Economic Growth Elasticity of Structural Changes: Case of Thailand

durongkaveroj, wannaphong

Chiang Mai University

16 February 2014

Economic Growth Elasticity of Structural Changes

Case of Thailand

Wannaphong Durongkaveroj[1]

Abstract

Thailand's economic base was gradually shifted from agricultural-based to industrial and service country for the last 30 years. The purpose of this study was to investigate the effect of those structural changes on economic performance using Cochrane - Orcutt and Newey-West Model.

For the result, an incremental employment in agricultural sector yielded the negative effect on economy. Also, an increase in employment in service sector was better than industrial sector in supporting economic growth. Thus, government of Thailand should no longer support agricultural sector but service-based economy instead.

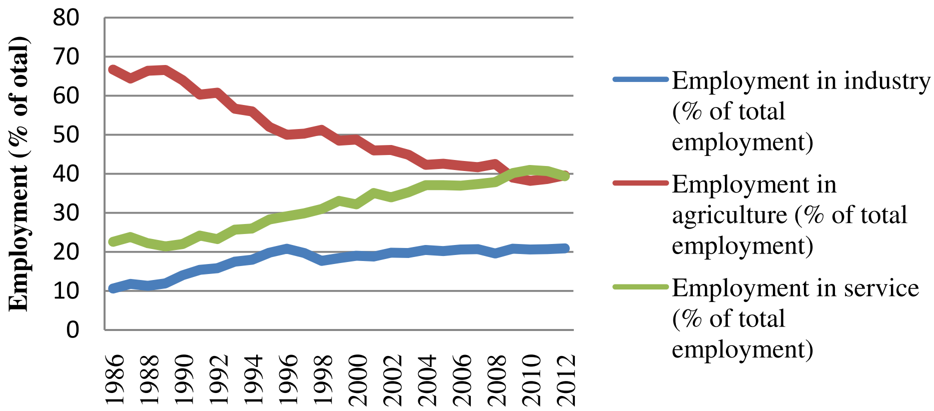
[1] Student of Master's Degree of Economics, Chiang Mai University, Thailand. It was self-interesting paper, not part of Thesis or curriculum's assignment.

Background and Introduction

Thailand is, as everyone known, agriculture-based country for a long time. With flourish nature, agriculture is, no need to say, first choice for sufficient living. But the question is "Is Thailand appropriate for being agricultural-based country?". Thai economist should answer some critiques that Thai people did agriculture because they can do it best relative to other economic base or they just have no potentials to do anything else.

However, economic structure in Thailand was dramatically changes for the last 30 years as shown in figure 1.

Figure 1: Structural Changes in Thai Economy



Source: World Bank

According to the figure 1, employment in agriculture started decreasing since 1986 while employment in industry and service began increasing. It represented the structural change from agricultural-based country to be more industrialized and serviced. In 1986, 10.6 percent of employment was in industry while 66.7 and 22.6 were in agriculture and service sector, respectively. In 2012, structure was totally changed. Proportion of employment in agricultural sector decreased to 39.6 percent while increased to 20.9 and 39.4 percent in industry sector and service sector, respectively. However, the majority of employment was still in agricultural sector. Rice, Palm, Cassava, rubber, and kenaf were industrial or economic crop in Thailand. but the poor in Thailand was, by majority, farmer due to unstable price. Always, Thai government would very much like to intervene crop product by price floor or price ceiling. Recently, rice pledging from current government was populism aimed at winning election. With the problem of inefficient administration and corruption, the policy was failed.

Besides the revenue used to promote agriculture market, Thailand has accepted the way of international economic interdependent by encouraging investment and industrial sector. Many institutions were established aimed at managing and operating a flow of funds from multi-enterprise, for example, BOI. Additionally, service sector was dramatically increasing, for example, financial sector (Banking) , tourism (hotel and restaurant), and telecommunication. ADB (2013) studied services sector in Thailand and found that services sector plays a major role to Thailand's economic growth. Policies should be issued in supporting this sector. However, industrial sector is the main source of national prosperity, especially, the developed countries in Europe region. Newly Industrialized Country (NIC) like Thailand should not reject this kind of strategy.

