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How China's Economy Promotes TFP and Potential GDP Growth from Classical and Keynesian Perspectives

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ABSTRACT
This study investigates the relationship between total factor productivity (TFP) and potential GDP growth, and critically examines how China might realize productivity enhancement through education, human capital, institutional innovation and scientific and technological inputs against the background of receding demographic dividend and diminishing marginal efficiency of capital from two theoretical perspectives: classical economics and Keynesianism. Through literature review, case analysis and Solow model path deduction, it highlights the multiple paths to enhance supply-side efficiency under the socialist market economy with Chinese characteristics, proposes multi-level policy recommendations, and accordingly looks forward to the sustainable development potential of China's economy in the future.

KEYWORDS
Total Factor Productivity (TFP); Potential GDP; Classical School; Keynesianism; Institutional Reform; Chinese Economy; Supply-Side Structural Reforms

1 Introduction

China's economy is currently undergoing a critical stage of transition from high-speed growth to high-quality growth. Under the combined effects of diminishing marginal efficiency of capital, fading demographic dividend and cyclical fluctuations of the global economy, how to enhance total factor productivity (TFP) to support the sustained growth of potential GDP has become a core issue in macroeconomic policy design and academic research. TFP is not only a core variable reflecting the efficiency of resource allocation and technological progress, but also a decisive indicator of a country's long-term growth potential.

Analyzing from the perspective of history of economic thought, the classical school advocates that economic growth originates from the accumulation of supply-side factors and technological progress, emphasizing the decisive role of the market mechanism in resource allocation, while Keynesianism pays more attention to the management of aggregate demand and structural intervention, and emphasizes that the government ought to play the role of a stabilizer and promoter in the case of market failure. Under China's special institutional and developmental background, it is of great theoretical and practical significance to integrate the market efficiency logic of the classical school and the structural intervention framework of Keynesianism, so as to form a productivity leaping mechanism adapted to China's national conditions.

This paper attempts to explore how China can realize TFP increase through institutional optimization, scientific and technological innovation and human capital accumulation in the context of the new era, and put forward systematic policy suggestions to build a theoretical and empirical framework to support potential GDP growth, taking into account the stage characteristics of China's economic development and institutional environment from the theoretical perspective of the classical school and Keynesianism, as well as the path decomposition of Solow's growth model through the literature review, case study analysis, and path decomposition of the new era. It also proposes systematic policy recommendations and develops a theoretical and empirical logical framework to support potential GDP growth. The author aims to provide academic support and policy reference for China's path toward high-quality development.

2 Definition of concepts

2.1 Potential GDP

Potential GDP refers to the maximum level of output that can be achieved by a country in a given period of time with full utilization of available economic resources and stable inflation, and it is a key indicator of the economy's ability to grow in the long run. Its main determinants include labor supply, capital stock, and technology level (TFP). Potential GDP is not equal to real GDP, but it constitutes the "ceiling" of real growth in the long run. (Okun, 1962)

2.2 Total factor productivity (TFP)

Total Factor Productivity (TFP) is a core measure of economic efficiency, which indicates the efficiency of output improvement given capital and labor inputs, and reflects the contribution of non-factor inputs such as technological advances, institutional efficiency, and managerial capacity. growth means achieving higher output through technological or efficiency improvements without increasing inputs, and is one of the core drivers of potential GDP improvement (Comin, 2006).

As China's economy faces an aging population and diminishing returns to marginal capital, increasing TFP has become a strategic priority to maintain the potential growth rate.

3 Literature review

3.1 Chinese and foreign studies on the relationship between TFP and potential GDP growth

3.1.1 Foreign studies

Foreign academics have long emphasized TFP as a core indicator of technological progress and institutional efficiency, with solid research foundations, theory and empirical evidence. Solow (1957) proposed for the first time to externalize technological progress in the growth model, leading to a large number of subsequent studies on the relationship between TFP and potential GDP. Hall and Jones (1999) Hall and Jones (1999) found that institutional quality, education level and technology diffusion are the determinants of TFP differentials, and Acemoglu and Robinson (2012) emphasized the importance of an "inclusive system" for technological innovation and productivity enhancement.

