

THE IMPACT OF ECONOMIC DEVELOPMENT ON TOTAL YEARS OF SCHOOLING

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Growth literature points out to the possibility that economic development influences in its turn human capital, including educational attainment. This paper has found evidence of a diminishing impact of gross national income per capita on total years of schooling, corroborated with a high partial effect of gross national income per capita on total years of schooling in the case of developing countries.

Introduction

Growth theory documents the important role of school attainment in economic development. A higher initial stock of human capital and thereby school attainment tends to generate higher economic growth primarily by facilitating the absorption of advanced technologies from leading countries and the creation of modern technologies locally. Another stream of economic research focuses on social return of schooling, pointing out externalities such as reduction in crime, welfare participation or more informed political decisions (Kodrzycki, 2002).

Of course, there are authors who point out some negative byproducts of education. For example Spence (1973) noted that education could be just a credential, which does not raise individuals' productivities. Other authors have pointed out that in some developing countries the incidence of unemployment might rise with education and, corroborated with a higher rate of return to physical capital than of human capital, could decrease total output (Krueger, Lindahl, 2001).

While negative byproducts of schooling might exist, it is generally accepted that education generates social net benefits. The very existence of positive externalities raises the possibility that governments might choose to simply "buy" more schooling for their citizens, investing more in education. Such a possibility is of course, nurtured by a prosperous economy. The present paper examines the possibility that economic development could raise schooling attainment, measured by total years of schooling⁷⁷.

The model

The determinants of total years of schooling

I have grouped the factors that affect education attainment into three categories. The first category includes factors related to economic development that serve the objective of a

⁷⁷ "Total years of schooling" is preferred as a measure of school attainment both as a left hand side variable (Barro (1997)) and as a right hand side variable (Tansel, 1998).

national education policy. A second category includes that accounts for traditions, customs and political conjecture. Finally, the third category accounts for the phenomenon of dying out of older generations.

Given the objective of this study, the main variable I want to control for is gross national income per capita (GNI). For more than a half century, education has been a strategic national policy all over the world. During the first period of the past half century, educational reform was driven heavily by political and economic competition between democratic and communist countries. In the US for example, education policy aimed in the first half of 20th century to rapidly develop the skills essential to national security and to ensure US economic supremacy in global competition. After the collapse of communism the focus of education reform in US shifted from achieving worldwide prowess to making progress on economic and social equality within the country (Kodrzycki, 2002). But the consistency of education policy depends on the development level of each country. Thereby a rich country can more easily afford to buy more education for its citizens. One way to do this is by the level of direct education expenditure. Public education expenditure per student, public education expenditure as percentage of gross national income or public education expenditure as percentage of total governmental expenditure could therefore influence total years of schooling. Not controlling for direct expenditure in education will lead to positive bias in our estimates, given that these expenditures are positively correlated with education attainment.

To account for development impact on education attainment it is not enough to control for direct expenditure in education. I have controlled explicitly for gross national income because there are more subtle ways a country might support education. It is well known that education is costly. Governments might choose to subsidize education. We can still see the effects of such an option in former communist countries.

In addition, there are also other factors that can serve the purpose of an ambitious education policy. Compulsory duration of education is one of them. Intuitively, more compulsory years of schooling implies an increased number of years of schooling.

Of prime importance is to account for different traditions, customs and political conjectures across countries. Gross national product per capita and gross national income per capita are considered the best measure of economic development available. However, they should be considered carefully when analyzing development across countries. Countries from the Middle East are known for their high level of gross national product per capita⁷⁸ due to heavy reserves of oil. At the same time they are known as highly conservative societies, with values and customs that are likely to influence the total number of years of schooling⁷⁹. The problem is that customs, tradition or the degree of political stability and democratic freedoms are difficult to measure. A possible solution to this problem is a proxy variable. Life expectancy at birth, infant mortality rate or age at first marriage could proxy for traditions and political conjecture. I have chosen infant mortality rate due to the higher variability of this variable across countries, which in turn will determine less variability in

⁷⁸ Kuwait' gross domestic product in 2000 was for example \$16,200 per capita. Considered alone, this value places Kuwait among the most industrialized countries.

⁷⁹ I mention here women position in the society, polygamy or legal age of marriage.

our estimates. Note however that infant mortality rate is a crude proxy for traditions & political conjecture⁸⁰.

As mentioned earlier, I have to account for the dying out of older generations. Populations all over the world have become far more schooled during the past three decades. However, much of the increase in schooling might be due to the dying of older population, with comparatively little education, rather than steadily growing educational attainment among younger generations. Kodrzycki (2002) has argued that US is confronting with this phenomenon. To account for the change of generation possibility I have used a lagged value of total years of schooling. Of course, using a lagged variable has also the advantage of controlling for other factors specific to each country.

