility rates, production by sector and per head and economic Development in America. Guisan and Aguayo(2007) analyse education, health and poverty in Latin America. Lamelas (2004) analyses the evolution of structural female employment and higher education in Venezuela, 1975-2000.

In the Annex we include an English summary of many interesting articles on Latin America published by our Association in Spanish:

Aguayo and Lamelas (2003) analyse factors that explain years of life expectancy in MERCOSUR countries, 1970-2000. Berumen (2005), elaborates and analyses and index of quality of life in Guatemala (PQIL). Canudas (2001) presents an econometric study of the positive impact of education on industrial productivity in Mexico, 1960-93. Carton and Slim (2008) analyses regional convergence in Mexico.

Cartagena (2003) analyses education and intergenerational mobility in Colombia, 1929-1996, Cerno (2002) presents an econometric study relating education and life standards of families in the North East of Argentina. Fernandez and Fernandez, (2006) inquire about the systems of higher education in Latin America and the financial effort. Gimenez (2008) presents an analysis of development factors in Latin America through cluster analysis.

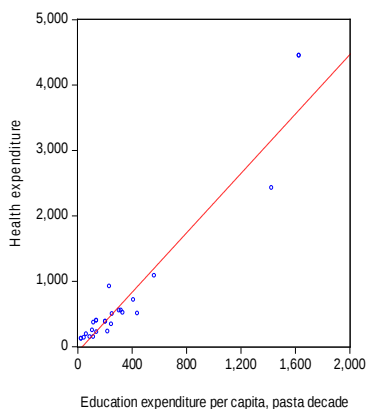
Guisan and Aguayo, (2002) analyse the evolution of education and development in Latin America for the 20th century and challenges for the 21st century. Lamelas (2007) presents and overview of education indicators of Brasil at national and regional level. Lamelas and Cancelo (2003) present an econometric analysis of the impact of education in the diminution of children mortality in the Andean Community Countries, for the period 1960-2000, Martin-Arnaiz(2007) analyses the relationship between education and competitiveness in Latin America, and Neira, Aguayo and

Exposito(2001) show the positive impact of human capital in Latin America for the period 1965-90.

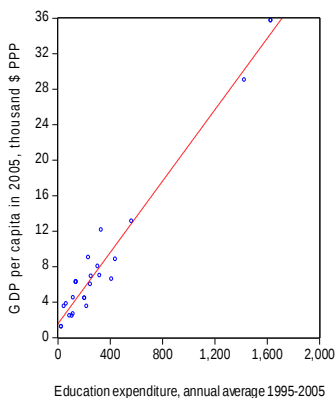
In spite of the already low level of expenditure per inhabitant in education in many Latin American countries, important advances for the period 1990-2008 have increased production per head and paved the way for future advancements in economic development and health welfare. Unfortunately a few countries, like Haiti, have not yet experienced a great advanced in the total years of average schooling of population and need urgently international cooperation in this regard, similarly to the poor countries of Africa and Asia

Graph 6 shows the positive impact of past education expenditure on current health expenditure per capita, and graph 7 the impact of past education expenditure on GDP per capita, in America.

Graph 6. Health and past Education expenditure: America



Graph 7. Development and past Education expenditure: America



The highest levels correspond to the United States and Canada, and we may notice that Latin American countries are already very far from reaching development levels of both countries. It is recommended an increase of support to education in Latin America, together with other factors, in order to foster convergence towards the high levels of the more developed countries.

3. Education, health and development in Africa and Asia

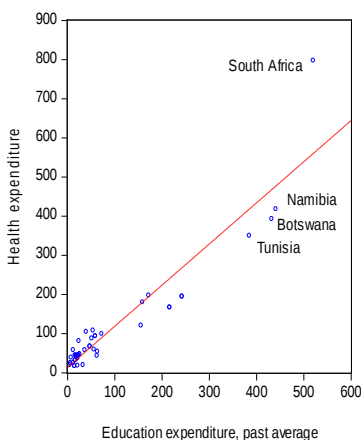
Some interested articles published in English are the following ones:

Amaghionyeodiwe and Osinubi (2007) inquire about Higher Levels of Schooling and Higher Returns To Education In Nigeria?, Jaunky, and Khadaroo 2009) analyse health care expenditure and GDP in Africa. Osakwe (2007) analyses primary commodity and manufacturing exports in Africa, 1992-2002 in relation with foreign aid, geography an education. Guisan and Exposito (2001 a) and (2002), analyse the evolution of education and development in African areas and countries for the last decades of the 20th century. Guisan and Exposito (2005) estimate some econometric models that relate education and development in Africa for 1950-2002.. Guisan, M.C. and Exposito (2009). present a cross-section econometric model of 39 countries in 2000-2005 to explain the positive impact of Education to foster development and health expenditure in Africa.