3.1.2 Domestic studies

Zhao Renwei et al. (2018) use Chinese provincial data to empirically find that human capital and R&D investment significantly drive TFP growth, especially in the eastern coastal region. Lin Yifu (2009) put forward the "structuralist neoclassical theory", which argues that the government ought to play the role of "active government" in technological upgrading. Cai Fang (2020) pointed out that the core of growth in the "post-demographic dividend" era ought to be shifted to TFP.

3.2 Branch studies on TFP influencing factors

3.2.1 Education and human capital accumulation

Education is the fundamental path to enhance TFP.The education database constructed by Barro and Lee (2013) shows that the improvement of the quality of basic education significantly promotes TFP growth. Li Shi and Li Chunding (2016) point out that the inequality of education resources between urban and rural areas in China restricts the coordinated development of TFP between regions. The survey shows that China's education expenditure as a percentage of GDP in 2022 will be 4.0%, significantly lower than the OECD average of 5.2%, while the United States is as high as 6.1%. This shows that the intensity and quality of China's investment in education still needs to be improved.

3.2.2 Technological innovation and R&D expenditures

Bloom et al. (2013) empirically found that firms' R&D intensity is positively correlated with TFP. Although China's R&D expenditure has reached 2.55% of GDP, the proportion of basic research is far lower than that of developed countries, limiting the development of original innovation capacity (China Statistical Yearbook, 2023).

3.2.3 Institutional environment and market-oriented reform

Zhang Jun (2019) emphasized that the improvement of property rights protection, market openness and rule of law environment can help to improve the efficiency of factor allocation and TFP level. There is a positive feedback mechanism between institutions and innovation, and the World Bank (1993) summarizes the experience of the "Four Little Dragons" in East Asia, which also confirms this logic.

3.3 Research gaps and frontier directions

At present, there is insufficient regional perspectives on TFP influencing factors, and fewer studies have been conducted on the identification of TFP differences and policy effects in the East, Central and West;

In addition, a unified theoretical model has not yet been formed to explain the synergistic evolution of China's systemic reforms and TFP; therefore, theoretical innovations and the construction of indicator systems are needed to support the "high-quality development" of this research. Therefore, the study needs theoretical innovation and indicator system construction to support "high-quality development".

4 Theoretical framework: classical and Keynesian perspectives

4.1 Classical perspective: emphasis on supply and market mechanism

The classical school advocates that long-term growth comes from the supply side, i.e., capital accumulation, labor supply, and technological advancement. TFP is the core embodiment of technological advancement. The Invisible Hand, advocated by Adam Smith, suggests that free markets and competition will guide the optimal allocation of resources. The "invisible hand" mechanism advocated by Adam Smith suggests that the free market and competition will lead to the optimal allocation of resources.

4.2 The Keynesian perspective: emphasis on aggregate demand management and structural interventions

Although Keynesianism is known for demand management, modern Keynesianism also emphasizes supply-side interventions, such as investment in education, infrastructure, and other measures, such as the use of the "invisible hand" mechanism. Although Keynesianism is known for demand management, modern Keynesianism also emphasizes supply-side interventions, such as investment in education, infrastructure construction and counter-cyclical fiscal policy.

China's "new type of nationalized system" can be seen as a manifestation of Keynesian structural intervention. TFP growth is guided by government-led investment in scientific research and the development of strategic emerging industries. For example, the National Natural Science Foundation of China (NSFC) and the "Double First Class" program for higher education have significantly increased innovation output.

