Macroeconomic Dynamics, **24**, 2020, 920–934. Printed in the United States of America.
doi:10.1017/S1365100518000536

ECONOMIC GROWTH WITH ENDOGENOUS ECONOMIC INSTITUTIONS

ZHAO LI
Tongji University

YUJING CHU
Shanghai Normal University

TIANRUO GAO
University of York

Unlike most existing studies on the endogenous institutions, literature on theoretical growth has traditionally considered institutions as exogenous. In this paper, a learn-by-doing-based growth model is adopted and integrated with endogenous institutions to study how economic agents' incentives engage in institutional improvements or exploit institutional imperfections. From maximization of identical agent utility, the economic growth model includes capital, labor, technology, and institutions. The study is to analyze the effect of institutions on the stability of equilibrium, balanced economic growth path, and convergence rate in the process of economic growth. It is concluded that, firstly, improving institutions is a decisive factor for China's high economic growth rate for the past years; secondly, improving institutions can increase the capital stock per unit of effective labor in steady state; thirdly, imperfect institutions can explain income difference among countries; and finally, technology plays a key role only under the conditions adapting to institutions.

Keywords: Endogenous Institutional Change, Capital Allocation, Economic Growth

1. INTRODUCTION

According to modern economic growth theory, factors contributing to economic growth include capital, human capital, and technology. While quite often overlooked, institutions, which define and enforce property rights, can also affect economic performance because they reduce transaction costs and uncertainty throughout exchange activities. As such, a theory of growth is incomplete without a theory of institutions. Institution as a rule of resource allocation, on the one hand, encourages people to increase capital investment, accelerating the process

We are grateful to anonymous referee and the editor for insightful comments on previous versions which substantially improved this article. This work was supported by the Social Science Foundation of Shanghai under grant no. 2017BJL003. The usual disclaimer applies. Address correspondence to: Yujing Chu, Tourism College, Shanghai Normal University, Room 501, 100 Guilin Road, Shanghai 200234, China. e-mail: chuyujing@163.com

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https://doi.org/10.1017/S1365100518000536 Published online by Cambridge University Press

of technological progress; and on the other hand, optimizes resources allocation to boost efficiency. In China, the discrimination of ownership is a unique problem of the socialist market economy with Chinese characteristics. Enterprises under different types of ownership may receive loans of significantly different interest rates and amount. State-owned enterprises with low return on capital inclined to invest by credit market, while private enterprises with higher return on capital must finance through internal accumulation [Song et al. (2011)]. Financial discrimination made it impossible for capitals to be allocated according to marginal output of enterprise, which has led to the loss of total output. In addition, different types of enterprise ownership can also affect investment decisions [Ninghua et al. (2016)], causing resources inefficient configuration. How did China achieve sustained and stable economic growth with a low capital allocation efficient since reform and open-up? In this specific case, while China undergoes dramatic social development, its economic growth cannot be fully explained merely from the aspects of capital, labor, and technological progress. Institutional changes also had profound impact on the economy. An influential amount of existing literature has studied China's economic growth without taking institutions into account or simply by assuming that the institutional environment had no effect on capital allocation efficiency between different enterprises.

This paper puts forward that physical capital accumulation and institutions are interrelated in producing the foundations for long-run economic development, and therefore, integrates endogenous institutions into the model of endogenous economic growth. Based on the new model, this study analyzes the effect of institutions on the stability of equilibrium, balanced economic growth path, and convergence rate in the process of economic growth. This paper is structured as follows. The second section defines the economic institutions, discusses the interaction mechanism between institution and economic growth, and makes a literature review on the empirical evidence of China since 2000. The third section describes the model and characterizes the equilibrium. The fourth section gives the stability of the equilibria and convergence speed. The conclusion is made in the final section.