Regression's results

I used an OLS cross section country analyzes. Using a pooled sample it would be problematic primarily because the lack of variability in x_{it} across time for some countries⁸¹. Data comes from World Bank database. Sample size is large enough so the Central Limit Theorem takes effect (3 out of 4 functional forms of the model use approximately 80 observations).

When I have regressed the total years of schooling on gross national income I obtained the results presented in Table 1.

Table 1. Basic regression's results

<i>Level –Level Form</i>			<i>LOG-LOG Form</i>		
<i>Variable</i>	<i>Coefficient</i>	<i>p-value</i>	<i>Variable</i>	<i>Coefficient</i>	<i>p-value</i>
C	5.00	0.00	C	0.13	0.56
GNI	0.00	0.00	LGNI	0.19	0.00

As Table 1 shows, coefficients on GNI and LGI are statistically significant. They also have the expected sign. RESET test shown no functional problems in the first case (the p-value on the overall F statistic is 0.000656). However, there are functional problem when using a quadratic term (p-value on the overall F statistic is 0.815189). The estimates are likely to be biased because of the omitted variable problem.

When to the basic model I controlled for direct expenditure in education, measured by public education expenditure per student, public education expenditure as percentage of gross national income or public education expenditure as percentage of total governmental

⁸⁰ Highly conservative societies are characterized also by political havoc. Africa, where different ethnicities dispute their supremacy by waging continuous war is a good example in this respect. Thereby we can choose one variable that can proxy for these unobserved factors. Infant mortality rate is correlated with any aspect of education attainment. Whether or not the average level of customs and political conjecture varies only with infant mortality rate is problematic.

⁸¹ For FE or FD method variability in explanatory variables across time is essential. Or in many countries, variables like mandatory years of schooling or infant mortality rate do not differs across time.

expenditure, I first noticed that although the coefficient on gross national income has remained statistically significant, its size has decreased as expected. The coefficients on the direct expenditure variable in education are jointly statistically significant at all conventional significance levels (the p-value on the F statistic is 0.0098). However, only expenditure per student is close to be statistically significant at 10% significance level ($p=0.1346$). There is more variation in expenditure per student than in the other two expenditure's variable, which might contribute to a more precise estimate of the coefficient on this variable.

Based on the previous analyzes of the determinants of years of schooling I still have to control for two factors: a lagged value of years of schooling and mandatory years of schooling. I choose a value of total years of schooling in 1985, considering that a 15 years period is appropriate to account for the dying out of older generations' problem.

Table 2: Main regression's results

Variable	I		II		III		IV	
	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
c	3.30	0.00	3.45	0.00	5.22	0.00	1.67	0.00
avgysc_85	0.26	0.02	0.31	0.00	0.37	0.00	0.06	0.00
gni	0.15	0.03	0.12	0.02	0.12	0.03	-	-
gni_sq	-0.004	0.01	-0.003	0.01	-0.003	0.03	-	-
mort_infant	-0.03	0.00	-0.03	0.00	-0.03	0.00	-	-
educomp	0.17	0.16	0.22	0.00	-	-	-	-
exp_stu	0.05	0.16	-	-	-	-	-	-
lgni	-	-	-	-	-	-	-0.15	0.04
linteract_c							0.05	0.00
lmort_infant	-	-	-	-	-	-	-0.27	0.00
leducomp	-	-	-	-	-	-	0.30	0.09
Sample size	57		80		83		80	
R-squared	0.72		0.79		0.78		0.73	
RESET TEST P-value on F statistic	0.05		0.13		0.02		0.00	

Table 2 shows the main results of the regression. The first 3 columns correspond to a level-level form of the model and the last one to a log-log form of the model. Only the functional form in column II it appears that suffers from functional problems. Before concentrating on the effect of development on total years of schooling, I will overview the effect on total years of schooling of the other variables.

