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DOES INCREASING UNIVERSITY ENROLLMENT PROMOTE ECONOMIC GROWTH?

Gary LAI
The University of Hong Kong, Hong Kong
garylai2@hku.hk

Abstract:

There is no doubt that the demand for higher education is rising. This paper seeks to find out if a higher tertiary school enrollment lead to higher economic growth. The data that is collected and analyzed showed a very significant and positive relationship between the two in middle-income countries. This result can be applied to upper middle-income countries like China, Ecuador, and Russia as well as poorer, lower middle-income countries like Bangladesh, Bolivia, and India – all of which face unique development challenges related to higher education. Enrolling students in universities and vocational schools seems to lead to economic growth.

Key words: education, economic growth, tertiary school enrollment, upper middle-income countries, lower middle-income countries

JEL classification: I25, O10

1. INTRODUCTION

Tertiary school enrollment rate has increased from 14% in 1992 to 32% in 2012 in the world.[1] The reality of the phenomenon is different in different countries. In Saudia Arabia, for example, the very wealthy send their children to universities abroad. Those who keep their children at home send them to private universities, where facilities are better but where the curriculum and professors are not necessarily better than public universities. Women there, who do not enjoy the same rights as men, do not enter the work force at the same rate as men if they attend universities.[2]

Sierra Leone's universities, by comparison, are decrepitated. Its universities were closed for several months in 2014 and 2015 because of the Ebola outbreak. Students from rural regions were hard-hit by the outbreak, which stalled agricultural activities for a year. Though it used to attract students from all over Africa, the economic crisis of the 1980s led to cuts in public funding. Recently, the government signed $37 million loan with the Arab Bank for Economic Development in Africa to restore universities. The IMF recommended universities to become independent of public funding.[3]

In India, private universities vie for students with public ones. And the satellite campuses of foreign universities operating in India. They cater to the increase of 40 million Indian university students (a gross enrollment rate of 30%) by 2020 (Levin, 2010). There are currently 35,000 colleges and 700 universities in the country.[4]

Ecuador has planned to increase its tertiary school enrollment rate by creating more inclusive universities. From 2008 to 2014, the percentage of poor students increased from 11% to 25%. The government has shut down 14 under-performing universities, catering to 38,000 students, in 2012 and has set up four world-class institutions of higher education. Under President Rafael Correra, the country abolished tuition for universities, and the current administration increased its budget for universities from $335 million in 2008 to $1.7 billion in 2013.[5]

In China, the government forsees a higher enrollment rate. The number of universities increased from 1022 to 2263 from 1998 to 2008. There has been a 20% annual increase in the number of students entering college between 1998 and 2009. The country's gross enrollment rate was only 23% in 2010, compared to 58% in Japan and 82% in the US. Levin (2010) reported that

China's "current leaders are keenly aware of the importance of a well-educated labor force for economic development."

Inspired by universities around the world that have or will build 280 campuses outside their countries by 2020 – much of it South to South – there will be a new cohort of universities that integrate technology in an effort to increase tertiary school enrollment.[6] Brody (2007), seeing an analogy with American universities with satellite presence in many countries, predicts the development of global, electronically-linked "Global U's" that use technology to reach students so as to make higher education more accessible to citizens of low- and middle-income countries. For example, the Kepler program of the successful Generation Rwanda uses both in-person as well as online education to reach otherwise geographically far-flung Rwandans.

To understand tertiary school enrollment rate, one must understand how the World Bank defines it. In this study, due partially to the availability of data from the World Bank, gross tertiary school enrollment rates are used. Unlike net enrollment rate, gross enrollment rate "includes students of all ages," unrestricted by any official age group. They include students outside of the age group of, say, 18-24 for any reasons, which may include late or early enrollment or repetition of a program or year of study. So the gross tertiary school enrollment rate can technically be greater than 100% (World Bank, 2017a).

Tertiary school enrollment rate can also be a measure of the quantity of education. More specifically, the amount of schooling of a student. Similar measures of the quantity of education include average years of schooling, adult literacy rate, and education expenditure (Cooray, 2009).

