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Flying Geese of Japan: Asian Electronic Industry

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Abstract

Although Japan is known as the largest electronics goods manufacturer, many Japanese companies are facing high cost production due to limited resources. Some Asian countries have been proven to surpass Japan due to their low cost production and cheaper labour. This study analyse the development of Asian leading electronic industries and validity Japan as the flying geese in Asian electronic industries. The empirical result shows that all Asian countries are divergence except Italy, India, United Kingdom and Indonesia. The study suggest that each of the Asian convergence countries should cooperate, give their obligation and commitment to track in the same direction of economic structure, political will and the income distribution of a country. This action could promote economic integration between Asian countries as a whole.

Keywords: Convergence; Economic growth; GDP

Introduction

Manufacturing sector plays a vital role in contributing to the economy. It has created massive job opportunity as well as raised the standard of living for developed and also developing countries including China, India, South Korea, Mexico, and Brazil. Manufacturing industry can be classified into few categories which are engineering, textile, construction, electronics, chemical, energy, food and beverage, plastic, transport and telecommunication. According to McKinsey [1] global institute, manufacturing industry has contributed nearly 16% of global GDP and created a total of 62 million of opportunity job in advanced economies in the year 2000. The manufacturing sector is also known as the top multiplier effect to the economy because it will bring additional value of $1.40 for every $1 spends in the manufacturing industry.

Technically, value-added manufacturing is the product of the number of workers multiplied by productivity (value-added per person). Japan has become a well-known exporting country with the capability to produce highly competitive electronic goods. Government of Japan displays their support by implementing various policies and strategies relating to export and manufacturing especially electronic production, hoping to boost this industry. The authorities provided fund and assistance in the research and development activities to aid these electronic industries become more competitive. For instance, after the financial crisis which is in the year 2010, the authorities had implemented subsidies for automobile and other electronic components and devices. As a result, Japanese electronics industry production had reached ¥15.3 trillion and ¥15.7 trillion respectively in 2010, 2011.

Japan is considered to own the absolute advantages in producing high-tech and precision products such as such as optical instruments, hybrid vehicles, and robotics. According to Economy Watch [2], electronic industry in Japan is known as the largest electronics goods manufacturer and world's third largest automobile manufacturer. The most famous Japanese electronics companies in the world are Sony and Panasonic. However, as this country seems to excel any other countries in this aspect, it also has its hardship that needed to be encountered. Many Japanese companies have to outsource their electronic products by purchasing low cost component goods from another company and shift part of the operation business to overseas. Not only that, Japanese companies are facing the obstacles to compete against lower price rivals from Asian country such as South Korea and Taiwan. Asian rivals prefer to set up their plant in country India, Thailand, and Indonesia because it has cheaper land and labor cost is very low. This enables them to produce high quality and lowest price of electronic devices to consumers. Therefore, if this situation persists, South Korea and Taiwan might become the new dominant in the market of electronic industry. As such, this study is to validity Japan as the flying geese in Asian electronic industries.

Literature Review

There has been extensive theoretical and empirical research on contribution of high-technology industry to economic growth in both developed and developing countries. For example, Sun et al. [3], Connolly et al. [4] have conducted a research on the relationship between high-tech capital investment and productivity by using variable output (value added), capital stock, labor. Sun et al. [3] found out that technological progress and technical efficiency were the major contribution to the total factor productivity (TFP) growth in the Korean manufacturing. Connolly et al. [4] on the other hand discovered three alternative ways to stimulate an increase in the production of high technology industry which are increasing multi-factor productivity (MFP) in the production process, capital accumulation, and improving the infrastructure.

Niininen [5] the main purpose is to investigate information technology and economic growth in Finland by using the neoclassical growth. The result indicated that the income share of capital in Finland has contributed nearly 28 percent to the net output growth. Moreover, Bregman et al. [6] demonstrated a research paper on contribution of high tech to productivity in Israeli by using method Cobb-Douglas and Trans log production function to examine the 670 of establishment companies in the year 1982. The finding implied that high tech firms

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are more productive, pay higher wages and generates a higher rate of return compare to other firms. Amato et al. [7] studied the relationship between high tech productivity and profitability in U.S. manufacturing industries from 1988 to 1992.

