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The Relationship Between Public Expenditure on Education and Economic Growth: Evidence from China

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THE RELATIONSHIP BETWEEN PUBLIC EXPENDITURE ON EDUCATION AND ECONOMIC GROWTH: EVIDENCE FROM CHINA

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ABSTRACT

Education is important for a country's economic growth. And public expenditure on education is important for improving education. Therefore, public expenditure on education will influence economic growth in a country. However, it is also possible that when the economy grows, maybe we have more public expenditure on education because government wants to improve education. Therefore, the relationship between public expenditure on education and economic growth needs to be discussed. This paper studies the relationship between public expenditure on education and economic growth in China. Firstly, I use regression analysis to study how the public expenditure on education influences the GDP. I find that the contribution of public expenditure on education is significant and high. It means that if government improve public expenditure on education, maybe it is helpful for economic growth. Then I consider the lag effect and the effect of GDP on public expenditure on education. Then I do the unit root test and I find that the data is stationary after second order difference. Finally, I do the Granger causality test, and I find that GDP Granger causes public expenditure on education in lag 1. I do not find that public expenditure on education Granger causes GDP in lag 1. I also do not find that Granger causality between public expenditure on education and GDP in lag 2, 3, 4, 5, 6.

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CHAPTER ONE

INTRODUCTION

Education is important for economic growth in a country. The improvement of education needs the investment. The public expenditure on education is an important part of investment in education. Therefore, public expenditure on education will influence the economic growth in China. However, it is also possible that when economy grows, maybe government will increase public expenditure on education because the government want to improve education. Therefore, the relationship between public expenditure on education and GDP needs to be studied. This paper will study the relationship between public expenditure on education and GDP.

Many people study the question about the relationship between public expenditure on education and economic growth before my research.

Alfranca and Galindo (2003) study what effects public expenditure have on economic growth. They use a Cobb-Douglas production function to set a theoretical model which introduce public capital. And they also estimate OLS, GLS, and SUR fixed effects models by using time series data and cross-sectional data. They find that the increase in public expenditures and improvements in capital productivity lead to bigger economic growth when other things are equal. This paper uses Cobb-Douglas production function. And based on this production function, this paper establish the econometric model. This method provides me with a useful framework to study the relationship between public expenditure on education and economic growth.

Hong-Sang Jung and Erik Thorbecke (2003) use a CGE model to analyze Tanzania and Zambia. The simulation results means that education expenditure can raise economic growth. For maximizing the education expenditure benefits, a high level of physical investment is needed. Another important result is that a good pattern of education expenditure may be useful for decreasing the poverty. We have similar theme. The method of this paper is complicated. This paper not only consider the relationship between education expenditure and economic growth, but it also consider poverty. My research focuses on the relationship between public expenditure on education and GDP. This paper provides me some thinking about the relationship between public expenditure on education and GDP.

W. Blankenau, N. Simpson and M. Tomljanovich (2007) studies the relationship between public expenditure on education, taxation and economic growth. They use overlapping generations growth model to analyze this problem. They collect data from 23 developed countries over the period 1960-2000. They find that the public expenditure on education has a positive relationship with long-run growth only when controlling for the government budget constraint. I will study the relationship between public expenditure on education and economic growth in China. This paper use data from developed countries, but we have similar theme. The method of this paper is different from me, but it provides me some useful frameworks.

Yousif Khalifa Al-Yousif (2008) uses the data of 1977-2004 to study the relationship between education expenditure and economic growth in the six GCC countries. He finds that the causality between education and economic growth is

bidirectional. However, he finds that the results are different for different countries and if we use different proxies for human capital, then we also have different results. And the relationship between education expenditure and economic growth cannot be generalized across countries. And a adjustment of measurement of human capital may help us to further study the relationship between education expenditure and economic growth. This paper study six GCC countries, but I will study China. We have similar theme. We both focus on relationship between education expenditure and economic growth. The method of this paper is helpful for me. The Granger causality test is useful for me to study relationship between public education expenditure and economic growth in China.

Namchul Lee (2000) studies the relationship between education and economic growth in Korea. This paper use Cobb-Douglas production function and time series data to study and analyze the relationship between education and economic growth. This paper finds that human capital is a significant factor for economic growth in Korea. It also finds that primary, secondary and higher education have had a positive effect on economic growth from 1966 to 1997 and there exists a strong correlation between GDP and education enrollment at each level. This paper studies the relationship between education and economic growth in Korea. My paper studies the relationship between public expenditure on education and economic growth in China. This paper uses Cobb-Douglas production function and regression analysis. This paper also uses ADF unit root test. This paper provides some useful methods. These methods are helpful for me to analyze problems.