More significantly, tertiary school enrollment rate can be used as a proxy for human capital in human capital theory. According to Barro (1991, 408) in his important paper on the link between human capital and income growth, human capital plays a "special role" in a number of models of endogenous economic growth, like in Romer (1990), Nelson and Phelps (1966), and Becker, Murphy, and Tamura (1990). Lucas (1988) wrote that the return on human capital increases over some range because of the spillover benefits from human capital.

School enrollment rate, as described by Baldacci, Clements, Gupta, and Cui (2008), is considered a good proxy for other measures of human capital, like years of schooling, by Woszmann (2003). Pritchett (2001) considered school enrollment rate – as used in Barro (1991) and Mankiw, Romer, and Weil (1992) – a bad proxy for years of schooling. Baldacci et al. (2008) said that it is consistent with the literature of human capital's effect on growth, like Bils and Klenow (2000) and Ranis and Ramirez (2000). I believe that it is consistent, too, and will use school enrollment rate at all three levels of education (responding to another criticism of Barro (1991) by Pritchett (2001)) in this study.

This paper builds on Barro (1991)'s study by adding tertiary school enrollment rate to primary and secondary school enrollment. Using the most recent data from WDI from a larger number of countries, I will conduct separate regressions for low-income, middle-income countries, and high-income countries. The analysis shows a very significant and positive relationship between the two in middle-income countries. This result can be applied to upper middle-income countries as well as poorer, lower middle-income countries – all of which face unique development challenges related to higher education. But enrolling students in universities and vocational schools seems to lead to economic growth.

2. BACKGROUND

Mankiw, Romer, and Weil (1992), in a seminal paper, extended the Solow production function to include education, as part of human capital. The augmented model takes the form

$$Y_t = A(t)*K_t^{\alpha_k}*H_t^{\alpha_k}*L_t^{\alpha_l} \quad (1)$$

which is familiar to most students of economics. The savings rate, population growth, and technological progress are exogenous. *Y* is output. *A* is the level of technology *K* is capital, *H* is the human capital stock, and L is labor.

There is a large literature on the effect of education, a human capital, on income and by extension economic growth. Levin (2010) claimed that tertiary education is a prerequisite for growth. On a theoretical level, Lucas (1988) and Romer (1986; 1990) modelled the link between human capital formation – of which higher education is a part of – and economic growth. Other than the seminal works of Barro (1991) and Mankiw, Romer, and Weil (1992), the research of Barro and Sala-i-Martin (1991) also found a positive link between human capital stocks and economic growth (Seebens and Wobst, 2005).

Tertiary education is also reported to increase labor force participation, which leads to growth. This is, however, at a lower rate for women in some countries.[7] And Richard (2006) suggested that economic growth is more pronounced in countries where professional colleges and universities are more prevalent.

There are more recent studies on tertiary school enrollment rate, unanimously revealing a positive effect on growth. Ruthson (1998) posed the question, "Does investment in education help growth?" Countries which have inefficient allocations gain little from investments in education have significantly lower elasticity of human capital growth in a growth decomposition regression and is insignificantly different from zero, compared to countries which have efficient allocations. If countries want to spur growth through investments in education, they cannot do so indiscriminately.

Keller (2006)'s study is similar to this paper's. Conducting cross-country panel regression on three levels of education for Asian countries, she found that the tertiary school enrollment rate, when regressed individually, is positive and highly significant (0.141).

Kyaw and MacDonald (2009) used an unbalanced panel dataset. Tertiary school enrollment is used to capture high-level technical – for example, advanced research qualifications – and managerial skills. The authors found that tertiary education affects growth positively and significantly in low-income, lower middle income and upper-middle income countries from 1985 to 2002. Benos and Zotou (2014) corroborated this result. Kyaw and Macdonald (2009) supported the view that there are aspects of education level that are better captured by tertiary education than secondary.

Lee and Kim (2009)'s paper found a positive and significant coefficient of 0.028 on tertiary school enrollment rate. Its results highlighted the importance of technology policies and tertiary education for upper-middle – especially those preparing to transition to a higher income level – and high income countries.

