Education and Sustainable Development: an Emphasis on Vietnam

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Abstract: This paper examines the impact of education on sustainable development—including productivity growth and reforestation—with a focus on the case of Vietnam. We employ the Vector Autoregressive model for panel data (Panel VAR) to examine any possible two-way causality between a pair of variables. The results suggest that education plays a more significant role on productivity in Vietnam compared to other countries in Asia. However, forest growth in Vietnam is slightly lower than in other Asian countries. Regarding reverse causality, we find that the effect of productivity growth on education is also lower in Vietnam than in different Asian countries. The reverse causality of forest growth on education is statistically insignificant for both groups.

Keywords: Education, productivity growth, Asian countries, Vietnam.

1. Introduction

Education has made significant contributions to economic development in Asia, particularly in terms of enhancing sustainability, including productivity growth and reforestation. In Vietnam, education was considered one of the most critical aspects of sustainable development before 1986. The government's encouragement among people nationwide resulted in a very high literacy rate in Vietnam during these years. Since the economic reform of 1986, education has received less attention due to people's focus on pursuing economic prosperity. Acutely aware of this problem, Vu (2011) writes: "Do not forget that the duty to fight against illiteracy is still essential."

There is limited literature on education, and papers on the interaction between education and sustainable development are even scarcer. Regarding the case of Vietnam, as early as 1945, Vu (1945) introduced and analyzed education methods around the world. He then recommends that education, in the form of continuing education, must go hand in hand with formal education. Vu (1946) explains why education in the form of common learning is crucial for a newly emerging economy like Vietnam.

Martin (2004) demonstrates that urban education programs have proliferated in many urban centers, encompassing new and previously unknown forms of learning opportunities. These programs comprise innovative partnership arrangements with previously unaffiliated organizations, targeting specialized groups of learners that can be found only in critical masses of urban areas. Various teaching methods are also introduced to meet the diverse learning and educational needs of urban learners.

The remaining literature for the world as a whole group focuses on education in general and productivity growth. Using OLS on two single-equation estimations for cross-sectional data from 81 to 93 countries, Bils and Klenow (2000) find that education has only a very weak effect on GDP per capita growth. Still, this GDP increase in turn has a positive impact on school enrollments. Vũ and Hammes (2007) employ a larger panel dataset and an advanced econometric method, three-stage least squares (3SLS). They find that the two-way causality is positive.

Nguyen (2005) provides a quick account of the current state of continuing education in Vietnam and the importance of strengthening it without collaboration on the causes and consequences of this reinforcement.

Concerning the Asian region, Ahme (2009) demonstrates a positive association between education and higher levels of knowledge and skills, which help reduce poverty in this region. However, he also points out that education suffers from negligence among Asian countries, resulting in enrollments that have fluctuated wildly over the past two decades. Hughes and Tso (1964) report that education is essential for business, commerce, and industrial development in Southeast Asia.

Recently, more attention has been given to the continuing education and elimination of illiteracy. Runckel (2011) provides a summary of education system in Vietnam in saying that under Vietnamese government decree 322008-ND-CP, the Ministry of Education and Training (MOET) has responsibility for all education and training at the national level, including adult education, which might be understood as being conducted through continuing education programs. Phạm (2011) notes that 2011 marked the first time Vietnam participated in International Literacy Day, emphasizing that literacy has a strong contribution to economic growth. None of the papers on Vietnam provides a

quantitative analysis of the effect of education on productivity growth.

Leal Filho et al. (2018) show that transformative initiatives on education for sustainability can be implemented across contexts. They also find that although transformative approaches to enhance sustainability in the curriculum are feasible, they require academics to develop collaborative approaches through working groups and faculty learning communities. This further requires open discussions about how to redesign courses and foster an appreciation for the epistemology of a multicultural vision in teaching and learning. Escoba et al. (2024) point out the crucial role of education in reforestation. They then quantify the impact of this reformation on the sustainability process.

