Sustainable forest management policy and the analysis of convergence effects on timber production

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ABSTRACT

Since the mid-1990s, three Malaysian regions, namely Peninsular Malaysia, Sabah and Sarawak, have implemented sustainable forest management (SFM) certification practices, one of the objectives of which is sustaining timber production per hectare. This paper attempts to examine the level of sustainability attained by these three regions by testing for convergence effects of timber production per hectare with respect to the implementation of SFM practices. Nonlinear unit root was applied to test for nonlinear convergence in the three Malaysian regions in comparison to the national average for the period of 1970 to 2007. The results of linear and nonlinear trends showed that the regions have attained long-run convergence with the national average timber production per hectare. As it stands now, this finding has shown that Malaysia practices timber production with managed sustainability.

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1. Introduction

Complying to the objectives of sustainable forest management (SFM) set by the International Tropical Timber Organization (ITTO) requires that member countries ascribe to the principle of maintaining forest stand regeneration for timber production, environmental stability, biodiversity conservation, recreational values preservation, and the conservation of other forest products and services (Kumari, 1996). The ITTO has set the year 2000 as a target for SFM in timber-producing countries. In this study, an attempt is made to gauge the attainment of timber production sustainability exclusively, since time series data of the other elements of SFM is not available. Despite the ITTO member countries' commitment to the SFM policy, there is a possibility that timber extraction activities in the natural forest diverge from prescribed practices. Consequently, this matter will make it more or less difficult for producer countries to penetrate European or other environmentally sensitive markets. Accordingly, this paper provides a concise analytical technique of tracing the SFM policy and practices of timber-producing countries, together with some preliminary conclusions about their true commitment to and implementation of sustainably managed forests. The presence of either convergence or divergence effects was analyzed to determine the state of progress of a country toward implementing SFM practices.

Convergence and divergence effects could be related to timber production among geographical regions. The forestry departments of the three Malaysian regions, Peninsular Malaysia, Sabah and Sarawak, have committed to implementing SFM practices as prescribed under the National Forest Policy of 1992. According to Chong et al. (2008), the convergence technique analysis of high converging effects supports the one nation policy. As these three Malaysian regions have practiced SFM, it is hoped that timber production will be operated in a sustainably managed fashion. On the other hand, diverging effects would suggest that timber production among these regions has fallen short of achieving sustainable management practices.

The technique of convergence effects analysis has attracted substantial attention from researchers in various fields of economics, agriculture and tourism (see Barro and Sala-i-Martin, 1992; Carlino and Mills, 1993; Oxley and Greasley, 1995; Narayan, 2006, 2007; Lean and Smyth, 2008; Muhammad and Zulkornain, 2009; Hirnissa and Habibullah, 2009; Lee, 2009). However, to the best of our knowledge, a study analyzing the convergence effects in forest-related matters is still new and would be focused on the issue of sustainable timber production practices. Malaysia's three regions were chosen for this study, which could potentially be extended to other ITTO-producing member countries at a later date.

This study focuses its attention on the procurement of timber policy and the consistency of governments toward implementing the policy, which would improve the current technique of tracing the effectiveness of ITTO countries in implementing SFM policy. Furthermore, it may help to reveal either the countries are diverging, converging or catching up with the implementation of this policy. In other words, timber production is used as a proxy to investigate whether the country is moving toward implementing SFM or the other way around.

Timber production from natural forests in Peninsular Malaysia, Sabah and Sarawak has been decreasing steadily since the 1990s. Fig. 1 shows the continuous decrease in timber production from 1990 to 2007: from 12.81 million m³ to 4.22 million m³, 8.44 million m³ to 5.94 million m³, and 18.83 million m³ to 11.8 million m³ for Peninsular Malaysia, Sabah

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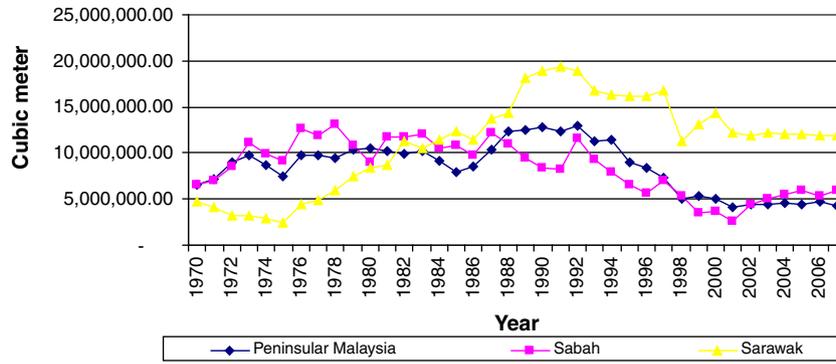*E-mail address:* abrahimabsamad@gmail.com (AS. Abdul-Rahim).