Oludele A. Akinboade and Lydia A. Braimoh (2010) talks about the relationship between international tourism and economic development in South Africa. They use the Granger causality analysis. They find that there exists a unidirectional causality from international tourism earnings to real GDP, both in the short run and in the long run. Although, we have different theme, the Granger causality analysis in the paper is very useful for my research. This method is helpful for me to talk about relationship between public expenditure on education and economic growth. It is possible that there exists bidirectional effect between public expenditure on education and economic growth. The Granger causality analysis is a good method to help me to deal with this problem.

Wadad Saad and Kamel Kalakech (2009) study the growth effects of government expenditure in Lebanon from 1962 to 2007. They use multivariate co-integration analysis to study what effect these sectors have on economic growth. They find that in the long-run, government expenditure on education has a positive effect on economic growth and in the short-run, it has a negative effect. The relationship between public expenditure on education and GDP is a part of their research. Their evidence is from Lebanon. My evidence is from China. They use co-integration analysis and VAR model to study the problem. It is useful for me to study the relationship between public expenditure on education and GDP in China.

Chandra Abhijeet (2010) studies relationship between government expenditure on education and economic growth in India from 1951 to 2009 by using linear and non-linear Granger Causality methods. This paper finds economic growth will influence government expenditure on education regardless of any lag effects, however investments

in education also tend to influence economic growth after some time-lag. Although this paper studies the relationship between government expenditure on education and GDP using evidence from India and I studies this relationship using evidence from China, we have similar theme. The method of this paper is linear and non-linear Granger causality test. This method is useful for me to study the relationship between public education expenditure and GDP in China.

CHAPTER TWO

DATA DESCRIPTION AND RESEARCH METHODOLOGY

This paper will use the data of original GDP from 1992 to 2013 from China Statistical Yearbook. The GDP includes consumption, investment, government expenditure, import and export. I will exclude the public expenditure on education and get the new GDP. The following data is new GDP. The unit of GDP is 100 million yuan. However, I will adjust new GDP and I will convert nominal new GDP to real new GDP (adjusted new GDP). I will use CPI index from 1992 to 2013 in China Statistical Yearbook. I will consider 1992 as base period, then I will adjust the data of new GDP from 1993 to 2013. I also will use the data of public expenditure on education from 1992 to 2013 from China Statistical Yearbook. The public expenditure on education includes primary school expenditure, middle school expenditure, higher education school expenditure, kindergarten expenditure, special education expenditure, education department expenditure. The unit of public expenditure on education is 100 million yuan. The public expenditure on education is a part of public finance expenditure. And I will convert nominal public expenditure on education to real public expenditure on education (adjusted public expenditure on education). Then I will CPI index from 1992 to 2013 in China Statistical Yearbook considering 1992 as base period and adjust the data of Public expenditure on education from 1993 to 2013. The data of capital stock are calculated by the method of Haojie Shan (2008). The unit is 100 million yuan. The capital stock does not include human capital, land and other natural resources. I also will use the data of

birthrate from 1992 to 2013 from China Statistical Yearbook. The unit of birthrate is the number of live births per thousand people.

Y represents adjusted new GDP. E represents adjusted public expenditure on education. B represent birthrate. K represent capital stock.

Table 2.1 The descriptive statistics of Y, E, B, K

Year	Y	E	B	K
Maximum value	219141.4836	8568.745842	18.24	255819.72
Minimum value	26358.53645	564.94	11.9	19277.08
Mean	92204.81202	2952.499885	14.02909091	90872.90273
Standard deviation	60430.5005	2615.602094	2.30911811	68803.26723

First, I will use regression model to analyze the relationship among adjusted new GDP, adjusted public expenditure on education and capital stock. Then I will add the birthrate to regression model and find the relationship among adjusted new GDP, adjusted public expenditure on education, capital stock and birthrate. Then I will consider the lag effect and the effect of GDP on public expenditure on education. And I will use Granger causality test to study the relationship between the ln(adjusted new GDP) and ln(adjusted public expenditure on education). The method of Granger causality test will tell us whether a time series is useful for predicting another time series and whether the two time series have causality which called Granger causality.

