

HUMAN CAPITAL AND
ECONOMIC GROWTH IN INDONESIA:
LONG RUN AND SHORT RUN ANALYSIS
FOR THE PERIOD OF 1970-2000

KURNIAWAN SAEFULLAH

Department of Economics
Kulliyah of Economics and Management Sciences
International Islamic University Malaysia

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**KURNIAWAN SAEFULLAH
G 9820699**

**Supervisor
DR LATIFAH MOHD. NOR**

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ABSTRACTS

This paper investigated long run relationship and short run dynamics between human capital and economic growth.

The Integration and Cointegration tests are used to indicate the long run relationship while OLS estimation is conducted to analyze the short run dynamics.

Using Indonesian data from 1970 to 2000, we found that education, government expenditure in education and health and economic growth have long run relationships. This result is confirmed in the short run analysis that education contributed positively to the economic growth in the fourth lag and government expenditure contributed positively to the economic growth in the second lag.

The results indicate that if Indonesia wants to enhance their economic growth performance in the next four years by using education factor, they should increase their school enrolment by this year. In addition, to stimulate the economy, the government should spend more on education and health this year if they want to enhance their economic performance in the next two years. In other words, the government should intensify human capital investment to stimulate the economy.

CHAPTER I

INTRODUCTION

How do we account for the persistence of poverty in the midst of plenty? If we knew the sources of plenty, why don't poor countries simply adopt policies that make for plenty? . . . We must create incentives for people to invest in more efficient technology, increase their skills, and organize efficient markets. Such incentives are embodied in institutions.
—Douglas C. North, 2000¹

1.1 Statement of The Issue

This paper attempts to investigate the human capital contribution to the economic growth, based on the Indonesian context. The above statement by Douglass C. North shows his support for stimulating the economy through human capital. The concept of human capital investment was first introduced by Theodore W. Schultz about four decades ago. Since then, it has been widely discussed by many researchers, such as Garry S. Becker, Jacob Mincer, Barro, Xavier-Sala-i-Martin, and Benhabib-Spiegel².

Traditionally, using The Solow growth model, labour was viewed as a form of productivity, which can only be increased by mixing it with greater capital, and at the same time, education was seen as a form of consumption. However, this

¹ *World Development Report*, 2002 edition, The World Bank, Washington DC, Oct. (2001).

² All the works can be seen in their articles follows: Schultz, Theodore.W. "Education and Economic Growth" in *Social Forces Influencing American Education* edited by N.B. Henry, Chicago: University of Chicago Press, 1961 ; Becker, Gary S. "Underinvestment in College Education", *American Economic Review* 50, (May 1960): 345-54 and His book titled *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*, New York: National Bureau of Economic Research, 1964. This book is already revised and published by University of Chicago on 1975 ; The pioneering of human capital research by Schultz, Becker and also Mincer is stated by Becker in his biography. See at <http://www.nobel.se/economics/laureates/1992/becker-autobio.html> ; See also Barro Robert J and Sala-i-Martin Xavier (1995) *Economic Growth*. New York: McGraw-Hill ; Benhabib J. and Spiegel M. M. "The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-country Data", *Journal of Monetary Economics*, 34, (1994):143-173.

view was criticized by Schultz and Becker who introduced the concept of Human Capital Investment. According to them, education should be seen as a form of productivity and, consequently, increases labour's productivity³.

The recent theory of economic growth has included the human capital factor into the economic growth measures. The Solow growth model which only includes labour and (physical) capital as factor inputs on the growth accounting has been criticized by some authors, who consider human capital also as an input factor. In this case, they formulated what is called an Augmented Solow Growth Model⁴. Referring to Kendrick (1976)⁵ estimation, Mankiw-Romer-and Weil (1992)⁶ noted that ignoring human capital would lead to incorrect conclusions on the process of economic growth.

With regard to the economic development, Smith (1992)⁷ compared economic performance of several countries based on their human capital factor. Using Human Development Index, GNP per capita, Adult Literacy Rate and Life Expectancy Rate, Smith argued that countries with good human capital development yields good economic performance. This comparison can be seen in the following table:

³ The focus of education as a human capital factor has been discussed thoroughly by Becker in his book titled *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*, New York: National Bureau of Economic Research, 1964, 1975(revised), University of Chicago Press.