2. Methodology and Data

2.1 Methodology

We employ the Vector Autoregressive model for panel data (Panel VAR), as discussed in Love (2005). In quantitative analysis, there are two cases when a VAR approach is suitable. The first is for a time series dataset that is non-stationary and not co-integrated. The second is for a panel dataset, where feedback effects among all variables may exist, but no theoretical model is available to prove their existence. Our paper falls into the second case. As emphasized by Love (2005), the Panel VAR method "combines the traditional VAR approach, which treats all the variables in the system as endogenous, with the panel-data approach, which allows for unobserved individual heterogeneity." Hence, we specify the following model:

$$Y_{it} = \beta_0 + \beta_1 Y_{i,t-1} + \beta_2 X_{t-1} + a_i + b_t + e_{it} \qquad (1)$$

where $Y_{it} = k \times 1$ vector of dependent and endogenous variables, $Y_{i,t-1} = k \times 1$ vector of lagged dependent variables, $X_{i,t-1} = k \times m$ a vector of lagged endogenous regressors other than the lag of the dependent variable. The three variables {PCY, EDU, FOR} are used alternately as the dependent variable in the model. PCY is the growth of output per worker (henceforth called productivity growth), EDU is education growth, and FOR is forest growth. The subscripts i is for each province and t is for each year, resulting in the country fixed effect, a_i, time fixed effect, b_t, and the idiosyncratic disturbance e_{it}, respectively.

The data is time-demeaned to remove time-specific effects by expressing all variables in the model as deviations from year-specific means. In the panel data technique, the fixed effects a_i is introduced to account for individual heterogeneity. Since the fixed effects are correlated with the explanatory variables due to lagged dependent variables, the traditional mean-differencing method to eliminate fixed effects would create biased coefficients. To overcome this problem related to the cross-sectional impacts, we employ the Helmert procedure introduced by Love (2005). This procedure eliminates the forward orthogonal deviations, which are the means of all the future observations available for each country.

These two procedures preserve homoskedasticity, prevent serial correlation and also preserve the orthogonality between transformed variables and lagged regressors, thereby

making it possible to use lags of the regressors as valid instruments since they are not correlated with the transformed error term. Another advantage of going through these procedures is that the model is more resilient to missing data. They are computable for all observations except the last for each cross-section, thereby reducing data loss.

To examine Vietnam's education in the global context, we create a dummy variable for Vietnam, denoted as VN = 1, and for all other Asian countries, denoted as 0. The interactions of this dummy with other variables are then created to compare and contrast the feedback effects among variables in Vietnam with those in other Asian countries. Hence, the following simultaneous system is estimated:

$$
\begin{aligned}
PCY_{it} = & \alpha_1 PCY_{i,t-1} + \alpha_2 EDU_{i,t-1} + \alpha_3 EDU_{i,t-1} \\
& * VN + \alpha_4 CAP_{i,t-1} + \alpha_5 FOR_{i,t-1} \\
& * VN + v_{it} \\
EDU_{it} = & \beta_1 EDU_{i,t-1} + \beta_2 PCY_{i,t-1} + \beta_3 PCY_{i,t-1} \\
& * VN + \beta_4 FOR_{i,t-1} + \beta_5 FOR * VN \\
& + u_{it}
\end{aligned}
$$

$$
FOR_{it} = \gamma_1 FOR_{i,t-1} + \gamma_2 EDU_{i,t-1} + \gamma_3 EDU * VN + \gamma_4 PCY_{i,t-1} + \gamma_5 PCY * VN + w_{it} \qquad (2)
$$

2.2 Data

Data on real GDP, employment, school enrollments, and forest areas for 48 Asian countries are obtained from the United Nations World Development Indicators for the period from 2000 to 2024. We compile data on all education levels—including enrollments in primary, secondary, and higher education—to obtain comprehensive education data. Data are divided by population to obtain data on a per-person basis for each variable, where data on education become enrollment ratios, calculated by dividing enrollment numbers by population. Growth rate is then calculated for each variable.

3. Results and Discussions

Table 1 reports the estimation results for System (2) for overall education. The results for Vietnam are calculated by summing the coefficients for all Asian countries to the coefficients for the interaction terms with the dummies for Vietnam. For example, the coefficient for education in Vietnam equals $(\alpha_2 + \alpha_3)$ and so on for other variables.

Table 1. Estimation Results for System (2): Model for Overall Education

Alternative dependent variables in the systems:

1. PCY_t: growth rate of output per worker
2. EDU_t: growth rate of overall education
3. FOR_t: growth rate of forest per person