5 Case study: practical path of TFP and potential GDP enhancement

5.1 Shenzhen's innovation-driven strategy

As a frontier city of reform and opening up, Shenzhen has constructed a technological innovation system that is enterprise-oriented, market-oriented, and deeply integrated with industry, academia and research. Data show that in 2022, Shenzhen's R&D expenditure accounted for as much as 5.81% of GDP, much higher than the national average. Through the development of high-end manufacturing and the digital economy, Shenzhen has effectively realized the continuous improvement of TFP (Shenzhen Bureau of Statistics, 2023).

According to the World Bank's assessment, Shenzhen's labor productivity level is close to that of the upper-middle OECD countries, indicating that the improvement in TFP has begun to translate into actual output efficiency.

5.2 Yangtze River Delta integration and institutional innovation

The regional integration strategy of the Yangtze River Delta reflects the growth model of "institutional synergy + factor mobility". For example, the G60 Science and Innovation Corridor breaks down administrative boundaries to promote high-end industrial layout and the flow of technological factors, which has led to a synchronized increase in TFP in the region (Jiang Zeihan, 2021).

A report released by the Yangtze River Delta Integration Office shows that the average annual growth rate of TFP in the region is 0.6 percentage points higher than that of the country as a whole, indicating that an improved institutional environment can directly promote technology diffusion and efficiency.

5.3 Beijing Zhongguancun and the empowerment of digital economy

As a national demonstration zone for independent innovation, Beijing Zhongguancun has gathered a large number of high-tech enterprises, research institutes and innovation and entrepreneurship platforms, forming an ecosystem with a high degree of integration of "science and technology-capital-talent". 2022, Zhongguancun's high-tech enterprises will have a high degree of integration of "science and technology, capital and talent". In 2022, the number of high-tech enterprises in Zhongguancun will exceed 25,000, accounting for more than 10% of the national total. According to the data released by China's Ministry of Science and Technology, the annual growth rate of TFP in Zhongguancun has reached 3.1%, significantly higher than the national average.

In addition, Zhongguancun has taken the lead in piloting the "Digital Business Environment Reform", such as the opening up of government data and AI-enabled industrial upgrading, which has constructed a new paradigm of data productivity, and this systematic innovation constitutes a new positive impetus to TFP.

5.4 Enclave park mechanism and TFP bridging strategies in the Western region

Midwestern regions such as Guizhou and Ningxia, with the help of "enclave economy" and East-West collaboration mechanism, have introduced external capital and technology to realize resource sharing and industry co-construction through the establishment of enclave parks. For example, "Gui'an New Zone". For example, the cooperation project between Gui'an New District and Huawei Cloud Data Center has promoted the construction of digital infrastructure and helped the western region find a "latecomer's advantage" in the path of TFP enhancement.

5.5 Summary

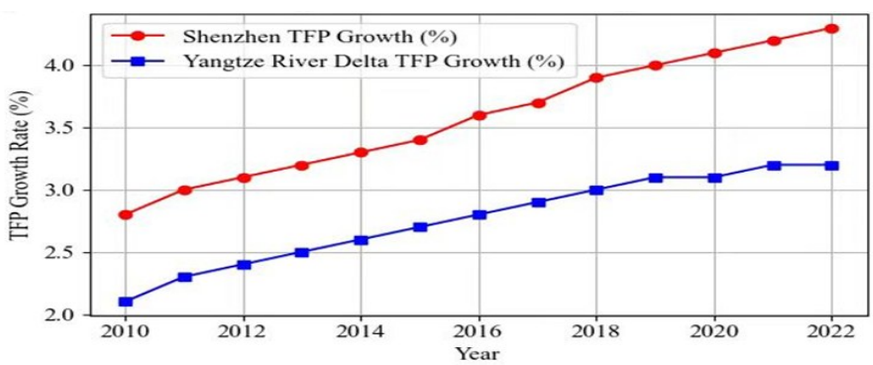

Figure 1 Comparison of TFP Growth between Shenzhen and Yangtze River Delta Region