2. LITERATURE REVIEW

At present, there is no unified definition of institutions. Based on the viewpoints of North (1990), Williamson (2000), and Hodgson (2004), institutions studied in this paper are economic institutions derived from Institutional Economics. According to the economic implications contained in the above definition, economic institutions can be further defined as formal and informal economic rules set for the formation of a normative market order and the reduction of transactional uncertainty, transaction costs, and the optimal allocation of resources. Specifically, in China, the economic institutions are a mix of different types of ownership. While public ownership is the leading factor, diversified ownership is developed simultaneously. Since the reform and open-up, China's economic institutions have

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gradually shifted from a planned economy to a socialist economy with Chinese characteristics, and China has achieved rapid economic growth since then. Based on the above rationale, this paper studied the effects of the endogenous economic institutional changes on China's economic growth during the period of the reform and open-up.

According to Coase (1937), the driving force of economic growth is still in debate between scholarship on new institutional economics and endogenous economic growth theory. Economic growth theories have shown that development depends on the accumulation of human capital, physical capital, and technology [Romer (1986), Lucas (1988), and Gennaioli et al. (2012)]. However, technological innovation, scale of economies, and capital accumulation are not the reasons for economic growth, but in fact, economic growth itself. Follow-up studies, presented by Acemoglu et al. (2014), comparing among the factors of production, suggest that institutions are the decisive factors of economic growth. They argued that geography, culture, and other factors were not the fundamental factors of economic growth. Furthermore, the impact of institution on economic growth is stable; in contrast, when limiting the impact of institutional variables, the impact of human capital on long-term economic growth is limited accordingly as well. This suggests that the institution is the root cause of long-term economic growth and played a role through material capital, human capital, and total factor productivity. Based on different indictors of economic institutions—for example, International Country Risk Guide, the openness index, Polity IV (investigated by Political Instability Task Force), the Worldwide Govern Index, and World Development Indicators (WDI)—a number of empirical studies also have proved that institution did have a positive effect on economic growth [Iqbal and Daly (2014), Nawaz (2015), Wietzke (2015), Fernández and Tamayo (2017), Langlois (2017), and Nikolaev and Salahodjaev (2017)]. However, the above researches only focused on the significance of regressions without the mechanism analysis of institutional–economic growth, which lacks theoretical foundations.

Later, the scholars started to explore the mechanism how institution affects economic growth. There are three main channels that institutionally affect economic growth. First, institutions affected technological innovation via the mechanism of "property rights institutions—capital investment—productivity—per capita output." Second, institutions affected technological human capital accumulation. The institutions of income distribution affected economic growth by influencing the amount of investment in education [Barro and Lee (2013)]. Acemoglu et al. (2014) argued that whether human capital investment could drive economic growth depended on the institutional environment. A similar analysis by DellaPosta et al. (2017) shows that the key to institutional impact on human capital is that it determines the return on education. Third, the better the institutions, the more mature the market is. This channel conduces to the improvement of productive and technological innovation. If the institutions lack fairness, it is easy to breed rent-seeking opportunities. Rent-seeking will hinder economic growth from

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the following aspects: (1) rent-seeking is the redistribution of social wealth rather than being productive, and it will lead to a waste of social resources; (2) vested interest groups strive to maintain their status quo through the rent-seeking profits, against the implementation of new and more beneficial social policies; and (3) rent-seeking behavior will lead to inadequate investment and innovation, hindering economic growth. There are also some researches from other perspectives, for example, the degree of marketization, the amount of foreign investment [Aisen and Veiga (2013) and Krammer (2015)], and informal institutions [Putterman (2013)].

Most economists begun to recognize the importance of institutions for economic development. However, existing researches mostly took institutions as an exogenous variable—how institutions are produced? How to make institution endogenous? Existing literature rarely studies the nature of endogenous institutions or how endogenous institutions affect economic growth. Based on neoclassical economic growth model, the AK model, Li (2005) makes the first attempt to add government behavior variable into the growth model and tries to study the institutional effect on the economic growth. Youcai (2008) embodies endogenous institutional variable into the endogenous economic growth model, making a theoretical analysis how institution as an endogenous variable affected the economic growth equilibrium path, but without empirical analysis. Sedgley and Elmslie (2013) explored the dynamics of semiendogenous versus fully endogenous growth models in "lab equipment" specifications of the models with expanding sectors. Gómez (2015) analyzed the dynamics of an endogenous growth model with external habit formation and elastic labor supply. Liu and Chen (2015) conduced an empirical analysis by adding institutional change as endogenous variable into the endogenous economic growth model. This empirical research shows that institutional change is the key factor of China's economic growth since reform and open-up. Maebayashi et al. (2017) constructed an endogenous growth model that includes productive public capital and government debt. Rey and Lopez-Garcia (2017) accommodated the concept of dynamic efficiency in an overlapping-generations economy with endogenous growth due to human capital accumulation.

