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Regional income disparities in Malaysia: A stochastic convergence analysis

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Abstract

For the last four decades, income disparities across states in Malaysia continue 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. The eight volumes of the 5-Year Malaysia Plan reflect the determination of the Malaysian government in alleviating if not totally eradicating the problem of regional or state level imbalances. The recent Ninth Malaysia Plan has again emphasized regional development policies in bridging the gap of regional disparities for the next five years. Using annual data for the period 1965 to 2003, the stochastic convergence definition suggested by Bernard and Durlauf (1995), univariate unit root tests suggested by Oxley and Greasley (1995) and panel unit root testing procedures proposed by Levin et al. (2002), Im et al. (1997) and Maddala and Wu (1999), our findings strongly support the stochastic convergence of catching up hypothesis for six regions in Malaysia. An important implication of this study is that Malaysia's regional development policies, on average, have had a positive impact on the per capita income in all of the six regions.

Keywords: catching up hypothesis, income disparities, poverty eradication, stochastic convergence analysis, panel unit root testing procedures, univariate unit root tests

Introduction

On 4th November 2006, the Malaysian government launched the most ambitious development project in the region – the South Johor Economic Region (SJER) which boasts the creation of some 800,000 jobs by the year 2020, comprises an area nearly three times the size of Singapore with passport free zone for foreigners, and is projected to generate an average rate of growth of eight percent for Johor. This marked the serious effort of the Malaysian government regional development plan laid out in the Ninth Malaysia Plan to reduce regional imbalances and income disparity among states. In the Ninth Malaysia Plan 2006-2010 (Government of Malaysia, 2006: p. 363), there are five main thrusts for balanced regional development. These includes: (1) accelerating development in lesser developed states through improving infrastructure, social facilities amenities in the rural areas; (2) improving the quality of life in rural and urban areas; (3) establishing new regional development authorities (RDAs) in Sabah and Sarawak; (4) enhance higher economic growth through developing growth centres and growth corridors transcending state boundaries; and (5) enhancing development of border states through ASEAN sub-regional development cooperation in the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT), the Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA), and the Joint Development Strategy for Border Areas (JDS).

Nevertheless, the effort of the Malaysian government to reduce regional or states imbalances is not new. During the last forty years, the government of Malaysia, through a series of five-year development plans has implemented various policies and programmes aimed at alleviating regional disparities and underdevelopment. The purpose of the regional development in Malaysia was to mainly focus on reducing the large imbalances in social and economic development among states in the country. To correct these imbalances is important because according to Hill (2002), regional economic disparities hamper economic growth and that countries with a relatively even spatial distribution of income are likely to grow faster. However, it was only during the Second Malaysia Plan 1971-1975 (Government of Malaysia, 1971) that the government established the State Planning Units to enable the individual states to identify and formulate projects and to coordinate development activities at their State level (Tengku-Hadi, 1996).

The Mid-Term Review of the Second Malaysia Plan (Government of Malaysia, 1973) recognized the obvious correlation between disadvantaged ethnic groups and regional disparities, and the glaring discrepancies between the richest regions of the south and central west coast and the poorest regions of the east coast of Peninsular Malaysia. Thus, the Third Malaysia Plan 1976-1980 (Government of Malaysia, 1976) was to further foster regional development to narrow these regional gaps. In the Third Malaysia Plan, for easy monitoring of the states performances, the government has categorized states in Malaysia into six regions: (1) The Northern region comprise of Perlis, Kedah, Penang and Perak; (2) Central region consist of Selangor, Federal Territory, Negeri Sembilan and Melaka; (3) Eastern region compose of Kelantan, Terengganu and Pahang; (4) Southern region consist of the state of Johor; (5) Sabah; and (6) Sarawak. In fact, Hill (2002) observes that, in Malaysia, the six richer states of West Malaysia's 'industrialized west' constitute a region of relatively high incomes and good social outcomes, in contrast to some of the West's eastern and northern states, together with East Malaysia.