Tsai, Hung, and Harriott (2010) used data from 1996-2000 in 60 countries. The OLS model specification used in their estimation is:

$$\text{(2)} \qquad \log Y_{i,t} = \omega_0 + \omega_1 \log Y_{i,t-1} + \omega_2 \log Y_{i,1999} + \log X_{i,t-j} + \log Z_{,i,t} + \eta_i + \delta_i + v_{i,t}$$

where $\log Y_{i,t}$ is the log of GDP per capita in 2000 US dollars) in year t. $Y_{i,1999}$ is the initial log of GDP per capita in the year 1999 and used to control for convergence. $X_{i,t-j}$ is a set of education variable with a lag of j periods: secondary and tertiary enrollment rate, the percentage of tertiary graduates in agriculture human capital, high-tech human capital, the humanities human capital, business and service human capital, and health and welfare human capital. $Z_{,i,t}$ represents openness to trade and inflation rate. η_i represents country fixed effect, δ_i represents time fixed effect, and $v_{i,t}$ represents an idiosyncratic error term.

The coefficient for tertiary education in developing countries, lagged three years, is 0.0837, showing that it is positive. Using system-GMM estimations (the panel estimator obtained through first-differencing from the OLS equation), the authors found the coefficient for tertiary education in developing countries to be 0.0009 – also positive. In general, tertiary education is revealed to be important for both developed and developing countries.

Castelló-Climent and Mukhopadhyay (2013, 305)'s study found a large impact on the economy from a larger share of population completing tertiary education. In fact, a 1% increase in tertiary education is equivalent to a 13% decrease in illiteracy rate. This is based on a panel study of

16 Indian states from 1961 to 2001. The authors noted that "tertiary education may be crucial in shaping the economic performance of a country."

Okuneye and Adelowokan (2014) found that tertiary enrollment rate has a positive correlation with economic growth in Nigeria.

There is doubtlessly a connection between tertiary education and advances in science and technology. Romer (1986; 1990) argues that human capital drives growth through innovation. The best universities are responsible for the discoveries that make the world a "safer, richer, and a more interesting place."[8] For instance, China and India are explicitly striving to create universities that can accomplish scientific research because of the role they played in driving growth in the US, Japan, and western Europe. After all, in the absence of cheap labor in the future, Chinese and Indian economies need technology, innovation, and scientific research to sustain growth (Levin 2010).

In the empirical literature, Tiago (2007) showed that enrollment ratio of engineering, mathematics and computer science to total enrollment significantly influences economic growth. Kyaw and Macdonald (2009) used tertiary education to capture high-level technical skills and found a positive relationship with growth. Kanwar and Evenson (2009), in their investigation, even used tertiary enrollment rate as an instrumental variable (IV) for research and development as a proportion of GDP. They found that countries with high tertiary enrollment rates have good scientific and engineering infrastructure for basic and applied research. That infrastructure is necessary to produce the human input for research.

In education research, there is an unrelated theory of human capital that posits that universities expand in response to economic growth and technical progress to meet society's need for qualified personnel. The theory perceives a straightforward, market-based relationship between the demand for trained personnel and university expansion. Instead of predicting the effect of enrollment rate on economic growth, the proposition runs in the other direction (Windolf, 1992).

Windolf (1992, 6) observed that "university enrollment expands in times of economic growth and contracts in times of economic recession." Furthermore, university expansion is limited by the demand for trained personnel. This model follows an exogenous explanation; educational expansions result from forces outside of the economic system. That is, this theory's has implications on the model's endogeneity issues, which I will discuss later.

Microeconomic theory also has an implication on this model, which I will develop in this paper. Van Praag and van Stel (2013) cited Marshall (1890), Kaldor (1934), and Coase (1937) and the theory of the firm as the basis for their paper. By studying the optimal rate of business ownership, they wanted to understand the connection between business owners on a micro level and production on a macroeconomic level.

Their paper was divided into two parts. Using an extended Cobb-Douglas function, the authors estimated the optimal business ownership rate. Variables that they included were research and development, business ownership rate, and the gross tertiary school enrollment rate.

In the second part of their analysis, the authors found that the top business owners have superior levels of education. Business-owning positions also have higher returns to education than wage employment. Projecting to the macro level, the authors found a steeper relationship between business ownership rate and economic value creation. By implication, the higher the tertiary school enrollment rate, the higher return there is to human capital.