Lehr et al. [8] and Chee [9] studied the relationship between information technology and economic growth in China and conduct the study using the neoclassical production function model for the period 1984-2001. The variables of the study consist of output, IT and non IT capital stock, employment. The results indicate that information technology is positively related to economic growth in China. In addition, Oulton [10] as well as Shao et al. [11] had done similar research the contribution of information and communication technology (ICT) to the economic growth. Oulton [10] has portrayed that the total of contribution ICT capital to growth of labour productivity in United Kingdom are 23%. The study on the contribution of the ICT industry continued by Shao et al. [11] on the selected 14 Organization for Economic Cooperation and development (OECD) countries. Their result has discovered that the performance of ICT industry in 14 OECD countries is growing steadily and become more competitive.

Data and Econometric Methodology

Data description

The selected data for this analysis are yearly observations from the sample period of 1998-2009. The electronic output in terms of value added of 10 countries is utilised in this study. The 10 countries comprises of United States, Japan, German, Korea, Malaysia, Italy, India, United Kingdom, Indonesia and Singapore. The data are obtained from the United Nations Industrial Development Organization (UNIDO) statistical database. In this study, the non-linear time varying factor model namely Phillip et al. [12] are employed to examine the possibility of convergence or divergence of Asian electronic industries. With this, it can identify the steady path of Asian leading countries in electronic industries.

Phillip and Sul [12]

Phillip et al. [12] suggest that there might be multiple equilibrium in a rejected convergence hypothesis. Apergis et al. [13] also mentioned that there are still chances of the existence of convergence despite of the rejection of null hypothesis of convergence. This methodology allows for the modelling of transitional effects to be taken placed as this idiosyncratic factor loadings gives a mechanism for heterogeneous behaviour across individuals.

Phillip et al. [12] adopt the following time-varying common-factor representation for y_{it} t of country i:

$$\log Y_{it} = \delta_{it}\mu_t$$

Where μ_t is a single common component and δ_{it} is a time-varying idiosyncratic element that captures the deviation of country *i* from the common path defined by μ_t. A process called cross sectional variation is to be computed to examine the overall convergence of transition parameters, h_{it}. The formula for h_{it} is as follows:

$$h_{it} = \frac{\log y_{it}}{1/N\sum_{i=1}^{N}\log y_{it}} = \frac{\delta_{it}}{1/N\sum_{i=1}^{N}\delta_{it}}$$

This equation is designed to measure the loading coefficient δ_{it} in relation to the panel average at time. This concept is applicable in the analysis of growth convergence and to measure transition effects. In this framework, all *N* economies will converge, at some point in the future, to the steady state, if $\lim_{k\to\infty}\delta_{it}+k=\delta$, for all $i = 1, 2, \ldots, N$, irrespective of whether countries are near the steady state or in transition. Smoothing methods are used before analysing the convergence concepts as these methods can encounter the unknowns in the sample data. In this study, Whittaker-Hodrick-Prescott (WHP) smoothing method is adapted.

Then Phillip et al. [12] suggested that the cross-sectional variance of h_{it}, denoted by $V_T^2 = \frac{1}{N}\sum(h_{it}-1)^2$ converges to zero. In order to specify the hypothesis of convergence, further steps have been taken. Phillip et al. [12] model δ_{it} in a semi-parametric form as shown below:

$$\delta_{it} = \delta_{it} + \frac{\sigma_i \xi_{it}}{L(t)t^{\alpha}}$$

Where δ_i is fixed, σ_i is an idiosyncratic scale parameter[3], ξ_{it} is iid (0,1), L(t) is a slowly varying function and α is the decay rate. The log t convergence test was developed by them based on a simple time series regression which involves a one sided t-test. The test is known as *t-test* as the t-statistics refers to the coefficient of log t regression in the equation. The log t regression for test the full null hypothesis of convergence is then established:

H0: $\delta_i = \delta$ for all i, $\alpha \geq 0$; Convergence for all countries

: $\delta_i \neq \delta$ for some i, $\alpha < 0$; No convergence for some countries

To test for convergence, Phillip and Sul (2007) have suggested the following regression:

$$\log\frac{H_1}{H_t} - 2\log L(t) = \hat{\alpha} + \hat{b}\log + \hat{\mu}_t$$

for $t = [rT], [rT]+1, \ldots, T$, and $r > 0$. They also suggested that we can test for convergence hypothesis by a *t* test of the inequality, $\alpha \geq 0$. The t test statistic follows the standard normal distribution asymptotically and is constructed using a heteroskedasticity and autocorrelation consistent standard error. Moreover, it also carries the possibility of club convergence in the sample data although it rejects the null hypothesis. The procedure of club clustering is summarised as follows:

Step 1 ordering: Asian countries are listed according to the last period value. This can be done by applying the last observation of final time series or some average of final observation to cluster the panel.