The Fourth Malaysia Plan (Government of Malaysia, 1981) acknowledges that although various programs were implemented in the past, regions and states in Malaysia still experienced different rates of growth as a result of varying historical development and resource development. Accordingly, policies and programs in the Fourth Malaysia Plan were designed to further narrow the regional disparity by affecting a shift in the pattern of investment and channeling development efforts to the less developed states of Kedah, Perlis, Kelantan and Terengganu. The plan claims that this strategy will contribute to the accelerated development of the nation as a whole and will ensure greater opportunities for the economic and social advancement of people in different parts of the country.

The Fifth Malaysia Plan 1986-1990 (Government of Malaysia, 1986) saw the need for the consolidation of efforts to ensure greater efficiency of resource utilization in the context of regional development to take cognizance of the prevailing market forces and the development. Towards this end, the plan emphasizes industrial and urban economies of location. In addition, the revitalization of the agriculture sector and the implementation of the rural urbanization programs were also planned.

During the Sixth Malaysia Plan 1991-1995 (Government of Malaysia, 1991), efforts were directed at diversifying the economic base of the lesser-developed states and expanding their social economic and physical infrastructures with the view of enhancing development and increasing their attractiveness to the private sector. The thrust of regional development in the Seventh Malaysia Plan 1996-2000 (Government of Malaysia, 1996) was aimed at achieving balanced regional development through sustaining the growth momentum, particularly of the less-developed states, with emphasis on the productive and efficient utilization of resources. This was to be achieved by diversifying the economic base of less-developed states from agriculture to manufacturing and services activities to enhance the growth potential of these states. Furthermore, efforts were directed at bringing about greater trade and investment opportunities for Malaysia as a whole, and consequently enhancing growth in the participating states.

The Eighth Malaysia Plan 2001-2005 (Government of Malaysia, 2001) reemphasizes efforts to transform all states into modern and resilient economies. This was to be achieved by further diversifying and strengthening the economic base of the states, in particular the economic base of the less-developed states. In addition, efforts were continued in promoting greater trade and investment opportunities in the participating states. In addition, the Mid-Term Review of the Eighth Malaysia Plan reaffirms the importance of achieving equity by acknowledging that efforts to narrow the disparities and inequities among and within ethnic groups and regions will foster the spirit of patriotism and provide the basis to foster national unity. In both the Seventh and Eight Malaysia Plan, the government of Malaysia has placed greater emphasis on the role of the regional cooperation through the growth triangles to stimulate economic development in the less developed states.

The purpose of the present study is to determine whether the effort of the Malaysian government through the various regional development plans for the past four decade has been successful in narrowing the regional income gaps. In other words, in economic terms, we are questioning whether the regions in Malaysia have been converging, diverging or catching up. In this study, we used annual data for the period 1965 to 2003, and based on the stochastic convergence definition suggested by Bernard and Durlauf (1995) and using univariate unit root test suggested by Oxley and Greasley (1995) and three commonly used panel unit root testing procedures proposed by Levin et al. (2002), Im et al. (1997) and Maddala and Wu (1999), our findings strongly support stochastic convergence hypothesis for the six regions in Malaysia.

The paper is organized as follows. In the next section we discuss some stylized facts on income disparity of the six regions in Malaysia, followed by a discussion on several tests for testing income convergence in section 3. In section 4 is our empirical results and the last section contains our conclusion.

Regional income disparity in Malaysia: Some stylised facts

The notion of economic convergence usually refers to a process in which national economies display increasing similarities in the patterns of their performance. From an economic policy point of view, the issue of convergence and divergence is very important. In a case of convergence, this would point to the existence of market forces, which will eventually lead to similar living standards across states. In the case of persistently large (or widening) gaps or divergence between poor and rich states, there could be a need for economic policy measures to stimulate a catch-up process. 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, 2002). One good example of transferring foreign technology and knowledge to the host country is through foreign direct investment.

Whether poor economies tend to converge towards rich ones or else to diverge over time is an issue that has attracted the attention of policy-makers and academics alike for some decades. Economic convergence or divergence is a topic of considerable interest and debate, not only for validating or otherwise the two leading and competing growth models (the neoclassical and the endogenous growth approaches) but also for its policy-oriented implications. In Malaysia, the issue of economic convergence is also much debated. Despite the various Malaysia Plans for the past three decades, regional disparity between states remains.