Finally, van Praag and van Stel (2013) observed that business owners with higher levels of human capital run larger firms. This leads to lower optimal business ownership rate. Therefore, higher tertiary school enrollment rates are associated with a steeper relationship between production outcomes and the business ownership rate – with lower levels of the optimal business ownership rate. In the context of this paper, this theory predicts that higher tertiary school enrollment rates should be associated with higher economic growth.

3. DATA

Lee and Lee (2016) described several measures of school enrollment rate. There are two widely used measures. The net enrollment rate or ratio is the "ratio of students in a designated age group, at a given level of schooling to the total population of that age group." With tertiary education, the age group would be 18-24 years old according to World Bank publications. The net enrollment rate does not count the students in universities who are younger or older than 18 and 24 years old, respectively.

The data available from World Bank's World Development Indicators (WDI) and UNESCO on university school enrollment are gross tertiary school enrollment rates. They consider the fact that different countries admit students into universities at different ages, as well as the fact that students take time off after high school and return to school for university at an older age – at a much higher rate than at the primary and secondary levels. The rate is calculated by dividing the number of all people enrolled in university, regardless of age, by the population of the age group corresponding to university studies (i.e., 18-24 years old).

The data used in this paper come from a variety of sources. All are accessible from the WDI. Per capita GDP and gross capital formation are collected by the OECD and the World Bank. UNESCO gathered data on the net primary school enrollment rate, net secondary school enrollment rate, gross tertiary school enrollment rate, and education expenditure – which is used to calculate government consumption along with military expenditure. Military expenditure data is collected by the Stockholm International Peace Research Institute (SIPRI), and the IMF has data on inflation rate (World Bank, 2017).

This model comes from the neoclassical growth model. An example of its derivation follows Mitra, Bang, and Biswas (2015) in the form:

$$\text{ecogro} = \alpha_1 + \beta_1\text{ecogrom1} + \beta_2\text{lcapgdpm1} + \beta_3\text{gcf} + \beta_4\text{govcon} + \beta_5\text{infl} + \varepsilon \quad (3)$$

where ecogro is the annual GDP growth rate; ecogrom1 is the annual GDP growth rate in the previous year; lcapgdpm1 is the log of the per capita GDP in the previous year; gcf is investment represented by gross capital formation; govcon is government spending (net military and education spending); infl is the inflation rate; ε is the error term.

To these OLS regressions, I added three education variables:

$$\text{ecogro} = \alpha_1 + \beta_1\text{ecogrom1} + \beta_2\text{lcapgdpm1} + \beta_3\text{gcf} + \beta_4\text{govcon} + \beta_5\text{infl} + \beta_6\text{netenrolprim} + \beta_7\text{netenrolsec} + \beta_8\text{grossenrolter} + \varepsilon \quad (4)$$

where netenrolprim is the net enrollment rate (primary); netenrolsec is the net enrollment rate (secondary); grossenrolter is the gross enrollment rate (tertiary).

The model is an extension of Barro (1991)'s study by adding tertiary school enrollment rate. It is similar to Keller (2006) in my inclusion of all three education levels. But this model uses different control variables and is regressed with the most recent data from WDI from a larger number of countries. As a result, there are many more observations in my study. I will also conduct separate regressions for low-income, middle-income countries, and high-income countries.

Compared to previously mentioned research, there are other stark differences. One is my choice not to include capital flow as an element of the model, like in Kyaw and Macdonald (2009). Another is my choice not to focus on the variable of science and technology. This study also does not incorporate microeconomic theory, like in van Praag and van Stel (2013).

Table 1 – Summary Statistics for All Countries (1960-2015) (Source: WDI 2017)

Variable	Obs	Mean	Std. Dev.	Min	Max
country	10,112				
ecogro	9,466	4.005984	6.145304	-62.07592	189.8299
ecogrom1	9,998	3.732608	6.01601	-51.03086	189.8299
lcapgdpm1	10,112	7.50359	1.670043	3.5658	12.1738
gcf	8,609	23.528	9.700525	-13.40517	219.0694
govcon	10,112	2.749772	3.509356	0	117.3877
Infl	7,920	19.78699	240.541	-35.83668	11749.64
netenrolprim	5,002	83.74964	17.47901	-2.477457	100
netenrolsec	3,212	63.14656	25.4793	1.39216	100
grossenrolter	5,995	22.43947	21.93789	0	119.7787

