Bordering neighbours: Testing for border effect on Malaysia's northern states and Southern Thailand

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BORDERING NEIGHBOURS: TESTING FOR BORDER EFFECT ON MALAYSIA'S NORTHERN STATES AND SOUTHERN THAILAND

by

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ABSTRACT

Economists agree that countries that are close together may experience common shocks that affect growth; that a country's growth rate depends not only on domestic investment but also on the investment of its neighbouring countries. On the negative point, common shock such as wars and political instability can also have an adverse effect on growth of neighbouring countries. First, regional instability disrupts trade flows. Second, regional instability forces increases in military outlays, and will have a negative effect on economic performance. The purpose of the present study is to determine whether the growth rate of the neighbouring provinces of Southern Thailand has an effect on the economic growth of the Northern states of Malaysia. Using annual data from 1983 to 2003, our results using the long-run *Granger* causality in the vector error correction model setting suggest that Songkhla and Yala *Granger* cause Kedah; Songkhla *Granger* cause Perlis; and Narathiwat *Granger* cause Kelantan. On the other hand, while Perak and Yala indicate *Granger* cause in both direction, Perlis and Satun are independent of each other.

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1. INTRODUCTION

Malaysia comprises of six regions. The northern region consisted of four states, namely; Kedah, Perak, Perlis and Penang. The central region also comprised of four states, that is, the states of Melaka, Negeri Sembilan, Selangor and Wilayah Persekutuan. The eastern region composed of three states-Kelantan, Pahang and Terengganu. The southern region consists of Johore as the only state. The other two regions are the states of Sabah and Sarawak. Of all the fourteen states, the more developed states are Johore, Melaka, Negeri Sembilan, Perak, Penang Wilayah Persekutuan and Selangor, and the less developed states are Kedah, Kelantan, Pahang, Perlis, Sabah, Sarawak and Terengganu.

Table 1 shows some interesting scenario for the economic performance of the states in Malaysia. As shown in Table 1, in the year 1970, the income of four states of the more developed states category are above the national average, where Wilayah Persekutuan as the leader. On the other hand, under the less developed states category, six out of seven of the states are below the national average. Only Sabah's real GDP per capita is above the national average. However, in year 2000, interesting development emerge. For the more developed states, Melaka and Penang has been catching-up and emerge as the new states that contribute to the above average to national GDP. Unfortunately, the states of Perak and Negeri Sembilan has been lagging for the past four decade and in year 2000, their real GDP per capita has been below the national average.

On the other hand, for the less developed states, the state of Terengganu has been catching-up to the richer states. But, Sabah being the third richest states in 1970, has been relegated to the third poorest states in Malaysia. In term of ranking (shown in the parentheses), Terengganu ranked second to Wilayah Persekutuan as the richest states. Kedah and Kelantan remain poor for the last three to four decades. Sarawak, on the other hand, despite bordering Sabah, manages to maintain her position as the eighth richest states in Malaysia in year 2000.

The purpose of the present study is to determine empirically whether the growth of the neighbouring country – Southern Thailand has an effect on the economic growth of the states of Perlis, Kedah, Perak and Kelantan. For the four northern states of Malaysia, namely; the state of Perlis is neighbouring to Satun and Songkhla; Kedah is neighbouring to Songkhla and Yala; Perak is neighbouring to Yala; while Kelantan is neighbouring to Narathiwat. Our main question to be addressed in this study is whether development in these neighbouring provinces matter for economic growth in the four northern states of Malaysia? In this study we employed the technique of univariate unit root tests and vector error correction model to determine the causal effect between Perlis, Kedah, Perak, Kelantan, Songkhla, Yala, Satun and Narathiwat for the period 1983 to 2003.

The plan of the paper is as follow. In the next section we discuss some evidence on the effect of geographical proximity or location and the growth of nations. In section 3, we present the unit root testing and *Granger* causality test in the VECM framework used in the study. In section 4, we discuss the empirical results and the last section contains our conclusion.

2. DOES DEVELOPMENT IN NEARBY COUNTRIES MATTERS?

Temple (1999) has observed that global income and output distribution shows geographically clustered together between prosperous and high growth countries as well as clusters of low growth and poor countries. The pattern suggests that fast growing countries apparently cluster together, as do slow-growing ones. For example, there has been concentration of growth failures in sub-Saharan Africa, success in East Asia, and high volatility synchronized across Latin American countries. There are several reasons why we expect strong correlation of growth between neighbouring countries (Silveira-Neto and Azzoni, 2005). First, areas with similar geographical (physical and human) and economic background conditions are sometimes artificially split into different jurisdictions (municipalities, states, etc). Since these jurisdictions belong to a similar socio-economic environment, intense interaction among them is to be expected. Second, interaction between neighbouring countries, through the flow of goods, factors and information, is easier and faster, due to lower transportation costs. Third, factors relates to the fact that neighbouring countries tend to experience common shocks, such as wars, political instabilities or even weather-related events, such as drought, similar rainfall patterns, etc., all of which can affect their economic performance.