Table 1 and Table 2 show some interesting observations on the performance of the fourteen states in Malaysia for the period 1970-2000. In the year 1970, five states- Negeri 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, contributing to real GDP per capita that is above the national average. Take for example the state of Sabah. 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. The poor performance of the Sabah economy has been recognized by the government of Sabah in the Outline Perspective Plan Sabah (1995). They revealed the following facts (i) The State's economy has been growing out of tandem with the national economy, (ii) The growth of the States's economy has been very erratic, (iii) The economy is still dominated by the primary sector, (iv) Unemployment remains persistently high, (v) The investment ratio is low by national standard coupled with a probable massive outflow of funds from Sabah, (vii) Rapidly depleting timber and petroleum resources, (viii) Limited sources of economic growth, and (ix) Low value-adding economic activities. As for Kedah, it 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 decade.

Table 1. Real GDP per capita, 1970-2000 (Malaysia=100)

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

Notes: Authors' calculation.
Sources: Five Year Malaysian Plans, various issues

Table 2. Ranking by States According to Real GDP per capita, 1970-2000

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

Notes: Authors' calculation based on Table 1.

Methodology

In this study, the time-series tests of the convergence and catching-up hypothesis for the six regions are employed following Bernard and Durlauf (1995). 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. Empirical studies on testing stochastic convergence, among others include Bernard (1991), Bernard and Durlauf (1995), Campbell and Mankiw (1989), Cogley (1990), Greasley and Oxley (1997), St. Aubyn (1999), Cellini and Scorcu (2000) and Carlino and Mills (1993). According to Bernard and Durlauf (1995), the notion of convergence in multivariate income is defined such that the long-term forecasts of income for all regions $i = 1, \ldots, n,$ are equal at a fixed time t:

$$E(y_{1,t+k} - y_{i,t+k} \mid I_t) = 0, \qquad \forall i > 1 \tag{1}$$

where $y_{i,t+k}$ is the logarithm of real per capita income for region i at time $t+k$, and I_t is all the information available at time t. Using the concepts of unit roots and cointegration, their convergence test determines whether $y_{1,t+k} - y_{i,t+k}$ in Equation (1) is a zero mean stationary process in a cointegration framework. Convergence in output for two regions, i and j, implies their income must be cointegrated with cointegrating vector $[1,-1]$. This concept of convergence has been criticized because it is rather strict, as for the strong convergence to exist it is necessary that the long-run expected value (forecast) of the per capita income differences between the two regions is equal to zero.

An alternative time-series definition of convergence, according to Bernard and Durlauf (1996) also known as catch-up holds when the "behaviour of the income differences between two regions over a fixed time interval and equates convergence with the tendency of the difference to narrow" (p. 165). This definition can be written as

$$E(y_{i,T} - y_{j,T} \mid I_t) < (y_{i,0} - y_{j,0}) \tag{2}$$

where 0 refers to the present and T to some year in the future. According to this definition, the difference between the two time series should also be stationary, but now the time trend can be deterministic. Once again, the only cointegration vector between the two regions can be $[1,-1]$.

Following Bernard and Durlauf (1995), stochastic convergence occurs if relative log per capita GDP, y_t, follows a stationary process, where $y_t = \log Y_{it} - \log Y_{qt}$, and Y_{it} is the log of real per capita GDP for country i, and Y_{qt} is log of real per capita GDP of a benchmark country, and both series is $I(1)$. Stochastic convergence in this study is tested by using the conventional univariate augmented Dickey-Fuller (ADF) regression of the following form

$$\Delta y_t = \alpha + \gamma t + \beta y_{t-1} + \sum_{j=1}^{p} \theta_j \Delta y_{t-j} + \varepsilon_t, \qquad t = 1,...,T \tag{3}$$

For $j = 1,..., p$ ADF lags. In a time series framework, a distinction is made between long-run convergence and convergence as catching-up (see Oxley and Greasley, 1995). The statistical tests are interpreted as follows. First, if y_t contains a unit root (i.e. $\beta = 0$), real GDP per capita for country i and q diverge over time. Second, if y_t is stationary (i.e. no stochastic trend, or $\beta < 0$) and (a) $\gamma = 0$ (i.e the absence of a deterministic trend) indicates long-run convergence between countries i and q; (b) $\gamma \neq 0$ indicates catching-up (or narrowing of output differences) between countries i and q.

