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The Effect of Average Years of Schooling on GDP Per Capita Change Rate: Evidence from Malaysia

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ABSTRACT: This study examines the impact of average years of schooling on the GDP per capita change rate in Malaysia, providing empirical evidence that highlights significant insights for educational policy and economic development strategies. Utilizing Vector Autoregressive (VAR) models and Granger causality tests, this paper explores the dynamic relationships between education expenditure and GDP growth within the Malaysian context. We find that therelationship between the increase in average years of schooling and the increase in GDP per capita is positive at first, then decreases rapidly, and then increases again. Specifically, our analysis of data from 1990 to 2020 demonstrates that enhanced educational attainment contributes significantly to the labor market's skill level, which in turn boosts economic productivity and technological innovation capacity. The study challenges the conventional view that higher educational investments lead automatically to better economic outcomes and stresses the importance of educational quality alongside quantity. By providing a detailed variance decomposition, we find that changes in schooling years explain about 15% of the variations in GDP per capita growth rates. These results underscore the critical role of education in Malaysia's economic modernization and suggest that policy interventions should not only increase educational investments but also enhance the quality of education to maximizeeconomic returns. Future research should further investigate the causality and interactions between educational quality and economic growth to refine educational policies effectively.

KEYWORDS: Average years of schooling, GDP per capita, VAR model, Granger causality test, Impulse response, Variance decomposition

INTRODUCTION

In the era of globalization and knowledge-based economy, education is widely recognized as akey factor in driving economic growth and development. Particularly in Malaysia, a rapidly developing country, investment in education is seen as one of the core strategies to improve thestatus and competitiveness of the national economy. Past studies have shown that there is a complex relationship between education expenditure and economic growth, and that this relationship exhibits diversity across countries and regions.

Despite the extensive evidence that education is crucial for enhancing human capital and economic output, empirical findings on how investment in education directly translates into economic growth are mixed. Some studies have found that the relationship between educationand economic growth may not always be positive, which may be affected by the quality of dataand the way education is measured. In the Malaysian context, the reliability of education data has been a focus of concern for policy makers and researchers.

The objective of this study is to examine the specific impact of education on economic growthby exploring comparisons between different education datasets in Malaysia. Vector Autoregressive (VAR) models and Granger causality tests are employed to gain insights into the dynamics of the relationship between education expenditure and GDP in Malaysia. In addition, this paper explores the correlation between education quality and economic growth, challenging the conventional view that higher investment in education automatically leads to stronger economic performance.

In particular, the paper provides an in-depth analysis of the impact of average years of schoolingon the rate of change of GDP per capita. By analyzing data between 1990 and 2020, we observethat as the average number of years of schooling increases, the level of skills in the labor marketimproves, which has a direct impact on the economy's productivity and technological innovation capacity. The study shows a positive correlation between increasing years ofeducation and GDP per capita growth, revealing the key role of education in contributing to themodernization of the Malaysian economy.

Through these analyses, we hope to provide insights for policy formulation in Malaysia and other similar economies, particularly in the areas of education and economic development strategies. These insights will guide future policies to ensure that investment in educationcontributes more effectively to economic growth and social progress.

LITERATURE REVIEW

In the context of globalization and knowledge-based economy, the role of education has been further highlighted, especially in rapidly developing countries like Malaysia. Education is not only seen as a means to enhance the quality of life of individuals, but also as a key strategy to drive the overall economic growth and competitiveness of the country. Grapragasem et al. (2014)highlights the Malaysian government's continuous investment in education, while Othman et al.'s (2024) study further confirms the direct impact of higher education levels on enhancing human capital and economic innovation capacity. impact.

Despite the existence of a general consensus that investment in education positively affects economic growth, the exact dynamics and terms of this relationship are debated by academics.For example, Lee (2005) and Wong and Yusoff (2015) point out that simply increasing the number of years of education does not guarantee accelerated economic growth without also focusing on the quality of education. In addition, the trend of globalization has had a profoundimpact on Malaysia's higher education policy, promoting the alignment of the education systemwith international standards, as well as increasing the flow of international students and resources.

Average years of schooling is a key indicator when measuring the drivers of economic growth.Extensive research has shown that an increase in years of schooling significantly increases percapita GDP growth. This positive association has been demonstrated across countries and regions, but the extent and nature of its impact varies depending on the structure of the local economy and the policy environment (Wong & Yusoff, 2015). In Malaysia, the increased investment in education has not only raised the educational level of the people, but also pavedthe way for the modernization of the economy, which is crucial for the long-term developmentof the country.

