Part 3 : Chapter 9 - Technology Choice, Change of Trade Structure and A Case of Hungarian Economy

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Chapter 9

Technology Choice, Change of Trade Structure and A Case of Hungarian Economy

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

Since 2003, Japanese IT firms have made rapid progress in increasing their profitability, based on the increase of production of system LSI, mainly for digital household electrical appliances. In producing system LSI, there is a need for a form of technology embodied in labor, i.e. human capital. There are no returns to scale. Therefore, firms from Japan, Europe and the United States are involved in the production of system LSI. It can be thought that the choice of whether the economy pursues a development path centering on technology which is tradable or technology which is embodied in labor, depends on the historical background. Firms from the United States are focusing their production on multi-purpose IT products, and those from Japan and Europe are focusing on system LSI. Now, it seems that these two types of technologies are competitive and that the position of superiority changes periodically. There is a need to capture and predict the trend of technology in order to analyze economic developments.

In Section 2, the economic background is explained in order to analyze and capture movements in the IT industry and technology. Until the 1980s, the Hecscher-Ohlin-Vanek theorem was very popular in the field of international economics. According to this theorem, trade systems are very static. It is thought, that a country with abundant capital exports capital and imports labor. However, it is impossible to use this to explain the economic and trade situation, given the very rapid technological progress in the IT sector today. Leontief pointed out that in the 1960s, the United States, which was supposed to be capital abundant, was in fact exporting labor-intensive and importing capital-intensive goods. Maskus [1985], Brecher et. al [1988], and Bowen [1987] also point

out that the Hecscher-Ohlin-Vanek theorem has empirical defects. Armington [1969] provides a method for substitution using the idea of a domestic consumption bias. Trefler [1995] also provides a method using the different method of technological choice. In this paper, we adopt Trefler's method. The choice of technology is made based on the historical background. The capital-labor ratio is taken to be constant, and to differ from country to country. In other words, a Ricardian model is adopted in this paper.

In Section 3, trends in IT technology are explained. Moore's law, formulated by Dr. Gordon Moore in 1965, proposes that the number of transistors on a chip doubles every 18 months. However, many engineers predict that Moore's law will cease to hold in 10 or 20 years. In the IC production process, the design is printed on a silicon wafer. As the design becomes more elaborate, the exposure device needs to become more sophisticated as well. For this purpose, the refractive index of the device has to increase. Up until now, optical microlithography has been used to do this. At present, there is an ongoing shift to Immersion Lithography and Extreme Ultra-Violet Lithography. However, these technologies are not yet established. This is the first bottleneck. In addition, the thickness of the insulating film for the transistor gate has gone down to the size of one molecule, and leakage has become a serious problem. A fundamental solution has yet to be found. This is the second bottleneck. If solutions cannot be found, technological progress will slow, and this will have a large impact on economies.

In comparison to the market for personal computers, the market for flat panel displays is growing rapidly. The semiconductor industry has maintained a growth rate of 14% over the last 50 years. By contrast, the market for flat panel displays has expanded by 17% over the last 25 years. Some engineers predict that by 2015, its market will be as large as the present market for personal computers. This market will likely have a large impact on the world economy. Because there are economies of scale in the flat panel display industry, Korean and Taiwan firms are increasing their investments. Recently a new technology, called SED (Surface conduction Electron-emitter Display), has emerged in this field. It is very sophisticated, and some engineers predict that it will monopolize the market within 10 years.

As mentioned above, these factors will influence the trend of IT technology and will have large effects to many economies.

Section 4 presents research on the Hungarian economy. Hungary's economic reform was launched in the 1980s. Therefore, the negative impacts of reform have been relatively small compared with those in neighboring countries. Of course, the economy experienced negative GDP growth for several years in the early 1990s. However, since this period, it has remained on a steady growth track. The remarkable change in Hungary's trade structure has been the rapid growth of exports in electrical machinery. Traditionally, Hungary has turned out many competent scientists and engineers. Foreign firms such as IBM, Nokia and Intel have set up R&D institutes there, focusing on IT. IBM's institute has around 1,000 researchers, a scale similar to Mitsubishi's R&D institute in Tokyo. It can be inferred that there are linkages among these institutes, venture businesses and firms.

An econometric model for Hungary has been constructed to estimate the effect of technological progress on the economy. Since 1991, around 3 billion US dollars have come into the country annually. This foreign direct investment has made a

large contribution to technological progress. It can be thought that accumulated FDI is closely linked to technological progress. When there is a 10% increase in FDI, supply rises above demand through the production function. As a result, the GDP deflator decreases and the export price decreases. The decrease in the GDP deflator and export price leads to an increase in the demand side. This increase of demand partially cancels out the increase in exports and GDP brought about by the GDP deflator. As the result, an increase in FDI of 10% leads to an increase in GDP of around 2%.