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Cooperation and Coevolution

—Analysis of ICT industry between China and Japan

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Abstract

China's ICT industry needs to import high technologies to enhance the sustainable power and keep the long-term growth of China's economy, while Japan need capital and profit to pull itself out from the economic stagnation. Given the strong interdependence, there is a possibility of a virtuous cycle between China and Japan's development. This paper will analyze the background, the process, and focus on how Foreign Direct Investment (FDI) facilitates technology spillover in China.

1 Introduction

1.1 Background

In recent years the whole world focus attention upon China's rapid economic growth. Not only traditional industries but also some advanced industries are developing rapidly including information and communication technology industry (ICT). With the influence of New Economy, ICT industry has become more and more important to total economy of China. Although there is still a huge gap between China and the developed countries in the development of ICT industry, the astonishing pace of its progress shows promise for the country's New Economy as demonstrated in **Fig.1.**which shows China's dramatic Internet diffusion in China.

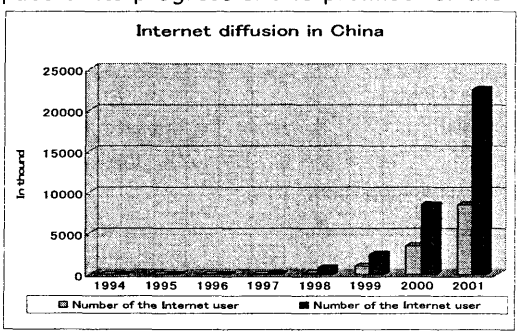

Fig.1. Internet diffusion in China

Source: CNNIC Report (2001).

Comparing the ICT industry of the two countries (see table 1), we can draw the conclusion that measured by the share in total GDP, the sustainable power differs between the two countries depend on the technology level. China's ICT industry is developing rapidly but its bottleneck is low level of technology. While Japan has high level of ICT but it suffers economic stagnation due to deflation. In the same time China has a large domestic market in a class by itself. From these facts, it is clear to see that there is strong interdependence between China and Japan. Given the strong interdependence there is a possibility of a virtuous cycle between the two countries. This virtuous cycle leads a way to co-evolution between China and Japan.

Table 1 Comparison to ICT industry between Japan and China.

Year		1995	1996	1997	1998	1999	2000
Growth rate (% p.a.)	Japan	-	14.2	12.8	8.8	3.5	6.9
	China	21.25	18.77	22.01	-	-	-
% in GDP	Japan	7.61	8.36	9.34	10.28	10.71	11.42
	China	0.77	0.78	0.87	-	-	-

Source: Japan's Information and Communication White book (year 2000).

1.2 Hypothetical View

The foregoing observation prompts as the following hypothetical views:

(i) Virtuous cycle leads a way to co-evolution between China and Japan.

(ii) Improvement of China's ICT level is indispensable for this virtuous cycle.

(iii) Effective utilization of spillover ICT from Japan is important for this improvement.

(iv) Therefore, improving China's assimilation capacity for maximum utilization of spillover ICT is significant.

1.3 Focus of the analysis

Given the above hypothetical views are proving China's strategic option focused constructing a virtuous cycle for ICT and nation's development can be illustrated as **Fig.2.** This paper attempts to demonstrate the foregoing hypotheses focus on the assimilation capacity.

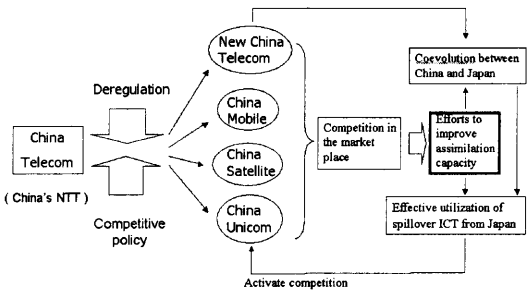

Fig.2.China's strategic option.

2 Analytical Framework

2.1 The Dynamism of TSO

Fig.3. shows the dynamism of Technology Spillover (TSO) from Japan to China. It is also the process of virtuous cycle between the two countries. The flow of TSO starts from the development of Japan's ICT industry by investment and trade it flows to China's ICT industry. After assimilation TSO affects China's economic development. The positive effect not only improves China's assimilation capacity but also stimulate economic interaction between the two countries. By exporting the technologies to China, enterprises in Japan also get profit from China's large domestic market. So Japan's GDP is stimulated by the process of TSO too. With the development of economy, enterprises in Japan will allocate more funds to support R&D, so it is reasonable that more and more new technology will be invented. In this way the virtuous cycle works.

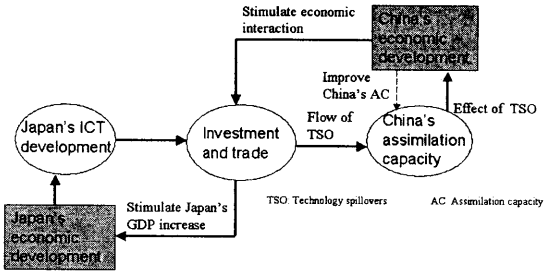

Fig.3. Dynamism of technology spillover from Japan to China.

Source: Authors' elaboration base on Watanabe et al. (2001)[1]

2.2 One factor influences assimilation capacity.

Now we focus on relation of the technology spillover facilitated by the foreign investment and the rate of productivity growth. Many economists subscribe to the result that local firms may increase their productivity by observing nearby foreign firms or becoming their suppliers or customers or through labor turnover as domestic employees move from foreign to local firms.