⁴ This criticism, or comparative study, between Solow Growth Model and Augmented Solow Growth Model theoretically and empirically is discussed by Barro and Xavier-Sala-i Martin in their book of *Economic Growth*, 1995, McGraw-Hill and also Mankiw, Romer and Weil in their article titled "A Contribution to The Empirics of Economic Growth", *Quarterly Journal of Economics*, 107,(1990): 407-437.

⁵ Kendrick (1973) estimated that over half of the total U.S. capital stock in 1969 was human capital.

⁶ Mankiw, Romer and Weil "A Contribution to The Empirics of Economic Growth", *Quarterly Journal of Economics*, 107, (1992): 407-437.

⁷ Smith, Charles, *Economic Development, Growth and Welfare*, MacMillan Press Ltd, (1994): 18.

Table 1.1
The Human Development Index and Some Other Indicators,
Selected Countries, 1992

Country	HDI	GNP percapita	Rank of HDI*	Rank of GNP*	Adult Literacy Rate 1990 (%)	Average Annual Inflation Rate(%)	Life Expectancy at Birth 1990 (Years)
Japan	0.981	25,430	2	3	99.0	1.5	78.6
UK	0.962	16,100	10	21	99.0	5.8	75.7
Germany	0.955	22,320	12	10	99.0	2.7	75.2
Korea	0.871	5,400	34	39	96.3	5.1	70.1
Singapore	0.848	11,160	40	25	88.0	1.7	70.0
Sri Lanka	0.651	470	76	120	88.4	11.1	70.9
China	0.612	370	79	130	73.3	5.8	70.1
Uganda	0.192	220	133	141	48.3	107.0	52.0
Sierra Leone	0.062	240	159	145	20.7	56.1	42.0

* Out of 160 Countries

Note: Source: UNPD, Human Development Report, 1992, adjusted from Charles Smith(1994), Economic Development, Growth and Welfare, MacMillan.Ltd, 1994

In table 1.1, we see that by comparing the literacy rate and GNP per capita rank and HDI rank, the contribution of human capital to economic development is clear. For instance, out of 160 countries, Sierra Leone with only 20.7 % of literacy rate has only US \$ 240 GNP per capita, 145 GNP rank, 0.062 HDI score and 159 HDI rank. This differs from Japan, which has literacy rate of 99 %. At this percentage, Japan is third in GNP per capita rank with US \$ 25,430, 0.981 HDI score and second in HDI rank.

In addition, the contribution of human capital to the economic development can also be seen by comparing life expectancy rates. For instance, Uganda with 52

years of life expectancy achieves only US \$ 220 GNP per capita, while Germany with 75.7 years of life expectancy achieves US \$ 22,230 GNP per capita.

The above results show how human capital really matters in the economic growth processes. Many authors discuss the issue of human capital in relation with economic growth. However, in this paper, the researcher agrees with some of them who argued that using different human capital proxies in explaining the economic growth will end up with different conclusions.

Generally speaking, the conclusions can be human capital contributes either positively or negatively to economic growth. For instance, using literacy rate, Romer (1990)⁸ found that human capital contribution is positively significant. However, Benhabib and Spiegel (1994)⁹ argued that literacy rate does not represent a stock variable of human capital and creates problems in the empirical evidence. As an alternative, Benhabib and Spiegel (1994) suggested school enrolment as the best proxy for human capital. But again, the use of this proxy is still debatable. For instance, using school enrolment, Benhabib and Spiegel (1994) found that human capital is negatively correlated to economic growth, while Mankiw, Romer and Weil (1992)¹⁰ found it positively correlated¹¹.

The above investigations show that different proxies bring about different results. In another study, Norman Gemmill (1998)¹² states that most researchers

⁸ Romer, Paul.M, "Human Capital and Growth: Theory and Evidence", *Carnegie- Rochester Conference Series on Public Policy*, No. 32, (1990): 251-286.

⁹ Benhabib J and Spiegel M M "The Role of Human Capital in Economic Development: Evidence from aggregate cross-country data", *Journal of Monetary Economics*, 34, (1994): 143-173.

¹⁰ Mankiw, Romer and Weil (1992). Op.Cit.

