Has Kelantan grown faster than other states in Malaysia? A panel data analysis

Habibullah, M.S. and Smith, Peter and Dayang-Afizzah, A.M.

Universiti Putra Malaysia, Universiti Malaysia Sarawak, University of Southampton

18 January 2008

HAS KELANTAN GROWN FASTER THAN OTHER STATES IN MALAYSIA? A PANEL DATA ANALYSIS

by

Muzafar Shah Habibullah[1*]
Peter Smith[2]
and
A.M. Dayang-Affizzah[3]

ABSTRACT

Kelantan has been the poorest state in Malaysia for the past five decades. Despite the various Malaysian Development Plans for the past several decades, regional disparity between states remains in Malaysia. Thus, the objective of the present paper is to address the question whether Kelantan has been narrowing their income gap with other states in Malaysia. Using annual data for the period 1961 to 2003, our panel unit root test result suggest that (i) Kelantan converges towards Kedah, Negeri Sembilan, Perak, Pahang, Perlis and Selangor.; (ii) Kelantan is catching-up to Johor, Melaka, Penang, Sabah, Terengganu and Wilayah Persekutuan; and (iii) Kelantan show divergence with Sarawak. In this respect, the government has an important role to play in enhancing growth by continuously providing stable economic environment for investment and other productive economic activities. This will ensure full convergence can take place in the future.

1. INTRODUCTION

Malaysia's economic growth has surpasses that of the other ASEAN nations including also the industrialized countries. Nevertheless, disparity in income across states in Malaysia continues to be a matter of concern. The existence of regional inequalities and the prospect that these inequalities may widen were recognized by the Malaysian government. As a matter of fact, the eight volumes of the 5-Year Malaysia Plan reflects the sincerity of the Malaysian government in eradicating if not elevating the problem of regional or states imbalances. Accordingly, in their quest to achieve both development and equity at the same time, policies and strategies are continuously being formulated and implemented across the states.

Table 1 and Table 2 show some interesting observations on the performance of the fourteen states in Malaysia for the period 1970 and 2000. In the year 1970, five states - Negeri

[1]Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia. [2]Department of Economics, University of Southampton, Highfield, Southampton, SO17 1BJ United Kingdom. [3]Department of Economics, Faculty of Economics and Business, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.
[*]Corresponding Author. Tel.: +603-89467635. Fax.: +603-89467665. Email addresses: muzafar@econ.upm.edu.my (M.S.Habibullah), P.Smith1@soton.ac.uk (P.Smith), daam1w07@soton.ac.uk (A.M.Dayang-Affizzah).

Sembilan, Perak, Selangor, Sabah and Wilayah Persekutuan registered real GDP per capita that is above the national average. However, in the year 2000, Melaka, Penang, Selangor, Terengganu and Wilayah Persekutuan has been acting as the engine of growth for Malaysia, contributing to real GDP per capita that is above the national average. Take for example the state of Sabah, where in the year 2000, Sabah has been lagging behind the national average by 35 percent of real GDP per capita. In terms of her ranking, in 1970, Sabah ranked third after Wilayah Persekutuan and Selangor. However in 2000, Sabah ranked twelve followed by Kedah (13th) and Kelantan (14th). The statistics suggest that in 2000 Sabah is the third poorest state in Malaysia, despite her high ranking as the third richest states in 1970.

As for the state of Kedah, she was ranked 11th in 1970, but since 1980 the state of Kedah has been the second poorest state in the country. Kelantan, however, remain the poorest of all the states in Malaysia for the last four decades. The states of Melaka and Terengganu are two good examples where poor states catch up to the richer states in Malaysia. The state of Melaka was ranked 13th in 1970 and by 2000 she was ranked 5th, while Terengganu was ranked 10th in 1970 but in 2000, the state of Terengganu is the second riches state in Malaysia in terms of real GDP per capita. On the other hand, the states of Selangor and Wilayah Persekutuan remain the richest states in Malaysia for the past decades.

The purpose of the present paper is to assess empirically whether the states of Kelantan has been converging, diverging or catching-up with the rest of the thirteen states in Malaysia. In a case of convergence, the existence of market forces will eventually lead to similar living standards across states. On the other hand, the catching-up hypothesis suggests that the poorer states with low initial income and productivity will tend to grow more rapidly by copying the technology from the leader country, say by replacing existing older capital stock with more modern equipment, implying that capital investment is necessary to import the more advanced technology embodied in new equipment (Lim and McAleer, 2004). One good example of transferring foreign technology and knowledge to the host country is through foreign direct investment.