In conclusion, although raising the average years of schooling is widely seen as an effective means of driving economic growth, how to optimize the allocation of educational resources, improve the quality of education, and ensure efficient investment in education through policy remains a key concern for policy makers and scholars. Future research needs to delve deeper into the complex interactions between education and economic growth and assess the economiceffects of different education policies.

METHODOLOGY

In this paper, we will establish the VAR model and use the Granger Causality test, the ImpulseResponse, and the Variance Decomposition to analyze the relationship and influence between the average years of school and the GDP per capita change rate in Malaysia.

Sample

In this paper data from Our World in Data, we collected data on Malaysia from 1950 to 2015,the average years of schooling and GDP per capita (Unite: 5 years), a total of 28 observation samples. At the same time, GDP per capita is defined as the change rate. It's

GDP per capita change rate (%) = $\frac{GDP\ per\ cap^{*}tat\ ,\ \mathrm{G}DP\ per\ cap^{*}tat''1}{\mathrm{G}DP\ per\ cap^{*}tat''1}$

At the same time, we conduct tests for stationarity of the data. The results show that when the test critical is 10% level, the P-value of average years of schooling in Malaysia is 0.0955. The P-value of the GDP per capita change rate is 0.041. that means the two sets of data are significant, the unit root test is passed, and the data is stationary, which can be used for the nexttest.

Null Hypothesis: AVERAGE_YEARS_OF_SCHOOLING_MALAYSIA has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.758694	0.0955
Test critical values:	1% level	-4.200056	
	5% level	-3.175352	
	10% level	-2.728985	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(AVERAGE_YEARS_OF_SCHOOLING_MALAYSIA)
Method: Least Squares
Date: 05/09/24 Time: 14:12
Sample (adjusted): 1965 2015
Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AVERAGE_YEARS_OF_SCHOOLING_MA...	-0.043398	0.015731	-2.758694	0.0281
D(AVERAGE_YEARS_OF_SCHOOLING_...	-0.002338	0.228682	-0.010226	0.9921
D(AVERAGE_YEARS_OF_SCHOOLING_...	0.697275	0.208711	3.340872	0.0124
C	0.568821	0.168337	3.379055	0.0118

R-squared	0.664156	Mean dependent var	0.772727
Adjusted R-squared	0.520223	S.D. dependent var	0.161808
S.E. of regression	0.112078	Akaike info criterion	-1.263968
Sum squared resid	0.087930	Schwarz criterion	-1.119269
Log likelihood	10.95177	Hannan-Quinn criter.	-1.356165
F-statistic	4.614333	Durbin-Watson stat	2.053526
Prob(F-statistic)	0.043896		

Figure 1: Test of stationarity of average years of schooling in Malaysia

Null Hypothesis: GDPCHANGE_RATE_MALAYSIA has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.236909	0.0410
Test critical values:	1% level	-4.057910	
	5% level	-3.119910	
	10% level	-2.701103	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDPCHANGE_RATE_MALAYSIA)
Method: Least Squares
Date: 05/09/24 Time: 14:16
Sample (adjusted): 1955 2015
Included observations: 13 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPCHANGE_RATE_MALAYSIA(-1)	-0.809691	0.250143	-3.236909	0.0079
C	0.165937	0.056887	2.916981	0.0140

R-squared	0.487838	Mean dependent var	0.011045
Adjusted R-squared	0.441278	S.D. dependent var	0.148383
S.E. of regression	0.110913	Akaike info criterion	-1.419509
Sum squared resid	0.135318	Schwarz criterion	-1.332594
Log likelihood	11.22681	Hannan-Quinn criter.	-1.437374
F-statistic	10.47758	Durbin-Watson stat	2.142204
Prob(F-statistic)	0.007917		

Figure 2: Test of stationarity of GDP per capita change rate in MalaysiaOperationalization and Test

Because the unit is 5 years, so when we choose 3 for lag length criteria, the results show that the best Lag interval for the VAR model for Endogenous is 3. At this time, the results of the Granger causality test show that when the test critical is at 10% level, average years of schoolingis the Granger causality of the GDP per capita change rate, but the GDP per capita change rateis not the Granger causality of average years of schooling.

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/09/24 Time: 13:51
Sample: 1950 2015
Included observations: 11

Dependent variable: AVERAGE_YEARS_OF_SCHOOLING_MAL...