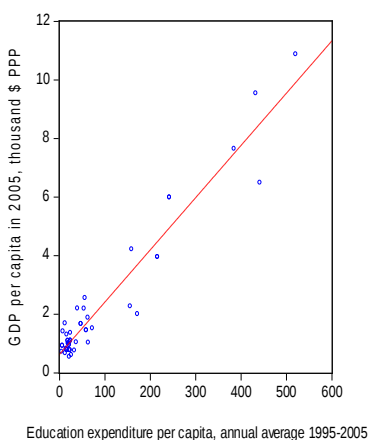
In the Annex we present a summary in English of some interesting article published in Spanish on Africa, including the following ones: Guisan, M.C. y Exposito (2001 b) and (2006).

Graphs 8 and 9 show, respectively, the positive impact of past education expenditure on current health expenditure per capita and GDP per capita in African countries.

Graph 8. Health and past Education expenditure: Africa



Graph 9. Development and past Education expenditure: Africa



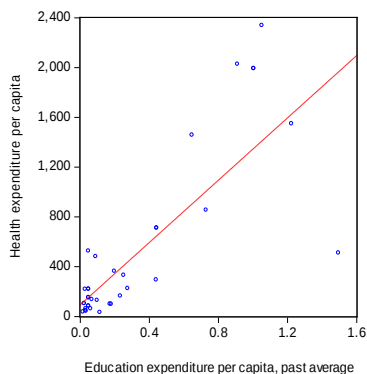
4. Asia and Pacific.

Some interesting studies published in English are the following ones. Guisan and Exposito (2003) on education and development of Asia-Pacific countries in 1980-99. Guisan (2004) estimates some econometric models of human Capital, trade and Development in India, China, Japan and other Asian Countries, 1960-2002. Mukherjee, (2006) analysis the positive impact of education and development on health in India with “A Note on Polio Count”.

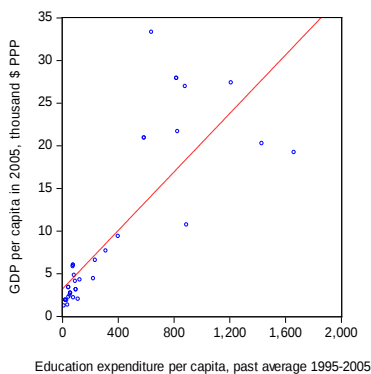
The Annex includes a summary in English of articles published in Spanish: Guisan and Exposito (2008) on Philippines and Guisan, Cancelo and Exposito (2007) on China, India.

Graph 8 shows the positive impact of past education expenditure on current health expenditure per capita, and graph 9 the impact of past education expenditure on GDP per capita, in Asia and Pacific.

Graph 6. Health and past Education expenditure: Asia



Graph 7. Development and past Education expenditure: Asia



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Annex on line at the journal Website: <http://www.usc.es/economet/rses.htm>

Annex (to be updated with summaries in English of cited articles published in other languages)

Correlations: Gross Domestic Product per capita and education

Table A1. GDP per capita (PPP) and Education in 132 countries, year 2000

Correlation	GDP per capita
Total years of Schooling of population over 15 year old	0.8318
Public education expenditure per capita, last years	0.9183

Note: TYR total years of schooling, based on Barro and Lee's data and some own estimations for some missing data. Public education expenditure is annual expenditure per capita for the previous decade (1990-1999) applying the percentage of GDP devoted to public education to GDP per capita in \$ at Purchasing Power Parities (PPP). Own elaboration from WB and other international sources.

Correlations: Years of Potential Life Lost and other variables

Table A2. Correlations of Potential years of life lost with Education, Expenditure and GDP per capita, OECD countries year 2005

	YPLLF	YPLLM
YPLLF	1.0000	0.8884
YPLLM	0.8884	1.0000
Education Expenditure per head	-0.3950	-0.6025
Health expenditure per head	-0.2980	-0.4880
GDP per head	-0.5321	-0.7183

Note: Data of tables 1 and 2 (excluding Luxembourg, given that GDP per capita in this case overvalues real income per capita, and Turkey due to missing data). Data of Education expenditure, Health expenditure and GDP per capita in \$ at Purchasing Power Parities (PPP). YPLL: years of potential life lost (f: female; m: male).