In this study, time-series data for the period 1961 to 2003 will be used to evaluate the convergence hypothesis between Kelantan and other states in Malaysia. In a time-series approach, stochastic convergence asks whether permanent movements in one country's per capita income are associated with permanent movements in another countries' income, that is, it examines, whether common stochastic elements matter, and how persistent the differences among countries are. Thus, stochastic convergence implies that income differences among countries cannot contain unit roots. In other words, income per capita among countries is stationary.

The paper is organized as follows. In the next section we present the three panel unit root tests procedure to test the convergence hypothesis. In section 3 we interpret and discuss the results of the analysis. The last section contains our conclusion.

2. METHODOLOGY

Following Bernard and Durlauf (1995), stochastic convergence occurs if relative log per capita GDP, y_{iqt}, follows a stationary process, where $y_{iqt} = \log Y_{it} - \log Y_{qt}$, and Y_{it} is the log of real per capita GDP for state i, and Y_{qt} is log of real per capita GDP of a reference state, and both series is $I(1)$. Stochastic convergence is commonly tested by using the conventional univariate augmented Dickey-Fuller (ADF) regression of the following form[2]

$$\Delta y_{iqt} = \alpha_i + \lambda_i t + \beta_i y_{iqt-1} + \sum_{j=1}^{p} \theta_{ij} \Delta y_{iqt-j} + \varepsilon_{iqt}, \qquad t = 1,\ldots,T \tag{1}$$

for $i = 1,\ldots,N$ states, and $j = 1,\ldots,p$ ADF lags. In a time series framework, a distinction is made between long-run convergence and convergence as catching-up. The statistical tests are interpreted as follows. First, if y_{iqt} contains a unit root (i.e. $\beta = 1$), real GDP per capita for state i and q diverge over time. Second, if y_{iqt} is stationary (i.e. no stochastic trend, or $\beta<1$) and (a) $\alpha_i = 0\, and\, \lambda_i = 0$ (i.e the absence of a deterministic trend) indicates absolute convergence between states i and q. In this case, poor states is growing faster than the rich states given the initial condition so that the gap between two states becomes zero; (b) $\alpha_i \neq 0\, and\, \lambda_i = 0$ indicates a conditional convergence whereby the gap between the two states diminishes in the course of time and finally becomes a constant; (c) $\alpha_i \neq 0\, and\, \lambda_i \neq 0$ indicates catching-up (or narrowing of output differences) between states i and q.

According to Oxley and Greasley (1995) catching-up differs from conditional convergence in that the latter relates to some particular period *T* equated with long-run steady-state equilibrium. In this case the existence of a time trend in the non-stationary $\log Y_{it} - \log Y_{qt}$ would imply a narrowing of the (per capita income) gap or simply that the states though catching-up had not yet converged. Conversely, the absence of a time trend in the stationary series implies that catching-up has been completed. The literature on catching-up suggests that due to diffusion and imitation, relatively backward countries should grow at a faster rate. Through diffusion and imitation it is supposed that a ‘follower’ country experiencing a technological gap can increase its rate of economic growth by catching-up with the technology of the ‘leader’. As pointed by Skonhoft (1995), a main premise for the process of convergence is the existence of differences in the level of technology embodied in a country’s capital stock compared to the level of technology embodied in the leading country’s capital stock. Catching-up therefore implies that the capital stock in a country following behind becomes relatively more recent than in the leading country as time goes by. Lim and McAleer (2004) further elaborate that technological catching-up is associated with innovation (e.g. R & D) and capital investment (importing advanced technology). Besides innovation and investment, the level of education (social capability) also plays a crucial role in determining the technical competence of the labor force.