In the process of promoting TFP growth in China, the regional "engines of growth" show a differentiated and synergistic multilevel structure: Figure 1 shows a comparison of TFP growth in Shenzhen and the Yangtze River Delta. Figure 1 shows the comparison of TFP growth between Shenzhen and the Yangtze River Delta. As can be seen from the figure, Shenzhen represents a technology-driven growth model. Its R&D investment rate of 5.81% and advanced manufacturing ecosystem prove that, under the environment dominated by knowledge-intensive industries, TFP can be rapidly improved through scientific and technological innovation, showing a typical "innovation-efficiency leap" path. The Yangtze River Delta emphasizes institutional integration and factor flow, and its institutional synergy mechanism breaks down administrative boundaries through the "G60 Science and Innovation Corridor" to build a regional innovation network, forming a "system-diffusion-integration" TFP enhancement mechanism. Its institutional synergy mechanism breaks down administrative boundaries through the "G60 Science and Innovation Corridor" and builds a regional innovation network, forming a "system-diffusion-convergence" TFP enhancement mechanism. On the other hand, Zhongguancun in Beijing and the enclave parks in the west provide two models of "new kinetic energy": the former highlights the digital economy and institutional innovation, while the latter drives the efficiency of central and western China to catch up with the spillover of technology from the east through the docking of resources and policy collaboration.

The regional differences shown in Figure 1 are essentially a mapping of the differences in technological capital intensity, institutional flexibility and resource endowment. Enhancing TFP is not a one-dimensional path, but rather a coupled driving mechanism of "system + technology + human capital" that is tailored to local conditions, realizing the "combination of high and low, gradient leap" between regions.

6 Policy suggestions for enhancing TFP and potential GDP

6.1 Reform of education and human capital input mechanism

As noted by Barro and Lee (2013), there is a significant positive correlation between high-quality human capital and long-term productivity improvement. China can optimize the regional allocation of education resources by expanding the penetration rate of higher education, narrowing the education gap between urban and rural areas and regions, and promoting the synergistic development of "double first-class" colleges and universities and the industrial chain. Enhance the quality of STEM education to strengthen workers' innovation ability and technology adaptability. In this regard, we can increase the ratio of fiscal expenditure on education to GDP to above the OECD average (>5.2%), with a focus on

higher education and technical and vocational education.

6.2 Innovation-driven and basic research incentives

Bloom et al. (2013) point out that management ability and technology diffusion are the key paths to improve TFP. China needs to build an effective intellectual property protection mechanism and encourage private enterprises to increase R&D investment. In addition, it can raise the proportion of basic research funding to more than 20% of total R&D spending, and encourage enterprises to invest more in innovation through tax breaks and financial subsidies. In the future, China needs to improve the system of technology transfer and intellectual property protection, and form a synergistic mechanism of "industry-university-research-government".

6.3 Institutional environment optimization and factor market reform

The classical school emphasizes the efficiency of resource allocation. The classical school emphasizes the efficiency of resource allocation. China's factor markets, such as land, capital, and labor, are still distorted, and deepening the reform can stimulate the production potential of the whole society. Therefore, in the future, China needs to accelerate the market-oriented reform of the allocation of factors such as land, capital, and labor, break down administrative barriers, and realize cross-regional factor flows. In addition, it needs to strengthen the protection of property rights and the rule of law, stabilize business expectations, and increase the participation rate and TFP contribution of the private economy.

7 Model analysis: TFP enhancement strategies under the perspective of solow growth model

Solow model is an important growth model in economics, proposed by economist Robert Solow in 1956.Solow model as a representative of the neoclassical growth theory, Solow growth model decomposes the economic growth into the three components of capital accumulation, labor growth and technological (TFP) progress The core of Solow's model is the production function: Y Its core lies in the production function: $Y(t)=A(t)\cdot K(t)^{\alpha}\cdot L(t)^{1-\alpha}$. Against the backdrop of slowing down of capital and labor growth, the increase of A(TFP) becomes the main driving force of Y growth.