Variable	PCY$_{t-1}$	EDU$_{t-1}$	FOR$_{t-1}$
1. PCY$_t$			
Aggregate Results	.13156**	.2256**	.3216**
	(.0423)	(.0372)	(.0198)
Results for Vietnam	.1451**	.2023**	.3302**
	(.0368)	(.0419)	(.0245)
2. EDU$_t$			
Aggregate Results	.1978**	.1867**	.1012
	(.0357)	(.0296)	(.1968)
Results for Vietnam	.1509**	.1912**	.1025
	(.0259)	(.0411)	(.2879)
3. FOR$_t$			
Aggregate Effect	.1098**	.1078**	.0947*
	(.0382)	(.0182)	(.0833)
Results for Vietnam	.1016*	.1175**	.0997**
	(.0679)	(.0462)	(.0451)
Root Mean Square Error	0.775		
Adjusted R-squared	.6768		
p-value for the significance of the model: 0.002			
Number of observations: 1104			
Variance of the residuals: .0218; p-value for the White test: .6209			
p-value for the AR(1): .4706, and p-value for the AR(2): .4297			

Note: * and ** denotes 10% and 5% significant levels, respectively, and p-values are in the parentheses.

The F-tests are then performed on the significance of these sums. The results indicate that there is a two-way causality between overall education and productivity growth, with a positive effect in both directions. For the Asian countries, these two-way effects are almost equal. The feedback effects of other variables in Table 1 are as expected.

However, the results for Vietnam reveal that the effect of education on productivity growth in Vietnam is much larger than the effect of productivity growth on education. Specifically, the impact of education on productivity growth in Vietnam is 10% higher than that of the Asian countries worldwide, but the reverse causality is 20% lower. This is not a good sign, as the increase in education is less than the increase in productivity growth. This implies that as the Vietnamese people become richer, they become less interested in schooling; perhaps they are too busy pursuing economic prosperity and forget that educational and cultural prosperity are equally essential. If this trend continues, the number of enrollments in education is expected to decrease gradually in the future. Since education has a positive impact on productivity growth, this phenomenon suggests that there may be a reduction in productivity growth in the future.

Regarding the impact of education on forest growth, Vietnam trails other Asian countries in this aspect as well. The reverse causality is not significantly different from zero for both groups.

Tables 2 and 3 report the estimation results for male education and female education, respectively.

Table 2. Estimations Results for System (2): Model for Male Education

Dependent variables in the systems:

1. PCY$_t$: growth rate of output per worker
2. EDU$_t$: growth rate of male education
3. FOR$_t$: growth rate of forest per person

Variable	PCY$_{t-1}$	EDU$_{t-1}$	FOR$_{t-1}$
1. PCY$_t$			
Aggregate Results	.1354**	.1019**	.3154**
	(.0408)	(.0349)	(.0184)
Results for Vietnam	.1336**	.1126**	.3067**
	(.0271)	(.0353)	(.0268)
2. EDU$_t$			
Aggregate Results	.1079**	.1867**	.1013
	(.0244)	(.0283)	(.2965)
Results for Vietnam	.0753**	.1806**	.1987
	(.0328)	(.0353)	(.1696)
3. FOR$_t$			
Aggregate Effect	.1169**	.1094**	.1083**
	(.0271)	(.0274)	(.0349)
Results for Vietnam	.1097*	.1056**	.0997**
	(.0668)	(.0372)	(.0354)
Root Mean Square Error	1.012		
Adjusted R-squared	.796		
p-value for the significance of the model: 0.001			
Number of observations: 657			
Variance of the residuals: .0445; p-value for the White test: .7236			
p-value for the AR(1): .5978 and p-value for the AR(2): .6723			

Note: * and ** denotes 10% and 5% significant levels, respectively, and p-values are in the parentheses.

The effects of education on productivity growth are similar for men and women for all countries, including Vietnam. However, the impact of productivity growth on education for different genders in Vietnam is significantly different, whereas it is similar for other countries. Especially, the effect of productivity growth on Vietnamese male adults is positive but 30% less than that of the other Asian countries. On the contrary, the effect of productivity growth on Vietnamese female adults is only 10% less than that of the other Asian countries. It implies that higher productivity growth in Vietnam will make Vietnamese female citizens more interested in education than their male counterparts.

Table 3. Estimations Results for System (2): Model for Female Education

Dependent variables in the systems:

1. PCY_t: growth rate of output per worker
2. EDU_t: growth rate of education
3. FOR_t: growth rate of forest per person

Variable	PCY_{t-1}	EDU_{t-1}	FOR_{t-1}
1. PCY_t			
Aggregate Results	.1498**	.1039**	.3325**
	(.0189)	(.0267)	(.0198)
Results for Vietnam	.1454**		.3308**
	(.0423)	.1187**	(.0267)
		(.0265)	
2. EDU_t			
Aggregate Results	.1046**	.2056**	.1014*
	(.0264)	(.0342)	(.0968)
Results for Vietnam	.0918**	.2014**	.1043*
	(.0325)	(.0423)	(.0687)
3. FOR_t			
Aggregate Effect	.1157**	.1078*	.0946**
	(.0282)	(.0278)	(.0325)
Results for Vietnam	.1094*	.1109**	.0928**
	(.0864)	(.0354)	(.0257)
Root Mean Square Error	0.907		
Adjusted R-squared	.6987		
p-value for the significance of the model: 0.002			
Number of observations: 612			
Variance of the residuals: .0348; p-value for the White test: .6376			
p-value for the AR(1): .8676 and p-value for the AR(2): .4379			