However, one important drawback of using the univariate ADF unit root test procedures is that the power of the test is quite low. Some authors recognised that the power could be significantly improved if panel data are used instead of a univariate time-series (Levin et al., 2002; Im et al., 1997). Furthermore, the panel approach appears extremely appealing because the inclusion of a limited amount of cross-sectional information induces significant improvement in term of power. For the panel unit root test procedures, Levin et al. (2002) proposed to perform the augmented Dickey-Fuller tests based on the following regression

[2] Empirical studies on testing stochastic convergence, among others include Bernard (1991), Bernard and Durlauf (1995), Campbell and Mankiw (1989), Cogley (1990), Greasly and Oxley (1997), St. Aubyn (1999), Cellini and Scorcu (2000) and Carlino and Mills (1993).

model. For a sample of N groups observed over T time periods, the panel unit root regression of the ADF test is written as

$$\Delta y_{it} = \alpha_i + \beta_i y_{it-1} + \sum_{j=1}^{p_i} \gamma_{ij} \Delta y_{it-j} + \varepsilon_{it}, \qquad i = 1,...,N, \qquad t = 1,...,T \tag{2}$$

where $\alpha_i, \beta_i \text{ and } \gamma_{ij}$ are parameters and the error terms ε_{it} are uncorrelated across regions. The Levin-Lin-Chu tests for the $H_0 : \beta_i = 0$ against $H_a : \beta_i < 0$. Under the null hypothesis, they show that the test statistics, τ^* is asymptotically distributed according to the standard normal distribution.

On the other hand, Im et al. (1997) extent the work of Levin et al. (2002) to allow for heterogeneity in the value of β_i in Equation (2). Im et al. (1997) proposed a $t-$bar statistic, which is based on the average of the individual ADF $t-$statistics. The null hypothesis of a unit root in the panel data is defined as $\beta_i = 0,$ for all i against the alternatives that all series are stationary processes β_i <0, $i = 1,2,...,N_1;$ $\beta_i = 0,$ $i = N_1 + 1, N_2 + 2,...,N$. This equation of the alternative hypothesis allows for $\beta_i = \beta < 0$ for all i.

To test the hypothesis, Im et al. (1997) propose a standardised $t-$bar statistic given by

$$\Psi_{\bar{t}} = \frac{\sqrt{N}\left(\bar{t}_{NT} - (1/N)\sum_{i=1}^{N} E\left[t_{i,T}(p_i, 0) \mid \beta_i = 0\right]\right)}{\sqrt{(1/N)\sum_{i=1}^{N} Var\left[t_{i,T}(p_i, 0) \mid \beta_i = 0\right]}} \tag{3}$$

where $\bar{t}_{NT} = \frac{1}{N}\sum t_{i,T}(p_i, \beta_i)$ and $t_{i,T}(p_i, \beta_i)$ is the individual $t-$statistic for testing $\beta_i = 0$ for all i. $E\left[t_{i,T}(p_i, 0) \mid \beta_i = 0\right]$ and $Var\left[t_{i,T}(p_i, 0) \mid \beta i = 0\right]$ are reported in Table 2 of Im et al. (1997). Under the null hypothesis, the standardised $t-$bar statistic $\Psi_{\bar{t}}$ is asymptotically distributed as a standard normal distribution ($\Psi_{\bar{t}} \sim N(0,1)$). The Im et al. (1997) panel unit root test is derived assuming that the series are independently generated, and they suggested subtracting cross-sectional means to remove common time specific effects. This assumes the error term in Equation (2) consists of two random components, $\varepsilon_{iqt} = \delta_t + \nu_{iqt}$ where ν_{iqt} is the idiosyncratic random component, and δ_t is a stationary time-specific effect that accounts for correlation in the errors across economies.

Another commonly used panel unit root test is the one based on Fisher (1932). Maddala and Wu (1999) propose the test statistic which is based on combining the *p*-values of the test statistics (of β_i) of N independent ADF regressions from Equation (2). The test statistic (the Fisher test $P(\lambda)$) is as follows

$$P(\lambda) = -2\sum_{i=1}^{N} \log(\pi_i) \tag{4}$$

where π_i is the *p*-value of the test statistic for unit i. The Fisher test statistic $P(\lambda)$ is distributed as a chi-squared distribution with $2N$ degree of freedom.

Sources of Data

The data used in this study are annual observations on per capita gross domestic product (GDP) in constant 2000 prices for fourteen states. These states are Perlis, Kedah, Kelantan, Terengganu, Penang, Perak, Pahang, Selangor, Negeri Sembilan, Melaka, Johore, Sabah, Sarawak and Wilayah Persekutuan. The sample covers the period 1961 to 2003. Data for states GDP at constant prices are collected from the various issues of the 5-Year Malaysia Plan. A complete range of time-series data for states per capita real GDP were interpolated using information on time, time-squared and lagged Malaysia's per capita real GDP.