7.1 Empirical estimation of solow decomposition in China

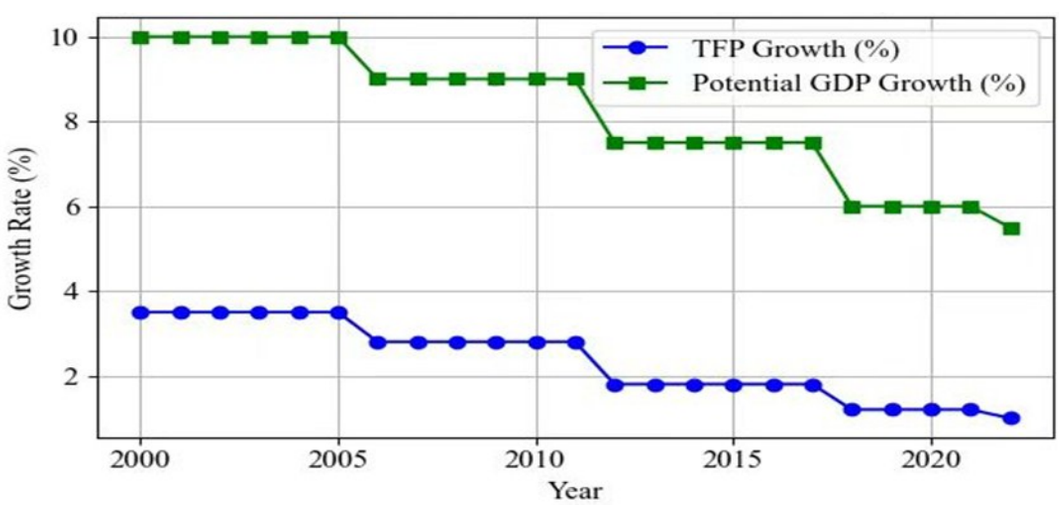

Figure 2 China's TFP and GDP Potential Growth Rate Relationship Curve (2000-2022)

Figure 2 demonstrates the positive correlation path between TFP and potential GDP growth, which is consistent with the core idea of the Solow growth model: in the context of diminishing marginal returns to capital and slowing labor force growth, TFP (A), as a proxy variable for technological progress and institutional efficiency, has become the dominant factor of potential output. According to Zhao Renwei et al.' s (2018) estimation based on provincial panel data, China's GDP growth rate averaged about 8.7% per year during the period of 2000-2020, of which: the contribution of capital accumulation was about 48%; the contribution of labor force growth was about 24%; and the contribution of TFP growth was about 28%. This suggests that although China' s high growth rate in the past was dominated by capital inputs, TFP has gradually become a key source of marginal growth. Figure 2 further demonstrates empirically that when TFP rises (especially during 2006-2008 and 2016-2018), China's potential GDP growth rate rises in tandem, reflecting the

effectiveness of institutions, innovation and human capital policies.

In the current context of diminishing marginal efficiency of capital and receding demographic dividend, TFP will be the main driving force to maintain the potential growth rate of around 5%.

