

1.0 Introduction

It has been heavily debated by many economists that education will only raise the levels of output per worker in the short run, but in the long run, will have little to no effect on the growth levels of that economy. This paper will examine random variables related to education, the amount of GDP invested in education, the labor force with certain levels of education attained and the amount of unemployed with certain levels of education attained. From this will be derived a regression analysis on how these variables affect the level of GDP per capita currently recorded from the year 2008. A total of 30 countries have been chosen at random including both developed and developing countries in order to figure out how these different economies respond to education levels through its GDP per capita. Using the World Development Indicators database, nine random variables were chosen as well as the average years of education for each country most current in 2008 in order to derive a regression equation that will indicate which variables have the greatest effect on GDP per capita, as well as which variables have a negative effect on GDP per capita. This paper specifically looks at data from the Twenty-First century as a means to better the immediate future of the economies of the selected countries. Data has been collected from the years of 1999 to 2005 to be analyzed as a time series affecting the current GDP per capita recorded from 2008.

One of the strongest educational systems in the world can be found in the United States where they lead the world in average years of education with twelve years. What this means is the average adult over the age of fifteen has completed both primary and secondary levels of education, earning their high school diploma. The use of colleges and universities is also crucial in developing strong skills that can be later used in the labor force, making each student have a

concentration in a specific subject or even two subjects when entering the job market. In the case for the United States, advancements in education are crucial in order to obtain a skilled job however there are variances among other countries that value education not quite as much. Sometimes the most effective way for a student to have a positive impact on the level of GDP per capita is to complete a basic level of education and then enter the labor force immediately. The average years of education among will help to determine among these countries whom value education the highest and whom value immediate entry into the job market. As cases before have shown, key determinants of economic growth in the long run do not rely on education as it is only a short term means to increase the levels of income for that country. A key working paper that will be referenced throughout this paper is titled, "Literacy and Growth," written by Serge Colombe and Jean-Francois Tremblay.

The rest of the paper is organized as follows: Section 2 gives trends in both education and growth over the years. Section 3 gives a brief literature review. Data and estimation methodology are discussed in section 4. Finally, section 5 presents and discusses the empirical results. This is followed by a conclusion in section 6.

2.0 Trends in Education and Growth

Education has been becoming more of a concern as every new day passes. As a child growing up in the United States, education is greatly stressed as the key to the future and the path that will help to develop careers later in life. In fact, education has become such an important tool of the individual that it is no longer acceptable in highly developed countries like the United States to merely obtain a high school diploma. With technology advancing to more and more intricacies, it is becoming almost a requirement for students to go on to a tertiary level of

education to become masters of a certain area of study. However, this is not consistent across every country of the world, but it is becoming more and more evident that overall, education is being treated more seriously and a tool that could lead to lessening the gap between developed and developing countries.

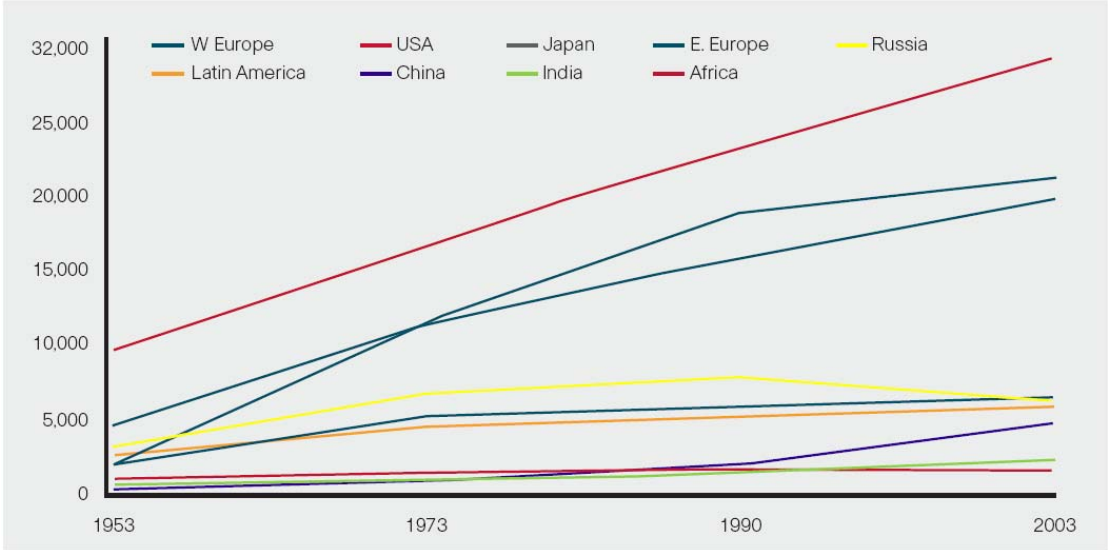


Figure 1: Growth of per Capita GDP: the World and Major Regions, 1950–2003. Level in 1990 International PPP \$
 Source: This chart is based on data from: Angus Maddison, Chapter 7, Table 7-3, Contours of the World Economy, 1-2030 AD, Oxford University Press, 2007, forthcoming. www.ggdc.net/Maddison