*Econometric models: cross-section sample
of 28 OECD countries in year 2005*

Variables:

YPLLF: Years of potential life lost per 100 thousand people of female population living less than 70 years.

YPLLM: Years of potential life lost per 100 thousand people of male population living less than 70 years.

HEALTHH: Health expenditure (public and private) per capita.

GDPH05PP: Gross Domestic product per capita (th \$ PPP)

Source of data: Tables 2 and 3, elaborated from OECD statistics and other international sources.

Note: Data of HEALTHH AND GDPH expressed in thousand dollars at Purchasing Power Parities (PPP).

Table A3. Health Expenditure per capita and GDP per capita

Dependent Variable: HEALTHH. Method: Least Squares. Observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPH05PP	0.094569	0.004049	23.35563	0.0000
R-squared	0.708817	Mean dependent var		2685.143
Adjusted R-squared	0.708817	S.D. dependent var		1202.129
S.E. of regression	648.6855	Akaike info criterion		15.82283
Sum squared resid	11361408	Schwarz criterion		15.87041
Log likelihood	-220.5197	Hannan-Quinn criter.		15.83738
Durbin-Watson stat	1.570519			

Table A4. YPLLF and Health Expenditure per capita (female)

Dependent Variable: YPLLF. Method: Least Squares. Observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
HEALTHH	-0.181806	0.114228	-1.591608	0.1236
C	3034.819	335.0506	9.057794	0.0000
R-squared	0.088781	Mean dependent var		2546.643
Adjusted R-squared	0.053734	S.D. dependent var		733.4989
S.E. of regression	713.5197	Akaike info criterion		16.04705
Sum squared resid	13236871	Schwarz criterion		16.14220
Log likelihood	-222.6587	Hannan-Quinn criter.		16.07614
F-statistic	2.533217	Durbin-Watson stat		1.535988
Prob(F-statistic)	0.123559			

Table A5. YPLLF and Health Expenditure per capita (male)

Dependent Variable: YPLLM. Method: Least Squares. Observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
HEALTHH	-0.673874	0.236391	-2.850670	0.0084
C	6708.198	693.3767	9.674680	0.0000
R-squared	0.238125	Mean dependent var		4898.750
Adjusted R-squared	0.208822	S.D. dependent var		1660.075
S.E. of regression	1476.607	Akaike info criterion		17.50163
Sum squared resid	56689567	Schwarz criterion		17.59679
Log likelihood	-243.0228	Hannan-Quinn criter.		17.53072
F-statistic	8.126318	Durbin-Watson stat		1.741784
Prob(F-statistic)	0.008430			

Table A6. Articles in Spanish. Journal EEDI.

2008. Desarrollo económico de Filipinas en 1950-2007: Análisis comparativo con otros países del Sur y Este de Asia, Guisán, M.C. and Expósito, P. Abstract
2008. <i>Aproximación a un indicador regional y nacional de los objetivos de Lisboa a partir de la medida de distancia P2</i> , Somarriba, N. y Pena, J.B. Abstract
2008. <i>Integración regional y Convergencia: Algunas Evidencias para las regiones mexicanas</i> , Carton, C. and Slim, S. Abstract
2008. <i>Una comparativa de factores de crecimiento en América Latina a través del análisis cluster</i> , Giménez, G. Abstract
2007. <i>Desarrollo económico de China, India y países limítrofes, 1990-2005</i> , Guisán, M.C., Cancelo, M.T. y Expósito, P. Abstract
<i>Capital humano y desarrollo económico mundial: Modelos econométricos y perspectivas</i> , Neira, I. Abstract
La conexión entre el capital humano y la competitividad en América Latina, Martín Arnaiz, J.L. Abstract
<i>Panorámica nacional y regional de indicadores educacionales en Brasil</i> , Lamelas, N. Abstract
2006. <i>Categorización de los sistemas de educación superior latinoamericanos: ¿importa el esfuerzo financiero?</i> , Fernández, Susana Fernández, Sara Abstract
2006. <i>Indicadores de producción científica en Economía, Ciencia y Tecnología: Análisis Comparativo de España, Unión Europea y Estados Unidos, 2001-2006</i> , Guisán, M.Carmen. y Cancelo, M.Teresa. Abstract
2006. <i>Desarrollo económico de África en 2000-2005: Educación, Gasto de Salud, Población y Renta</i> , Guisán, M.Carmen. y Expósito, Pilar Abstract
2005. <i>Construcción y análisis del Índice de Calidad de Vida en Guatemala (PQIL)</i> , por Berumen, Sergio A. Abstract
2004. <i>El sector comercial en la Europa ampliada, 1990-2000: un modelo econométrico</i> , por Vázquez, Emilia y Expósito, Pilar. Abstract

