

Innovation-Driven and Economic Growth: Research on National Conditions of China

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Abstract: As China's economy has entered the "New Normal", how to shift from a factor-driven, investment-driven economy to an innovation-driven one need further studies. The article identifies proximate causes of economic growth, illustrates why innovation is the single, most important component of economic growth in the long run, and presents several channels through which innovation drives economic growth. Furthermore, the article makes some suggestions in line with the national conditions of China.

1. Introduction

For such a long time, economic growth had been attributed to increasing inputs. However, after the Second World War, empirical work found that the growth of inputs could only account for a small portion of the actual growth in the output of the American economy. Also, differences across countries in level of income and per capita output became increasingly remarkable. Questions came that where came from the unexplained residual and why some countries developed faster than others. The Neoclassical Growth Theory, the Endogenous Growth Theory and the neo-institutional approach came in succession, each addressing part of the questions. Today, it is taken as axiomatic that innovation has been the most important component of long-term economic growth. This article identifies some channels through which innovation contributes to economic growth. In light of existing challenges, some initiatives that facilitate the economic transformation are proposed.

2. Literature Review

Different schools of thoughts have tried to explore the conditions and trends of economic growth in the long run. Adam Smith viewed factor inputs and increasing specialization as determinants of economic growth. Smith's theory consists of a rise in the productivity of labor by means of the division of labor, and an increase in productive labor by way of capital accumulation. In Harrod and Domar (1952), the growth rate was determined by the saving ratio and the investment-to-output ratio. For the long run, the economic system is at equilibrium only when the natural rate of growth is equal to the warranted rate of growth. Solow (1956) abandoned the assumption of Harrod-Domar model that production takes place under conditions of fixed proportions. In "Solow Growth Model". The economy gets more productive over time with the level of technology assumed to be growing

at a constant rate[1]. Lucas (1988) included the effects of human capital accumulation, trade in capital goods and labor mobility to explain the observed wide diversity in income levels and growth rates across countries. The growth rate derived from this mechanics, called “Endogenous Growth Model”, is no longer subject to the exogenous productivity growth but instead, depends on the other parameters of the model[2]. Barro (1991) implied that, if all countries shared the same production and utility parameters, then poor countries tended to grow at a faster rate than rich ones[3]. North (1994) argued that appropriate institutional structure could reduce transaction cost as well as promote technological progress and accumulation of broad-defined capital[4]. Acemoglu et al.(2005) argued that differences in income and growth could be explained by variation in institutions[5].

3. Innovation-Driven and Economic Growth

3.1. Schumpeter's Theory of Innovation

Schumpeter (1934) distinguished invention from innovation, and defined “innovation” as “new combinations” of new or existing knowledge, resources, equipment and other factors, with intend of commercialization. The prospect of monopoly profits is an important incentive to innovation. The leader company may spell monopoly for a moment until its competitors catch up. Innovation, entrepreneurial activities and market power serve as the engines of economic change[6].

3.2. The Transition of Driving Forces of Economic Growth

There are 4 phases of economic development: factor-driven, investment-driven, innovation-driven and wealth-driven economic development[7]. The underlying sources of growth differ from one phase to another. Solow (1956) focused on the role of capital accumulation and investment in economic growth. Romer (1986) stated that the accumulation of knowledge produced a spillover effect through learning by doing, which made the presence of increasing returns possible[8]. Aghion and Howitt (1992) argued that the incentive to innovate determined the rate of technological progress, which in turn determined the economy’s long-run growth rate, independently of the amount of capital in the economy[9]. Funke and Strulik (2000) demonstrated that each theory could represent a different state of economic development. Transition to a higher stage of development can be explained endogenously: the state of economic development depends on the relative returns of capital and innovation. When the R&D becomes more profitable, the economy enters the stage of innovation[10].

4. Paths of Innovation-Driven Economic Growth

4.1. Technological Innovation

Technological innovation comprises new products and processes and significant technological changes of products and processes.

The basic assumption of the Neoclassical Model is the diminishing marginal product of capital. The Neoclassical Model also assumes technological progress to grow at a constant rate. But the Endogenous Growth Model and R&D-based Growth Model offer alternative views: technological progress is explained endogenously by R&D input or accumulation of knowledge.

Following this thought, we find several channels through which technological innovation drives economic growth. Traditional production factors, sourcing from exhaustible natural sources or limiting population growth, become increasingly expensive with increases in inputs while their marginal productivity decreases. The economy will reach its limits of production possibilities in the long run. What is the ultimate source of economic growth? It is innovation. The increasing marginal

productivity of knowledge offsets the diminishing one of capital and enables the production of consumption goods to exhibit increasing returns to scale. In addition, as a partially excludable good, knowledge suggests a natural externality. Investment in knowledge of a company is assumed to have a positive external effect on the production possibilities of other companies. Technological innovations make the rate of return on capital increase rather than decrease with increases in capital stock, that is, enhances efficiency of investment.

Technological innovation can be embodied in physical capital or human capital. The former increases the productivity of physical capital via new machines. The latter, product of learning-by-doing or formal education, explains improving quality of labor that can be used to produce final product more efficiently than before. Also, technological innovation can create new factors of production. For example, the artificial intelligence may substitute labor in the near future.

4.2. Institutional Innovation

North (1990) offers the following definition: “institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction[11].” The result of institutional innovation is that organizations can become more adept at generating richer innovations at other levels, including products, services, business models, and management systems[12]. Innovation is a highly risky activity that requires intensive investment. The first one to innovate faces not only the risk of failing, but also the risk of being imitated. Therefore, institutional structure which assures companies of legitimate expected returns provides incentives for innovation. For example, the protection of intellectual property rights, gives exclusive rights to entities who has innovated.

