

## Part3 Chapter 8:Technology Choice and Changes in the Trade Structure of the IT Industry

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# Chapter 8

## Technology Choice and Changes in the Trade Structure of the IT Industry

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As is well known, the IT industry has experienced rapid growth, and the volume of production and demand in this sector has become enormous. The Japanese IT industry, which performed well during the 1980s, rapidly lost its share in the world market in the 1990s. By contrast, the IT industry in the United States has increased its share, driven by technological progress mainly in CPUs, and South Korea's industry has also raised its share, driven by an investment deluge taking advantage of the economies of scale that characterize the industry. However, with the rapid progress in IT technology, further improvements in the functions of products began to be sought. Following this, there has been a remarkable increase in the demand for system LSI. A system LSI must be produced, tailor-designed for each electrical appliance. It is said that this production method has made the IC cycle ambiguous in recent years.

Since 2003, Japanese IT firms have made rapid progress in increasing their profitability based on an increase in the production of system LSI mainly for digital household electrical appliances. Producing system LSI requires a form of technology embodied in labor, or human capital. There are no returns to scale. Firms in Japan, Europe and the United States engage in the production of system LSI. It can be said that the choice of whether an economy pursues a development path centered on tradable technology or technology embodied in labor, depends on historical background. Firms in the United States are focusing on the production multi-purpose IT products, while firms in

Japan and Europe are focusing on system LSI. These two technologies are now competing against each other in the IT industry, and their position of superiority is changing periodically. There is a need to capture and predict trends in technology in order to analyze economic developments and the trade structure.

This chapter explains trends in IT technology and industry, and technology choices. The relationship between tradable technology and technology embodied in labor is changing with dizzying speed. Therefore, the explanation will focus mainly on IT technology.

Recently, the demand for system LSI has started to increase, particularly in the automobile industry. It is predicted that the demand for system LSI in the automobile industry will increase four-fold compared to current demand. It is desirable that they will increase efficiency by creating common platforms for the production of system LSI. In the case of FPD (Flat Panel Display) larger than 40 inches, Plasma Display takes predominance over LCD (Liquid Crystal Display), with a 70% share of the market. In the case of sizes smaller than 40 inches, LCD has superiority, because Plasma Display requires more volume of system LSI than LCD. Japanese firms have achieved good results in Plasma Display. Then, there exists a third device, the organic EL (Organic Electronic Luminescence). OEL utilizes system LSI more than Plasma Display. If OEL manufacturers focus on sizes smaller than 40 inches and create a common platform for the production of system LSI, they can survive in this market.

Today, January 2009, the world economy is in depression. In the early part of 2008, the price of crude oil was around US\$40. It temporarily increased to around US\$150 last year, but has fallen below US\$40 today. Many economists estimate that it will be around US\$80 a year from now. The economic growth of BRICS may be changing the distribution of profits between the resource and manufacturing industries. It may have brought about an increase in the price of parts in the IT industry. At the same time, the device producing industry (for the production of memory) is showing increasing advancements in technology. Until now, the scale merit has prevailed in the IT industry. However, it seems that the role of technology embodied in labor, seen particularly in industries producing parts, materials, and devices, is gaining predominance.

### **Supplementary: External Debt Problem in Hungary, and Optimization of Savings and Investment**

The worldwide depression and currency crisis that was initiated by the sub-prime loan problem struck the Hungarian economy, as it did everywhere else. However, the economy had already had some problems. The largest was that the share of government expenditure in GDP was very large compared to other countries. Also during this time, this economy was confronted by two big problems. First was the depreciation of the national currency Forint against the US dollar. Second was the sharp increase in external debt.

Some economic reforms were conducted in the former Soviet Union and Eastern Europe in the 1960s. However, only the New Economic Mechanism (NEM), which was implemented in Hungary in 1968, survived. This reform had a close relationship with the reform

which was conducted in the late 1980s. In the early 1980s, Hungary established a system of private contracts with small-scale national firms. This made it possible to issue corporate bonds. From that time, various reforms were conducted, and in 1989, the privatization of national firms and liberalization of prices were implemented. Because Hungary started making reforms earlier than other countries in the region, its economy was able to minimize fluctuations. However, this gradualism in reform brought about a side effect at the same time, and laid restraint on the reforms. Expansions of fiscal and monetary policies were conducted consistently under an economic structure in which inefficiency still remained. Firmly supported by these expansions and the foreign direct investment, the Hungarian economy maintained a growth of around 5%. After the start of reforms in 1989, the economy changed trade partners, from the former socialist countries to the advanced Western countries. At the same time, the trade structure also changed largely. Under the old regime, the economy imported energy such as crude oil and raw materials, and exported manufactured products. The metal and machinery industries were active, utilizing ironstone, bauxite and coal produced domestically. After the reforms in 1989, industries such as general machines and electric machines related to computers grew rapidly.

Apprehensions of the debt problem were pointed out often. Until then, the Hungarian economy was able to maintain a steady growth rate similar to that of its neighbor country, Poland. In the case of Poland, drastic and complete reforms were implemented, followed by expansions of fiscal and monetary policies, up to the year 2000. After that, the country took a rather passive stance. In the case of Hungary, policy expansions were continued even after 2000. It seems that the administration aggravated the external debt problem, but the recent worldwide depression and currency crisis

aggravated the problem even more.

This paper provides an outline of the Hungarian economy and its debt problem. Then the maximum principle is used to calculate state variables, current balance and capital accumulation. The method of inter-temporal optimization based on the discrete

maximum principle will be used. The objective function will be set up by the evaluation of accumulated debt. Finally, optimal savings and investment will be determined. Some simulations will be conducted for cases of tax increases and increases of interest rate, using this model.

