

Study on the Evolution and Current Status of Technical Progress Path in China

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Abstract

China's economy has grown rapidly in recent decades, and China's economic development has entered a new stage of development. The transformation of development mode has become an important main line of China's economic development. The technological progress and innovation are important support for realizing the transformation of development mode. This paper analyzes the evolution process of technological progress since China's reform and opening up. Analyze the mechanism of economic growth driven by technological progress, and clarify the present situation of technological progress in China's economic growth around the ability of technological innovation.

Keywords: Technological Progress; Evolution Path; Self-innovation

I. Main Ways of Technical Progress

Generally, the technical progress of a nation is mainly from two ways of external and internal: the external ways are mainly technical introduction and imitative innovation while internal ways are mainly self-innovations. In the early years of reform and opening-up, the innovative technology was inadequate domestically, so our technical innovations were mainly from external ways as the advanced technologies introduced from abroad were generally matured with definite certainty and can be immediately used after import. Besides, the technological spillover effects caused by FDI were approved by many experts. The main feature of the internal way is its uncertainty and a large sum of money has to be spent before any research outcomes are obtained. Moreover, there is probably the risk of no outcome at all. Therefore, only with great support from the nation, can the technical progress depending on internal ways come true. The endogenous growth theory has also explained that the two main ways to promote technical progress are innovation and imitation.

II. The Mechanism Where Technical Progress Drives Economic Growth

Technical progress will increase the output efficiency. From the mechanism where technical drives economic growth, the developed countries and the developing countries differ. The cutting-edge technology adopted by the developed countries are usually more advanced than those adopted by the developing countries. With latest cutting-edge technology, the economic development in developed countries can be realized by their technical innovation mechanism. However, with no latest cutting-edge technology, developing countries can only achieve their economic growth through imitative innovation or technical introduction (Caselli and Coleman, 2000). So, the selection of national technical progress path is determined by the nation's developing stage. Being a large developing country, China can only achieve its endogenous economic growth driven by technical progress by selecting the right technical progress paths. Our long-term goals are the advanced, high-precision and cutting-edge technologies with self-innovation, the technologies able to enhance the ecological benefits and social effects, and the technologies which are technology-intensive and natural resource conserving. However, at current stage, technical introduction is still our prime critical source of technical progress. Although our long-term goals are the advanced, high-precision and cutting-edge technologies with self-innovation, the technologies able to enhance the ecological benefits and social effects, and the technologies which are technology-intensive and natural resource conserving, further discussions are still required on whether or not our country has been ready with basics for self-innovation.

The root of the disputes over the main theories influencing the selection of the national technical progress paths is whether the economic development in developing countries follows competitive advantage or comparative advantage. Thus, there appear "the theory of technological catching-up" under the theory of competitive advantage and the "factor endowment theory" under the theory of comparative advantage. As China is a large developing country in the world, the result of the disputes above will have an important instructive significance to the selection of our technical progress paths.

From the theory of comparative advantage, regarding the selection of the technical progress paths for developing countries, the Factor Endowment Theory following the comparative advantage are supported by some scholars represented by Lin Yifu. In their opinions, the technical progress paths must be selected in combination with the factor endowment of our nation and the current economic development, following the comparative advantage of our country to select the technical progress path with adaptive capacity and viability.

According to the Factor Endowment Theory, the technical progress path of gradual model should be adopted in our country. According to Lin Yifu (2003), most developing countries have improperly adopted the Theory of Technological Catching-up which has made it impossible to narrow the gap to the developed countries. Scholars like Lin Yifu (2003) hold that one nation's factor endowment determines its optimum industrial structure and technical structure. Under the mechanism of marketing economy, the product type produced and the technology chosen by the producer are both decided by the price, and the upgrade of the factor endowment structure will certainly bring the upgrade of industrial structure and technical structure. Therefore, when the government in developing countries set their goals, they should target the upgrade of the gross factor endowment structure other than that of the technical and industrial structure.

Because once the factor endowment structure is upgraded, the competition pressure and the profit will drive and facilitate the enterprise's industrial structure and technology to upgrade. According to Chen Youfang (2003), the production technology selection must be in accordance with the "principle of appropriateness". The standard to choose the production technology is whether or not this technology is appropriate to local factor endowment, not pursuing the advancement of the production technology blindly.