Table 2 – Summary Statistics for Low-Income Countries (1960-2015) (Source: WDI 2017)

Variable	Obs	Mean	Std. Dev.	Min	Max
Country	816				
ecogro	764	3.468691	6.22284	-50.24807	35.22408
ecogrom1	807	3.224563	6.049358	-50.24807	35.22408
lcapgdpm1	816	5.81618	0.7767224	3.624825	8.810127
gcf	776	16.99485	8.795019	-2.424358	60.15617
govcon	816	2.381543	4.256599	0	47.93159
infl	632	56.3403	971.8493	-35.83668	24411.03
netenrolprim	290	60.21111	20.29634	19.15098	99.86248
netenrolsec	102	24.78484	21.58964	2.48411	93.02904
grossenrolter	362	4.61698	9.22365	0	58.05497

Table 3 – Summary Statistics for Middle-Income Countries (1960-2015) (Source: WDI 2017)

Variable	Obs	Mean	Std. Dev.	Min	Max
Country	2,574				
ecogro	2,439	4.15159	6.948997	-44.9	149.973
ecogrom1	2,548	3.926798	6.878765	-44.9	149.973
lcapgdpm1	2,574	7.109317	1.086236	3.5658	10.27289
gcf	2,226	24.78234	13.81655	0.2986439	219.0694
govcon	2,574	2.45383	3.06898	0	17.38374
infl	2,038	30.85626	307.0332	-18.10863	11749.64

netenrolprim	1,066	83.68564	19.67473	-2.477457	99.86248
netenrolsec	587	57.21465	24.31714	5.70021	99.46545
grossenrolter	1,263	19.80115	19.52763	0	119.7787

Table 4 – Summary Statistics for High-Income Countries (1960-2015) (Source: WDI 2017)

Variable	Obs	Mean	Std. Dev.	Min	Max
Country	1,772				
ecogro	1,642	3.459875	4.417784	-19.82672	26.17025
ecogrom1	1,751	3.20355	4.374371	-19.82672	26.17025
lcapgdpm1	1,772	9.06243	1.271873	5.257634	11.46104
gcf	1,435	23.88136	6.471954	-13.40517	53.31139
govcon	1,772	3.185785	3.488562	0	22.64931
infl	1,383	7.932492	23.06383	-4.863278	504.7339
netenrolprim	731	93.84755	6.529706	42.79732	100
netenrolsec	595	81.42265	15.13931	17.35909	99.83368
grossenrolter	937	38.62363	24.9416	0	110.2631

In summary, there are 181 countries or economies (they will be referred to collectively as countries) whose data I used when all three education variables are regressed (Column 3 of Table 5 (table no. 5)) to 209 when only the gross tertiary school enrollment rate is regressed (Column 1 of Table 5 (table no. 5)). Table 1 (table no. 1) shows that the mean economic growth rate for all countries is 4.01%, based on a minimum observed value of -62.08%, a maximum value of 189.83%, and a standard deviation of 6.15%. The mean tertiary school enrollment rate is 22.44%. The values range from 0 to 119.78%, and the standard deviation is 21.94%.

31 countries are classified as low-income by the World Bank. 108 are middle-income (which includes both upper- and lower-middle income countries), and 79 countries are high-income (World Bank 2017b). Tables 2 (table no. 2), 3 (table no. 3), and 4 (table no. 4) show that low-, middle-, and high-income countries have mean economic growth rates of 3.47%, 4.15%, and 3.46%, respectively. Their mean tertiary school enrollment rates are 4.62%, 19.80%, and 38.62%, corroborating the view that low-income countries lag behind the rest of the world – compared to the world average and in group-by-group comparisons – in growth and participation rate in higher education.

