Does an improvement in health encourage economic growth?:Case of Thailand

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" Economic Growth and Health Indicator in Thailand between 1980 - 2011"

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Abstract

This study aimed at estimating the relationship between economic growth measured by per capita Gross National Income (GNI) and health indicators including life expectancy and mortality rate under 5 in Thailand between 1980 - 2011 using Cochrane - Orcutt Model.

The results from revealed that only mortality rate under 5 has a strong relationship with an economic growth. Thus, the reform in medical and sanitation system in Thailand will be able to stimulate the economic prosperity and lead to development further.

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Introduction

As mentioned by Todaro & Smith (2008), health and education are the main component of human capital which encourage an economic development. Health and education link each other. Healthy labor can work with maximum productivity while educated people are easier in learning new technology or innovation correspondent to skilled labor. Additionally, Besley & Burgess (2003) explained that an increase in human capital is the core of development. Thus, this study was inspired so as to study that how can an improvement in health system affect national prosperity. The result of this study will be beneficial in issuing national policy.

Research Question

Does an improvement in medical and sanitation system can raise citizen's living standard ?

Purpose

To estimate the relationship between economic growth and health indicator in Thailand

Model Specification :

Simple Regression was implemented. There were two models. For the first model, dependent variable was economic growth and independent variable was life expectancy. For the second model, dependent variable was economic growth while independent variable was mortality rate under 5. The data of all three variable was derived from World Bank data base. All data are time series data whose range is in between 1980 to 2011.

Results

Time Series data, typically, is necessary to test stationarity (Unit Root Test) before taking them to regression model. Stationary condition displays an acceptable level of data fluctuation. Non - stationary data is able to lead to the problem of statistical inference or spurious regression. For Unit Root test, implemented Augmented - Dickey Fuller, per capita GNI is stationary at 10% alpha. Mortality rate under 5 is stationary at 5% alpha and life expectancy is stationary at 1% alpha.

After stationary process, the next step is to find the relationship between dependent and independent variable through log-linear model. The reason why I use log-linear model because the easiness in interpretation of the result (percentage change).

For the first model, per capita GNI and life expectancy. The result was shown in table 1.

Table 1: The relationship between per capita GNI and life expectancy.

Source	SS	df	MS
Model	9.71137575	1	9.71137575
Residual	2.73341172	30	.091113724
Total	12.4447875	31	.401444757

Number of obs	= 32
F(1, 30)	= 106.59
Prob > F	= 0.0000
R-squared	= 0.7804
Adj R-squared	= 0.7730
Root MSE	= .30185

loggni	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
loglifeex	18.05407	1.748746	10.32	0.000	14.48266	21.62549
_cons	-68.98777	7.474373	-9.23	0.000	-84.25248	-53.72307

Source: Author's calculation

According to table 1, there is a statistically relationship between economic growth measured by per capita GNI and life expectancy. If life expectancy increase by 1 percent, per capita GNI will increase by 18.05%. R-squared is 78.04 representing strong relationship. However, to use time series data is required to test Heteroskedasticity and Autoregression.

The result from Heteroskedasticity test was shown in table 2

Table 2: Heteroskedasticity of model 1

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of loggni

         chi2(1)      =     0.32
         Prob > chi2  =   0.5733
```

Source: Author's calculation

The result suggests that there is no the problem of heteroskedasticity.

The next step is to test autocorrelation. I used two methods to test including White Test and Durbin Watson Test (D.W.). The result from D.W. is shown in table 3

Table 3: White Test of Model 1

```
. wntestq loggni

Portmanteau test for white noise

 Portmanteau (Q) statistic =   111.6754
 Prob > chi2(14)           =     0.0000

.
```

Source: Author's calculation

According to table 3, there is autocorrelation because p - value is able to reject null hypothesis (Null hypothesis = No autocorrelation). To make sure about this result, I add the lag in to white test. The result was shown in table 4.

Table 4: White Test (lags 10) of model 1

```
. wntestq loggni, lags(10)

Portmanteau test for white noise
---------------------------------------
 Portmanteau (Q) statistic =   110.2379
 Prob > chi2(10)           =     0.0000
```

Source: Author's calculation

The result still suggested that there is autocorrelation in this model. Then, I test further using D.W. test (D.W. value has to be around 2 to reject autocorrelation). The result was shown in table 5.

Table 5: Durbin Watson Test of model 1