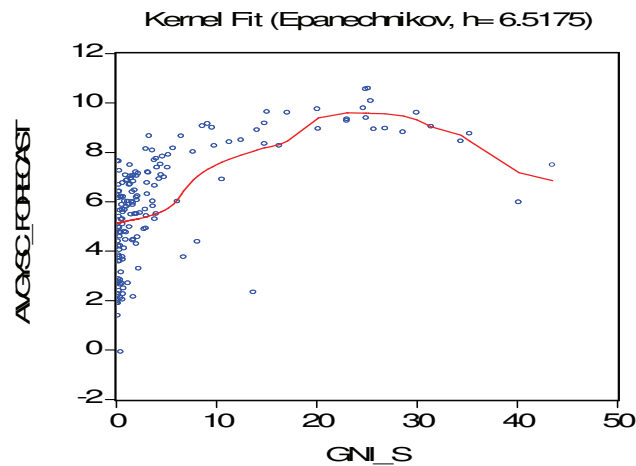
In column I of Table 2 the sample size is smaller due to the data availability on expenditure per student. This might contribute to a less precise estimate on expenditure per student

(EXP_STU), which is statistically insignificant at 10 % significance level. This was anticipated by previous results. A smaller sample size could impact also the precision of the estimated coefficient on mandatory years of schooling, which is therefore statistically insignificant at 10 % significance in column 1. However, it becomes statistically significant in the others functional forms of the model, where the sample size is larger because I have renounced to control for expenditure per student. Another possible cause of less precise estimates in column I is multicollinearity, which is generated primarily by correlation between gross national income and its squared term (correlation coefficient 0.947006). But we have high correlation also between total expenditure per student and expenditure in education as percentage of gross national income (correlation coefficient 0.726487).

Infant mortality rate is statistically significant and has the negative sign, as expected. Since the infant mortality rate is used as a proxy for traditions and political conjuncture, it makes sense that stiffening traditions or instability impacts negatively people's education. However, the effect of mortality rate on total years of education is much more complex and this is shown in column IV where an interaction term between gross national income and infant mortality rate in logarithmic forms is included. This will be discussed later. The lagged variable is also statistically very significant. In addition, its estimated coefficient is large. These accords with the findings of previous studies which have pointed out to the importance and magnitude of the dying out of older generation impact on total years of schooling of population (Kodrzycki, 2002).

As Table 2 shows, the effect of gross national income on total years of education is more complicated than expected. Figures 1 shows a suggestive picture of this effect.

Figure 1. The impact of gross national income per capita on total years of schooling



First of all, the coefficient on gross national income decreases when we control for more variables (from 0.41 in the basic model with quadratic to 0.11 in the second column of the Table 3). Second, as Figure 1 shows, gross national income per capita has a diminishing effect on total years of schooling. There is a turning point at a gross national income per capita of approximately \$18,730, after which an increase in gross national income per capita has a negative effect on total years of schooling. Even more interesting in the effect depicted in column IV, where I have introduced the interaction term between gross national income and infant mortality rate in logarithmic forms. When we plug in the mean value for

infant mortality rate, the effect is positive and surprisingly large: one percent increase in gross national income per capita is predicted to increase total years of schooling by 17.3%.

One could have expected a positive linear relationship between economic development and total years of schooling. However our results show a far more complex relation, which is nevertheless logical. We can easily provide explanations for the diminishing effects of gross national income on total years of schooling. First of all, as stressed out, for more than a half of century, education has become the subject of an intense national effort. Corroborated with the dying out phenomenon of older generation with comparatively lower education, it is likely that quantitative level of education in more developed countries has reached a saturation level – and thereby it is of no surprise that in this case increasing gross national income per capita has no positive effect on total years of schooling in developed countries. It is also likely that development has a more powerful effect on qualitative effects of schooling, as pointed out by the growth literature (Barro, 1997). Second, most developed countries are confronting with huge legal and illegal immigration. Thereby it might be the case that an increase in gross national income in the case of most developed countries could be associated with a decrease in total years of schooling⁸². The effect revealed by the interaction term is related with the diminishing effects of development on total years of schooling that I previously discussed. Since most developed countries might have reached a saturation level of total years of schooling, it follows logically that in less developed countries that have resources (due to oil business for example) and with comparatively less educated population, development impact positively and to a large extent total years of schooling, as mentioned earlier.

Conclusions

The present study has found evidence that economic development influences total years of schooling. This agrees with the conclusions of growth theories, which have first signaled this possibility. However, the relationship is complex. First of all there is evidence of a diminishing effect of gross national income per capita on total years of schooling. Second, there is evidence that the relationship differs across countries, depending on their development status. To summarize we can say that, except for immigrant population, data shows a kind of saturation of quantitative aspects of schooling in most developed countries. Thereby it is of no surprise that an increase in gross national income tends to impact total years of schooling to a greater extent in developing countries. Further research on this issue would concentrate on finding the best IV which would solve the problem of endogeneity.

References

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⁸² Of course, whether or not countries are successful in accounting for the educational attainment of immigrants is another problem.