Moreno and Trehan (1997) has shown evidence of growth spillovers across countries. In China, the rapid growth in the coastal areas of China was the result of a significant shift proportion of Hong Kong's manufacturing sector to this area starting in the 1980s. It has been recognized that the growth in some areas of Indonesia and Malaysia was the result of several decades of rapid growth in Singapore when firms from Singapore routinely set up manufacturing plants in the nearby states and countries. Growth in neighbouring countries can also have adverse effect on growth. Lall and Shalizi (2003) found a negative association between growth in neighbouring municipios and individual municipios. Lall and Shalizi (2003) explain that improvements in the structural variables are likely to increase growth performance in the region. If growth in a particular region is higher than that of its neighbours, the region is likely to attract mobile capital and skilled labour from neighbouring regions, thereby having a detrimental effect on growth performance in neighbouring regions.

Similar evident was found by Boarnet (1998) who shows that highway projects in California countries provide benefits to investing countries at the expense of other countries within the state, suggesting possibilities of negative output spillovers from public investments. In contrast, however, Haughwout (1998) shows positive spillover effect of public investment. Haughwout (1998) argues that central city investments provide benefits to the suburbs, demonstrating the case for positive spatial externalities. The evidence of regional spillovers from human and physical capital between countries located in common geographical regions are further supported by Ades and Glaeser (1994) and Chua (1993). Ades and Glaeser (1994) show that railroad density in nearby states had a positive influence on urbanization and manufacturing growth rates in the United States during the second half of the nineteenth century. Chua (1993) provides empirical support for the proposition that a country's growth rate depends not only on domestic investment but also on the investment of its neighbouring countries.

Countries that are close together may also experience common shocks that affect growth as well. Moreno and Trehan (1997) put forward that the yen appreciation of the mid-1980s and the early 1990s caused a permanent transfer of Japanese technology and the relocation of some production facilities to East Asia. Another common shock such as wars and political instability can also have an adverse effect on growth of neighbouring countries. As pointed by Ades and Chua (1997), the economy of Burundi and Rwanda has suffered as a result of political turmoil in neighbouring Uganda and Tanzania. The transportation, trade and tourism sectors in Rwanda were severely affected by the wars. In the Middle East, the Gulf Crisis between 1990 and1991 affects neighbouring country like Jordan. Jordan lost her export markets in Iraq, Saudi Arabia and Kuwait, and remittances from Jordanian workers in Kuwait and Saudi Arabia. In their study of ninety-eight countries, Ades and Chua (1997) conclude that political instability in neighbouring countries has a strong adverse effect on economic performance. According to Ades and Chua (1997), there are two main channels through which regional instability affects economic performance. First, regional instability disrupts trade flows. Second, regional instability forces increases in military outlays, to the extent that these increased military outlays crowd out resources from other productive forms of government expenditure, they will have a negative effect on economic performance.

Another channel for spillover is explained by technological spillovers. Goodfriend and McDermott (1998) explored the direct influence of technical progress in neighbouring countries. They treat location as a key factor in the determination of the degree of income convergence in a growth model with technological spillovers. Barro and Sala-i-Martin (1997) construct a model in which growth depends on the discovery of new products or technologies in a few leading economies. Barro and Sala-i-Martin (1997) conclude that in the long, the world growth rate is driven by discoveries in the technologically leading economies. Followers converge toward the leaders because copying is cheaper than innovation over some range. A tendency for copying costs to increase reduces followers' growth rates and thereby generates a pattern of conditional convergence.

In another study, Eaton and Kortum (1994, 1996) use data on patents to show that technological spillovers extend beyond national borders and that this relationship tends to get weaker as the distance between countries increases. Co and Wohar (2004) point out that knowledge diffusion can be a function of distance. This imply that not only lagging regions benefit from knowledge spillover from leading regions, but those closest to the leading regions benefit more. In conclusion, Co and Wohar (2004) argue that technological convergence depends on inter-region spillover where both proximity to leading states and lagging states' technological abilities determine the extent of inter-region knowledge spillover.

3. METHODOLOGY

We proceed our analysis by employing the vector error correction model to infer cointegration (that is long run relationship between the variables involved) among the series. According to the 'Granger Representation Theorem' not only does cointegration imply the existence of an error correction model but also the converse applies, that is, the existence of an error correction model implies cointegration of the variables. Recent developments in cointegration and error correction model as pointed by Pesavento (2004) suggest that the Johansen's test for cointegration has low power in both large and small sample compared to the error correction model. In fact, Kremers et al. (1992) have argued that the standard *t*-ratio for the coefficient on the error-correction term in the dynamic equation is a more powerful test for cointegration. Banerjee et al. (1986) and Kremers et al. (1992) show that standard asymptotic theory can be used when conducting the test in the context of an error correction model; specifically, the *t*-statistics on the error correction term coefficients have the usual distribution.