Objectives

The purpose of this study was to investigate the effects of changing economic structure in three kinds of pace including agricultural-based economy, industrial-based economy, and service-based economy on economic performance.

Methodology and Model Specification

Log-linear model was the main tool in analyzing. The coefficient of regressor in log-linear model was normalized as elasticity. Then, it was economic growth elasticity of an increase in employment in each sector. With time series data of the percentage of employment in agricultural, industrial, and service sector to total employment from 1986 - 2012, stationary test should be implemented firstly before running simple regression. There are three models as written;

$$loggdppc = \alpha + \beta logea \qquad (1)$$

where loggdppc stands for log of per capita GDP, logea stands for log of the proportion of employment in agricultural sector to total employment, and β stands for economic growth elasticity of an increase in agricultural employment.

$$loggdppc = \alpha + \delta logei \qquad (2)$$

where loggdppc stands for log of per capita GDP, logei stands for log of the proportion of employment in industrial sector to total employment, and δ stands for economic growth elasticity of an increase in industrial employment.

$$loggdppc = \alpha + \varphi loges \qquad (3)$$

where loggdppc stands for log of per capita GDP, loges stands for log of the proportion of employment in service sector to total employment, and φ stands for economic growth elasticity of an increase in service employment.

Results

For stationary test, employment in industrial sector was stationary at lags(0) by 95% confidence. Employment in agricultural sector was stationary at lags(6) by 95% confidence. Employment in service sector was stationary at lags(4) by 95% confidence. Per capita GDP was stationary at lags(0) by 95% confidence.

After Unitroot test, the next was to find the relationship between economic growth and employment in each sector. Firstly, the relationship between per capita GDP and employment in industrial sector. The result suggested that an increase in employment in industrial sector by 1 percents can create an increase in per capita GDP by 2.1017. R-squared was 85.71%. There was no heteroskedasticity. However, there was autocorrelation tested by durbin watson method. Then, the model was solved by using cochrance - Orcutt Model. The result shown that an increase in employment in industrial sector by 1 percent can create an increase in per capita GDP by 0.3890 percent. The result was statistically significant.

Secondly, the relationship between per capita GDP and employment in agricultural sector. The result suggested that an increase in employment in agricultural sector by 1 percent can create a decrease in per capita GDP by 2.4913. R-squared was 93.56 which shows the strong relationship. However, there were heteroskedasticity and autocorrelation. The model was solve by using Newey-West method. The result shown that an increase in employment in agricultural sector by 1 percent can lead to a decrease in per capita GDP by 2.4913 percent. The result was statistically significant.

Thirdly, the relationship between per capita GDP and employment in service sector. The result suggested that an increase in employment in service sector by 1 percent can create an increase in per capita GDP by 2.043 percent. R-squared was 87.67%. However, there were autocorrelation and heteroskedasticity. The model was solved by using Newey-West. The result shown that an increase in employment in service sector by 1 percent can create per capita GDP by 2.043 percent. The result was statistically significant.

Conclusion

With the reliable econometric method and data availability in the sense of time series, any increase in employment in agricultural sector in Thailand yields the negative effect on economy. However, an increase in other sectors positively affect economic performance, especially service sector.

Policy Suggestion

1. Government should cut any programs that supports an expand in agricultural sector, especially market intervention, for example, rice pledging which can create an artificial incentive for people to be a new farmer so as to get the benefit from the program.

2. Thailand should reform to be service-based country like many developed countries. Service sector requires high quality of labor. Then, an improvement in education and health system should be policy priority.

