Journal of Service Science and Management, 2011, 4, 280-283
doi:10.4236/jssm.2011.43033 Published Online September 2011 (http://www.SciRP.org/journal/jssm)

East Asian Economic Growth—An Evolutionary Perspective

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Received June 27th, 2011; revised August 2nd, 2011; accepted August 18th, 2011.

ABSTRACT

The High Performing Asian Economies have been the fastest growing economies anywhere, anytime. This phenomenal growth experience has stimulated extensive research on its determinants. What is less known however, is dynamics of the distribution of income. This paper considers a statistical model to describe convergence of cross-country incomes across the High Performing Asian Economies. The empirical results illustrate that diffusion is a potential technique for the analysis of spatial dynamics of economic growth.

Keywords: *East Asian Economic Growth*, *Evolutionary Perspective*

1. Introduction

The High-Performing Asian Economies (HPAE) have been the fastest growing economies anywhere, anytime[1]. **Figure 1** and **Table 1** illustrate the strong economic growth which spread like a wave over the region between the years of 1960-1995.

Compared to large parts of Asia, Africa and Latin America, the High Performing Asian Economies have been unusually successful at achieving high growth rates. At the same time that the HPAE were growing at over 5.5%, richer industrial economies were growing at around 2%, South Asia likewise at 2%, and Latin America at 1%. Africa and the Middle East were shrinking[2]. The phenomenal growth in HPAE altered the global economic balance and contributed to closing of the economic gap between the OECD and developing countries.

The growth experience of East Asia has stimulated extensive research on its determinants [1-5]. Much attention has been devoted to the explanation of the shape of the distribution of income in the region by reference to steady state arguments. What is less known however, is the dynamics in question. To fill this gap, the present paper examines the dynamics in the cross-sectional distribution of income in High Performing Asian Economies.

[1]For purposes of this paper, High Performing Asian Economies include: China, Hong Kong, Indonesia, Japan, Malaysia, South Korea, Singapore, Taiwan, and Thailand.

[2]These figures are annual averages, based on GDP per person, 1965-1996. The author acknowledges and thanks Mark Hannay for assistance in the estimation section of this paper.

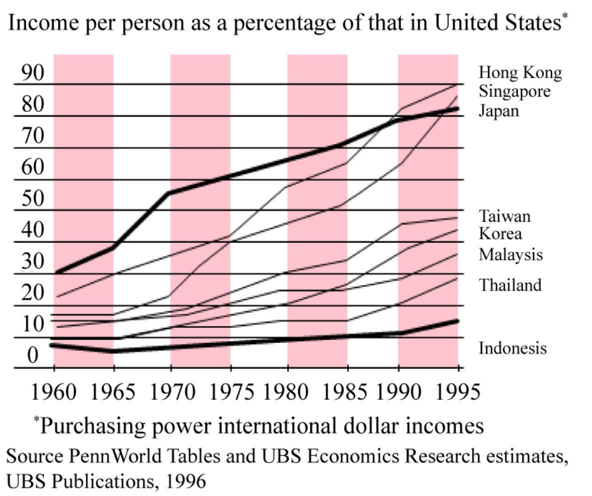

Figure 1. Strong economic growth spread like a wave over Asia.

2. The Model

Consider a region consisting of countries with different levels of income. The set of country incomes forms a long-run distribution which evolves over time. Assume that the dynamics of this distribution rely on two counteracting forces: 1) a mean-reversion process along time, driven by mobility of factors of production [6]; and 2) a diffusion process across regions, driven by search and learning [7-9].

Table 1. Asian economic growth.

(Average Real GDP Percent Per Annum)				
	1960-1969	1970-1979	1980-1989	1990-1995
East Asia				
Japan	10.5	5.2	3.8	1.9
Asian "Tigers"				
Hong Kong	-	7.9	3.0	5.1
Korea	7.7	9.4	8.1	7.9
Taiwan	9.8	10.2	8.1	6.4
Singapore	-	9.5	7.4	8.6
Other high growth*				
Malaysia	-	8.1	5.8	8.9
Thailand	8.3	7.4	7.3	8.9
Indonesia	4.0	7.8	5.8	7.1
Other East Asian				
Chian	2.9	7.5	9.4	10.2
Philippines	4.9	6.1	2.0	2.4
Vietnam	-	-	-	7.7
Other Asian				
India	3.7	3.2	6.0	4.8

Source: UBS Publications 1996, reproduced with permission.

Consistent with the above, assuming that income behaves like a stochastic process and that it is continuous and Markovian, the evolution over time of income distribution can be expressed by the following classical second order partial differential equation:

$$\frac{\partial f}{\partial t}+\frac{\partial}{\partial s}\left(\lambda\left(u-s\right)f\right)=\varepsilon\frac{\partial^2 f}{\partial s^2} \quad (1)$$

where f measures probability density and s measures income. λ represents the income adjustment rate, u represents the mean of the distribution in the long run, and ε represents a diffusion parameter[3].