Step 2 core group formations: Select the first (base) country that has the highest rank. Then run the log t regressing and the convergence test statistics is computed for each subgroup of size k.

Step 3 club membership: Add one country at a time to the base club. If the t statics is greater than the critical value -1.65 at 5% significant level, formed the new country in the convergence club. If the corresponding test statistics greater than some chosen critical value c, then added the unit in the current subgroup. If the condition is not satisfied, the subgroup forming is completed.

Step 4 stopping rule: The process stop when the t-statistics is less than critical value (-1.65). Then, the next cluster is form. If no subgroup detected, these show divergence behaviour.

Empirical Findings

Full panel convergence

The table below reports the results of the panel convergence methodology for output (value added) of 10 Asian countries. According to Phillips et al. [12], the log t-test result -8.504151 is smaller than critical value -1.65 at 5% percent significant level. The null hypothesis

of convergence is rejected for the period of 2001-2009. The first r% (0.3) of the data is trimmed before analysis to avoid initial effect. Based on this analysis, the overall Asian countries are heterogeneous in terms of value added (output). However, there is possibilities of convergence might exist in the sub group lead to the trimmed observation. As such, method formed by Phillip et al. [12] is applied for the next section (Table 1).

Cross-sectional variation

Figure 1 shows the result of cross sectional variation of 10 Asian countries within the period 2001-2009. India (HIT_LINDIA) has an increasing trend of transition parameter path. The Singapore (HIT_LSINGAPORE) and Indonesia (HIT_INDONESIA) are among the lowest of transition parameter path in term of output (value added) from the year 2001-2009. We could observe that India, Italy and United Kingdom they have strong evidence of convergence among them. This technical mechanism is commonly employed for the separation of the cyclical component of a time series from raw data.

Club clustering and convergence

The table below shows that the last year observation of Asian countries. Based on this ranking, United States is the benchmark and it is considered as the core group (Club 1). The clustering process goes on by adding one country at a time to the United States and run the log-t regression to obtain the compute t- statistics. If the value of t-statistic is greater than the critical value which is -1.65 then it is consider as converging. However, if the t-statistic is smaller than the critical value then it is consider as diverging from the core group. The latter situation happens on Japan whereby the t-statistics obtained is -133.03. This means that Japan is diverging from the core group, hence created second group. This analysis has resulted in 7 clubs where there is only one group that is converging. The first diverging group would be USA; followed by Japan as the second group; then solely Germany is the third diverging group; Korea is the fourth group; Malaysia is ranked as the fifth diverging group and lastly Singapore as the diverging group. As for the converging ones, they are Italy (base), India, United Kingdom and Indonesia.

Clubs	States	t-Statistic	Remarks
Full Sample	10 Asian Countries	-8.504151**	Divergence

Notes: Asterisk (**) denotes statistically significance at 5% level. The 5% critical value is -1.65

Table 1: Panel convergence (Per Capita GDP).

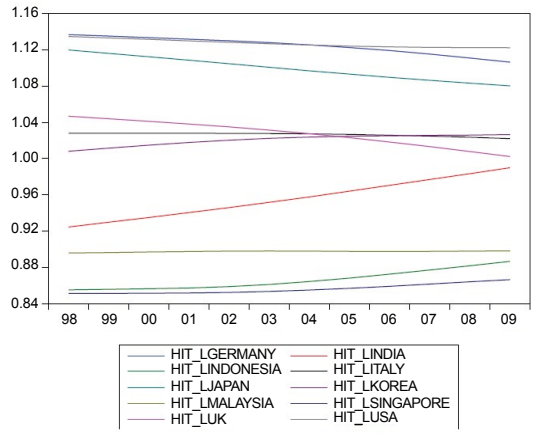

Figure 1: Cross-sectional variation of the 10 Asian countries.