Among the existing literature of the relationship between institution and economic growth, most researchers have analyzed whether various macroeconomic institutions can promote economic growth through empirical analysis. However, there is a need to engage empirical evidence with theoretical analysis in order to conduct a full discussion on the mechanism of how institution affects economic growth. Besides, some empirical studies only carried out the basic Ordinary Least Square (OLS) analysis, lacking the necessary robustness test and, potentially, containing endogenous and other issues. While experiencing a dramatic social change since reform and open-up, China's economic growth cannot be fully explained from the aspects of capital, labor, and technological progress, because the institutional changes also have a profound impact on the economic growth.

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3. THEORETICAL MODEL

This paper introduces an institutional structure into Romer's (1986) model of learn-by-doing-based endogenous growth. Institutions in this model refers to economic agents' incentives to engage in institutional improvements or exploit institutional imperfections.

3.1. Production Function

ASSUMPTION 1. Institution is also a kind of scarce factors as technology, knowledge, physical capital, and human capital. From the mechanism of institution on economic growth, on the one hand institution can accelerate the technological progress through promoting people to increase capital investment; on the other hand, it can improve efficiency of factors by optimizing the allocation of factors. To a certain extent, the increase of factor use efficiency is not simply impact on a single factor such as human capital or physical capital, but as a scarce resource playing a role in the process of economic growth. Just as tools, improve labor skills and promote economic growth. The institutions cannot be replaced by human capital, physical capital, and technology. Therefore, the institutions should be put into the production function as the fourth scarce factor just like technology, physical capital, and human capital, which is consistent with Acemoglu et al. (2014), that the institutions are the basic factor of economic growth. The impact of institutional changes and technological progress on economic growth are mainly labor augment, namely institutional change and technological progress is Harold neutral. Institutions factor and technological progress combination with labor are called effective labor. Based on the above considerations, in this paper the production function will be set as:

$$Y_t = K_t^{\alpha} \cdot (A_t I_t L_{Y,t})^{1-\alpha}. \tag{1}$$

Here, Y_t is final output, A_t is a measure of technology, K_t is total physical capital, $L_{Y,t}$ is labor in final output, α is output elasticity of physical capital and $0 < \alpha < 1$, I_t is the institution factor.

For simplicity, the total labor force grows at the exogenous rate n::

$$\dot{L}_t = nL_t. \tag{2}$$

In the labor market, there are two kinds of labor, labor in final output $L_{Y,t}$ and institutions-building lawyers $L_{I,t}$. So the total labor force L_t equals labor in final output $L_{Y,t}$ plus institutions-building lawyers $L_{I,t}$, namely, $L_t = L_{Y,t} + L_{I,t}$.

The technological progress, A, since reform and open-up in the technology progress in China is mainly from learn by doing of the capital deepening the work of Li et al. (2017), so in this paper, we follow the vintage process idea described by Romer (1986):

$$A_t = DK_t^{\beta}. \tag{3}$$

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Here, D is the technological transformation efficiency, is a constant from 0 to 1, and β is elasticity of physical capital on technology.

According to Perpetual inventory method, the capital accumulation equation is set as follows:

$$\dot{K}_t = \mathrm{Y}_t - C_t - \delta_K K_t. \tag{4}$$

Here, δ_K is a depreciation rate of physical capital.