Since our task is to determine the causal direction between the two variables in question, we estimate the following vector error correction model and for a two variable case, we specify the following bi-variate vector error correction models (VECM) as

$$\Delta y_t = a_0 + \sum_{i=1}^{k} \alpha_i \Delta y_{t-i} + \sum_{j=1}^{k} \alpha_j \Delta x_{t-j} + \gamma_1 ecm_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta x_t = b_0 + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + \sum_{j=1}^{k} \beta_j \Delta x_{t-j} + \gamma_2 ecm_{t-1} + \varepsilon_{2t} \quad (2)$$

where ecm_{t-1} is the lagged residual from the cointegration between y_t (say, kedah's gdp) and x_t (Yala's gdp) in level. Granger (1988) points out that based on equation (1), the null hypothesis that x_t does not *Granger* cause y_t is rejected not only if the coefficients on the x_{t-j}, are jointly significantly different from zero, but also if the coefficient on ecm_{t-1} is significant. The VECM also provides for the finding that x_{t-j} *Granger* cause y_t, if ecm_{t-1} is significant even though the coefficients on x_{t-j} are not jointly significantly different from zero. Furthermore, the importance of α's and β's and represent the short-run causal impact, while γ's gives the long-run impact. In determining whether y_t *Granger* cause x_t, the same principle applies with respect to equation (2). Above all, the significance of the error correction term indicates cointegration, and the negative value for γ's suggest that the model is stable and any deviation from equilibrium will be corrected in the long-run.

Description and Sources of Data

In this study we are using real per capita regional gross domestic product (proxy for regional income) for four states of northern Malaysia, and four regions of southern Thailand for the period 1983 to 2003 in US$. To derive at each of the regional per capita income, each of the nominal (domestic currency) regional GDP was divided by the regional population and consumer price index. To convert to income of common currency, we deflate all real per capita regional gross domestic products with US currency. All data were converted into natural logarithm for estimation throughout the study.

Data for nominal regional GDP, consumer price index, population and exchange rate (domestic per US$) for the states and provinces were compiled from various sources as follow: (a) Perlis, Kedah, Perak and Kelantan from various issues of the 5-Year Malaysia Plan. A complete range of time series data for states per capita GDP were interpolated using information on time trend, time squared and lagged states GDP per capita; and (b) the four provinces of the Southern Thailand, that is, Satun, Songkhla, Tala and Narathiwat; time series data were collected for various issues of Yearbook Statistics published by National Economic and Social Development Board, Thailand.

4. DISCUSSIONS ON EMPIRICAL RESULTS

Before testing for causality based on Equations (1) and (2), it is essential to determine the order of integration for each of the regions income series. The standard augmented Dickey-Fuller (ADF, Dickey and Fuller, 1981) unit root test regression is as follow:

$$(3) \qquad \Delta y_t = a + bt + \beta y_{t-1} + \sum_{i=1}^{n} d_i \Delta y_{t-i} + \nu_t$$

where Δ is the difference operator, t is a linear time trend and ν is the disturbance term. The hypothesis that a series contains a unit root is tested by $H_0 : \beta = 0$. Rejection of the latter hypothesis suggests the existence of a deterministic trend. τ_T is the t-statistic for testing the significance of β when a time trend is included in the above equation while τ_μ when time trend is excluded. The result of the ADF test are reported in Table 2, with series in levels are run with constant and trend, while series in first difference are run with a constant only. The chosen lag length n, is selected based on SC criteria.[2] The estimated $t-$statistics for the ADF test reported in Table 2 indicate that all regions real GDP per capita series are $I(1)$ processes. The null hypothesis of unit root cannot be rejected at the 5 percent level of significance for series in levels, while for series in first difference, the null hypothesis of $I(2)$ can be rejected at the 5 percent level of significance. In other words, the regions per capita income series achieve stationarity after first differencing.

Having determined that all regional per capita GDP are integrated of order one, that is, they are $I(1)$ processes; we proceed for the testing of *Granger* causality by using the vector error correction framework. The results of estimating equations (1) and (2) are presented in Table 3. In our study, we can also determine whether two regions are related in the long-run and when these variables are related or exhibit long-run relationship, we would expect the estimated parameters of the error correction terms in equations (1) and/or (2) are statistically significant from zero. From the VECM results in Table 3, we presented the *t*-statistics of the error correction term, ecm_{t-1}, where we can infer the long-run *Granger* causality between the variables. The significance (at least one) of the error correction term implies cointegration or exhibit long-run relationship between two regions.