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

$$\Delta y_{it} = \alpha_i + \beta_i y_{it-1} + \sum_{j=1}^{p_i} \gamma_{ij} \Delta y_{it-j} + \varepsilon_{it}, \qquad i = 1,..., N, \qquad t = 1,...,T \tag{4}$$

where α_i, β_i *and* γ_{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, t^* 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 (4). 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

$$\beta_i = 0, \text{ for all } i \tag{5}$$

against the alternatives that all series are stationary processes

$$\beta_i < 0, \; i = 1,2,..., N_1; \;\; \beta_i = 0, \;\; i = N_1 + 1, N_2 + 2,..., N\,. \tag{6}$$

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

$$\Psi_{\bar{t}} = \frac{\sqrt{N}\left\{\bar{t}_{NT} - (1/N)\sum_{i=1}^{N} E\left[t_{i,T}(p_i,0) \mid \beta_i = 0\right]\right\}}{\sqrt{(1/N)\sum_{i=1}^{N} Var\left[t_{i,T}(p_i,0) \mid \beta_i = 0\right]}} \tag{7}$$

where

$$\bar{t}_{NT} = \frac{1}{N}\sum t_{i,T}(p_i,\beta_i) \tag{8}$$

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 (8) consists of two random components, $\varepsilon_{it} = \delta_t + \nu_{it}$ where ν_{it} 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 (3). The test statistic (the Fisher test $P(\lambda)$) is as follows

$$P(\lambda) = -2\sum_{i=1}^{N}\log(\pi_i) \tag{9}$$

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 six regions' per capita gross domestic product (GDP) in constant 2000 prices computed from fourteen states in Malaysia. These states are Perlis, Kedah, Kelantan, Terengganu, Penang, Perak, Pahang, Selangor, Negeri Sembilan, Melaka, Johore, Sabah, Sarawak and Wilayah Persekutuan. The samples cover the period 1965 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 GDP were interpolated using information on time, time-squared, and lagged one year Malaysia's per capita real GDP.

Discussion on empirical results

Before testing for convergence based on Equation (3), 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 differences are run with a constant only. The chosen lag length is selected based on SIC. The estimated t – statistics for the ADF test reported in Table 3 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.

Table 3. Result of Unit Root Test for Regions' Per Capita Income Series

Per capita income by region	Levels (Constant and trend)	Lag length	First difference (Constant)	Lag length
Central Region	-1.23	1	-9.18	0
	[0.91]		[0.00]*	
Eastern Region	-1.30	0	-4.31	0
	[0.87]		[0.00]*	
Northern Region	-2.20	0	-5.94	0
	[0.47]		[0.00]*	
Southern Region	-1.94	0	-6.25	0
	[0.61]		[0.00]*	
Sabah	-3.43	0	-6.92	0
	[0.06]		[0.00]*	
Sarawak	-0.77	2	-8.80	1
	[0.95]		[0.00]*	

Notes: All unit root estimations were done using EViews5.1. EViews5.1 automatically select lag length based on SIC as default and was used throughout the analysis. The square brackets [.].contain the *p*-values. Asterisk (*) denotes statistically significance at 5% level. Critical values for unit root test are referred to MacKinnon (1996).

Having determined that all regions 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 (3). We do this by employing the ADF unit root test on the differential between each region per capita GDP and the central region as the benchmark. The result is presented in Table 4. We report the result of the estimated

Table 4. Univariate ADF Unit Root Test for Convergence

Relative regional per capita income to Central Region	Conditional convergence (with constant)	Lag length	Convergence of catching up (with constant and trend)	Lag length
Central Region:				
Eastern Region	-1.25	1	-3.36	1
	[0.64]		[0.07]	
Northern Region	-2.56	0	-2.42	0
	[0.10]		[0.36]	
Southern Region	-0.78	1	-3.40	0
	[0.81]		[0.06]	
Sabah	-0.88	1	-4.38	0
	[0.78]		[0.00]*	
Sarawak	-2.83	1	-6.41	0
	[0.06]		[0.00]*	

Notes: All unit root estimations were done using EViews5.1. EViews5.1 automatically select lag length based on SIC as default and was used throughout the analysis. The square brackets, [.].contain the *p*-values. Asterisk (*) denotes statistically significance at 5% level. Critical values for unit root test are referred to MacKinnon (1996).