3.2. Endogenous Economic Institutions

ASSUMPTION 2. There are many factors affecting the institutional changes, from the micro perspective technology, human capital, and institutions itself. According to the theory of institutional changes, economic growth will require institutional change. In the process of economic development, the new interest group inevitably requires the government to protect their vested interest from the institutional arrangements and the constitutional order; at the same time in order to make their own representative economic continuous development, they will also require defining the property rights, the social incentive mechanism, and competition mechanism, which will induce institutional change. The continuous development of economy will constantly produce new requirement of definition on the right, incentive mechanism, and the allocation of resources. In addition, the operation of institutions demands the institutions-building lawyers to promise the enterprise innovation profit, and in turn the institutions-building lawyers will put forward better institutions to ensure a better economic environment to encourage the enterprise innovation, which leads to more accumulation of it over the long run, thus generating a self-sustainable mechanism. For the sake of simplicity, in this model, according to the theory of institutional change, institutional change is the internal requirements of economic growth, also the result of the economic growth, and assume that there are L_I institutions-building lawyers in each period, while ignoring other factors.

$$I_t = B \cdot Y_t^{\gamma} \cdot L_I^{\nu}. \tag{5}$$

Here, B is a constant, γ is elasticity of final output on institutions, ν is elasticity of institution-building lawyers on institutions, L_I is institutions-building lawyers, with the features: (1) $I_{L_\mathrm{I}} > 0$; and (2) $I_{L_\mathrm{I}L_\mathrm{I}} < 0$.

3.3. Labor Market Equilibrium in China

Since the reform and open-up, the economic institutions have gradually shifted from a planned economy to a socialist economy with Chinese characteristics. Enterprises in China, whatever the innovation enterprises, imitating enterprises or both, faced a weaker property rights institution. Government officials purposively delay procedures that are necessary for firm operation (i.e. license registration). They, in fact, seek economic rent from the firm. As a result, managers have to

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spend more time with government officials in building personal relationships to promise their property and maintain operations [Che and Wang (2013)]. Besides, during this period, the imitating enterprises could imitate the innovation enterprise at low cost or even costless. Innovation enterprises are assumed to hire institutions-building lawyers at higher wage to resort to third parties (courts) in order to protect their property rights and resolve business disputes with imitating enterprises and government. The accumulation of institutions-building lawyers can lead to institutional improvement on the quality of economic policies. Such institutional improvement leads to an increase of the number of innovation entrepreneurs in the economy. Innovation entrepreneurs demand human capital to improve the institutions, which leads to more accumulation of human capital over the long run, thus generating a self-sustainable mechanism. They then choose the number of institution-building lawyers so as to maximize their net income, that is,

$$\max_{L_I} IPY - w_I L_I - w_Y L_Y - Kr. \tag{6}$$

where P is the price of final goods, as in Pargianas (2017), and I is the institution efficiency. It captures the endogenous economic institutions, like taxes, labor market regulations, etc. w_I is the wage of institutions-building lawyers L_I and w_Y is the wage of common labor L_Y. Here, assume that the institutions-building lawyers wage, w_I, is exogenous. A common labor will choose to become an institution-building lawyer if his expected net benefit from becoming an institution-building lawyer is greater than the common labor wage. The expected net benefit is the institution-building lawyers wage, minus the cost of becoming institution-building lawyers wage, which is assumed to be a constant fraction of institution-building lawyers wage μw_I, $\mu \in (0,1)$. In labor market equilibrium, $w_Y = (1-\mu)w_I$. According to the first order, we can get the optimality condition:

$$IP\frac{\partial \mathrm{Y}}{\partial L_Y} = w_Y. \tag{7}$$

Free entry into the output sector implies that wage payments to institutions-building lawyers L_I, common labor L_Y, and capital must exhaust the profit. That is,

$$w_Y L_Y + w_I L_I + Kr = IPY. \tag{8}$$

The labor market equilibrium requires that institutions-building lawyers and common labor exhaust the fixed supply of labor in the economy, L, so that

$$L_Y + L_I = L \tag{9}$$

Combine equations (1) and (7)–(9), then we can get

$$L_I = \frac{(1-\mu)(1-\varphi-\zeta)}{\varphi + (1-\mu)(1-\varphi-\zeta)}L. \tag{10}$$

Here, define $\varphi = \partial YL_Y/\partial L_Y Y$ is the elasticity of output with respect to common labor, and $\zeta = \partial YK/\partial KY$ is the elasticity of output with respect to capital.