CHAPTER THREE

REGRESSION ANALYSIS

I will use linear regression model to analyze the relationship adjusted new GDP, adjusted public expenditure on education and capital stock in China. In economics, we generally use the Cobb-Douglas function to indicate the relationship among them. I will use Cobb-Douglas function to build my model:

$$Y = AE^{\alpha}K^{\beta}$$

Then I take natural logarithm on both sides and build linear regression model:

$$LnY = LnA + \alpha LnE + \beta LnK + \mu$$

I hope to collect the data to get the estimated model:

$$\widehat{LnY} = \widehat{LnA} + \hat{\alpha} LnE + \hat{\beta} LnK$$

In this situation, I use the log-log specification. I will study the relationship among the percent change of Y, the percent change of E, and the percent change of K.

I use stata to get the following results:

Table 3.1 The results of regression in lnY, lnE and lnK

Number of obs	F-statistic	P-value	R-squared	Adj R-squared	Root MSE
22	4774.78	0.0000	0.9980	0.9978	.03166
lnY	Coefficient	Standard Error	t	P-value	95% Confidence Interval
lnE	.323555	.0649856	4.98	0.000	.1875385 .4595715
lnK	.4713565	.077577	6.08	0.000	.308986 .6337269
_cons	3.517249	.3780225	9.30	0.000	2.726039 4.308459

I find that for the constant, the p-value is 0.000 and it is less than 0.05. For the coefficient of lnE, the p-value is 0.000 and it is less than 0.05. For the coefficient of lnK, the p-value is 0.000 and it is less than 0.05. I can find that adjusted new GDP and adjusted public expenditure on education have a positive relationship and I also can find that adjusted new GDP and capital stock have a positive relationship. When E increases 1 percent, Y will increase 0.32 percent, on average, holding other variables constant. When K increases 1 percent, Y will increase 0.47 percent, on average, holding other variables constant. It means that the influence of E on Y is relatively less than the influence of K on Y. It means that the motivation of capital for economic growth is relatively higher than the motivation of public expenditure on education for economic growth. However, I find that the contribution of public expenditure on education is still high.

CHAPTER FOUR

EXTENDED REGRESSION ANALYSIS

In last section, I talk about the relationship among adjusted new GDP, adjusted public expenditure on education and capital stock. However, I still need other factors that maybe influence the Y. The birthrate maybe is a factor that will influence the Y. When the birthrate increases, it is possible that the consumption is motivated and it maybe influences Y. When the birthrate increases, it is possible that the government may increase the public expenditure on education and it will also motivate the consumption.

I hope to add the birthrate to our model:

$$LnY = LnA + \alpha LnE + \beta LnK + \gamma B + \mu$$

I collect the data and get the estimated model:

$$\widehat{LnY} = \widehat{LnA} + \hat{\alpha} LnE + \hat{\beta} LnK + \hat{\gamma} B$$

B represents the birthrate. And then I use the stata to get the following results:

Table 4.1 The results of regression in lnY, lnE, lnK and B

Number of obs	F-statistic	P-value	R-squared	Adj R-squared	Root MSE
22	3537.71	0.0000	0.9983	0.9980	.03004
lnY	Coefficient	Standard Error	t	P-value	95% Confidence Interval
lnE	.3119611	.0620021	5.03	0.000	.1816995 .4422226
lnK	.5166222	.0779457	6.63	0.000	.3528644 .68038
B	.0116087	.0065828	1.76	0.095	-.0022212 .0254387
_cons	2.93851	.4861262	6.04	0.000	1.917197 3.959823

I find that the coefficient of lnE, lnK and constant are significant at the 5% significance level. However, I find that for the coefficient of B, the p-value is 0.095 and it is larger than 0.05. Therefore, the coefficient of B is not significant at the 5% significance level. I do not find that the birthrate has a significant effect on Y. It is possible that the the birthrate in China is low, and it does not play an important role in motivating the economy. However, it needs to be researched further. In my model, because the birthrate is not significant, I will eliminate the birthrate. If I eliminate the birthrate, then this model is the same as the log-log specification model in chapter three. Therefore, I will use the log-log specification model in chapter three to analyze the problem.