According to the theory of competitive advantage, if a nation or an area wants to win the competitive advantage, the invest in technological innovation has to be increased to encourage self-innovation. Under this strategy, "technological catching-up" becomes a path which must be chosen by the developing countries for technical progress. Some experts and scholars regard that to make a large developing country to be a powerful developing country, the most important coefficient to measure it is its science and technology power, so some scholars support technological catching-up under the theory of competitive advantage.

According to Huang Qixuan (2009), it is of the characteristics of a powerful country by choosing internal technical progress. After "WWII", self-innovation other than war has become an important political act in the power conversion of powerful countries. In the policy proposals made by some scholars and the science and technical policies formulated by the governments, the expediting of technical progress was taken as an important strategic guidance, such as the implemented strategy of reinvigorated the nation through science, education and human resources.

Secondly, some scholars hold that if we follow the strategy of comparative advantage, the technology progress in our nation will be in the "trap of comparative risk". Less developed countries want to make use of technical progress to promote industrial structure upgrade to replace the primary product with finished product for export. But they have weak technology foundations with no ability of independent research and development, and under such situation, they improve their technology level by introducing the advanced technology from abroad or improving their own and thus to improve their status in the international division of labor. Nevertheless, it will result in a vicious circle in which due to too much dependence on introduced technology without mastering core technology, they cannot complete the technological upgrade but have to depend on import of upgraded technology from developed countries, which make it impossible to improve their self-innovation ability. In addition, the technology imported from abroad is definitely not the most advanced technology, so it is impossible for the less developed countries to master the cutting-edge technology through technology introduction, which shall caught them into "the trap of comparative advantage". That is also why some experts insist that only by following the technical catching-up route, strengthening the self-innovation ability can we take the leading position in the whole world.

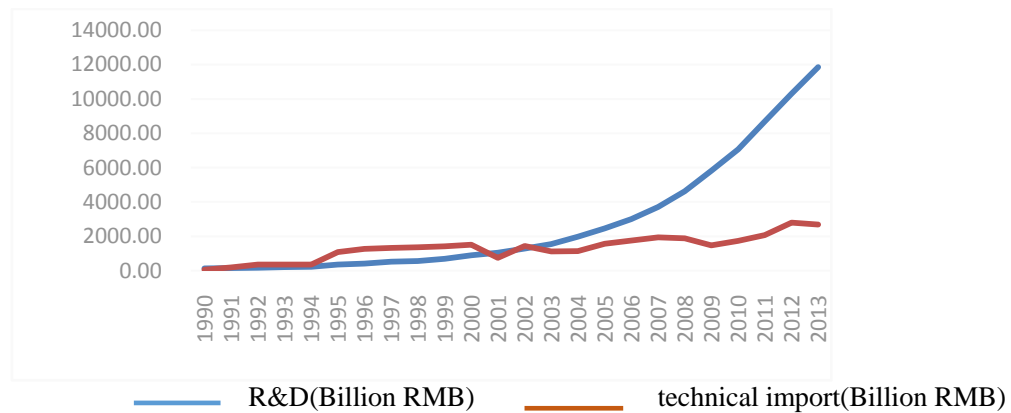
III. The Evolution of the Technical Progress Path in China

Regarding the study on the selection of China's technical progress path, no consensus has been reached no matter from the angle of theory or practice. However, based on the reality, the two viewpoints are not entirely against each other and can be integrated. And some other scholars advocate that we should combine technical introduction with self-innovation. Some scholars think that we should integrate self-innovation with technical introduction. Hu Angang (2003) emphasized that "technical introduction" and "self-innovation" are complementary to some extent instead of completely opposite to each other. From a long-term view, we should transform our economic growth driven by imitative innovation to the economic growth driven by innovation. Li Siyi (2000) studies countries like Japan and South Korea and holds that the developing countries must go through a process from technology introduction, assimilation and absorption to self-innovation.

Therefore, the selection of technical progress path in our nation is more complementary rather than a tit-for-tat. Lin Yifu (2003) holds that only on the basis that the comparative advantage is fully utilized can the enterprise’s industrial comparative advantage be maintained and created, and that the comparative advantage and competitive advantage are not absolute opposite or replacement to each other.