3. THE EMPIRICAL RESULTS

Before testing for convergence based on Equation (2), it is essential to determine the order of integration for each of the states income series. The standard ADF tests are used to test for the presence of unit roots in the logarithm of per capita states income. The result of the ADF test are reported in Table 3, 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 is selected based on SIC.[3] The estimated $t-$statistics for the ADF test reported in Table 3 indicate that all states 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 states per capita income series achieve stationarity after first differencing.

Having determined that all states per capita GDP are integrated of order one, that is, they are $I(1)$ processes; we proceed for the testing of stochastic convergence by using Equation (2). We do this by employing the panel unit root test due to Levin et al. (2002), LLC-test; Im et al. (1997), IPS-test; and Maddala and Wu (1999), MW-test, on the differential between Kedah per capita real GDP and the rest of the Malaysian states per capita real GDP. The result is presented in Table 4.

In testing for convergence hypothesis in the panel setting, we follow the strategy suggested by Jungmittag (2006). In the first step, all the 13 income differential variables, y_{iqt} , is estimated using Equation (1) and each of the individual equations are check for the significant of the constant and trend. The individual estimated equation that shows significant constant and trend (or trend) is cluster into Group 3. Group 2 should contain y_{iqt} that show significant in the constant term (with no trend) while Group 1 should contain y_{iqt} that show insignificant constant term or no constant (and no trend). In the second step, the panel unit root tests-LLC-test, IPS-test and MW-test, by using Equation (2) are carried out for the subgroups of test equations without a (or with insignificant) constant (if stationary: absolute convergence), with a constant (if stationary: conditional convergence), and with a constant and a time trend (if stationary: convergence as catching-up).

Table 4 shows the results of clustering of y_{iqt} using Equation (1). Group 1 consists of Sarawak only. Group 2 comprises of Kedah, Negeri Sembilan, Perak, Pahang, Perlis and Selangor, while Group 3 compose of Johor, Melaka, Penang, Sabah, Terengganu and

[3]In this study, we used EViews6.1 and the software automatically selects the optimal lag length based on SIC.

Wilayah Persekutuan. For Group 1, since Sarawak is the only state in this group, the valid unit root test is the univariate ADF test procedure. Our result indicates that the null hypothesis of a unit root cannot be rejected at the 5 percent significant level. Thus, this suggests divergence between Kelantan and the state of Sarawak.

For Group 2, the results of univariate ADF unit root tests indicate that the state of Kedah converge stochastically with the states of Kedah, Negeri Sembilan, Perak, Pahang, Perlis and Selangor. For all these states the null hypothesis of a unit root can be rejected at the 5 percent level of significant. On the other hand, the panel unit root test of LLC, IPS and MW clearly suggest that there is stochastic convergence between Kedah and all the states in the group. Thus, a permanent technology innovation, for example, does not affect long-run relative real GDP since the differential between economies is temporary. State-specific economic shocks do not cause permanent or persistent deviations in relative per capita real income.

Lastly, for Group 3, we can observe that Kedah showing convergence in catching-up with states in the group. The univariate ADF test results suggest that Kedah has been catching-up with the states of Johor, Melaka, Penang, Sabah, Terengganu and Wilayah Persekutuan. Similarly, our panel unit root test results overwhelmingly suggest that Kedah has been catching-up with all the states in the group. Results indicate that the null hypothesis of a unit root in the panel can be rejected at the 5 percent level of significant for all three panel unit root tests-LLC, IPS and MW.

In summary our panel unit root test results suggest that the state of Kedah converges stochastically towards Kedah, Negeri Sembilan, Perak, Pahang, Perlis and Selangor, while catching-up with Johor, Melaka, Penang, Sabah, Terengganu and Wilayah Persekutuan.

4. CONCLUSIONS

Since independence, Malaysia has undergone profound transformations and has been considered as one of the fastest growing economy in the Asian region. Despite having recognized as the new emerging market economies, Malaysia's regional income disparity has been a major concern of the Malaysian authority. There are instances that rich states become richer and poor states become poorer over time for the past 40 years. However, the state of Kelantan is an exception in this case. It ranked fourteen as the poorest state in 1970 and over 40 years Kelantan performance has sustained as the poorest state in Malaysia in 2000. Nevertheless, despite this poor ranking, our question is has Kelantan been converging, diverging or catching-up with other states in Malaysia for the past four decades.