¹¹ See also Johannes Hers who did study of the literature on Human Capital and Economic Growth on his article titled "Human Capital and Economic Growth: A Study of the Literature", *CPB Report No.2*, (1998) Can be obtained at www.cpb.nl/nl/cpbreport/1998_2/s2_5.pdf

¹² Gemmill, N, "Reviewing the New Growth Literature", *New Political Economy*, Vol 3 No.1, (1998): 129-134.

use education factor as a proxy for human capital. Recent growth theory accommodates human capital as one of the factors that contribute to economic growth. The theory has proposed a number of mechanisms that show education affects productivity levels, that is education is important for successful research activities (e.g. by producing scientists and engineers) which are, in turn, important for productivity growth. Besides, education also creates human capital which directly affects knowledge accumulation and, in turn, productivity growth as well.

Recent Growth theories in which education generates human capital typically incorporate at least one of two crucial assumptions:

- (i) there are constant returns to all (physical and human) capital used in production (implying increasing returns to all factors including “raw” labour) ; and
- (ii) there are positive externalities to human capital in production.

The empirical evidences of these assumptions, however, are still debatable and thus researchers may end up with different conclusions. Responding to this, the previous studies argue that the difference is mainly influenced by the different proxy, data context and methodology used. Under the discussion of methodology, the above elaboration on different proxies for human capital, using a particular way of estimation which will be discussed extensively in the next chapters, may be considered to fall under the category of short run phenomena. While for that of long run phenomena, using another way of estimation, the following illustration on government expenditure may give readers an introduction to the issue.

Government expenditure may contribute to human capital accumulation and economic growth. Assumingly, if a government increases its spending on education, for instance, there will be more people having chances to enrol in school or increase their school level. If this happens, it will affect the quality of the people as well as the labour. At the end, it affects the productivity and economic growth. This priori understanding is confirmed by Landau (1997)¹³ who proposed the question that the more the government spends on education in the country, as a proxy of human capital, the better its economic growth will be. Surprisingly, Landau found that government expenditure on education has statistically insignificant in stimulating the economic growth.

However, the influence of education and government expenditure on economic growth may be realized after a long period of time. The output of whether education contributes positively or negatively to economic growth, for instance, cannot be evaluated within a number of days, weeks or months. Usually, people spend several years on education. Therefore, to evaluate how education (as a proxy of human capital) contributes to economic growth, it must be based on a yearly basis, not on the daily, weekly or monthly basis. It is for this reason that a particular way of estimation which captures not only the short run dynamics, but also the long run relationship between human capital and economic growth should be employed.

This paper attempts to investigate the long run and short run relationships between human capital and economic growth. The integration and co-integration

¹³ Landau, L Daniel, "Government Expenditure, Human Capital Creation and Economic Growth," *Journal of Public Budgeting, Accounting and Financial Management*, 93, (1997): 467-487.

methods provide the venue to examine the long run relationship between human capital and economic growth while the Ordinary Least Squares(OLS) estimation will examine the short run dynamics.

1.2. Objectives of the Study

The purpose of this study is to reexamine the relationship between human capital and economic growth by using the cointegration techniques and estimation methods. The main objectives of this research are:

1. To examine the impact of human capital on economic growth in Indonesia.
2. To examine the long run relationship and short run dynamics between human capital and economic growth in Indonesia.
3. To examine the composition of the explanatory variables which relates to economic growth in Indonesia.
4. To discuss the implications of human capital investment, government expenditure on education, and economic growth in Indonesia.

1.3. Significance of the study

This paper attempts to investigate the relationship between human capital and economic growth in Indonesia using the cointegration analysis.

The Cointegration analysis is becoming more important in time series analysis, since it indicates the possibility of integration and cointegration among the variables in the long-run relationship. It also avoids the possibility of spurious regression that can be observed if ordinary least squares (OLS) estimation method

is used¹⁴. Cointegration method is used whenever non stationary variables exist in OLS estimation¹⁵.

To date, research on human capital and economic growth in Indonesia that uses cointegration analysis has not been explored in which this study plans to undertake. From the results obtained in this study, various recommendations will be made to the government on human capital investment policies.

1.4. Limitations of the study

This study used school enrolment as the proxy for human capital factor and Gross Domestic Product as the proxy for economic growth. In addition, this study includes government expenditure on education and health to observe government policies in the human capital investment. Using different proxies may give different results in explaining the relationship between human capital and economic growth; therefore, the explanation of the results would be limited on the proxies used.

Since this research used Indonesian data , the results represent only Indonesia. Therefore, analyzing data from different countries may give different results, which is open to further research on these issues.

¹⁴ This terms will be more explained in the research methodology section.

¹⁵ See the article written by Mansor H Ibrahim, "Public and Private Capital Formation and Economic Growth in Malaysia, 1961-1995", *IJUM Journal of Economics and Management* 8, No.1, (2000): 21-40. In this article He mentioned the importance of using Cointegration technique on time series studies.