3. Industrial sector also yields the positive effects to economy but its effect is statistically smaller than service sector. However, infrastructure and political stability are together an important factors in supporting this sector. Besides, a cut in tax (Tax holiday) or red tape should be more encouraged throughout economy.

References

Asian Development Bank. 2013. **A Turning Point for the Services Sector in Thailand**. Retrieved February 15, 2014, from http://adb.ord/publications/turning-point-service-sector-thailand.

Oscar, T. n.d. **Time Setries**. Princeton University. Retrieve February 6, 2014, from http://www.princeton.edu/~otorres/TS101.pdf

World Bank. 2013. **World Development Indicator**. Retrieved February 15, 2014, from http://databank.worldbank.org.

Regression Results (Stata)

1. Unitroot Test

tsset year

time variable: year, 1 to 27

delta: 1 unit

. dfuller logei

Dickey-Fuller test for unit root   Number of obs   =   26

---------- Interpolated Dickey-Fuller ---------

Test   1% Critical   5% Critical   10% Critical

Statistic	Value	Value	Value

Z(t)	-2.970	-3.743	-2.997	-2.629

MacKinnon approximate p-value for Z(t) = 0.0378

. dfuller logea

Dickey-Fuller test for unit root Number of obs = 26

	---------- Interpolated Dickey-Fuller ---------		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) -1.020	-3.743	-2.997	-2.629

MacKinnon approximate p-value for Z(t) = 0.7458

. dfuller logea, lag(1)

Augmented Dickey-Fuller test for unit root Number of obs = 25

	---------- Interpolated Dickey-Fuller ---------		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) -0.857	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.8018

. dfuller logea, lag(2)

Augmented Dickey-Fuller test for unit root Number of obs = 24

	---------- Interpolated Dickey-Fuller ---------			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.342	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.6099

. dfuller logea, lag(3)

Augmented Dickey-Fuller test for unit root Number of obs = 23

	---------- Interpolated Dickey-Fuller ---------			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.922	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.3218

. dfuller logea, lag(4)

Augmented Dickey-Fuller test for unit root Number of obs = 22

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
	---------- Interpolated Dickey-Fuller ---------			
Z(t)	-2.218	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.1998

. dfuller logea, lag(5)

Augmented Dickey-Fuller test for unit root Number of obs = 21

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
	---------- Interpolated Dickey-Fuller ---------			
Z(t)	-1.956	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.3060

. dfuller logea, lag(6)

Augmented Dickey-Fuller test for unit root Number of obs = 20

---------- Interpolated Dickey-Fuller ---------

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.995	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0353

. dfuller loges

Dickey-Fuller test for unit root Number of obs = 26

---------- Interpolated Dickey-Fuller ---------

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-0.835	-3.743	-2.997	-2.629

MacKinnon approximate p-value for Z(t) = 0.8087

. dfuller loges, lag(1)

Augmented Dickey-Fuller test for unit root Number of obs = 25

---------- Interpolated Dickey-Fuller ---------

Test 1% Critical 5% Critical 10% Critical

Statistic	Value	Value	Value
Z(t) -0.533	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.8855

. dfuller loges, lag(2)

Augmented Dickey-Fuller test for unit root   Number of obs   =   24

	---------- Interpolated Dickey-Fuller ---------		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) -1.193	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.6765

. dfuller loges, lag(3)

Augmented Dickey-Fuller test for unit root   Number of obs   =   23

	---------- Interpolated Dickey-Fuller ---------		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) -2.305	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.1703

. dfuller loges, lag(4)

Augmented Dickey-Fuller test for unit root Number of obs = 22

	---------- Interpolated Dickey-Fuller ---------		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) -3.520	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0075

. dfuller loggdppc

Dickey-Fuller test for unit root Number of obs = 26

	---------- Interpolated Dickey-Fuller ---------		
Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t) -2.907	-3.743	-2.997	-2.629