Using annual data of states' real GDP per capita for the period 1961 to 2003, we employed three panel unit root test procedure for testing the hypotheses of stochastic convergence, divergence or convergence as catching-up between Kelantan and the rest of the thirteen states in Malaysia. Our results using both univariate and panel unit root tests suggest that the state of Kedah has been catching-up with the states of Johor, Melaka, Penang, Sabah, Terengganu and Wilayah Persekutuan, while stochastic convergence is shown between Kelantan and Kedah, Negeri Sembilan, Perak, Pahang, Perlis and Selangor. However, the case for divergence is shown between Kedah and Sarawak.

Generally, the lack of convergence and the existence of lagging states imply that resources are being underemployed. Thus, one way of improving economic welfare is to put these unused resources to productive use. It follows that national GDP per capita could be increased by raising the productivity of these lagging regions; and regional policy provides a means of achieving this objective. In this respect, the local government has an important role to play to promote economic growth and development in the state of Kelantan.

REFERENCES

Bernard, A.B. (1991). Empirical implications of the convergence hypothesis. Working paper. Stanford University: Center for Economic Policy Research.

Bernard, A.B., and Durlauf, S.N. (1995). Convergence in international output. *Journal of Applied Econometrics*, 10, 97-108.

Campbell, J.Y., and Mankiw, N.G. (1989). International evidence on the persistence of economic fluctuations. *Journal of Monetary Economics*, 23, 319-333.

Carlino, G.A., and Mills, L.O. (1993). Are U.S. regional incomes converging? A time series analysis. *Journal of Monetary Economics*, 32, 335-346.

Cellini, R., and Scorcu, A. (2000). Segmented stochastic convergence across the G-7 countries. *Empirical Economics*, 25, 463-474.

Cogley, T. (1990). International evidence on the size of the random walk in output. *Journal of Political Economy*, 98, 501-518.

Fisher, R.A. (1932). *Statistical methods for research workers*. Edinburgh: Oliver and Boyd.

Greasley, D., and Oxley, S. (1997). Time-series based tests of the convergence hypothesis: Some positive results. *Economics Letters*, 56, 143-147.

Im, K., Pesaran, M.H., and Shin, Y. (1997). Testing for unit roots in heterogenous panels. Working Paper No. 9526, Department of Applied Economics, University of Cambridge.

Jungmittag, A. (2006). Innovation dynamics in the EU: Convergence or divergence? A cross-country panel data analysis. *Empirical Economics*, 31, 313-331.

Levin, A., Lin, C.F., and Chu, C.S.J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, 108, 1-25.

Lim, L.L., and McAleer, M. (2004). Convergence and catching up in ASEAN: A comparative analysis. *Applied Economics*, 36, 137-153.

Maddala, G.S., and Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61, 631-652.

Malaysia. *5-Year Malaysia Plan*, various issues.

Oxley, L., and Greasley, D. (1995). A time-series perspective on convergence: Australia, U.K., and U.S. since 1870. *The Economic Record*, 71, 259-270.

St. Aubyn, M. (1999). Convergence across industrialised countries (1890-1989): New results using time series methods. *Empirical Economics*, 24, 23-44.

Skonhoft, A. (1995). Catching up and falling behind, a vintage model approach. *Journal of Evolutionary Economics*, 5, 285-295.

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

States	1970	1980	1990	2000
Johore	84	89	91	96
Kedah	73	61	59	60
Kelantan	44	60	38	42
Melaka	72	75	83	104
Negeri Sembilan	104	101	84	93
Perak	103	93	79	81
Pahang	93	79	82	67
Perlis	72	60	66	66
Penang	96	113	118	143
Selangor	148	156	142	124
Sabah	118	101	85	65
Sarawak	92	80	88	90
Terengganu	81	71	159	154
Wilayah Persekutuan	176	197	191	205
Malaysia	100	100	100	100