3 Empirical analysis

3.1 The effect of technology spillover

First let's see the structure of the total technology stock of ICT industry in China facilitated by FDI. It can be divided in to two parts. $\mathbf{T_i}$ is the technology stock associated

The total technology stock facilitated by FDI

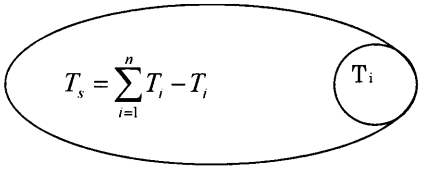

Fig.4. The Pool of Spillover

with FDI in one industry in ICT, $\mathbf{T_s}$ is the result of technology spillover in whole ICT industry based on the FDI.(see **Fig.4.**)

To examine the external effect of FDI, we first develop a production function based on externality in which FDI is allowed to have an impact on the productivity of its recipients as well as nonrecipients.

We develop the production function for the industry i in the ICT industry based on the Cobb- Douglas production function.

$$Q_i = A_i L_i^{\alpha} K_i^{\beta} T^{\gamma} \qquad (1)$$

where Q_i denotes value-added, L_i and K_i the services of labor and capital inputs, A_i scale factors, α the elasticity of labor, and β the elasticity of capital. The technology factor has three possible factors (C. Watanabe and B. Asgari, 2002)

$$\begin{aligned} &(i) T = T_i + ZT_s \\ &(ii) T = T_i + T_s \\ &(iii) T = B_i e^{at} T_i^{\gamma} \bar{T}_s \end{aligned} \qquad (2)$$

In the (i)$T=T_i + ZT_s$, Z is the assimilation capacity and can be measured as follows: (Watanabe et al.,2001[1]):

$$Z_i = \frac{1}{1+\frac{\Delta T_s}{T_s} \Big/ \frac{\Delta T_i}{T_i}} \frac{T_i}{T_s} \qquad (3)$$

In 2001, professor C. Watanabe et al have found the(i) in (2) is the most efficient model to analyze the Japan's machinery industry (See the references [2]). But what is the case of China's ICT industry?

3.2 Analysis – A case of ICT industry in Shenzhen, China

This case was done by Zhiqiang Liu in State University of New York at Buffalo, with the method of (2)-(iii) $T = B_i e^{at} T_i^{\gamma} \bar{T}_s$. He selected the data over the period from 1993 to 1998 in the Shenzhen Special Economic Zone of China which is considered one the most important areas of FDI and R&D center of ICT in China by using the *Shenzhen Statistical and Information Yearbook* and focused on the impact of FDI on the rate of productivity growth by extend the model as follows:

$$\Delta \ln Q_i = a + \alpha \Delta \ln L_i + \beta \Delta \ln K_i + \delta \ln T_i + \varphi \ln \bar{T} + \varepsilon_i \quad (4)$$

It is difficult to make whole nation data comparison, especially in the case of a country like China that is experiencing rapid economic change. So we select the data over the period from 1993 to 1998 in the *Shenzhen Statistical and Information Yearbook.* In this case to see Whether FDI influences the rate of productivity he begin with the growth regression model as specified in Eq. (4) and then extend the model to account for factors of potential importance to productivity growth. Here, T_i is defined as the percentage of registered capital owned by foreign investors in industry i and $\bar{T}$ is defined as the average share of foreign equity participation across all ICT industries, weighted by employment share. Table 3 reports the results.

Table 2 Growth rate regressions (29 ICT Industries, 1993 -1998)

Variables	1	2	3	4	5
T_i	-0.103	-0.12	-0.105	-0.0926	-0.128
$\bar{T}$	0.523	0.537	0.517	0.506	0.535
Output 93	-	-0.0812	-	-	-0.106
Growth rate of national sales	-	-	0.805	-	0.959
Public capital	-	-	-	0.156	0.00718

Source: Journal of Comparative Economics **30**, 579–602 (2002)

3.3 Interpretations

Column 1 contains the weighted least-square estimates of Eq. (4). The effect of FDI on the rate of productivity growth of the recipient industry is negative but statistically insignificant. In contrast, the spillover effect of FDI is shown to be large and statistically significant. The estimated

coefficient on, $\bar{H}$ 0.523, which is statistically significant at the 1% level, implies that a 1% increase in the average share of foreign equity participation in the whole industry will raise the average rate of productivity growth of the component industries by about 0.523 percentage points.

To test the factors of potential importance to productivity growth, he extend the model by introducing three variables they are output 93, national sale growth rate and public capital. The results show from column 2 to 4. The column 5 is the result of adding the three variables in the same time. The paper found in every case the estimated spillover effect of FDI, as the coefficient on $\bar{H}$ remains positive and statistically significant.

4 Conclusions

4.1 General Summary

This paper introduced the background and dynamism of virtuous cycle between Japan and China. And Focused on the assimilation capacity of China's ICT industry especially on the effect facilitated by the FDI in the virtuous cycle. Then as an example, introduced the case in Shenzhen China by using model (2)-(iii) done by Zhiqiang Liu in State University of New York at Buffalo.

4.2 New Findings

The result of the case of Shenzhen suggests that FDI generates externalities in the form of technology transfer. The point estimates of the external effect of FDI on productivity suggest that a 1%increase in the average level of FDI in the whole ICT industry could raise the rate of productivity growth among all ICT industries by as much as 0.5 percentage points. The results are robust to a number of alternative specifications, which control for variables usually considered as important determinants of productivity growth, and to alternative measures for the presence of foreign investment.

4.3 The Future Works

This paper introduced three possible models of TSO facilitated by FDI and gave the case of Shenzhen analyzed by one model as an example. The future work will be analysis on China's ICT industry by using the other two models, Which were proved most efficient on analyzing Japan's electrical machinery industry by C. Watanabe et al in2001. If it is possible to get enough data, the analysis of whole ICT industry in China will be proceed too.

References

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