MacKinnon approximate p-value for Z(t) = 0.0445

2. Regression Result

2.1 Test relationship between per capita GDP and employment in industrial sector

```
. reg  loggdppc logei

      Source        SS       df       MS            Number of obs =      27
                                                    F(  1,    25) =  149.89
       Model   5.10407605     1  5.10407605         Prob > F      =  0.0000
    Residual   .851297796    25  .034051912         R-squared     =  0.8571
                                                    Adj R-squared =  0.8513
       Total   5.95537385    26   .22905284         Root MSE      =  .18453

    loggdppc       Coef.   Std. Err.      t    P>t     [95% Conf. Interval]

       logei    2.101672   .1716632    12.24   0.000     1.748125    2.455219
       _cons    2.448931   .4936044     4.96   0.000     1.432333    3.465528

. hettest

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

         chi2(1)      =     1.97
         Prob > chi2  =   0.1609
```

. dwstat

Durbin-Watson d-statistic(2, 27) = .314803

. prais loggdppc logei, corc

Iteration 0: rho = 0.0000

Iteration 1: rho = 0.8941

Iteration 2: rho = 0.9152

Iteration 3: rho = 0.9252

Iteration 4: rho = 0.9314

Iteration 5: rho = 0.9357

Iteration 6: rho = 0.9389

Iteration 7: rho = 0.9414

Iteration 8: rho = 0.9434

Iteration 9: rho = 0.9451

Iteration 10: rho = 0.9464

Iteration 11: rho = 0.9476

Iteration 12: rho = 0.9486

Iteration 13: rho = 0.9494

Iteration 14: rho = 0.9502

Iteration 15: rho = 0.9508

Iteration 16: rho = 0.9514

Iteration 17: rho = 0.9519

Iteration 18: rho = 0.9524

Iteration 19: rho = 0.9528

Iteration 20: rho = 0.9532

Iteration 21: rho = 0.9535

Iteration 22: rho = 0.9538

Iteration 23: rho = 0.9541

Iteration 24: rho = 0.9543

Iteration 25: rho = 0.9545

Iteration 26: rho = 0.9547

Iteration 27: rho = 0.9549

Iteration 28: rho = 0.9551

Iteration 29: rho = 0.9552

Iteration 30: rho = 0.9554

Iteration 31: rho = 0.9555

Iteration 32: rho = 0.9556

Iteration 33: rho = 0.9557

Iteration 34: rho = 0.9558

Iteration 35: rho = 0.9559

Iteration 36: rho = 0.9560

Iteration 37: rho = 0.9561

Iteration 38: rho = 0.9562

Iteration 39: rho = 0.9562

Iteration 40: rho = 0.9563

Iteration 41: rho = 0.9563

Iteration 42: rho = 0.9564

Iteration 43: rho = 0.9564

Iteration 44: rho = 0.9565

Iteration 45: rho = 0.9565

Iteration 46: rho = 0.9566

Iteration 47: rho = 0.9566

Iteration 48: rho = 0.9566

Iteration 49: rho = 0.9567

Iteration 50: rho = 0.9567

Iteration 51: rho = 0.9567

Iteration 52: rho = 0.9567

Iteration 53: rho = 0.9568

Iteration 54: rho = 0.9568

Iteration 55: rho = 0.9568

Iteration 56: rho = 0.9568

Iteration 57: rho = 0.9568

Iteration 58: rho = 0.9569

Iteration 59: rho = 0.9569

Iteration 60: rho = 0.9569

Iteration 61: rho = 0.9569

Iteration 62: rho = 0.9569

Iteration 63: rho = 0.9569

Iteration 64: rho = 0.9569

Iteration 65: rho = 0.9569

Iteration 66: rho = 0.9569

Iteration 67: rho = 0.9569

Iteration 68: rho = 0.9570

Iteration 69: rho = 0.9570

Iteration 70: rho = 0.9570

Iteration 71: rho = 0.9570

Iteration 72: rho = 0.9570

Iteration 73: rho = 0.9570