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Therefore, the proportion of institutions-building lawyers is

$$s = \frac{(1-\mu)(1-\varphi-\zeta)}{\varphi + (1-\mu)(1-\varphi-\zeta)}. \tag{11}$$

From equation (11), we can know that the proportion of institutions-building lawyers s is affected by fixed cost μ, the elasticity of output with respect to common labor φ, and the elasticity of output with respect to capital ζ. The proportion of institutions-building lawyers decreases over the increasing of institutional change parameter μ, which suggests that the more fixed cost of common labor turning into institutions-building lawyers, the more scarcely of institutions-building lawyers in labor market, which also shows the bad economic institutions environment.

PROPOSITION 1. *When the parameters satisfy the following conditions: The elasticity of output with respect to common labor $\varphi = 1-\alpha$, and the elasticity of output with respect to capital $\zeta = \alpha$, the proportion of institutions-building lawyers s will equal zero, then the model will become the standard model of neo-classical growth model with perfect results.*

3.4. Utility Function

The representative consumer maximizes his utility across time:

$$U(C_t) = \int_0^{\infty} \mathrm{e}^{-\rho t} \frac{C_t^{1-\theta}}{1-\theta} \mathrm{d}t, \tag{12}$$

where θ the inverse of the elasticity of substitution, $\theta > 1$, and ρ the discount rate.

3.5. General Equilibrium and the Growth Path

Objective function:

$$\max \int_0^{\infty} \mathrm{e}^{-\rho t} \mathrm{U}(C_t) \mathrm{d}t. \tag{13}$$

The constraint is

$$\dot{K}_t = \mathrm{Y}_t - C_t - \delta_K K_t, \tag{14}$$

where K_t is state variable and C_t is control variable.

The Hamiltonian function for this problem is

$$H = \frac{C_t^{1-\theta}}{1-\theta} + \lambda_t (Y_t - C_t - \delta_K K_t). \tag{15}$$

In the above formula, λ_t is the shadow price of K_t.

Then, according to the first-order condition,

$$C_t^{-\theta} = \lambda_t. \tag{16}$$

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Then, the Euler equation is

$$\frac{\dot{\lambda}}{\lambda} - \rho = -\frac{\partial Y}{\partial K_t} + \delta_K. \tag{17}$$

Transversal Condition (TVC)

$$\lim_{t\to\infty} e^{-\rho t} \cdot \lambda_t \cdot K_t = 0. \tag{18}$$

Log-differentiating equation (16) and combining it with equation (17) produces consumption growth rate, and divide equation (14) both sides K_t produces physical capital growth rate:

$$\frac{\dot{C}}{C} = \frac{1}{\theta}\left(\frac{\partial Y}{\partial K_t} - \delta_K - \rho\right), \tag{19}$$

$$\frac{\dot{K}}{K_t} = \frac{Y}{K_t} - \frac{C_t}{K_t} - \delta_K. \tag{20}$$

Here define $c(t)$ to be consumption per unit of effective capital $c = C/K$; $k(t)$ to be capital per unit of effective labor $k = K/IAL$, then $g_k = g_K - g_I - g_A - g_L$. Then, according to equations (19) and (20),

$$\frac{\dot{k}}{k} = g_k = \frac{1-\gamma-\beta}{1-(1-\alpha)\gamma}\left(k_t^{\alpha-1} - c_t - \delta_K\right) - \frac{(1+\upsilon)n}{1-(1-\alpha)\gamma}, \tag{21}$$

$$\frac{\dot{c}}{c} = g_c = \left(\frac{1}{\theta}\cdot\frac{\alpha+\beta(1-\alpha)}{1-(1-\alpha)\gamma} - 1\right)k_t^{\alpha-1} + \left(1-\frac{1}{\theta}\right)\delta_K - \frac{1}{\theta}\rho + c_t. \tag{22}$$