Equation (3) with the inclusion of both deterministic components: with a constant in column 2 as a test of conditional convergence, and with a constant and trend in column 4 as a test of convergence of catching up. As shown in column 2, the null hypothesis of a unit root cannot be rejected at the 5 percent significance level implying that there is no long run conditional convergence between the central region and the rest of the five regions in Malaysia. On the other hand, the result for the test for convergence as catching-up is shown in column 4 of Table 4. Except for the northern, eastern and southern regions, our result suggests that catching-up exists between Sabah and Sarawak and the central region in Malaysia as the null hypothesis of convergence of catching-up cannot be rejected at the 5 percent level of significance.

However, on the other hand, result from the panel unit root test gives richer and more interesting observations. The result for the panel of unit root test for convergence and catching-up are presented in Table 5 and Table 6 respectively. In both tables we report the results of the three panel unit root tests for the full sample period 1965 to 2003. Further in the analysis we have sub-divided the sample period by interval of five years which correspond to the five-year Malaysia plans. In this study we manage to test for the convergence issues for each of the 1st Malaysia Plan until the 7th and 8th Malaysia Plans.

Table 5. Result of Panel Unit Root Tests Testing for Conditional Convergence

Sample period	Levin-Lin-Chu test , t^{*} [a]	Im-Pesaran-Shin test, $\psi_{\bar{t}}$ [a]	Maddala-Wu test, $P(\lambda)$ [b]
Full sample	-0.21 (0-1)	-0.35 (0-1)	11.77 (0-1)
	[0.41]	[0.35]	[0.30]
1966-1970,	-4.44 (0)	-1.59 (0)	20.15 (0)
1MP	[0.00]*	[0.05]*	[0.02]*
1971-1975,	-13.66 (0)	-4.56 (0)	37.43 (0)
2MP	[0.00]*	[0.00]*	[0.00]*
1976-1980,	-0.98 (0)	0.35 (0)	7.78
3MP	[0.16]	[0.63]	[0.64]
1981-1985,	-4.30 (0)	-1.07 (0)	16.46 (0)
4MP	[0.00]*	[0.14]	[0.08]
1986-1990,	-5.38 (0)	-1.55 (0)	19.68 (0)
5MP	[0.00]*	[0.05]*	[0.03]*
1991-1995,	-2.92 (0)	-0.35 (0)	11.37 (0)
6MP	[0.00]*	[0.36]	[0.32]
1996-2000,	-2.44 (0)	-0.18 (0)	9.95 (0)
7MP	[0.00]*	[0.42]	[0.44]
1996-2003,	-3.50 (0-1)	-1.36 (0-1)	18.41 (0-1)
7MP & 8MP	[0.00]*	[0.08]	[0.04]*

Notes: [a]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 EViews5.1. The numbers in parentheses denote the range of lag length and those in square brackets are *p*-values. The *p*-values are estimated from the one-tail test of the standardised 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. Lag length chosen is based on the basis of SIC automatically selected by EViews5.1. The *p*-values are estimated from a chi-squared distribution with $2N$ degree of freedom. Asterisk (*) denotes statistically significance at 1% level.

Table 6. Result of Panel Unit Root Tests Testing for Convergence of Catching Up

Sample period	Levin-Lin-Chu test , $t^{*\,a}$	Im-Pesaran-Shin test, $\psi_{\bar{t}}$ [a]	Maddala-Wu test, $P(\lambda)$[b]
Full sample	-4.49 (0-1) [0.00]*	-4.99 (0-1) [0.00]*	44.39 (0-1) [0.00]*
1966-1970, 1MP	-0.72 (0) [0.23]	0.57 (0) [0.71]	6.12 (0) [0.80]
1971-1975, 2MP	-17.85 (0) [0.00]*	-1.99 (0) [0.02]*	30.32 (0) [0.00]*
1976-1980, 3MP	-7.91 (0) [0.00]*	-0.47 (0) [0.31]	15.50 (0) [0.11]
1981-1985, 4MP	-10.99 (0) [0.00]*	-1.23 (0) [0.10]	22.01 (0) [0.01]*
1986-1990, 5MP	-11.22 (0) [0.00]*	-1.59 (0) [0.05]*	25.43 (0) [0.00]*
1991-1995, 6MP	-18.61 (0) [0.00]*	-1.08 (0) [0.13]	19.08 (0) [0.03]*
1996-2000, 7MP	-2.31 (0) [0.01]*	0.77 (0) [0.78]	3.13 (0) [0.97]
1996-2003, 7MP & 8MP	-4.87 (0) [0.00]*	-0.18 (0) [0.42]	11.23 (0) [0.33]