This graph represents the growth of per capita GDP for nine major regions of the world over a fifty year period. With the exceptions of Russia and Africa, every region of the world has shown a long term growth in its GDP per capita.

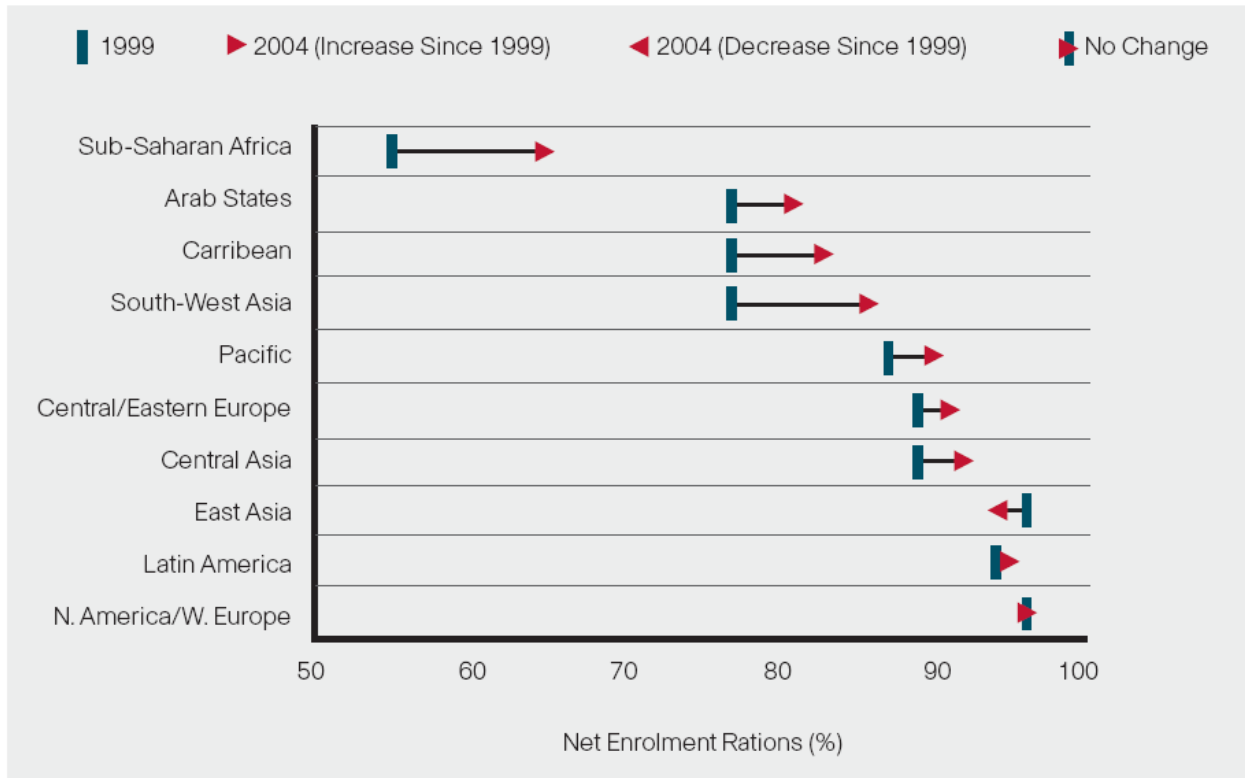


Figure 2: Net Enrolment in Primary Education Worldwide 1999 to 2004

Sources: Education for All, UNESCO, 2007, p. 1.

Education in general is being understood as an important role in developing human capital and as shown above, the net enrollment in almost every region in primary education has seen an increase in numbers. There has been either little or no change in the US and Western Europe as they have been at the highest percentage of enrolment for many years but an encouraging image is the other regions of the world that are increasing their percentages of enrolment. It is becoming ever more important with more and more technological advancements that these other regions of the world become better educated simply in order to understand what these new technologies accomplish as well as bringing some form of contribution to these advancements in technology within their own regions.