Seven clusters of convergence indicate the weak convergence among them which also means that there is vast dissimilarity in its economic structure as a whole. Most of the diverging countries faced the same problem that lead to this behaviour which is the financial crisis in 2008. As Japan is diverging in this analysis, it symbolises that Japan's performance in electronic industry has dropped within the sample period. Japan was one of the electronic technology leaders in the world. Japan is rich in term of great amount of highly educated and experience engineers. Due to these strong brainpower and massive foreign direct investment, Japan has become the successful leader which some called as the flying geese. However, an economic crisis in 2008 had led to value of Yen to depreciate. A larger number of Japanese companies choose to shut down as they have experience series of difficulty in term of high cost, lack of capital. Not only that, the negativity continues when the share of research and development (R&D) spending in Japan is decreasing from 11.2 percent to 10.8 percent during the period 2011 until 2013 [14]. As cruel as the reality to Japan, South Korea and Taiwan might take over the lead in electronic industry production.

As for the only converging group lead by Italy, it might be due to massive improvement in emphasis on high technology industries in the country by the policy makers. According to Federal Ministry of Education and Research [15], the share of R&D spending in Italy is increasing from 1.09 percent to 1.27 percent during the period 2005 until 2009. Up to 60% of small and medium enterprise (SME) involve in the electronic industry. In 2003, the Italian Ministry University and Research have declared high technology industries will be clustered together and specialist in new Nanotechnology. India is one of the converging countries which are due to the same reason as Italy. The authorities of India have allocated annually $2 billion (US dollar) for Indian institutes to conduct R&D in atomic energy, space, health and others [16]. India has a comparative advantage in term of low wages with high skill labour, huge local demand market, high capital and expertise in the electronic field.

Furthermore, contribution of electronic industry to the United Kingdom GDP is relatively small. Most of electronic industry is involved in producing high value added and low volume project such as medical equipment, aerospace, national defence, and others. According to the Federal Ministry of Education and Research [15], the share of R&D spending for United Kingdom are increasing from 1.73 percent to 1.85 percent during the period 2005 until 2009. Continuity of support such as reduction tax, business and subsidies had been implemented by government to protect the infant industries has also aid in boosting the industry. As for Indonesia, it shows a converging behaviour with Italy. According to Electronic Producers Association of Indonesia (2010), Indonesia has become the choice of electronic producers to relocate their factories and make the country their global production basis. In addition to that, Industry Ministry Director General for Transportation, Telecommunications and IT Industries Budi Darmadi [17] said the government offered several incentives that he believed could boost investment, particularly in the electronics sector (Table 2).

Conclusion

The analysis on the possibility of convergence of Asian electronic industry shows that countries including Italy, India, United Kingdom and Indonesia are convergent. Summarily, these countries' government has done their part in boosting electronic industry by increasing the budget for the total R&D expenditure in science and technology. On the other hand, the divergent countries comprises of Singapore, Japan, German, Korea, United States America and Malaysia. These countries

Last T order	Countries	Step 1	Step 2	Step 1	Step 2	Step 1	Club	Remarks
1	USA	Base					1	Divergence
2	Japan	-133.03	Base				2	Divergence
3	Germany		-7.08	Base			3	Divergence
4	Korea			-4	Base		4	Divergence
5	Malaysia				-21.89	Base	5	Divergence
6	Italy					-16.13	6	Convergence
7	India					2.14	6	Convergence
8	United Kingdom					2.61	6	Convergence
9	Indonesia					-1.4	6	Convergence
10	Singapore					-4.66	7	Divergence

Table 2: Results of Convergence Clubs in GDP per capita.

displays diverging behaviour are due to the big impact from financial crisis in 2008.

Electronic industry plays a vital role in contributing to the economy growth. Electronic sector can benefit the country by creating high job opportunity as well as raising the standard of living especially for the middle class country in new emerging player such as China, India and Taiwan. The diverging countries should implement continuous development planning of R&D and innovation to boost the exports and productivity growth of the country. By on-going R&D, it ensures the countries to obtain the comparative advantages and enjoy the global economic scales.

Government can also create awareness for the youths to motivate them to venture in the field of science and technology. For instance, launching campaign on the importance of science and technology or provide extensive courses training to the youths to produce more skilled-labour. Moreover, these countries should also form a regional cluster to create advance technology and products. Formation of regional cluster in the electronic industry will expand the output production as well as accumulate greater capital. These countries should collaborate with each other to in terms of policy, trade liberalization and R&D. By forming the global production network of electronic, it could enable them to increase the economic growth, hence become more competitive in the international markets as a whole.

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