```
. dwstat

Durbin-Watson d-statistic(  2,    32) =  .096959
```

Source: Author's calculation

According to table 5, there is autocorrelation. Then, I also tested further by using Breusch - Godfrey. It was shown in table 6.

Table 6: Breusch - Godfrey of model 1.

Durbin's alternative test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	157.528	1	0.0000

H0: no serial correlation

. estat bgodfrey

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	27.025	1	0.0000

H0: no serial correlation

Source: Author's calculation

From the result of table 6, it is concluded that there is autocorrelation in the model. When autocorrelation occurred, the result from table 1 (simple regression) cannot use. For correcting, I use Cochrane - Orcutt Regression. The result was shown in table 7.

Table 7: Cochrane - Orcutt of Model 1

Cochrane-Orcutt AR(1) regression -- iterated estimates

Source	SS	df	MS
Model	.005652654	1	.005652654
Residual	.058837018	29	.002028863
Total	.064489672	30	.002149656

Number of obs	=	31
F(1, 29)	=	2.79
Prob > F	=	0.1058
R-squared	=	0.0877
Adj R-squared	=	0.0562
Root MSE	=	.04504

loggni	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
loglifeex	-3.723826	2.230948	-1.67	0.106	-8.286627	.8389755
_cons	25.66015	9.707826	2.64	0.013	5.805415	45.51488
rho	.9489176					

Durbin-Watson statistic (original) 0.096959
Durbin-Watson statistic (transformed) 1.176267

Source: Author's calculation

From table 7, the result suggests that Beta (coefficient of independent variable) is indifferent with zero). It can be implied that life expectancy is not statistically related with per capita GNI.

For the second model, economic growth measured by per capita GNI and mortality rate under 5. The result from simple regression model was shown in table 8.

Table 8: Regression model of per capita GNI and mortality rate under 5.

. reg loggni logmor5

Source	SS	df	MS
Model	12.2549199	1	12.2549199
Residual	.189867591	30	.00632892
Total	12.4447875	31	.401444757

Number of obs	=	32
F(1, 30)	=	1936.34
Prob > F	=	0.0000
R-squared	=	0.9847
Adj R-squared	=	0.9842
Root MSE	=	.07955

loggni	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logmor5	-1.174104	.0266819	-44.00	0.000	-1.228596	-1.119613
_cons	11.98902	.0877907	136.56	0.000	11.80972	12.16831

Source: Author's calculation

The results suggest that there is a statistically relationship between per capita GNI and mortality rate under 5. If mortality rate under 5 is decreased by 1 %, per capita GNI will be increased by 1.17%.

However, due to time series data, the importance of heteroskedasticity and autocorrelation was realized. The result from heteroskedasticty test was shown in table 9.

Table 9: Heteroskedasticity of model 2

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
          Ho: Constant variance
          Variables: fitted values of loggni

          chi2(1)      =     0.17
          Prob > chi2  =   0.6845
```

Source: Author's calculation

The result from Breusch - Pagan suggested that there was no heteroskedasticity. Then, I tested further on autocorrelation. Durbin Watson test was shown in table 10:

Table 10: Autocorrelation with Durbin Watson Test of model 2

```
. dwstat

Durbin-Watson d-statistic(  2,    32) =  .2362855
```

Source: Author's calculation

According to table 10, there is a problem of autocorrelation. Then, it was tested further with Breusch - Godfrey. The result was shown in table 11.

Table 11: Breusch - Godfrey

Durbin's alternative test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	73.119	1	0.0000

H0: no serial correlation

. estat bgodfrey

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	22.913	1	0.0000

H0: no serial correlation

.

Source: Author's calculation

According to the table 11, there is autocorrelation. Additionally, White Test was implemented. The result was shown in table 12:

Table 12: White Test of model 2

```
. wntestq logmr5

Portmanteau test for white noise
---------------------------------------
 Portmanteau (Q) statistic =   127.1024
 Prob > chi2(14)           =     0.0000

. wntestq logmr5, lag(10)

Portmanteau test for white noise
---------------------------------------
 Portmanteau (Q) statistic =   124.3094
 Prob > chi2(10)           =     0.0000
```

Source: Author's calculation

According to table 12, the result confirmed that there is autocorrelation correspondent with Durbin Watson Test. Then, it is necessary to correct this problem by using Cochrane - Orcutt Ar(1) Regression. The result was shown in table 13.

Table 13: Cochrane - Orcutt Regression of Model 2

```
Cochrane-Orcutt AR(1) regression -- iterated estimates

      Source |       SS       df       MS              Number of obs =      31
-------------+------------------------------           F(  1,    29) =  158.64
       Model |  .211280714     1  .211280714           Prob > F      =  0.0000
    Residual |  .038624087    29  .001331865           R-squared     =  0.8454
-------------+------------------------------           Adj R-squared =  0.8401
       Total |  .249904802    30   .00833016           Root MSE      =  .03649

------------------------------------------------------------------------------
      loggni |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      logmr5 |  -1.086086   .0862312   -12.60   0.000    -1.262448   -.9097233
       _cons |   11.75141   .2567208    45.78   0.000     11.22636    12.27647
-------------+----------------------------------------------------------------
         rho |    .836581
------------------------------------------------------------------------------
Durbin-Watson statistic (original)    0.236286
Durbin-Watson statistic (transformed) 1.227162
```

Source: Author's calculation

According to table 13, it suggested that per capita GNI is statistically related to mortality rate under 5. If mortality rate under 5 is decreased by 1%, per capita GNI will be increased by 1.086%. R-squared of 84.54% confirmed that a strong relationship.

Conclusion and Suggestion

As mortality rate under 5 has statistical relationship with economic growth measured by per capita Gross National Income. It was implied that a decrease of child mortality can help creating a national prosperity. When child can survive and grow up to be labor, their participation in economic activity, in production sector, service sector, or administration sector can encourage growth. A decrease in mortality rate can be reduced by a development, improvement, or reform in medical and sanitation system. Medical equipment and innovation should be supplied and distributed to rural hospital throughout the country. Doctor, nurse, and hospital worker have to work at their best for utilizing productivity aimed at generating the development of nation.

References

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