Figure 1 shows the variation trend of technical progress path in China since 1990. Since 1990, China’s investment in self-innovation (measured based on R&D investment) has shown a great growth from RMB 12.543 billion in 1990 to RMB 1.18466 trillion. The contract amount for technical import from abroad has increased slowly and maintains at around RMB 100 – 200 billion from 1995 to 2013. So, it can be seen that after 1990, along with technical introduction, our country has always paid attention to independent research by increasing the investment in it. In the *Outline of the National Program for Long- and Medium-Term Scientific and Technological Development (2006-2020)*, it has been clearly defined that we must firmly follow the route of self-innovation of China characteristics and give prominent attention to enhancing self-innovation ability. Over some time during the 30 years since the reform and opening-up, the development in our country was basically depending on foreign technologies which were the early second-hand technologies from developed countries. If self-innovation is not strengthened, China will for a long time be locked in the low-end of the distribution of international labor.

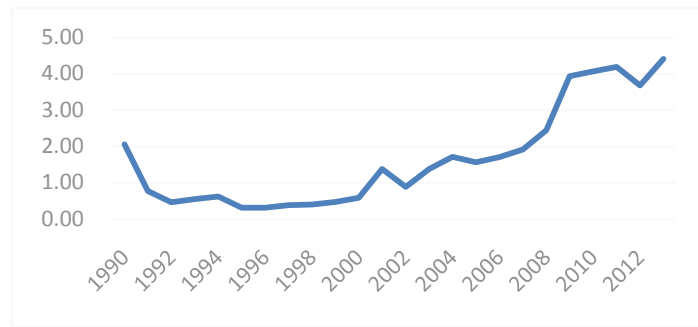
Figure 1 The growth trend of the contract amount of our investment in independent research and that of the technical introduction



Data source: *The Yearbook of China Science and Technology*, 1990-2014

Figure 2 shows the coefficient of our selection of technical progress path (the ratio of self-innovation investment to technical introduction cost) and the evolution of our technical progress path can be inferred from it. The coefficient of our selection of technical progress path shows a tendency from stabilization to rapid growth. In particular, from 2002 until now, our expense in independent research has been increased at a great speed and the ratio of independent research cost to technical introduction cost has been increased.

In the early stage of the reform and opening-up, we were in lack of innovation factor endowment. In order to improve our technical level, we adopted the strategy of “purchasing technology with market”. The introduction of foreign capital has brought rapid economic growth and uplifted our technical level. At that time, the technical introduction and domestic imitative innovation have played a crucial role in our economic growth and technical improvement. However, along with constant elevation of our economic development level, the occurrence of Lewis Turning-Point and the disappearance of population dividend, when the factors are gradually in shortage, enterprises have reasonably chosen to replace the factors with technology so as to maintain their constant competition to promote the innovation capacity of the entire society. Hence, since the initial proposal of building our national innovation system in the *Outline*, our investment in self-innovation has been apparently reinforced.

Figure 2 The variation trend of our selection coefficient of the technical progress path

Data source: *The Yearbook of China Science and Technology*, 1990-2014

It can be seen from the above that since the reform and opening-up, on the technical progress path, we have experienced a process from imitative innovation to imitative innovation with the auxiliary of self-innovation, and then to the self-innovation with the auxiliary of imitative innovation, and finally to entire self-innovation. Viewing from the current stage, technical introduction is still the important source of technical progress and it has greatly influenced and contributed to the technical progress and self-innovation capacity.

IV. Conclusion

Under the situation that China's economic growth has already crossed the initial development phase, the innovation capacity of core technology has gradually become the key factor to our economic growth in face of the complex foreign and domestic economic environment with many changes. The transform of economic growth mode requires that the technical progress path should be gradually changed to be the development mode focusing on self-innovation. Many times, General Secretary Xi Jinping has clearly proposed that the transition of our economy from "factor-driven or investment-driven to innovation-driven" must be taken as one of the main features of the new normal of China economy. Seen from macro policies, the development strategy of core innovation capacity must be further strengthened with more policy support. The technical policy should also be optimized further and the technical obstacles against enterprise innovation should be cleared out to unceasingly improve enterprise's innovation capacity and innovation force so as to make innovation a new engine to drive development.

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