In my model, I want to focus on the relationship between adjusted new GDP and adjusted public expenditure on education. In my model, I find that adjusted new GDP and adjusted public expenditure on education have a positive relationship and I also find that

When adjusted public expenditure on education increases 1 percent, adjusted new GDP will increase around 0.3 percent, on average, holding other variables constant. However, in my model, I do not consider the lag effect and the effect of adjusted new GDP on adjusted public expenditure on education. It is possible that adjusted public expenditure on education has a lag effect on adjusted new GDP and adjusted new GDP has a lag effect on adjusted public expenditure on education. This model cannot tell us lag effect and the effect of adjusted new GDP on adjusted public expenditure on education. This model is deficient. I need other methods to study the relationship between adjusted new GDP and adjusted public expenditure on education. In following sections, I will use Granger causality test to study the lag effect and the relationship between adjusted new GDP and adjusted public expenditure on education.

CHAPTER FIVE

UNIT ROOT TEST

If I want to use Granger causality test, then I need use stationary data. However, when I collect the data, I do not know whether the data are stationary. Therefore, I need test whether the data are stationary. The method of testing whether the data are stationary is unit root test. The general type of unit root test is Augmented Dickey-Fuller test (ADF test). I will use this ADF test to test whether the data are stationary.

I will use Eviews to do the ADF test. Our variable is ln(adjusted new GDP). When I test for unit root in level, I get the result:

Table 5.1 ADF test of lnY in level

		t-Statistic	P-value
Augmented Dickey-Fuller test statistic		-1.157351	0.6670
Test critical values:	1% level	-3.886751	
	5% level	-3.052169	
	10% level	-2.666593	

The null hypothesis is that the variable has a unit root and the alternative hypothesis is that the variable does not have a unit root. If the variable has a unit root, then it means the variable is non-stationary. If the variable does not have a unit root, then it means the variable is stationary. I find the p-value is 0.6670 and is higher than 0.01, 0.05 and 0.10. Therefore, I fail to reject the null hypothesis. Then it means the variable

has a unit root and it is non-stationary. Therefore, I cannot use it to do the Granger causality test.

Therefore, I need difference it. Firstly, I test for unit root in 1st difference. I get the result:

Table 5.2 ADF test of lnY in 1st difference

		t-Statistic	P-value
Augmented Dickey-Fuller test statistic		-2.165211	0.2247
Test critical values:	1% level	-3.920350	
	5% level	-3.065585	
	10% level	-2.673459	

I find the p-value is 0.2247 and is higher than 0.01, 0.05 and 0.10. Therefore, I fail to reject the null hypothesis. The first order difference of ln(adjusted new GDP) is still non-stationary.

Therefore, I need 2nd difference. And I get the result:

Table 5.3 ADF test of lnY in 2nd difference

		t-Statistic	P-value
Augmented Dickey-Fuller test statistic		-4.911808	0.0012
Test critical values:	1% level	-3.857386	
	5% level	-3.040391	
	10% level	-2.660551	

I find the p-value is 0.0012 and is lower than 0.01, 0.05 and 0.10. Therefore, I reject the null hypothesis. Then the variable is stationary. Then second order difference of ln(adjusted new GDP) is stationary.

Next, I will test another variable, ln(adjusted public expenditure on education). When I test for unit root in level, I get the result:

Table 5.4 ADF test of lnE in level

		t-Statistic	P-value
Augmented Dickey-Fuller test statistic		-0.464160	0.8792
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

I find the p-value is 0.8792 and is higher than 0.01, 0.05 and 0.10. Therefore, I fail to reject the null hypothesis. Then the variable is non-stationary.

Then, I test for unit root in 1st difference, and get the result:

Table 5.5 ADF test of lnE in 1st difference

		t-Statistic	P-value
Augmented Dickey-Fuller test statistic		-2.326324	0.1739
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

I find the p-value is 0.1739 and is higher than 0.01, 0.05 and 0.10. Therefore, I fail to reject the null hypothesis. Then first order difference of ln(adjusted public expenditure on education) is still non-stationary.

Therefore, I need 2nd difference. And I get the result:

Table 5.6 ADF test of lnE in 2nd difference

		t-Statistic	P-value
Augmented Dickey-Fuller test statistic		-5.183176	0.0006
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

I find the p-value is 0.0006 and is higher than 0.01, 0.05 and 0.10. Therefore, I fail to reject the null hypothesis. Then second order difference of ln(adjusted public expenditure on education) is stationary.