CHAPTER II

THEORETICAL BACKGROUND

2.1. Introduction

This chapter discusses the theoretical and empirical backgrounds of human capital and economic growth. It is divided into three sections. The first section discusses the background of Indonesia from which the data is taken. In the next section, the theoretical concept on the issue of human capital and economic growth are explored. Findings of past research on human capital and economic growth is discussed in the last section.

2.2. The Indonesian Economy

2.2.1. The History of the Indonesian Economy

The Republic of Indonesia is the world's largest archipelago. It is located in South East Asia and has a total of 13,667 islands of which approximately 6,000 are inhabited. Indonesia's territory extends over 5,000 kilometres from east to west and 1,750 kilometres from north to south. The total land area is about 1.9 million square kilometres.

Indonesia is known for its rich natural resources, such as oil, mining, timber and also agriculture. Resource-rich countries certainly give more policy options than resource-poor ones. Efficient use of resources would maximize the benefits that can be reaped and minimize the problems of misallocation of resources. In this situation, the government should decide which sectors should be the country's priority to invest and which sectors should not be taken into account.

During Soeharto's era, industrialization was main sector of the economy. Extensive capital-intensive industries and massive foreign investment took place during this period. As a result, the private sectors significantly replaced the state as the engine of growth.

The Indonesian economy during the 1980s and 1990s also put forward the importance of macroeconomic management coupled with a freer system of competition. However, less emphasis was given to the development of Indonesia's human resource or on the Human Capital Investment. As tabulated in table 2.1, we can see that among the ASEAN countries, Indonesia is still lagging behind on human capital investment.

Table 2.1
Ratio Government Expenditure on Total Expenditures

Country	Ratio Government Expenditure on Education / Total Population, 1980-1990-1995		
	1980	1990	1995
Indonesia	0.097	0.105	0.104
Malaysia	0.157	0.185	0.209
Singapore	0.074	0.199	0.188
Philippines	0.126	0.129	0.139

Source: Key Indicators of Developing Asian and Pasific Countries, Asian Development Bank, 1998. Note: The Currency based on each national currency.

The above table clearly shows that Indonesia paid less attention in investing on human capital while other ASEAN countries spent more on human capital. The figures reveal that Indonesia and Singapore spent lower on education in 1980 compared to the Philippines and Malaysia. In 1990, however, Singapore spent the highest on education than other ASEAN countries.

In many developing countries, even though education was found to contribute positively to the economic growth, a less amount of money was spent on education. Measuring in terms of education expenditure to total national expenditure, this percentage seems to be smaller for these countries, compared to those in developed countries.

Table 2.2
Estimated Public Expenditure on Education, 1980–1997

	US\$ (billions)					Percentage of GNP				
	1980	1985	1990	1995	1997	1980	1985	1990	1995	1997
WORLD TOTAL	567.6	606.7	1 004.6	1342.6	1386.8	4.9	4.8	4.7	4.7	4.8
More developed regions	407.8	444.4	818.5	1101.9	1098.4	5.1	4.9	5.0	5.0	5.1
of which:										
Northern America	155.1	221.6	330.2	406.8	452.8	5.2	5.0	5.4	5.3	5.4
Asia/Oceania	83.3	87.5	133.3	225.4	193.5	5.0	4.3	4.0	4.0	4.0
Europe	189.5	155.4	352.9	469.7	452.2	5.2	5.2	5.1	5.3	5.3
Countries in transition	81.3	82.3	49.8	36.5	45.5	6.4	6.3	4.3	4.6	4.8
Less developed regions	98.5	99.9	138.5	204.3	242.9	3.8	3.9	3.8	3.8	3.9
of which:										
Sub-Saharan Africa	16.2	11.7	15.2	19.0	22.7	5.0	4.5	4.6	5.1	5.1
Arab States	18.2	23.8	24.5	28.1	34.3	4.1	5.8	4.9	5.0	5.4
Latin America/Caribbean	33.7	27.9	44.5	78.5	92.8	3.9	4.0	4.0	4.5	4.8
Eastern Asia/Oceania	16.2	20.1	31.8	58.6	67.3	2.8	3.1	3.0	2.9	2.9
of which: China	7.6	7.7	9.1	15.6	20.7	2.5	2.5	2.3	2.3	2.3
Southern Asia	13.0	15.4	18.6	17.7	21.1	4.1	3.4	3.7	3.2	3.3
of which: India	5.2	7.4	11.9	11.3	12.9	3.0	3.5	3.9	3.3	3.3
Least developed countries	3.8	3.5	4.8	5.3	6.4	2.8	2.7	2.3	2.1	2.0