Equations (21) and (21) fully characterize the dynamics of the economy. This system can be solved for its steady state, $\dot{c}/c = 0$, $\dot{k}/k = 0$, then we can get the per capita effective consumption and per capita effective capital in equilibrium state, c^* and k^*:

$$k^* = \left(\frac{1-\gamma-\beta}{(1-\gamma-\beta)(\rho+\delta_K) + (1+\upsilon)n\theta}\cdot T\right)^{\frac{1}{1-\alpha}}, \tag{23}$$

$$c^* = \frac{\rho}{T} + \left(\frac{1}{T} - 1\right)\delta_K + \frac{(1+\upsilon)n}{1-\gamma-\beta}\left(\frac{\theta}{T} - 1\right). \tag{24}$$

Define $T = \alpha + \beta(1-\alpha)/1-(1-\alpha)\gamma$.

PROPOSITION 2. *There exists a Balanced Growth Path (BGP) along which the income shares of capital and labor are constant and strictly positive when factors are paid their marginal products, only when* $0 < \beta + \gamma < 1$ *and* $(1-\alpha)\,\gamma < 1$.

Proposition 2. (i) better institutions can successfully transform the technology progress into driving factor of economic growth; (ii) the improvement of the institutions should adapt to the current level of science and technology. If it does not satisfy Proposition 2, there may not exists a steady state, or even the existence of economic equilibrium, this equilibrium is extremely unstable, any small perturbation leads to an irreversible damage economic system. As economic

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growth rate is negative, it can cause the rich countries to become poor, poor countries become poorer.

From equation (23) we can know that the per capita effective capital in equilibrium state, k^*, is affected by the parameter υ change. When the parameter υ increases, the per capita effective capital will decrease. If a country has imperfect institutions, it will cause larger demand of institutions-building lawyers, then lead to a smaller per capita effective capital k^* in steady state, which can explain the per capita income difference among countries. Besides, excessive participation in institutional construction can also result in lower capita capital efficiency. The innovation enterprise should balance the process of improving the institutions.

In steady state, the growth rate of the economy is $g_Y = g_K = g_C = g_I + g_A + g_L$, then we can express it as

$$g_Y = \frac{(1+\upsilon)n}{1-\gamma-\beta}. \tag{25}$$

Now we discuss the effect on the economic growth rate in steady state when the parameters γ and υ change. From equation (25), we know that the growth rate of the economy increases over the increasing of institutional change parameter γ, which suggests that institutional change has a positive effect on the growth rate of the economy. When the other parameters not change, the growth rate of the economy increases over the increasing of the participation in institutional construction υ, which suggests that the more effect of institution-building lawyers on institutions, the more long-term economic growth rate g_Y.

PROPOSITION 3. *When the parameters satisfy the following conditions: institutional change γ and institution-building υ equal zero, and institutional transformation B equals 1, then the model will become the standard model of Romer (1986) with perfect results.*

4. STABILITY OF THE EQUILIBRIA AND CONVERGENCE SPEED

Equations (21) and (22) describe $\dot{c}$ and $\dot{k}$ as functions of k_t and c_t. Take first-order Taylor approximations to (21) and (22) around x (k^*, c^*). That is, we write

$$\dot{c} \cong \frac{\partial \dot{c}}{\partial k}[k-k^*] + \frac{\partial \dot{c}}{\partial c}[c-c^*], \tag{26}$$

$$\dot{k} \cong \frac{\partial \dot{k}}{\partial k}[k-k^*] + \frac{\partial \dot{k}}{\partial c}[c-c^*]. \tag{27}$$

Define $\tilde{c} = c - c^*$ and $\tilde{k} = k - k^*$. Since c^* and k^* are both constants, $\dot{\tilde{c}}$ equals $\dot{c}$, and $\dot{\tilde{k}}$ equals $\dot{k}$. We can, therefore, rewrite (26) and (27) as

$$\dot{\tilde{c}} \cong \frac{\partial \dot{c}}{\partial k}\tilde{k} + \frac{\partial \dot{c}}{\partial c}\tilde{c}, \tag{28}$$

$$\dot{\tilde{k}} \cong \frac{\partial \dot{k}}{\partial k}\tilde{k} + \frac{\partial \dot{k}}{\partial c}\tilde{c}. \tag{29}$$