Institutional innovation reduces transaction cost so as to improve economic efficiency. Take the protection of intellectual property for example again. Appropriate intellectual property system facilitates intellectual property exchange and fastens the process by which the technological innovation is applied into production. Another example is institutional innovation to financial system. Costly research may prevent small and middle entities from innovating. Institutional innovation to financial system enables financial institutions to provide funds for enterprises more efficiently.

5. Existing Challenges

Though China has achieved enormous economic development in the past 40 years, it is now facing some challenges that impedes the economics transformation.

5.1. Resource Allocation Highly Dependent on Government Intervention

The Chinese government has played a vital role in China’s economic growth since the economic reforms. The historical roots of the top-down approach to resource allocation explain why the government plays a role at least as important as the market even today, but the approach has its own drawbacks. First, though the top-down planning has achieved great success during the catch-up phase, it fails to work at the technological frontier because of information asymmetry. Second, factor markets are primarily regulated by the government, which means that factor prices do not reflect the scarcity of factors. Specifically, current factors like capital and labor are undervalued and send a wrong message that activities consistent with extensive growth are still highly profitable. As a result, increasingly important firms will follow the extensive growth mode, and no firms will have incentives to innovate, which strengthens the "path dependence" on extensive growth.

5.2. Underdeveloped Innovation Capacity

As a result of the top-down approach, universities and research institutes master the majority of economic resources while enterprises do not have access to sufficient resources. Poor cooperation between enterprises and universities makes it even harder for enterprises to become the mainstay of innovation. Moreover, research activities in universities and research institutes put more emphasis on paper publication than commercialization of scientific achievements, which leads to a disconnect between scientific achievements and the demand.

5.3. Absence of Incentives for Innovation

The most fundamental motivation for innovation lies in the pursuit of profits. But the externality of knowledge makes it hard to maximize profits and reduces companies' willingness to innovate. Institutional design like intellectual property rights provides companies with exclusive rights and alleviates external problems. However, in China, not only do companies lack awareness of legal rights protection, penalties are also not strong enough to deter violation. Moreover, credit discrimination is widespread among banks. The financial system which consists mainly of state-owned banks is incapable to fund private companies, leaving out deleveraging and credit crunch that has put more intensive credit pressure on these companies. Innovative activities not fully supported, the willingness of enterprises to innovate is weakened.

5.4. Lower-Stage Factor Endowments and Industry Structure

Economic development requires continuous structural change. China's structure of factor endowments is mainly composed of labor, capital, and natural resources while more advanced factors like human capital and knowledge makes up for a small proportion. The industrial structure depends heavily on the support of resource-intensive, labor-intensive and capital-intensive industries. The development of high value-added industries and service industries lags behind. The level of factor endowments obstructs industry upgrading, and furthermore, the shift of Chinese economy to a more advanced one.

6. Suggestions

6.1. Strike an Appropriate Balance Between the Market and the Government

Regardless of the level of development, the market remains the basic and almost the best way for resource allocation. In no way can the government replace the market, but be complementary to it. Through macro-control, the government can support emerging industries in which high technology is embedded. It is necessary to consolidate the decisive role of the market in resource allocation while properly playing the role of government macro-control.

As a coordinator of the economy, the government should provide a favorable institutional and public policy environment as well as facilitate interactions between different entities within innovation system. But it should not take the place of entities to become subjects of investment. The investment scope of the government should be limited to fields that private enterprises are reluctant to enter, such as infrastructures and education. It is time that the government shift from decision maker to coordinator, from purchaser to service provider.

6.2. Promote Interactions Between Different Subjects Within the Innovation System

Universities and research institutes play a dominant role in conducting basic research and creating knowledge. Enterprises can absorb the original research achievements of universities and institutes.

First, cooperation between industry and higher education can improve the capacity for innovation of enterprises. Second, agglomeration effects of industry clusters is another factor to promote innovation capacity. Places like national high-tech industrial development zones enhance interactions between different types of knowledge and create face-to-face exchange opportunities for enterprises so as to get the spillover effect. Third, supporting elements which facilitate the process of innovation, such as business incubators, should also be developed.

6.3. Improve Institutional Structure and Public Policies That Encourage Innovation

Tax incentives can reduce innovation costs without disrupting the operation of market mechanism. One possible way is to deduce the value-added taxes. Expenditures such as intellectual investments and technology introduction can be bought into the scope of tax deduction to reduce costs of R & D investments. As for returns, income related to technological innovation, scientific research and conversion of research achievements can be exempted from taxation. Financial institutions should also pave the way for private enterprises in the course of implementing innovation. Venture capital is a possible way to better finance small and middle enterprises.

6.4. Upgrade the Level of Factor Endowments and Industry Structure

The development of secondary and tertiary sectors is expected to step at a more advanced stage. Traditional manufacturing industry can shift to high-tech, high value-added and low energy-consumption one, or it can be integrated into other industrial chains. Aghion (2005) identified higher education as a growth-enhancing factor and concluded average growth decreases more rapidly as a country approaches the world frontier when higher education is poor[13]. Expanding higher education helps to train well-educated workers capable of innovating. And the promotion of professional training, professional higher education and on-the-job training help cultivate proficient technicians and in turn increase labor productivity.

7. Conclusion

Discussions of growth of this century have focused on the role of innovation. Aforementioned theoretical work has explained why the economy will be fully driven by innovation in the long run. At this turning point of development, China is supposed to better handle the relationship between the market and the government, to give more incentives to enterprises, to increase the importance of human capital and knowledge in factor endowments etc. The analysis of innovation would gain richness if the discussion of the quality of economic growth were introduced. Also, it would be more interesting to extend the analysis to culture of innovation and organizational innovation.

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