CHAPTER SIX

GRANGER CAUSALITY TEST

When the variable is non-stationary, I cannot do the Granger causality test. Therefore, I need stationary data. After I difference the variables, I get the second order difference of ln(adjusted new GDP) and ln(adjusted public expenditure on education). I will use them to do Granger causality test. In the textbook of Helmut Lutkepohl and Markus Kratzig (2004), they say that the difference will be helpful for removing a series trend and will convert a non-stationary series to a stationary series. I could difference the series d times and make the series stationary. In the textbook of Ruey S. Tsay (2010), it talks about if a time series contain more than one unit-root, and if I want to make this time series stationary, then I need to difference it more than one time and make it stationary. Oludele A. Akinboade and Lydia A. Braimoh (2010) talks about the relationship between international tourism and economic development in South Africa. We both use the Granger causality test. There are some differences between our model, but they take logarithm for variables and difference the variables. They explain the results by saying whether there exists a Granger causality between real GDP and tourism receipts or real exports and real GDP and so on. They do not explain the results by change rate or growth rate. Paresh Kumar Narayan and Russell Smyth (2004) talks about the relationship between crime rates, male youth unemployment and real income in Australia. Although, our themes are different, we use the similar method, Granger causality test. And this paper establishes the VAR model and take logarithm for variables and difference the variables.After they difference the variables, they explain their results

by saying whether there exists a Granger causality between unemployment and income or between income and homicide or between homicide and unemployment. They do not explain the results by change rate or growth rate.

The Granger causality test is based on the Vector Autoregression (VAR) model. Therefore, I need build the VAR model.

The VAR model is :

$$\Delta^2 \ln(adjustednewGDP)_t = \sum_{i=1}^{q} \alpha_i \Delta^2 \ln(adjustedPublicedu)_{t-i} + \sum_{j=1}^{q} \beta_j \Delta^2 \ln(adjustednewGDP)_{t-j} + u_{1t}$$

$$\Delta^2 \ln(adjustedPublicedu)_t = \sum_{i=1}^{s} \lambda_i \Delta^2 \ln(adjustedPublicedu)_{t-i} + \sum_{j=1}^{s} \theta_j \Delta^2 \ln(adjustednewGDP)_{t-j} + u_{2t}$$

The first equation is used to test whether ln(adjusted public expenditure on education) Granger causes ln(adjusted new GDP). The second equation is used to test whether ln(adjusted new GDP) Granger causes ln(adjusted public expenditure on education).

I do the Granger causality test from lag 1 to lag 6. And I get the results:

Table 6.1 The Granger Causality Test from lag 1 to lag 6

Lags: 1		
Null Hypothesis	F-Statistic	P-value
D2LN_ADJUSTEDNEWGDP does not Granger Cause D2LN_ADJUSTEDPUBLICEDU	5.25327	0.0358
D2LN_ADJUSTEDPUBLICEDU does not Granger Cause D2LN_ADJUSTEDNEWGDP	0.19983	0.6609

Lags: 2		
Null Hypothesis	F-Statistic	P-value
D2LN_ADJUSTEDNEW GDP does not Granger Cause D2LN_ADJUSTEDPUBLICEDU	1.29453	0.3071
D2LN_ADJUSTEDPUBLICEDU does not Granger Cause D2LN_ADJUSTEDNEW GDP	0.24844	0.7836

Lags: 3		
Null Hypothesis	F-Statistic	P-value
D2LN_ADJUSTEDNEW GDP does not Granger Cause D2LN_ADJUSTEDPUBLICEDU	1.04848	0.4132
D2LN_ADJUSTEDPUBLICEDU does not Granger Cause D2LN_ADJUSTEDNEW GDP	0.33123	0.8031

Lags: 4		
Null Hypothesis	F-Statistic	P-value
D2LN_ADJUSTEDNEW GDP does not Granger Cause D2LN_ADJUSTEDPUBLICEDU	0.61121	0.6680
D2LN_ADJUSTEDPUBLICEDU does not Granger Cause D2LN_ADJUSTEDNEW GDP	0.20412	0.9282

Lags: 5		
Null Hypothesis	F-Statistic	P-value
D2LN_ADJUSTEDNEW GDP does not Granger Cause D2LN_ADJUSTEDPUBLICEDU	0.95332	0.5333
D2LN_ADJUSTEDPUBLICEDU does not Granger Cause D2LN_ADJUSTEDNEW GDP	0.46352	0.7895