Generally, results in Table 3 indicate that there are cointegration between the state of Kedah and Songkhla and Yala; between Perlis and Songkhla; between Perak and Yala; and between

[2]In this study, we used EViews5.1 and the software automatically selects the optimal lag length based on SC.

Kelantan and Narathiwat. At least one of the error-correction terms, ecm_{t-1} is statistically significantly different from zero at the 5 percent level in the two variable VAR systems. In other words, these states/regions are bound together by the long-run relationships. Further, the significance of the error correction term (*ecm*) suggest support for *Granger* causality. As shown in Table 3, one-way directional *Granger* causality are shown by Songkhla and Yala which *Granger* cause Kedah; Songkhla *Granger* causes Perlis; and Narathiwat *Granger* causes Kelantan. A bi-directional *Granger* causal relationship is shown between Perak and Yala. On the other hand, the state of Perlis and Satun in southern Thailand are independent of each other.

5. CONCLUSION

The objective of the present study is to test empirically whether economic growth in neighbouring country, in this case, southern Thailand has an impact on the growth of the four northern states of Malaysia. Various studies on spillover effect have indicated that the development in nearby states or regions have positive and/or negative effect on regional growth.

By using *Granger* causality analysis from the perspective of the vector error correction framework, generally our findings indicate that except for Perlis and Satun, the southern regions of Thailand have an impact on the economic development in the northern states of Malaysia for the period 1983 to 2003. This, suggest that the growth of neighbouring countries either positive of negative does play a key role in explaining economic growth in the northern states of Malaysia for the period under study.

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Table 1: Real GDP per Capita, 1970 and 2000 (Malaysia=100)

States	1970	2000
Northern Region:		
Kedah	73 (11)	60 (13)
Perak	103 (5)	81 (9)
Perlis	72 (12)	66 (11)
Penang	96 (6)	143 (3)
Central Region:		
Melaka	72 (13)	104 (5)
Negeri Sembilan	104 (4)	93 (7)
Selangor	148 (2)	124 (4)
Wilayah Persekutuan	176 (1)	205 (1)
Eastern Region:		
Kelantan	44 (14)	42 (14)
Pahang	93 (7)	67 (10)
Terengganu	81 (10)	154 (2)
Southern Region:		
Johore	84 (9)	96 (6)
Sabah	118 (3)	65 (12)
Sarawak	92 (8)	90 (8)
Malaysia	100	100

Notes: Author's calculation. Figures in the parentheses are indicator of states ranking according to real GDP per capita.
Sources: Computed from various issues of the Malaysia Development Plans.

Table 2: ADF unit root tests for the order of integration

Real per capita regional GDP series	**Levels: Constant and trend**	**p**	**First differences: Constant**	**p**
Kedah	-1.70	0	-5.24*	0
Kelantan	-2.40	0	-4.86*	0
Perak	-1.79	0	-4.62*	0
Perlis	-1.59	0	-4.17*	0
Narathiwat	-1.91	0	-5.13*	0
Satun	-3.01	0	-5.30*	1
Songkhla	-2.55	0	-6.04*	0
Yala	-1.80	0	-5.38*	0

Notes: Asterisk (*) denotes statistically significant different from zero at the 5% level. The calculated statistics are those computed in MacKinnon (1996). The critical values at 5% for T=50 is -3.49 and -2.91 for τ_T and τ_μ respectively. The optimal lag length was chosen based on SC criterion throughout the analysis.

Table 3: Results of Long-Run Causality from the VECM Models (VAR=2)

Regions	Dependent variable	*t*-statistics of ecm term from VECM models: ecm_{t-1}	Implication of direction of *Granger* causality
Kedah vs Songkhla	ΔKedah	-2.41*	Songkhla==> Kedah
	ΔSongkhla	-0.69	Kedah=/=> Songkhla
Kedah vs Yala	ΔKedah	-2.33*	Yala ==> Kedah
	ΔYala	-1.03	Kedah =/=> Yala
Perlis vs Satun	ΔPerlis	-1.43	Satun=/=> Perlis
	ΔSatun	0.81	Perlis=/=> Satun
Perlis vs Songkhla	ΔPerlis	-2.88*	Songkhla==> Perlis
	ΔSongkhla	-0.88	Perlis =/=> Songkhla
Perak vs Yala	ΔPerak	-2.50*	Yala==> Perak
	ΔYala	-2.14*	Perak==> Yala
Kelantan vs Narathiwat	ΔKelantan	-2.67*	Narathiwat==> Kelantan
	ΔNarathiwat	-1.23	Kelantan=/=> Narathiwat

Notes: Asterisk (*) denotes statistically significance at the 5% level. The symbol ==> denotes *Granger* direction of causal causes.