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Combine equations (21), (22), (28), and (29), then we can get

$$\frac{\dot{\tilde{c}}}{\tilde{c}} \cong \left(\frac{T}{\theta} - 1\right)(\alpha - 1)(k^*)^{\alpha-2}c^*\frac{\tilde{k}}{\tilde{c}} + c^*, \tag{30}$$

$$\frac{\dot{\tilde{k}}}{\tilde{k}} \cong W(\alpha - 1)(k^*)^{\alpha-1} - Wk^*\frac{\tilde{c}}{\tilde{k}}. \tag{31}$$

Define $W = 1 - \gamma - \beta/1 - (1 - \alpha)\gamma$. Equations (30) and (31) imply that the growth rates of $\tilde{c}$ and $\tilde{k}$ depend only on the ratio of $\tilde{c}$ and $\tilde{k}$. In terms of the diagram, $\tilde{c}$ and $\tilde{k}$ are falling at equal rates, and the economy moves along a straight line to (k^*, c^*) at a constant rate. Define $\mu = \dot{\tilde{c}}/\tilde{c}$, in the condition that $\dot{\tilde{k}}/\tilde{k}$ equals $\dot{\tilde{c}}/\tilde{c}$ is thus

$$\mu^2 - \mu[W(\alpha - 1)(k^*)^{\alpha-1} - c^*] + W\frac{T}{\theta}(\alpha - 1)(k^*)^{\alpha-1}c^* = 0. \tag{32}$$

This is a quadratic equation in μ. The solutions are

$$\mu = \frac{b \pm [b^2 - 4a]^{1/2}}{2}. \tag{33}$$

Define $b = W(\alpha - 1)(k^*)^{\alpha-1} - c^*$, $a = W\frac{T}{\theta}(\alpha - 1)(k^*)^{\alpha-1}c^*$.

If μ is positive, then $\tilde{c}$ and $\tilde{k}$ are growing; that is, instead of moving along a straight line toward (k^*, c^*), the economy is moving on a straight line away. Thus, if the economy is to converge to (k^*, c^*), then μ must be negative. Inspection of (33) shows that only one of the μs, namely $b - [b^2 - 4a]^{1/2}/2$, is negative. Let μ_1 denote this value of μ.

When $0 < \beta + \gamma < 1$ and $(1 - \alpha)\gamma < 1$, then $W > 0$ and $a < 0$, then $\tilde{c}$ and $\tilde{k}$ are growing; that is, moving along a straight line AA toward (k^*, c^*). When $\beta + \gamma > 1$ and $(1 - \alpha)\gamma < 1$, then $W < 0$ and $a > 0$, then $\tilde{c}$ and $\tilde{k}$ are growing; that is, instead of moving along a straight line toward (k^*, c^*), the economy is moving on a straight line BB away. For such an economic system at this point, any small disturbance causes an irreparable destruction. Figure 1 shows the line along which the economy converges the saddle path.

In real life, how long does it take for a country to arrive at an economic equilibrium from its economic point of origin? When production function is the same, that is a question how poor countries or regions as soon as possible to catch up with rich countries, namely the convergence rate, which is widely concerned problems, affect the world peace and development as well as the regional harmonious development of a country. When the economic system does not have a steady state, the discussion of convergence speed will not be of any economic significance, so the analysis of the following sections is performed under the conditions of $0 < \beta + \gamma < 1$ and $(1 - \alpha)\gamma < 1$.