7.2 Solow extended model and the introduction of human capital

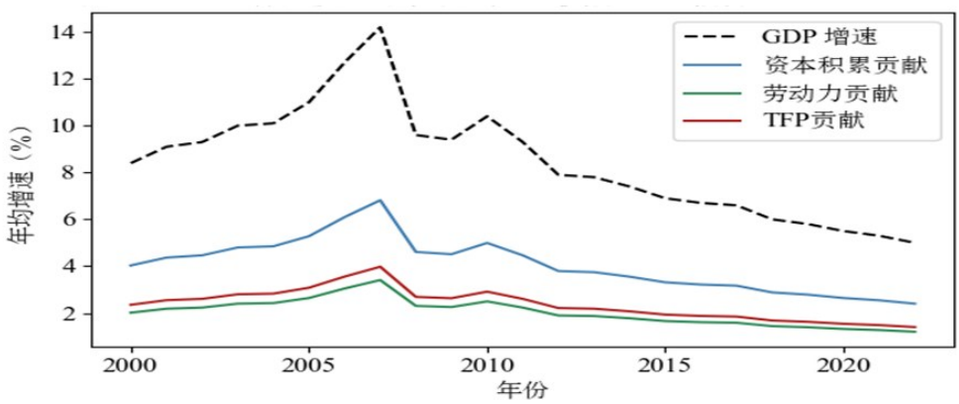

Figure 3 Solow Growth Model Path Plot and Share of TFP Contribution (Estimated)

The three paths in Figure 3 depict the dynamic trends of these three factors, constituting a logical map of the evolution of China's growth structure "from factor-driven to efficiency-driven". The Solow model initially treats TFP as an exogenous variable, however, Figure 3 reveals the dynamics and structural response of TFP, which is closely linked to China's actual economic system and policy environment. 2000-2010: capital-led stage, government investment dominates high growth, capital contribution curve rises steeply in the figure; 2010-2015: marginal demographic dividend decreases, labor contribution tends to slow down; 2015-2022: TFP contribution from 2015 to 2022: TFP contribution rises gradually and becomes the main force to support the stabilization of potential GDP growth, proving the proposition of "transformation of growth momentum".

The Solow model suggests that there is diminishing marginal returns to capital and labor inputs, and TFP growth can break through this limitation. This means that the traditional path of infrastructure and capital-intensive expansion is no longer sustainable, and China must endogenize TFP through institutions, education, and innovation, etc. The Solow model also supports the necessity of the "transformation of growth momentum", i. e., shifting from "factor-pull" to "efficiency-led". The Solow model also supports the need for "transformation of growth dynamics", i. e., from "factor-pull" to "efficiency-led".

To be more relevant to reality, Chinese scholars have constructed an extended Solow model with human capital H: $Y(t)=A(t)\cdot K(t)\alpha\cdot(H(t)\cdot L(t))1-\alpha$. The path of TFP as reflected in Fig. 2 is no longer exogenous, but partly endogenous to policies, institutions, education and innovation inputs, which constitutes the "efficiency engine" in China's development model. "efficiency engine". The addition of human capital reflects the improvement of labor quality through education and training, which in turn leads to TFP growth through "effective labor". Therefore, improving the quality of education, scientific and technological R&D capabilities and institutional efficiency have become important mechanisms for the endogenization of TFP.

The Solow model not only provides a framework for the attribution of growth, but also constitutes a guidepost for structural reform in the stage of high-quality development.

8 Conclusion

Based on the theoretical framework of "supply determines growth" of the classical school and the complementary logic of "effective demand management and structural intervention" of Keynesianism, this paper systematically analyzes the paths of China's economy in terms of raising TFP and potential GDP. The study finds that TFP is the key bottleneck of China's economic growth, and technological innovation, institutional optimization and human capital enhancement constitute the three strategic pillars; in terms of institutional characteristics, China's economic development path integrates classical market efficiency and national governance capacity, and regulates the invisible hand through the invisible hand. In terms of institutional characteristics, China's economic development path integrates classical market efficiency and national governance capacity, and regulates the invisible hand through the "visible hand", forming a supply-side reform model with Chinese characteristics; there is a structural differentiation of TFP in the development of different regions in China, and a gradient development model of "innovation-radiation-transfer" should be formed. The

author believes that the future high-quality development of China's economy depends on the implementation of systematic policies and optimization of the institutional environment for TFP enhancement. The author suggests that in the 15th Five-Year Plan, the state should make "productivity leap" a strategic priority, construct a quantifiable TFP index system, and consolidate the foundation of potential GDP growth. The TFP indicator system has been constructed to strengthen the foundation of potential GDP growth. It should also form precise policy linkages in the allocation of financial resources, reform of the education system, and coordinated regional development.

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