Fig. 1. Malaysian three regions' timber production.
Source: Department of Statistics (2007).

and Sarawak, respectively. MTC (2007) attributed this trend to the effectiveness in implementing SFM practices, such as tightened enforcement of laws and regulations governing forest harvesting by the respective regions. According to Article 74(2) of the Federal Constitution, Malaysian forestry comes under the jurisdiction of the respective state governments. As such, each state is empowered to enact laws and formulate its own forestry policies toward achieving SFM practices. Does the above trend in timber production statistics connote attainment of SFM among all three regions? Adoption of the convergence effects technique could help evaluate the performance of each of these regions accordingly.

The above matter is of concern since several questions relating to failure to adhere to prescribed timber production criteria in the producing country and regions within it have been highlighted by ITTO, particularly on the annual coupe restrictions, both in terms of timber volume and area open for logging. These criteria are reflected in the ITTO and Forest Stewardship Council (FSC) certification schemes and have been widely accepted as evidence of satisfying sustainable production or the equivalent of 'sustainably produced' (Baharuddin, 1995).

2. Data and methodology

The main data set for this study consists of annual volume of timber production per hectare basis measured in cubic meter (m^3) per hectare for the three Malaysian regions (Peninsular Malaysia, Sabah and Sarawak). This standard unit of measurement was chosen to avoid the element of bias with forest land area which would vary regionally. The data were collected from the regional forestry departments and the Department of Statistics, Malaysia from 1970 to 2007.

2.1. Linear and nonlinear test of convergence effects

Oxley and Greasley (1995) argued that the rejection of convergence by time series test should necessarily be based on evidence. Many countries may still be in the transitional process of convergence. This is consistent with Datta (2003), who argued that disparities among countries were most likely attributable to catching up rather than divergence, which indicates that nonlinearity may affect the power of the time series-based test. This test falls under the linear and time-invariant assumptions. Hence, for the purpose of this study, timber production per hectare by each region will be compared with the average Malaysian timber production per hectare. Consider the model:

$$\Delta z_t = \mu + \phi z_{t-1} + \alpha t + \sum_{k-1}^{n} \delta_k \Delta z_{t-k} + \varepsilon_t \quad (1)$$

where

$z_t = \text{TIMBERPROD}_{\text{REGION}} - \text{TIMBERPROD}_{\text{AVERAGE}}$
$\text{TIMBERPROD}_{\text{REGION}}$ is the timber production per hectare for each region

$\text{TIMBERPROD}_{\text{AVERAGE}}$ is the average timber production per hectare in Malaysia,
μ is the mean of z_t and
ε_t refers to the error term.

To test for catching up and long-run convergence would require that the timber production differential be stationary. Empirically, the absence of unit root ($\phi < 0$) means either catching up in the presence of a deterministic trend ($\alpha \neq 0$) or long-run convergence if the deterministic trend is absent ($\alpha = 0$). If the timber production per hectare differential contains a unit root ($\phi = 0$), then the timber production per hectare of the region and average timber production per hectare are said to diverge over time. However, Eq. (1) may not be able to detect convergence if z_t is nonlinear.

Kapetanios et al. (2003) extended the augmented Dickey–Fuller (ADF) unit root test to overcome issues of nonlinearity by incorporating nonlinearity as characterized by the Smooth Transition Autoregressive (STAR) process:

$$\Delta x_t = \sum_{j-1}^{\rho} \rho_j \Delta x_{t-1} + \delta y_{t-1}^3 + \nu_t \quad (2)$$

whereby $x_t = z_t - \alpha - \beta t$ is a de-meaned and de-trended series with α and β being the least squares estimators obtained from regressing z_t on constant and trend terms. The null hypothesis of H_0: $\delta = 0$ (nonstationary) against the alternative H_1: $\delta < 0$ (stationary) can be tested.

Even though this test is useful in the study of nonlinear convergence, it failed to show the significance of the deterministic trend. Therefore, it is not directly applicable here. There is a way to distinguish between long-run convergence and catching up in nonlinear by using the modified time series test of convergence proposed by Chong et al. (2008). They incorporated an additive β and trend component $G(trend)$ into Eq. (3) to yield:

$$\Delta y_t = \mu + \sum_{j-1}^{\rho} \rho_j \Delta y_{t-j} + \delta y_{t-1}^3 + \phi G(trend) + \xi_t. \quad (3)$$

Whereby y_t is the original series under this study, which is different from the de-meaned and de-trended series x_t, and $G(trend)$ is the trend component of the specific functional form. Two commonly used trend variables are linear trend and square of the trend. ξ_t is the error term. The absence of a nonlinear unit root test ($\delta < 0$) implies either nonlinear catching up, given the presence of a deterministic trend ($\phi \neq 0$), or nonlinear long-run convergence if a deterministic trend is absent ($\phi = 0$). However, if the output differential contains a nonlinear unit root ($\delta = 0$), the total output of the two contrasting regions is said to diverge over time. The statistical significance of δ and ϕ can be tested by using t-statistics. As Chong et al. (2008) have