Iteration 74: rho = 0.9570

Iteration 75: rho = 0.9570

Iteration 76: rho = 0.9570

Iteration 77: rho = 0.9570

Iteration 78: rho = 0.9570

Iteration 79: rho = 0.9570

Iteration 80: rho = 0.9570

Iteration 81: rho = 0.9570

Iteration 82: rho = 0.9570

Iteration 83: rho = 0.9570

Iteration 84: rho = 0.9570

Iteration 85: rho = 0.9570

Iteration 86: rho = 0.9570

Iteration 87: rho = 0.9570

Iteration 88: rho = 0.9570

Iteration 89: rho = 0.9570

Iteration 90: rho = 0.9570

Iteration 91: rho = 0.9570

Iteration 92: rho = 0.9570

Iteration 93: rho = 0.9570

Iteration 94: rho = 0.9570

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

Source SS df MS Number of obs = 26

F(1, 24) = 6.37

Model .01122296 1 .01122296 Prob > F = 0.0186

Residual .04226208 24 .00176092 R-squared = 0.2098

Adj R-squared = 0.1769

Total .05348504 25 .002139402 Root MSE = .04196

loggdppc Coef. Std. Err. t P>t [95% Conf. Interval]

logei .3890272 .1540977 2.52 0.019 .0709852 .7070691

_cons 8.634735 .5678476 15.21 0.000 7.462755 9.806715

rho .9570315

Durbin-Watson statistic (original) 0.314803

Durbin-Watson statistic (transformed) 1.707667

2.2 Test relationship between per capita GDP and employment in agricultural sector

. reg loggdppc logea

Source SS df MS Number of obs = 27

F(1, 25) = 363.26

Model 5.5719042 1 5.5719042 Prob > F = 0.0000

Residual .383469649 25 .015338786 R-squared = 0.9356

Adj R-squared = 0.9330

Total 5.95537385 26 .22905284 Root MSE = .12385

loggdppc	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
logea	-2.491307	.1307136	-19.06	0.000	-2.760517	-2.222097
_cons	18.21089	.5113003	35.62	0.000	17.15784	19.26393

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of loggdppc

chi2(1) = 6.36

Prob > chi2 = 0.0116

. dwstat

Durbin-Watson d-statistic(2, 27) = .6208789

. newey loggdppc logea, lag(0)

Regression with Newey-West standard errors Number of obs = 27

maximum lag: 0 F(1, 25) = 245.90

Prob > F = 0.0000

Newey-West

loggdppc	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
logea	-2.491307	.1588725	-15.68	0.000	-2.818511	-2.164103
_cons	18.21089	.6076243	29.97	0.000	16.95946	19.46231

2.3 Test relationship between per capita GDP and employment in service sector

. reg loggdppc loges

Source	SS	df	MS		
				Number of obs =	27
				F(1, 25) =	177.83
Model	5.22132485	1	5.22132485	Prob > F =	0.0000
Residual	.734048991	25	.02936196	R-squared =	0.8767
				Adj R-squared =	0.8718
Total	5.95537385	26	.22905284	Root MSE =	.17135

loggdppc	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
loges	2.042983	.1532029	13.34	0.000	1.727456	2.35851
_cons	1.48272	.5254955	2.82	0.009	.4004416	2.564998

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of loggdppc

chi2(1) = 6.57

Prob > chi2 = 0.0104

. dwstat

Durbin-Watson d-statistic(2, 27) = .4648503

. newey loggdppc loges, lag(0)

Regression with Newey-West standard errors Number of obs = 27

maximum lag: 0 F(1, 25) = 142.18

Prob > F = 0.0000

		Newey-West				
loggdppc	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
loges	2.042983	.1713343	11.92	0.000	1.690114	2.395853
_cons	1.48272	.6076503	2.44	0.022	.2312406	2.734199

....