Note: Authors' calculation

Table 2: Ranking by States According to Real GDP per Capita, 1970-2000

States	1970	1980	1990	2000
Johore	9	8	5	6
Kedah	11	13	13	13
Kelantan	14	14	14	14
Melaka	13	10	9	5
Negeri Sembilan	4	5	8	7
Perak	5	9	11	9
Pahang	7	6	10	10
Perlis	12	12	12	11
Penang	6	4	4	3
Selangor	2	2	3	4
Sabah	3	7	7	12
Sarawak	8	11	6	8
Terengganu	10	3	2	2
Wilayah Persekutuan	1	1	1	1

Note: Authors' calculation

Table 3: Result of Unit Root Test for State Per Capita Real Income Series

Per capita income by state	Levels (Constant and trend)	Lag length	First difference (Constant)	Lag length
Johor	-2.26 [0.44]	0	-5.36 [0.00]*	0
Kedah	-2.64 [0.26]	4	-5.08 [0.00]*	0
Kelantan	-2.66 [0.25]	9	-6.84 [0.00]*	1
Melaka	-2.34 [0.40]	1	-7.69 [0.00]*	0
Negeri Sembilan	-2.78 [0.21]	0	-7.47 [0.00]*	0
Perak	-2.40 [0.36]	2	-5.74 [0.00]*	0
Pahang	-2.70 [0.24]	0	-7.92 [0.00]*	0
Perlis	-2.56 [0.29]	0	-7.12 [0.00]*	0
Penang	-2.05 [0.55]	0	-6.87 [0.00]*	0
Selangor	-2.84 [0.18]	1	-9.44 [0.00]*	0
Sabah	-2.79 [0.20]	0	-8.11 [0.00]*	0
Sarawak	-1.76 [0.70]	2	-7.81 [0.00]*	1
Terengganu	-3.03 [0.13]	2	-6.30 [0.00]*	0
Wilayah Persekutuan	-2.77 [0.21]	0	-7.80 [0.00]*	0

Notes: All unit root estimations were done using EViews6.1. EViews6.1 automatically select lag length based on SIC as default and was used throughout the analysis. The square bracket [.].contains the *p*-values. Asterisk (*) denotes statistically significance at 5% level. Critical values for unit root test are referred to MacKinnon (1996).

Table 4: Panel Unit Root Tests for Convergence

States	*ADF*-statistic	*p*-values	Lags	Remarks
Group 1: No constant, no trend				
Sarawak	0.6821	0.859	2	Divergence
Panel data tests for Group 1				
LLC-test[a]	-	-		-
MW-test[b]	-	-		-
IPS-test[c]	-	-		-
Group 2: Constant, no trend				
Kedah	-3.7036*	0.007	0	Convergence
Negeri Sembilan	-4.0051*	0.003	0	Convergence
Perak	-3.5377*	0.011	0	Convergence
Pahang	-4.1206*	0.002	0	Convergence
Perlis	-3.8883*	0.004	0	Convergence
Selangor	-4.0800*	0.002	0	Convergence
Panel data tests for Group 2				
LLC-test	-4.1521*	0.000		Convergence
MW-test	64.7558*	0.000		Convergence
IPS-test	-6.6116*	0.000		Convergence
Group 3: Constant and trend				
Johor	-4.1333*	0.011	0	Catching-up
Melaka	-3.6492*	0.037	1	Catching-up
Penang	-4.2490*	0.008	0	Catching-up
Sabah	-4.8340*	0.001	0	Catching-up
Terengganu	-3.8767*	0.022	0	Catching-up
W. Persekutuan	-4.1685*	0.011	5	Catching-up
Panel data tests for Group 3				
LLC-test	-5.0204*	0.000		Catching-up
MW-test	54.2344*	0.000		Catching-up
IPS-test	-5.9247*	0.000		Catching-up

Notes: [a]Under the null hypothesis that all series in the panel are unit root against the alternative that all series are stationary, the adjusted t-statistic τ^*, obtained from the pooled regression has a limiting distribution of a standard normal distribution. [b]Under the null hypothesis, the Fisher test statistic $P(\lambda)$ is distributed as a chi-squared distribution with $2N$ degree of freedom. [c]Under the null hypothesis the standardised $t-$bar statistic $\psi_{\bar{t}}$ (the IPS test statistic) is asymptotically distributed as a standard normal distribution. Lag length chosen is based on SIC which is automatically selected by EViews6.1. Asterisk (*) denotes statistically significance at 5% level.