Lags: 6		
Null Hypothesis	F-Statistic	P-value
D2LN_ADJUSTEDNEW GDP does not Granger Cause D2LN_ADJUSTEDPUBLICEDU	92.7486	0.0793
D2LN_ADJUSTEDPUBLICEDU does not Granger Cause D2LN_ADJUSTEDNEW GDP	2.44427	0.4540

I want to test the Granger causality whether exists or not. By observation, I find the second order difference of ln(adjusted new GDP) does not Granger Cause the second order difference of ln(adjusted public expenditure on education) in VAR model in lag 2, 3, 4, 5 because I find the p-value is obviously larger than 0.01,0.05 and 0.1. Although, in lag 6, the p-value is less than 0.1, it is larger than 0.05 and 0.01. At 5% level, it is still not significant. However, in lag 1, I find the p-value is 0.0358 and it is less than 0.05. Therefore, I reject null hypothesis at 5% level. Therefore, I can say that the second order difference of ln(adjusted new GDP) does Granger Cause the second order difference of

ln(adjusted public expenditure on education) in VAR model in lag 1 at the 5% level. And the second order difference of ln(adjusted public expenditure on education) does not Granger Cause the second order difference of ln(adjusted new GDP) in VAR model in lag 1, 2, 3, 4, 5 and 6 because I find the p-value is obviously larger than 0.01, 0.05 and 0.1. I do not find the second order difference of ln(adjusted public expenditure on education) does not Granger Cause the second order difference of ln(adjusted new GDP). We assume that lag 1, lag 2 and lag 3 represent the short run and lag 4, lag 5 and lag 6 represent the long run. In the short run, I find the second order difference of ln(adjusted new GDP) will Granger Cause the second order difference of ln(adjusted public expenditure on education) in VAR model in lag 1 and we do not find Granger causality between the second order difference of ln(adjusted public expenditure) and the second order difference of ln(adjusted new GDP) in lag 2 and lag 3 and we also do not find that the second order difference of ln(adjusted public expenditure on education) will Granger Cause the second order difference of ln(adjusted new GDP) in VAR model in lag 1. It means that in the short run, adjusted new GDP Granger causes adjusted public expenditure on education in lag 1. In the long run, I do not find Granger causality between the second order difference of ln(adjusted public expenditure) and the second order difference of ln(adjusted new GDP). Therefore, I do not find that Granger causality between adjusted public expenditure and adjusted new GDP.

CHAPTER SEVEN

CONCLUSION

This paper attempts to study the relationship between public expenditure on education and GDP. I use the linear regression model and Granger causality test to study my questions. When I use the linear regression model, I find that the influence of public expenditure on education on GDP is relatively less than the influence of capital stock on GDP. Although, the motivation of capital for economic growth is relatively higher than the motivation of public expenditure on education, the contribution of public expenditure on education is still high. It means that public expenditure on education plays an important role in economic growth and if government improve the expenditure on education, then it is helpful for economic growth. When I add birthrate to our model, I do not find that the birthrate has a significant effect on GDP. It is possible that the the birthrate in China is low, and it does not play an important role in motivating the economy. In this situation, I do not consider the lag effect and the effect of GDP on public expenditure on education. When I consider the lag effect and the effect of GDP on public expenditure on education, I will use Granger causality test to study my questions. Before I do the Granger causality test, I difference the ln(adjusted new GDP) and ln(adjusted public expenditure on education) twice and make them stationary. We assume that lag 1, lag 2 and lag 3 represent the short run and lag 4, lag 5 and lag 6 represent the long run. After I do the Granger causality test, in the short run, GDP Granger causes public expenditure on education in lag 1 and I do not find that public expenditure on education Granger causes GDP in lag 1 and I also do not find Granger causality between

GDP and public expenditure on education in lag 2 and lag 3. In the long run, I do not find that Granger causality between public expenditure on education and GDP. I do not find that public expenditure on education has a lag effect on GDP. But I find that GDP has a lag effect on public expenditure on education in lag 1. It might mean that public expenditure on education is influenced by GDP in lag 1 and the decision of government about how to invest education is influenced by GDP in lag 1. These results may help us to understand the relationship between public expenditure on education and GDP. It is possible that if we have more data or we use different method, we maybe will get more information about the relationship between public expenditure on education and GDP. It is possible that further research is helpful for us to understand the relationship between public expenditure on education and GDP.

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