Thus, if we linearize the equations for $\dot{c}$ and $\dot{k}$, we can characterize the dynamics of the economy in terms of the model's parameters. The convergence equation of per capita effective production, which shows how initial per capita effective production converge to the steady state. Hereafter, c and k converge to

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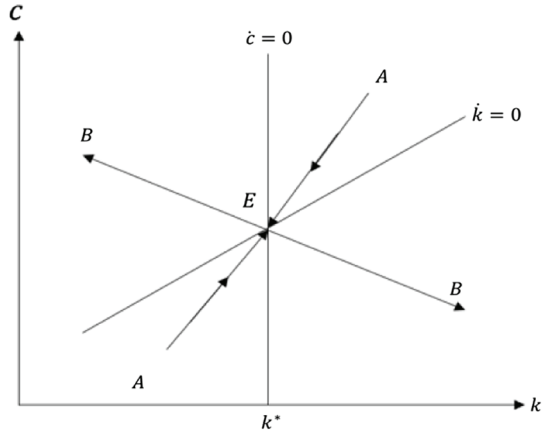


FIGURE 1. The linearized phase diagram.

their balanced-growth-path values at rate μ_1. It is easy to demonstrate that the convergence rate of per capita effective production is μ_1.

When the institutions factor γ increases, the convergence rate of per capita effective production μ_1 increases, the time the poor areas catch up with the rich region, or the economic system deviation is back to steady state from the equilibrium because the external economic shocks decrease. It means that once the institution was improved. The institution will create a good economic atmosphere for economic growth and further promote economic growth.

When the institutions factor υ increases, the convergence rate of per capita effective production μ_1 increases. It means that the more effect of per institution-building lawyer on institutions improvements, the more protection for innovation enterprises, and then it will take less time for the economic system to converge to steady state.

5. CONCLUSION

The main contribution of this paper is that it integrates endogenous economic institutions into a learn-by-doing-based growth model to analyze the effects of imperfect economic institutions and endogenous economic institutions on the performance of the economy. More specifically, economic institutions are endogenously determined by physical capital, common labor and lawyer labor size, and the parameters β and γ. Since reform and open-up, China's high-speed economic growth rate mainly depends on physical capital accumulation. The growth can also be attributed to deregulation and corresponding economic institutions improvement brought by the transition from planned economy to market economy, which released market vitality. During this period, the economic institutions improvement is mainly endogenously determined by physical capital. Although lawyer labor size may also affect such improvement, its importance

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in economic institutions improvement only manifests under the conditions that there are a lot of innovation entrepreneurs in the economy. Innovation enterprises hire institutions-building lawyers at higher wage to resort to third parties (courts) in order to protect their property rights and resolve business disputes with imitating enterprises and government. The accumulation of institutions-building lawyers can lead to institutional improvement on the quality of economic policies. Such institutional improvement leads to an increasing number of entrepreneurs in the economy. Entrepreneurs' demand for human capital leads to more accumulation of it in the long term, thus generating a self-sustainable mechanism. China's economic growth pattern is shifting from factor-driven to innovation driven. As shown in the report of *19th National Congress of the Communist Party of China*, the China economy will shift from high speed to high quality, therefore more and more innovative entrepreneurs will emerge. Subsequently, the lawyer labor will play an important role in economic institutions improving and then further in sustainable economic growth.

It is concluded that firstly, improving economic institutions is a decisive factor for China's high economic growth rate for the past years. Secondly, improving economic institutions can increase the capital stock per unit of effective labor in steady state, accelerate the speed of convergence, and decrease the time the economy returns to the equilibrium point. Thirdly, imperfect economic institutions cause capital loss and the per capita income difference among countries. Last but not least, technology can play a key role only under the conditions adapting to the development institutions. The model provides theoretical foundations for several regularities that have been discussed in the empirical growth and institutions literature.

In this paper, it is found that the economic institutions can explain the difference of per capita income among countries. The better the economic institutions are in a country, the less physical loss and higher economic growth rates. Improving the economic institutions and making more physical capital investment flow into productive activities can solve the problem of per capita income gap among countries. Besides, countries should not only focus on the improvement of economic institutions. The improving economic institutions should adapt the current technology, which will together promote the economic growth or will lead to positive effect. China, as a typical developing country, has experienced high economic growth rate for nearly 40 years, so the conclusions not only explain the process of economic growth in China since reform and open-up, but also provide some inspiration for the economic institutions reform in other developing countries.

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