Excluded	Chi-sq	df	Prob.
GDPCHANGE_RATE_...	2.218541	3	0.5283
All	2.218541	3	0.5283

Dependent variable: GDPCHANGE_RATE_MALAYSIA

Excluded	Chi-sq	df	Prob.
AVERAGE_YEARS_O...	9.454544	3	0.0238
All	9.454544	3	0.0238

Figure 3: The Granger Causality Test

We also test the stability of the VAR model, and the results show that all the points are withinthe circle, and the VAR model is stable.

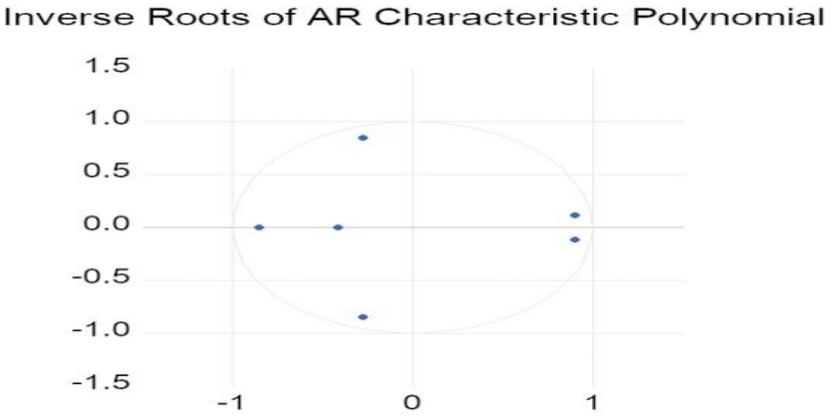

Figure 4: Stability test of the VAR model

The results of the impulse response show that the impact of the average education on the rate of change of GDP per capita is gradually convergent, which proves that the impact of the average education on the rate of change of GDP per capita will decrease with the increase of time.

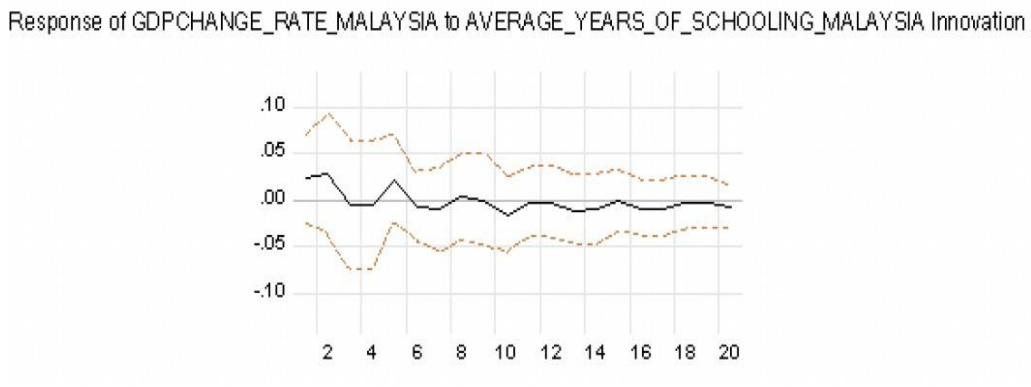

Figure 5: Result of Impulse response

According to the results of Variance Decomposition, the impact of average years of schoolingon the rate of change of GDP per capita in Malaysia is 15%.

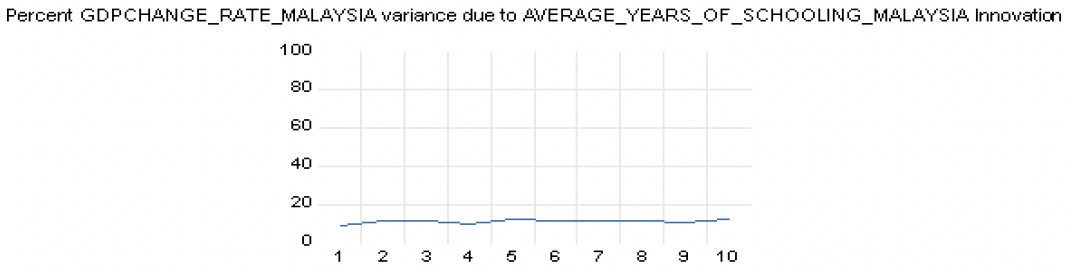

Figure 6: Result of Variance Decomposition

RESULTS AND DISCUSSION

According to the results of the test in the last part, when the test critical is 10% level and GDPper capita change rate is the dependent variable, the P-value is 0.0235, which proves that the average years of schooling is Granger causality of the GDP per capita change rate in Malaysia.When the average years of schooling are the dependent variable, the P-value is 0.5283, which means the GDP per capita change rate is not Granger should be related to the average years ofschooling in Malaysia, when the test critical is 10%.