	1999	2000	2001	2002	2003	2004
Not in Primary School	110,244	107,852	105,307	107,395	101,038	91,032
Not in School	98,172	94,787	92,379	93,824	86,828	76,841

Table 1: Estimated Numbers of Children Out of School 1999–2004 (thousands)
Source: UNESCO, Education for All, 2007, p. 28

The table above represents the entire world of children who are not a part of the educational system for each year between 1999 and 2004. It has been reported that data from 2007 has shown that there are around 77 million children that are not enrolled in schools, varying little from the number shown for 2004. It also gives the numbers of children who are not in some form of primary school either. Although these numbers are high, the trend since the turn of the new millennium gives hope for the futures of the worlds’ economy. There has been a steady decline in the numbers reported showing that education is being identified as an important indicator for economic development across the entire world.

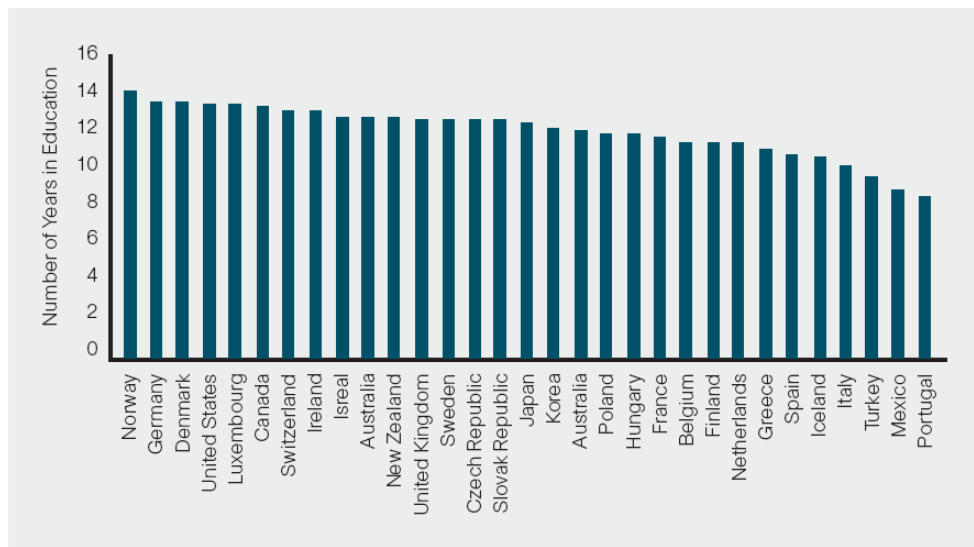


Figure 3: Educational attainment of the adult population: average number of years in the educational system for the OECD countries 2004.
1. Year of reference 2003.
Countries are ranked in descending order of average number of years in the education system of 25-to-64 year-olds.

The above graph depicts the educational attainment of the adult population. It is taken from the year 2004 and includes all of the adult population with the average number of years those adults had spent in the educational system. Apart from what this paper has used as average number of years currently found for the countries used, we can see that the levels of education are actually a little bit higher than what was found. What this can tell a researcher is that it is including every level of education, for example the extra years spent in a college or university, or that for those other countries, either pre-school education is included in the statistics or that those countries have longer minimal requirements for children in the educational systems, reflected in the numbers for the entire adult population. The data that was found and used in this paper however has the United States ranked as the leader in average years spent receiving an education, which is 12; expressing that on average the entire population has received at least a high school diploma.