3. Empirical application

3.1. Data and Descriptive Statistics

The empirical analysis employs data on Gross Domestic Product (GDP) per capita of High Performing Asian Economies from 1980 to 2007. **Figure 2** illustrates the evolution of the distribution of GDP per capita for the population[4]. A steady growth can be observed, with the South East Asian financial crisis standing out. **Table 2** shows the descriptive of log GDP per capita.

3.2. Estimation

The model has been applied to log GDP per capita distribution of the HPAE as a function of time, to estimate the five model parameters[5]. u_0 and u denote the initial and long-run mean of the distribution respectively. σ_0 represents the initial standard deviation, ε represents the diffusion parameter, and λ represents the income

[3]Ref [10] provides a full analysis of this model but in a different context.

[4]Data graphed are yearly means.

[5]The expression representing the time-development of the distribution is:

$$f(s,t)=N\mathrm{e}^{\lambda t}\sqrt{\frac{a}{a+\beta}}\mathrm{e}^{-\frac{((s-u)\mathrm{e}^{\lambda t}+u-u_0)^2}{2\sigma_0^2+\frac{2\varepsilon}{\lambda}(\mathrm{e}^{2\lambda t}-1)}}=N\mathrm{e}^{\lambda t}\sqrt{\frac{a}{a+\beta}}\mathrm{e}^{-\frac{(s-u_t)^2}{2\sigma_t^2}}$$

where

$$a=\frac{\sigma_0^2}{2}$$

$$\beta=\frac{\varepsilon}{2\lambda}(\mathrm{e}^{2\lambda t}-1)$$

$$u_t=E[f]_t=u(1-\mathrm{e}^{-\lambda t})+u_0\mathrm{e}^{-\lambda t}$$

$$\sigma_t^2=\sigma_0^2\mathrm{e}^{-2\lambda t}+\frac{\varepsilon}{\lambda}(1-\mathrm{e}^{-2\lambda t})$$

N is the normalization constant. Ref [11-14] provide an elaboration, albeit for different contexts.

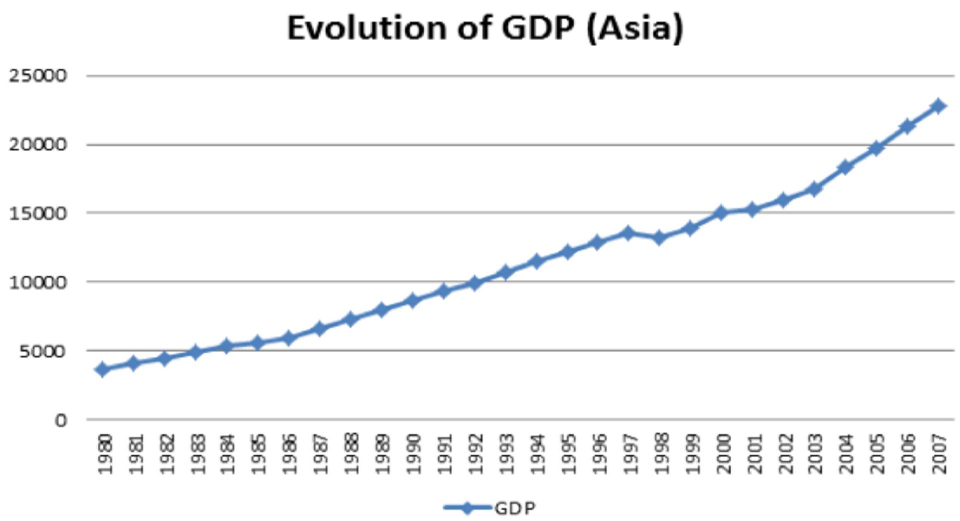

Figure 2. Evolution of GDP.

Table 2. Descriptive of GDP per capita for HPAE from 1980 to 2007.

	N	Years	Minimum	Maximum	Mean	Std. Deviation
All data	252	1980-2007	5.530	10.814	8.686	1.323
Used for fit	171	1989-2007	6.419	10.814	9.021	1.208

adjustment rate. **Table 3** reports estimates for the five model parameters.

The value for the income adjustment parameter λ is positive as expected. The value for the diffusion parameter ε is small and positive, likewise conforming to our theoretical predictions. The results predict that if one begins with a normal distribution and allows the model drive the distribution, the distribution variance will tend toward a constant $\lim_{t\to\infty}\sigma_t^2 = \varepsilon/\lambda$, and concentrated around a mean u.

4. Conclusions

Our findings have interesting implications for dynamics of the distribution of income across the High Performing Asian Economies. The results suggest that diffusion is a potential technique for the analysis of spatial dynamics of economic growth.

Table 3. Parameter estimates.

Parameter	Value	Std Error.	t-value
λ	0.014	0.011	1.221
u	13.393	3.578	3.743
u_0	7.781	0.125	62.250
σ_o^2	2.251	0.084	26.680
ε	0.010	0.009	1.143

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