4. RESULTS

Table 5 – Regression Results for All Income Groups (Source: WDI 2017)

	(1)	(2)	(3)
VARIABLES	**ecogro**	**ecogro**	**ecogro**
ecogrom1	0.203***	0.130**	0.164***

	(0.0459)	(0.0616)	(0.0526)
lcapgdpm1	-0.587***	-0.858***	-0.918**
	(0.164)	(0.258)	(0.369)
gcf	0.142***	0.176***	0.162***
	(0.0249)	(0.0323)	(0.0318)
govcon	-0.0159	-0.0758**	-0.0605*
	(0.0300)	(0.0305)	(0.0340)
infl	-0.00209**	-0.00163**	-0.00569**
	(0.000840)	(0.000656)	(0.00247)
netenrolprim		0.0104	0.0134
		(0.0213)	(0.0248)
netenrolsec		0.00994	0.00928
		(0.0198)	(0.0213)
grossenrolter	0.0103		0.00524
	(0.00904)		(0.0122)
Constant	4.198***	5.155***	5.472***
	(1.121)	(1.771)	(2.025)
Observations	5,077	2,646	2,359
R-squared	0.105	0.103	0.108
Number of country	209	191	181

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When the model is regressed with all countries' data and without primary and secondary school enrollment rates – as shown in Column 1 of Table 5 (table no. 5) – it produced a positive coefficient on gross tertiary school enrollment rate, although it is not significant. Column 2 presents the results when only the primary and secondary school variables are regressed. Two positive, though insignificant, coefficients are produced. Primary school enrollment rate's coefficient is larger at 0.0104. Secondary school enrollment rate's coefficient is smaller at 0.00994.

Table 6 – Regression Results for Low-, Middle-, and High-Income Countries (Source WDI 2017)

	Low-Income	**Middle-Income**	**High-Income**	**Low-Income**	**Middle-Income**	**High-Income**	**Low-Income**	**Middle-Income**	**High-Income**
	(1)				**(2)**			**(3)**	
VARIABLES	**ecogro**	**ecogro**	**ecogro**	**ecogro**	**ecogro**	**ecogro**	**ecogro**	**ecogro**	**ecogro**
ecogrom1	0.0505	0.249***	0.396***	-0.178	0.105	0.215***	-0.113	0.0607	0.181***
	(0.116)	(0.0671)	(0.0633)	(0.190)	(0.115)	(0.0531)	(0.194)	(0.152)	(0.0606)
lcapgdpm1	0.177	-1.676***	-1.261***	3.030	-1.601	-1.750***	12.03*	-1.947	-1.376*
	(0.707)	(0.357)	(0.412)	(3.479)	(1.005)	(0.567)	(6.331)	(1.443)	(0.780)
gcf	0.118***	0.171***	0.0560	0.187**	0.215***	0.148**	0.291***	0.228**	0.191*
	(0.0365)	(0.0502)	(0.0598)	(0.0647)	(0.0652)	(0.0571)	(0.0360)	(0.0844)	(0.0948)
govcon	-0.109	-0.131**	0.00224	-0.643**	-0.186**	-0.0516	-0.487*	-0.276**	-0.0548
	(0.118)	(0.0577)	(0.0475)	(0.296)	(0.0908)	(0.0703)	(0.268)	(0.116)	(0.0734)
infl	-0.0310**	-0.00523***	-0.0153***	-0.0610***	-0.00509*	-0.167***	-0.0113	-0.00515*	-0.221***
	(0.0129)	(0.00141)	(0.00268)	(0.00794)	(0.00300)	(0.0442)	(0.174)	(0.00295)	(0.0647)
netenrolprim				0.318***	-0.0435	-0.0688	0.0251	-0.0995	-0.0118
				(0.0728)	(0.0437)	(0.0527)	(0.223)	(0.0759)	(0.0635)
netenrolsec				-0.728***	0.0485	0.0218	-0.946*	0.0664	0.0163
				(0.232)	(0.0506)	(0.0371)	(0.492)	(0.0764)	(0.0457)
grossenrolter	0.00923	**0.0696*** **	0.0186				-0.0531	0.0124	-0.0124
	(0.249)	(0.0207)	(0.0142)				(0.358)	(0.0573)	(0.0236)
Constant	1.742	10.55***	11.69**	-15.30	13.16***	21.26***	-47.07	19.82***	12.63*
	(3.533)	(2.161)	(4.487)	(18.96)	(4.264)	(5.343)	(31.28)	(4.943)	(6.689)

Observations	295	981	850	60	431	475	42	307	423
R-squared	0.186	0.325	0.365	0.768	0.480	0.430	0.773	0.334	0.425

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Column 3, all three education variables' coefficients are positive but insignificant when they are regressed together. Primary school enrollment rate has a coefficient of 0.0134. Secondary school enrollment rate has a coefficient of 0.00928. Tertiary school enrollment rate has the smallest coefficient at 0.00524.