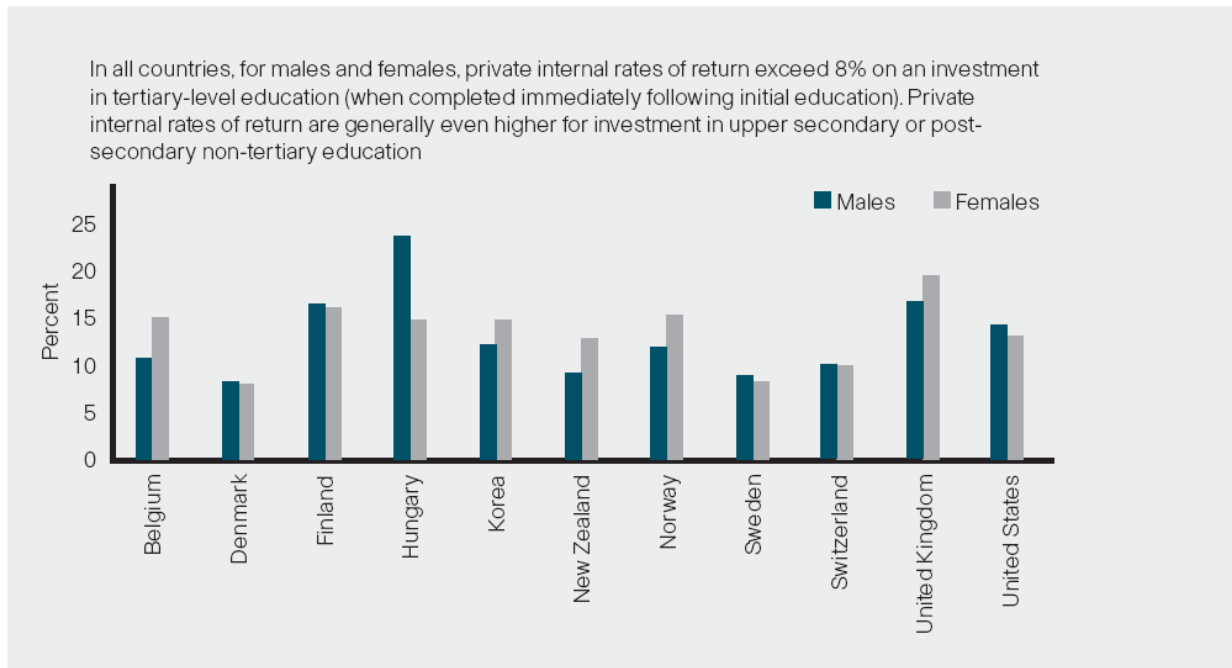


Figure 7: Private internal rates of return for university level achievement in OECD countries
 Source: OECD, Table A9.6. See Annex 3 for Notes (www.oecd.org/edu/eag2006).

What the above graph represents is the return that the populations of countries have from the advancement of their education into tertiary levels of education, or the advancement into a college or university. It is also broken down to specifically show the return that both males and females of the selected countries experience as a result of this investment.

3.0 Literature Review

In the paper, *Literacy and Growth*, Coulombe and Tremblay use a time series from 1960-1995 measuring the literacy levels of the labor markets. It uses 14 OECD countries and considers literacy levels as an investment in education. The measure of human capital based on literacy scores tells us more for the relative growth of countries rather than using years of schooling. Overall, literacy scores have significant, positive effects on growth paths and long run levels of GDP per capita and labor productivity. One more year of schooling increase aggregate labor productivity by about 7%. Investment in human capital for women is actually more important than that for men. In turn, increasing the average tests scores becomes a more accurate measure of human capital than schooling data would because it is more comparable across countries. However at the same time it could be distorted by migration and the depreciation of human capital over time. One should be cautious about an open economy as convergence of human capital is the driving force behind the convergence of GDP per capita during the economy's transition to the steady state. Imbalances of human and physical capital could also result. In the future, other analysis could include comparisons of the performance of human capital based on literacy tests with those based on schooling data for growth in sub-national economies.

Relationship between Education and GDP Growth: a multivariate causality analysis for Bangladesh written by Islam, Wadud and Islam uses a multivariate causality analysis on the relationship between education and growth, specifically for Bangladesh. This paper also includes both capital and labor as variables which also shows bidirectional causality between education and growth. This bidirectional causality can be defined in three categories including income driving education to grow, education causing income to grow or both education and income causing each other to grow simultaneously. It was originally thought that it would be one or the other and never determined that it could be possible to occur simultaneously in fact. In order to determine the trend, one should use an income equation and an education equation that are both statistically significant at the 1% level. As a result of the paper's finding, if the analysis is confined to 1984-2003, then there is actually no evidence of a long term relationship between education and growth specifically for Bangladesh.

Philip Stevens and Martin Weale's paper, *Education and Economic Growth*, provides data from the early 20th century that is more representative of thoughts today about the relationship between education and economic growth. It analyzes the role of education in facilitating the use of best-practice technology. Overall, the living standards have risen greatly since the 1800's and can be linked to the advancement of education. Education is needed for people to benefit from scientific advancements as well as being able to provide contribution to that advancement. Levels of income do in fact depend on the levels of education and education should be looked at as an investment decision into human capital. In the end, there is no conclusive evidence that returns to education will vary more than 6%-12% based on previous studies. There is evidence however that education is needed as a means to make good use of available technology respecting that returns to education diminish with levels of development.