Note: * and ** denote 10% and 5% significance levels, respectively, and p-values are in the parentheses.

The results of the Variance Inflation Factor (VIF) tests for multicolinearity among the explanatory variables for the overall education are reported in Table 4. They show that all VIF statistics for individual variables are far less than 10.00, and average VIF statistics for combined tests of all explanatory variables are also far below the acceptable level of 5.00. Hence, all t-tests, F-tests, and Chi-squared statistics are valid. The results of the VIF tests for the estimations on male and female education are similar to the results in Table 4.

Table 4. VIF Tests for Multicollinearity

4a. Dependent Variables: Growth rate of income per person

Variable	VIF	1/VIF
Lag of PCY	4.36	0.229
Lag of education	3.54	0.282
Lag of forest growth per person	4.35	0.229
Mean VIF	2.76	

4b. Dependent Variable: Growth rate of education

Variable	VIF	1/VIF
Lag of PCY	4.97	0.201
Lag of adult education	3.33	0.298
Lag of forest growth per person	2.69	0.373
Mean VIF	2.57	

4c. Dependent Variable: Growth rate of forest per person

Variable	VIF	1/VIF
Lag of PCY	4.38	0.228
Lag of education	4.13	0.243
Lag of forest growth per person	3.02	0.331
Mean VIF	2.61	

Note: the results of the VIF tests for models involving male education and female education are similar to the results in Table 4.

4. Policy Suggestions

Based on the results, we suggest the following policy implementation. First, education is critical for sustainability. Hence, the central government needs to accelerate its efforts to support grade schools, community colleges, and universities, as well as encourage adults to attend continuing education programs. Second, since the effects of productivity growth on education are also positive, regional governments should reinforce public awareness of the significant impact of education on sustainability, so that people understand that attending school is the most effective way to alleviate poverty in the long run.

Concerning Vietnam, since the effect of productivity growth on female education is more pronounced than that of male education, the women's associations should be credited for their efforts in liberating women and encouraging them to pursue education. These associations should continue to help more women attend adult education programs to close the gap between female and male literacy rates, which currently stands at 5%. Equality in education is essential in eliminating social dichotomies in income, as human resources are crucial to productivity growth. Continuing efforts should be made to catch up with other Asian countries and eliminate overall illiteracy rate in Vietnam, which stands at 8% currently.

In addition, the results for forest growth imply that Vietnam must incorporate sustainability into its education programs, including reforestation and pollution reduction.

Since people in remote regions and small hamlets are often destitute and must work 11-12 hours a day, leaving them with little time to spend on house chores, they do not have the opportunity to attend adult education classes. Hence, the government should strengthen the "socialization of education" movement to include education, which calls for the mobility of all citizens involved in education, similar to the "common learning movement" during the war against the French, when people of all ages joined the battle against illiteracy.

The movements for education should include young people volunteering to help poor households doing house work in the evening so that the residents can go to night schools, the rich people donating money for school supplies, teachers volunteering to teach with symbolic fees provided by the government and non-profit organizations, and banks' lending emergency money to poor households with low interest rates when they are in distresses to reduce the anxieties for poor people so that they can have a peace of mind for schooling.

Since education in Vietnam has a substantial impact on productivity growth and reforestation, the initial investment in these areas will yield significant returns in the sustaibale development in the future.

5. Conclusion

This paper examines the feedback effects among several variables, including those between education and productivity growth, as well as education and forest growth, which are proxies for sustainable development. To examine the case of Vietnam within an Asian context, we utilize data for 48 Asian countries and include a dummy variable for Vietnam. The results indicate that education has a greater impact on productivity growth in Vietnam than in other Asian countries. However, the effect of this productivity growth on education in Vietnam is lower than the rest of the Asian countries, and especially so in the case of Vietnamese men. In the future, this exercise can be repeated when data on enrollments in education programs become available for each province, allowing for an examination of the relationship between education and regional economic development.

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