Source: World Education Outlook, UNESCO

In table 2.2, the percentage of expenditure on education of total GNP for developing countries for the years of 1980 to 1997 is 3.8% to 3.9 %, whereas in the developed countries the figure is 4.9% to 5.1 % of the total GNP. The amount spent

on education for developed countries is between US \$407.8 billion to US \$1,098.4 billion from 1980 to 1997, while developing countries spent only US \$ 98.5 billion to US \$ 242.9 billion.

There are many reasons why most of the developing countries, particularly Indonesia, spend less money on human capital. The reasons may be due to various factors that retard the investment of human capital, such as less job opportunities, government policies, quality of education, political instability, and other variables that requires further investigation.

In the next section we would like to discuss briefly how human capital or education in particular, plays an important role in the Indonesian economy.

2.2.2. The Indonesian Education and the Economy

Education in Indonesia is executed through the school system and out-of-school system, or through the formal and informal education system. The informal education system comprises education in family, courses, and other kinds of learning system. The school system in Indonesia generally comprises three levels of education: 1) pre-school and primary school, 2) secondary school, and 3) tertiary or higher level of education.

Most graduates of all the levels will enter the labour market. The labour force in Indonesia is defined as the subset of the population 10 years and older, which is economically active. People are economically active if they are working or are looking for work. People are working if they work for income or profit (or helped in same) at least one hour in a single day in the week, proceeding the

census enumeration date. Table 2.3 shows the positions of the graduates in the labour market.

Table 2.3
Distribution of Employment and Unemployment by Education Level

Level of Education	Employed Male	Employed Female	Total Employed	Unemployed Male	Unemployed Female	Total Unemployed
No School	15.05	33.54	21.71	2.53	4.67	3.14
>preliminary	34.84	33.64	34.50	13.83	9.75	11.72
Preliminary	30.65	22.16	27.59	14.31	15.86	19.23
Lower Second	8.69	4.13	7.05	17.44	13.12	15.06
Upper Second	9.26	5.67	7.97	49.17	51.92	47.60
Diploma	0.25	0.28	0.26	0.22	0.54	0.32
Academy and University	1.26	0.58	1.01	2.50	4.14	2.93
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Source: DR. Hananto Sigit, Central Bureau of Statistics, can be seen at Survey of Indonesia, Op.cit

Table 2.3 reports the employment pattern in the Indonesian labour market. The largest percentage of labour force who are unemployed are those with secondary school education (47.60 %), while the largest percentage of the labour force who are employed has primary school education (34.50 %), or no schooling (21.71%). Thus, this clearly tells us that Indonesia is still struggling in solving the unemployment problem, even though there are many people who have higher educational level.

The figures in table 2.3 also indicate that most of the graduates after obtaining higher levels of education do not benefit from education since they could not get a job. This may be the prime reason why earlier research found that education or human capital is insignificant in stimulating the economic growth in

Indonesia. There is an excess supply of labour to fill in limited job opportunities in the labour market. Therefore, the process of education contribution to the economic growth is disrupted. The disruption exists when the graduates cannot actively stimulate the economy through the production process, since they cannot afford the job market. Due to this limited job opportunities, the unemployed graduates have to wait for a longer period to be employed, and in turn, this affects the economic productivity.

2.3. An Overview of Human Capital and Economic Growth Theory

The period of 1960's and 1970's has shown that monetary and fiscal policies have played an important role in determining economic policies. These policies figured prominently in short-term business fluctuations, the issue which attracted most economists at that time. This emphasis reflected naturally focused on aggregate-demand management in a short-term context¹⁶.

As discussed by Barro, much attention were given on longer term issues in the late 1980's, specifically, the effects of government policies on the long-term rate of economic growth. Even though monetary and fiscal policies are important in determining the economic policy, but other policies are also important. Among the important policies are the nation's political, legal and economic institutions. The 2002 World Development Report of The World Bank reported the roles that should be played by the institutions¹⁷.

¹⁶ Barro, Robert.J, *Human Capital and Growth in Cross-Section Regressions*, Harvard University, (1998).