2003. <i>Educación y movilidad intergeneracional en Colombia, 1929-1996</i> , por Cartagena, Katherine Resumen
2003. <i>Factores determinantes de la esperanza de vida en los países del Mercosur, 1970-2000</i> , por Aguayo, Eva y Lamelas, Nélida Abstract
2003. <i>Análisis Económico de la Relación entre la Educación y la Mortalidad Infantil en la Comunidad Andina. 1960-2000</i> por Lamelas, Nélida y Cancelo, Mª Teresa Abstract
2002. <i>Vínculo entre Logro Educativo y Características de estándar de vida en los hogares del Noreste de Argentina: un enfoque econométrico cualitativo</i> por Cerno, Leonel Abstract
2002. <i>Capital Social: Concepto y Estudio Económico sobre el Capital Social en España</i> por Portela, Marta y Neira, Isabel Abstract
2002. <i>Educación y desarrollo económico de América Latina en el siglo veinte y perspectivas para el siglo veintiuno.</i> , Guisan M.C., Aguayo, E. Abstract
2001. <i>Educación, desarrollo y emigración en África. Nuevas políticas de cooperación europea e internacional</i> por Guisán, M.Carmen y Expósito, Pilar Abstract
2001. <i>Estudio econométrico de la influencia del capital humano en el crecimiento de la productividad industrial de México, 1960-93</i> por Canudas, Rocío Abstract
2001. <i>Capital humano y capital físico en la OCDE, su importancia en el crecimiento económico en el período 1965-95</i> por Guisán, M. Carmen y Neira, Isabel Abstract
2001. <i>Comparación internacional del gasto público en Sanidad y Educación de España con los países de la OCDE 1985-96</i> por Neira, Isabel e Iglesias, Ana Abstract
<i>Educación y crecimiento: una perspectiva mundial 1960-99</i> por Guisán, M.Carmen y Neira, Isabel Abstract
<i>El capital humano en América Latina en el período 1965-90 y su contribución al desarrollo económico</i> por Neira, Isabel, Aguayo, Eva y Expósito, Pilar Abstract

Table A7. Articles in Spanish, journal RSES

2004. <i>Competitividad de la oferta entre universidades regionales</i> , Fernández, S. y Ruza, E. Abstract (pp. 87-106)
2004. Educación e Investigación en las regiones españolas y portuguesas, Vieira, E. y Neira, I. Abstract (pp. 107-120)
2003. Rendimiento de las Inversiones Educativas y Diferencias de Ganancias en Andalucía por Gamero, Carlos, Marcenaro, Oscar D. y Navarro, M ^a Lucía Abstract

Table A8. Articles of RSES in Portuguese, French or Italian

2007. <i>Externalidades da Investigação Universitária Sobre a Produtividade Das Empresas Em Portugal</i> , Pereira O., Correia, I.M. Abstract
2006. Educação e produtividade na Euroregião Galiza- Norte de Portugal, 1995-2002. Vieira, E Moreira, María, C. Pereira, O. Abstract
2005. <i>A empresa e a formação profissional: uma aplicação aos têxteis portugueses</i> , Pereira, O. Abstract
2005 <i>Regioni e Territori nello Spazio Europeo della Ricerca</i> , Caruso, R., Palano, D. Abstract
2001, Vol.1-2. <i>Eicher Evolution et problemes de l'enseignement superiur en Europe</i> , por Jean-Claude Eicher Abstract

Sources of data: World Bank, OECD, Barro and Lee and the URLs:

http://en.wikipedia.org/wiki/Years_of_potential_life_lost

<http://stats.oecd.org/Index.aspx?DatasetCode=RFIN1>

Journal published by the EAAEDS: <http://www.usc.es/economet/eaah.htm>