Table 6 (table no. 6) presents results for regressions performed on low-, middle-, and high-income countries separately. In the left column of Column 1, low-income countries yielded insignificant coefficients for tertiary school enrollment rate. When only the primary and secondary school enrollment rates are regressed, as in the left column of Column 2, the coefficients are very significant at 0.318 and -0.728 respectively. In the middle column of Column 1, when the tertiary school enrollment rate is regressed for middle-income countries, I found a positive and very significant coefficient of 0.0696. This supports the theory and empirical literature that tertiary enrollment has a positive effect on economic growth. But the coefficient of the variable is insignificant when regressed along with primary and secondary school enrollment rates, presented in Column 3. Likewise, when regressed with data from only high-income countries, all education variables are insignificant (right column of Column 3).

5. CONCLUSION

Mass higher education started in the US in the 19th century, then spread to Asia and elsewhere except sub-Saharan Africa in the 20th century and beyond. Lee and Kim (2009) observed that tertiary education and the closely related technology policies matter less for low-income countries – more so for high-income countries and those in transition from middle-income to high income. There is no doubt, however, that the demand for higher education is rising.

But does a higher tertiary school enrollment lead to higher economic growth? The data that I collected and analyzed showed a very significant and positive relationship between the two in middle-income countries. This supports the empirical results of Okuneye and Adelowokan (2014) in Nigeria, for example, and can be applied to upper middle-income countries like China, Ecuador, and Russia as well as poorer, lower middle-income countries like Bangladesh, Bolivia, and India – all of which face unique development challenges related to higher education. Enrolling students in universities and vocational schools, according to this study, will lead to economic growth.

But there may be an endogeneity problem. Windolf (1992) mentioned that in Italy, using spectral analysis, tertiary school enrollment rate is affected by economic growth. He reasoned that people go to universities during a recession and join the work force in an economic boom.

Other studies perpetuate this view of reverse causality and endogeneity. Owen (1999) assumed that per capita income has a causal effect on college enrollment rate in her model on trade openness. Ansell (2008) included GDP as a determinant of gross tertiary enrollment and found a negative and insignificant relationship. Furthermore, there can be omitted variables in this model, such as those other measures of quantity and quality of education mentioned by Hanushek and Wößmann (2007), that would affect the accuracy of the regressions.

Assuming that there is an endogeneity problem, one can propose an IV to study economic growth. Windolf (1992) mentioned a theory of competition for status in determining the size of education enrollment, maybe leading to an IV based on the status of education – like the sale of luxury goods. The author has also proposed a political theory, referring to other factors correlated to education enrollment that can be used as IV's (e.g., proportion of resources to invest in education, entrance requirements, proportion of women in universities).

In response to adherents of the belief that there is an endogeneity problem with this model, one can say that there is no strong empirical evidence to show causality from economic development to expansion of any level of education, nor was the expansion of higher education in the 1960s occurring at the same time as any large changes in occupational structures, job skill requirements, or labor market demands (Schofer and Meyer, 2005). Although this observation means that there is no need to respond to questions about using an IV in the regressions, Psacharopoulos and Patrinos (2004) replied that whether IV's are used or not, the regression coefficients are expected to be similar.

An extension of this study is to add regression covariates. One group of variables is science and technology (e.g., patent and trademark applications, research and development expenditure), considering how important and intertwined R&D is with university enrollment. Another group of variables is education (e.g., youth and adult literacy rates, cognitive test scores, student to teacher ratio), which should yield similar empirical results (e.g., the coefficient should be positive).

Another method of analyzing this paper's dataset is to group the countries into other categories. Regressions can be performed separately on lower and higher middle-income countries to determine for which group the coefficient is significant and positive. Separate regressions can also be performed on Middle Eastern and North African countries and South Asian Association of Regional Cooperation member states, to examine policy applications that will help meet the unique challenges of the regions.

ENDNOTES

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