¹⁷ *World Development Report 2002*, The World Bank, Washington D.C. (2001).

It is important to focus on institutional approaches in the future. These institutions, according to Barro (1998)¹⁸, typically remain stable from year to year and, therefore, have little to do with the latest recession or boom. However, the long-lasting differences in these institutions across countries have proven empirically to be among the most important determinants of differences in rates of economic growth and investment.

The accumulation of human capital is an important part of the development process, and this accumulation is influenced in major ways by public programs for schooling and health. Also important are government policies that promote or discourage free markets, including regulations of labour and capital markets and interventions that affect the degree of international openness. Finally, the government's policy should include the amount and nature of public investment, especially in areas related to transportation and communication.

The recognition of long term economic growth is the central macroeconomic problem in the recent growth theories. The Augmented Growth Model introduced by Mankiw, Romer and Weil (1992)¹⁹ is one of the recent theories being discussed by many researchers. The model itself is an adjusted version of the Solow Growth Model. The main difference between the Solow Growth Model and the augmented one is in the incorporation of human capital factors into the model.

¹⁸ Barro, J. R (1998), Op.Cit.

¹⁹ Mankiw N G, Romer D, and Weil D N, "A Contribution to The Empirics of Economic Growth", *Quarterly Journal of Economics*, 107, (1992): 407-437.

In addition, Gemmel (1998)²⁰ stated that Human Capital is typically introduced in new growth theories either by:

- (a) Incorporation of educated labour or human capital as a factor input, or
- (b) Explaining the process of knowledge (education) accumulation. It can be done by relating it to human capital accumulation either directly or via research and development (R&D) activity.

Incorporating human capital as a factor input in the Solow Growth model is known as augmented Solow model, pioneered by Mankiw, Romer and Weil (1992)²¹, Lucas (1988)²² and Romer (1986)²³. The models that have been used by them can be categorized into three:

- a. Sources of Growth equation model
- b. An Augmented Solow Model
- c. Endogenous growth models in which an education sector produces human capital for use in the production sector.

As the earlier chapters mentioned, the differences of using the model reflects the differences in the methodology that the earlier researchers used. In fact, they came up with different conclusions.

²⁰ Gemmell, N, "Reviewing the New Growth Literature", *New Political Economy*, Vol 3 No.1, (1998): 129-134.

²¹ Mankiw N. G, Romer D, and Weil D N, "A Contribution to The Empirics of Economic Growth", *Quarterly Journal of Economics*, 107, (1992): 407-437.

²² Lucas R E, "On The Mechanics of Economic Development", *Journal of Monetary Economics*, 22, (1988): 3-42.

²³ Romer P M, "Increasing Returns and Long-run Growth", *Journal of Political Economy*, 94, (1986): 1002-1037.

2.4. Empirical Evidence on Human Capital and Economic Growth

This section discusses the empirical evidence on the topic of Human Capital and Economic Growth. Generally, the empirical results are still unclear or may be mixed. Different sets of data and methodology yield different results and conclusions. This section briefly analyzes the situation

The contribution of human capital on economic growth to the economy is very clear as shown earlier (Table 1.1). Table 2.4 that follows gives more evidence on the contribution of human capital to the economic growth in developed countries.

Table 2.4
Contribution of Human Capital to Production Growth, 1913-1984

	1913-1950	1950-1973	1973-1984	1960-1989 ^a
	<i>percentage of total growth</i>			
US	14.8	10.9	23.4	18.5
UK	25.5	6.6	30.2	11.4
Japan	27.0	5.5	11.7	11.4
Germany	19.0	3.3	5.9	8.9
France	33.9	7.1	27.5	14.5
Netherlands	11.0	9.2	34.6	28 ^b

^a Sources: 1913-1984: calculations based on Maddison (1987) by Paape and Webbink (1997) 1960-1989: Dougherty and Jorgenson (1996) 1973-1994: calculations by Johannes Hers based on van Ark and de Jong (1996)

^b see at his article²⁴ for further investigation

The highest contribution of human capital on the economic growth can be observed in Netherlands, in which human capital contributes 28% of the total growth. This is followed by the USA (18.5 %), France, UK, Japan and Germany. The positive sign indicates that human capital contributes positively to economic growth.

²⁴ Hers, Johannes, "Human Capital and Economic Growth: A Survey of the Literature", *CPB Report no 2*, (1998), can be obtained at http://www.cpb.n.nl/cpbreport/1998_2/s2_5.pdf