Notes: [a]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 EViews5.1. The numbers in parentheses denote the range of lag length and those in square brackets are *p*-values. The *p*-values are estimated from the one-tail test of the standardised normal distribution. [b]Under the null hypothesis, the Fisher test statistic $P(\lambda)$ is distributed as a chi-squared distribution with 2*N* degree of freedom. Lag length chosen is based on the basis of SIC automatically selected by EViews5.1. The *p*-values are estimated from a chi-squared distribution with 2*N* degree of freedom. Asterisk (*) denotes statistically significance at 1% level.

We report the estimated *t*-star statistics of the Levin-Lin-Chu (LLC) test, $t-$bar statistics for the Im-Pesaran-Shin (IPS) test and λ-values for the Fisher $P(\lambda)$ test with their accompanying *p*-values. We noted that among the three panel unit root tests, study by Im et al. (1997) have demonstrated by Monte Carlo simulations that their panel test suggest better finite sample performance of the $\psi_{\bar{t}}$ over Levin-Lin-Chu's t^*. On the other hand, Breitung (1999) has showed that the Maddala and Wu (1999) panel unit root tests have considerable more power relative to the IPS test.

As shown in Table 5 the full sample panel unit root test result clearly indicates that there was no convergence among the six regions in Malaysia for the period 1965 to 2003. All three panel unit root tests suggest that the null hypothesis of unit root cannot be rejected at the five percent significance level. As to the impact of the Five-Year Malaysia Plans on convergence, that is, in reducing the regional income gap between regions, our results suggest that only 1^{st}, 2^{nd}, 5^{th}, and 7^{th} and 8^{th} Malaysia Plans indicate that convergence occurs during the period. This implies that these regional development plans suggest narrowing of income disparity between regions in Malaysia. On the other hand, result of the full sample period in Table 6 suggest that the six regions in Malaysia conform to the convergence of catching up as all three panel unit root tests result indicate that the null hypothesis of unit root can be rejected at the five percent significance level. As for the individual effect of the Malaysia plans on convergence, our results suggest that the 2^{nd}, 4^{th} and 5^{th} Malaysia Plan suggest convergence of catching up.

Conclusion

The objective of the present study is to test empirically the question of regional economic convergence in per capita GDP across the six regions of the northern, central, southern, eastern, Sabah and Sarawak for the period between 1965 and 2003 using a time-series framework. Upon testing the time-series properties of the regions' per capita GDP by using the standard ADF test, we found that all regional income series are $I(1)$ processes.

Based on the stochastic convergence definition suggested by Bernard and Durlauf (1995) and using both univariate, and three commonly used panel unit root testing procedures proposed by Levin et al. (2002), Im et al. (1997) and Maddala and Wu (1999), generally, our findings strongly support stochastic convergence of catching-up hypothesis for the six regions in Malaysia. An important implication of this study is that it appears that each of the Five-Year Malaysia Plan has its merit on income convergence in Malaysia.

Nevertheless, in general, the lack of convergence is still seen by many mainstream economists and policy advisers as the results of a lack of commitment on the part of national governments to move sufficiently quickly in liberalizing their economies. On the other hand, the key to catch-up lies in closing the technology gap between the poor and rich regions. Although this can be accelerated by imports of capital goods and by FDI, however, the effectiveness of such channels depends crucially on "adsorptive capacity" and "social capabilities", which are understood broadly to include a wide range of political and economic institutions as well as political and macroeconomic stability (Abramovitz, 1986).

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