Reil Miller's article, *Education and Economic Growth: From the 19th to the 20th Century* says that overall, schooling is necessary for industrial development. Schooling from the 19th century generates cognitive, behavioral and social knowledge which in turn causes organization. Schooling is necessary but it is not the driving factor behind industrial development however individuals and societies clearly gain from investments made into schooling. The specific form of education system is an indispensable component of an industrial growth society. Making investments in all elements of the schooling system and making people attend those schools is necessary but not a sufficient condition for expanding the GDP. The participation in education has steadily increased in 2007, however there are still 1 in 5 adults in the world's population that do not have minimum literacy skills as well as 77 million children who are not enrolled in the schooling system. It has been proven that each additional year of schooling will raise the income of that individual about 10% here in the United States. In an OECD area, the long term effects of one more year of schooling on the output is between 3% and 6%. Future predictions make it possible for the relationship between what people know and the wealth of a society to become stronger and clearer in the near future.

4.0 DATA and Empirical Methodology

4.1 Definition of Variables

The basic model used in this model uses GDP per capita as the dependant variable and bases findings from the literature review to determine other possible influential variables that will have a direct return on that GDP per capita. The model chosen is as follows:

$$\begin{aligned} \text{GDP (PPP)} = & \beta_1 + \beta_2(\text{AVGED}) + \beta_3(\text{LIT}) + \beta_4(\text{LFPRI}) + \beta_5(\text{LFSEC}) + \beta_6(\text{LFTER}) + \\ & \beta_7(\text{PUB}) + \beta_8(\text{UNPRI}) + \beta_9(\text{UNSEC}) + \beta_{10}(\text{UNTER}) + \beta_{11}(\text{EXPPRI}) + \beta_{12}(\text{EXPSEC}) \\ & + \beta_{13}(\text{EXPTER}) + \varepsilon \end{aligned}$$

GDP (PPP) is the GDP per capita for the year 2008 and all variables are part of a time series of data collected from the year 1999-2005 from 30 various countries around the world.

Independent variables consist of twelve variables obtained from various sources. Appendix A provides the data source, acronyms and descriptions of selected variables. First, AVGED represents average years of education received for selected countries. Second, LIT represents literacy rate as a percent of total population. Third, LFPRI represents % of the total labor force with a primary education. Fourth, LFSEC represents % of the total labor force with a secondary education. Fifth, LFTER represents % of the total labor force with a tertiary education. Sixth, PUB represents public spending on education as a total (% of GDP). Seventh, UNPRI represents the unemployed with primary education (% of total unemployment). Eighth, UNSEC represents the unemployed with secondary education (% of total unemployment). Ninth, UNTER represents the unemployed with tertiary education (% of total unemployment). Tenth, EXPPRI represents the expenditure per student for primary education (% of GDP per capita). Eleventh, EXPSEC represents the expenditure per student for secondary education (% of GDP per capita). Lastly, EXPTER represents the expenditure per student for tertiary education (% of GDP per capita).

4.2 Data

This study uses results collected yearly from the period of 1999 to 2005 for thirty different countries around the world. Data was primarily obtained from the WDI Online database as well as a few other worldwide data sources. Summary statistics for the data are provided in Table 1.

Table 1: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDP (PPP)	30	28653.33	12940.60	4400.00	55600.00
AVGED	30	8.73	1.96	4.90	12.00
LIT	30	96.44	4.63	82.40	99.70
LFPRI	30	29.83	16.23	3.43	69.17
LFSEC	30	41.26	15.44	12.50	73.43
LFTER	30	24.60	10.16	7.00	49.00
PUB	30	5.38	1.15	3.83	8.00
UNPRI	30	40.27	15.52	1.17	72.00
UNSEC	30	40.97	12.52	14.43	65.29
UNTER	30	15.99	9.56	2.80	44.57
EXPPRI	30	18.19	4.71	11.00	27.60
EXPSEC	30	22.68	6.18	10.20	36.00
EXPTER	30	35.57	12.49	14.50	67.00

5.0 Empirical Results

The primary objective of this particular study was to find out which specific variables related to education will have a positive return to the levels of GDP per capita. Initial tests showed many variables to be skewed or highly correlated and therefore many regressions had to be performed.