The results of the impulse response show that the GDP per capita change rate increases as the average years of schooling increase, the increase will quickly decline to negative values after reaching the apex, and then it then fluctuates between positive and negative correlations, whichmeans proving that the effect is not stable. At the same time, the impact of average years of schooling on the GDP per capita change rate in Malaysia is gradually converging, which meansthat the impact of average years of schooling on the GDP per capita change rate will decrease with the increase of time.

For the variance decomposition result, the impact of average years of schooling on the rate of change of GDP per capita in Malaysia is 15%.

POLICY IMPLICATIONS AND CONCLUSIONS

Reliability

In this paper data from Our World in Data. We collected data on average years of schooling andGDP per capita from 1950 to 2015 in Malaysia (unit: 5 years), and we used the GDP per capitachange rate as the data variable for testing. At the same time, we will ensure the result is effective in this paper, so we conduct stationarity tests respectively on the GDP per capita change rate, average years of schooling, and VAR model, and the test results are all significant.Therefore, the output results of this paper have certain reference values.

Validity

This paper has a certain contribution, which finds that the average years of schooling is the Granger causality of the GDP per capita change rate in Malaysia, but the GDP per capita changerate is not the Granger causality of the average years of schooling. This paper finds that as the

average years of schooling increase, the GDP per capita change rate will also increase, and thenit will float between positive and negative correlations, and this effect will decrease over time.Therefore, we suggest that the Malaysian government pay attention to the average years of schooling and increase the average years of schooling as much as possible. At the same time, we suggest that the Malaysian government should increase the penetration rate of compulsory education to ensure that school-age children can get

the education they deserve.

Policy recommendations

Given the significant impact of average years of schooling on the rate of change in Malaysia's GDP per capita as explored in this study, a number of specific policy recommendations are made. Firstly, given the positive correlation between years of schooling and economic growth,it is recommended that the government increase public investment in education, particularly inbasic education and vocational skills training. Such an investment would not only raise the overall skill level of the labor force, but also promote increased productivity, thereby accelerating economic growth.

At the same time, this study finds that simply increasing the number of years of education without upgrading the quality of education may not be sufficient to achieve optimal economic growth. Therefore, we further recommend that the government support educational institutionsto adopt modern teaching methods and technologies, and regularly update the education curriculum to ensure that the content of education matches the current and future needs of the economy. Such qualitative upgrading will maximize the return on investment in education andfurther boost economic growth.

Furthermore, in order to realize the broader social benefits of investment in education, policymakers should pay particular attention to the accessibility and equity of education. This study shows that it is crucial to ensure that all social groups, especially children in remote and poor areas, have access to quality education. To this end, governments may consider building more schools, providing rich online education resources and subsidizing students with limited access to transport.

In summary, with these targeted policy recommendations, we hope to provide Malaysia and other countries with similar economic backgrounds with effective strategies to ensure that investment in education can maximize its effectiveness in promoting economic growth and social progress.

Future Research

From the results of the impulse response, it can be seen that the impact of average years of schooling on the GDP per capita change rate is not stable in Malaysia. Future research will tryto find the causes of instability and try to avoid unstable factors in future policy formulation and implementation.

For future research, we suggest that the relationship between the quality of education and economic growth should be explored in depth, especially considering the impact of different levels of education (e.g., secondary versus tertiary education) and different types of education (e.g., theoretical versus vocational) on the rate of economic return. In addition, the study shouldfocus on the optimal allocation of investment in education, including the ratio of public to private investment and the allocation of funds to different stages of education, in order to determine the most effective education policies in different economic environments. At the same time, exploring the interactions between education and other economic variables, such astechnological development, international trade and demographic changes, and how they work together to drive economic growth will also provide new perspectives for understanding the role of education in the broader economic framework.

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APPENDIX: DATA

Test data in Malaysia			
year	average years of schooling Malaysia	GDP per capita Malaysia	GDPchange rate malaysia
1950	2.2	2485	-6%
1955	2.5	2327	5%
1960	3	2439	18%
1965	3.5	2876	15%
1970	4.4	3314	27%
1975	5.1	4221	38%
1980	6.1	5829	14%
1985	7	6626	23%
1990	8	8179	43%
1995	8.7	11725	15%
2000	9.5	13475	16%
2005	10.2	15651	19%
2010	10.9	18574	21%
2015	11.5	22550	8%