Table 2

	Coefficient	Std. Error	t-Statistic	Prob.
AVG_EDU	2962.459	1166.44	2.539744	0.0187
EXPSEC	1556.34	277.3267	5.611936	0
EXPTER	293.1553	140.0034	2.093916	0.048
LFTER	995.1515	340.9446	2.918807	0.008
PUB	-5670.973	1874.559	-3.025231	0.0062
UNSEC	-175.7432	133.6736	-1.314719	0.2021
UNTER	-631.0387	276.4473	-2.282673	0.0325
C	-19605.61	7032.182	-2.787983	0.0107

R-squared = 0.809161

Adjusted R-squared = 0.748439

The above regression proved to be the most statistically significant out of any test that was run and also reflected the highest R^2 value of 0.809161. In this test however, there was one statistically insignificant variable, UNSEC or unemployed with a secondary education. Every other variable was statistically significant at the 95% confidence interval.

Table 3

	Coefficient	Std. Error	t-Statistic	Prob.
LIT	1784.662	650.316	2.744301	0.0118
EXPPRI	-268.95	510.7842	-0.526543	0.6038
EXPSEC	499.861	459.5825	1.087642	0.2885
EXPTER	302.0047	167.5816	1.802136	0.0852
LFPRI	117.0582	163.4525	0.716161	0.4814
LFSEC	11.80037	164.8751	0.071572	0.9436
LFTER	480.4644	192.1392	2.500606	0.0203
C	-176446.4	61250.62	-2.880728	0.0087

R-squared = 0.760721

Adjusted R-squared = 0.684586

In the above regression, instead of using the average years of education, literacy rate was used. Also, every variable related to expenditure on grade level and the labor force level was used. Public expenditure on education was also omitted.

Another regression that was run used average education, as well as the public expenditure per student. Instead, this regression looked at the relationship that unemployment plays and at what levels of education those people are at. However, the regression proved to be statistically insignificant.

In order to fully test the insignificance, instead of using the average years of education, the literacy rate was used. Results are as follows:

Table 4

	Coefficient	Std. Error	t-Statistic	Prob.
LIT	2043.064	412.1833	4.956688	0
PUB	2550.001	1507.396	1.69166	0.1037
UNPRI	219.8154	156.4291	1.405208	0.1728
UNSEC	98.74788	184.0801	0.53644	0.5966
UNTER	336.964	189.4369	1.778766	0.0879
C	-200394.3	42710.79	-4.69189	0.0001

R-squared 0.686657

Adjusted R-squared 0.621377

In this regression, it is proven that the literacy rate is statistically significant when also considering the unemployed levels of education and the public expenditure on education.

6.0 Conclusion

This paper examines many different factors of education, including the levels of education received, the expenditures per student as well as for each level of education, and the measurement of unemployed with said levels of education as to how it affects the levels of GDP per capita. What is consistent across each regression is that in fact, the average years of education received by the population will most closely have a beneficial effect on the levels of GDP per capita.

What these regressions also show are tendencies to look more towards the future rather than the past. When considering unemployment, it didn't matter much of how much was being spent on education but rather simply, what the literacy rates were for the population. As holds true with the working papers discussed in the literature review, education must be looked at as an investment into the future and as time moves on, it is becoming more and more critical to obtain some level of tertiary education rather than just obtaining a basic level or even the completion of high school. Trends have proven that there is more awareness of the importance of education for long term development primarily because as the developed countries become more technologically advanced, in order for the developing countries to try and keep up they must teach their youths how to use that technology to their own economic benefit.

Appendix A:
Variable Description and Data Source

Economic Variable	Description	Source
GDP (PPP)	GDP per capita (2008)	The 2008 World Factbook
AVGED	Average years of education received	Nation Master Online
LIT	Literacy rate as a percent	United Nations Development Report
LFPRI	% of total labor force with primary education	WDI ONLINE
LFSEC	% of total labor force with secondary education	WDI ONLINE
LFTER	% of total labor force with tertiary education	WDI ONLINE
PUB	Public spending on education, total (% of GDP)	WDI ONLINE
UNPRI	Unemployed with primary education (% of total unemployment)	WDI ONLINE
UNSEC	Unemployed with secondary education (% of total unemployment)	WDI ONLINE
UNTER	Unemployed with tertiary education (% of total unemployment)	WDI ONLINE
EXPPRI	Expenditure per student for primary education (% of GDP per capita)	WDI ONLINE
EXPSEC	Expenditure per student for secondary education (% of GDP per capita)	WDI ONLINE
EXPTER	Expenditure per student for tertiary education (% of GDP per capita)	WDI ONLINE

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