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Li, Zhao

Donghua University Xuri School of Business Administration
Shanghai

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The Impact of Economic Institutions on Finance Sector : Evidence from China

ZHAO LI*
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Abstract:

This paper studies how economic institutions affect private firm sectors capital accumulation through finance sector and operation objectives of different ownership firms in socialist market economy with Chinese characteristics, which extended the neo-classical economic growth method. Based on above framework, this paper finds that economic institutions were the main factors affecting the efficiency of capital allocation between private sector and stated-owned sector. Compared with stated-owned sector, economic institutions lead private sector to a decrease in loans and government subsidies through finance sector, and an increase in its production costs. Our evidence suggests that private firms take efforts to improve economic institutions as a substitute for political capital.

JEL: P3 - Socialist Institutions and Their Transitions

Keywords: Economic institutions, ownership discrimination, Capital allocation, Economic growth

1. Introduction

Benefits from reform and opening up, human capital and physical capital accumulation, promotion of factor allocation efficiency and technological progress, the Chinese economy has remained sustained high growth for nearly forty years. However, with China's economic growth entered the stage of medium-speed growth, the problems of economic institutions in the process of economic development have become obvious. Ownership discrimination that state-owned enterprise and private enterprise faced different treatment when they raise funds for investment through the financial sector. State-owned enterprises with low return on investment could more easily obtain loans from the financial sector with more relaxed loan conditions; private enterprises with higher return on capital were constrained by financing difficulties and had to rely more on their own internal accumulation. The difference in financing conditions made it impossible for capital to flow to production areas with higher marginal output, which restricts the efficiency of factor allocation and caused the loss of total social output (Song et al., 2011); the inefficiency of factor allocation was also found in other aspects, such as the regional market segmentation, the low efficiency of capital space allocation, the blocked capital mobility, the slowing down of capital accumulation rate and of the technological progress of the "learn by doing". Under the combined influence of the above factors, China's economic growth rate has begun to slow down and total factor productivity has stagnated (Li et al., 2018).

China's economic growth rate and total factor productivity both had an upward trend between 1997 and 2007. After 2008, China's economic growth rate became a downward trend, and total factor productivity stagnated. Faced with the downward pressure on economic growth, the party's report on the 18th National Congress of the Communist Party of China proposed: further deepening reforms, continuing to release the institutional dividends of reforms; reducing government intervention in economic operations, and exerting market regulation on resource allocation to enhance resource allocation for the promotion of capital allocation efficiency and economic growth rate. However, the existing literature on the slowdown of economic growth mostly analyzed the efficiency of production factor allocation or technological progress within the framework of the new economic growth theory, but ignored the impact of economic institutions on economic growth. The economic institutions studied in this paper did not include all the contents of the economic systems, but only the economic institutional factors related to the enterprise property ownership and economic operation coordination institutions. That is to say, the current market coordination mechanism in China has different financial constraints on the differences in financing constraints between state-owned enterprises and private enterprises, and the impact of firm property ownership on decision-making goals. How does the economic institutional factor affect the scale of firm finance, and how does it affect the efficiency of capital allocation? What kind of transmission method is affecting economic growth? The above questions are the focus of this paper.

This paper is structured as follows. The second part define 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 part describes the model and characterizes the equilibrium. The fourth part gives the empirical analysis. The conclusion is made in the final part.

2. Literature Review

The definition of economic institutions in the paper mainly refers to two aspects: the property ownership and the economic operation coordination mechanism. Property ownership is defined through law, which incentives the reasonable use of property, and sanctions for abuse. The second aspect of the economic operation coordinating mechanism. The core is the rules of factors allocation and the rules of

product exchange. In theory, there are four typical combinations of property ownership and economic operation coordination mechanism: public-owned planned economy, public-owned market economy, private-owned planned economy, and private-owned market economy. Single public ownership institutions with a single private ownership, purely planned economy, and purely market economy are not effective institutional arrangements. China's current institutional choice is a mixed economy type that emphasizes the public ownership and market coordination mechanism in nature, while developing the private economy and using policy guidance, that is, the socialist market economy with Chinese characteristics. This mix economy can avoid the inevitable monopoly and welfare losses under pure market conditions, and can make up for the inflexibility and inefficiency of purely centralized planning. Based on the above discussion, the economic institutions studied in this paper includes two aspect, namely: the impact of property ownership on firm decision-making objectives; the impact of China's current market regulation and government macro-control coordination mechanism on firm financing.

About the driving force of economic growth, new economic growth theories have shown that the accumulation of human capital, physical capital, and technology are main factors (Romer, 1986; Lucas, 1988; Acemoglu, Johnson, and Robinson, 2014). The new economic growth theory was to explain the sustained economic growth by analyzing the accumulation of human capital and physical capital, the efficiency of capital allocation, and the endogenous technology within a given framework of economic institutions (Cox, 2017). However, if there is no institutional environment compatible with economic development, institutional factors may have a negative effect on factor allocation and technological progress (Avner G, 2017). It may also constrain economic growth. A number of empirical studies also have proved that institution did have a positive effect on economic growth (Fernández&Tamayo, 2017; Langlois, 2017; Nikolaev & Salahodjaev, 2017). There are three main channels that institution affect economic growth. First, institutions affected technological innovation via the mechanism of "property rights institutions- capital investment - productivity - per capita output" (Egidi, 2017; Davidson, 2018). Second, institutions affected technological human capital accumulation. The institutions of income distribution affected economic growth by influencing the amount of investment in education (Barro & Lee, 2013; Aguirre, 2017; Pastor et al., 2018). Acemoglu (2014) argued that whether human capital investment could drive economic growth depended on the institutional environment. A similar analysis by Della Posta 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 a market is. If the institutions lack fairness, it is easy to breed rent-seeking opportunities (Constantine ,2017; Wako, 2018; Nguyen et al., 2019)

For a developing country like China that has transformed from a planned economy to a socialist market economy and its economic institutions are still in a period of continuous improvement (Bennett, 2017; Gagliardi, 2017). Its forty years economic growth cannot be fully explained only by the accumulation of human and physical capital, the improvement of factors allocation efficiency and technological progress. On the contrary, the continuous improvement of economic institutions cannot be ignored for economic growth (Xi, 2017) . Therefore, it is necessary to incorporate economic institutional factors into the analytical framework of economic growth. Although the new institutional economics introduces institutional factors into the analytical framework, it mainly uses the method of logical reasoning at the level of speculation, which is insufficient in quantitative analysis and empirical verification. In this paper, through adding economic institutional factors into the new economic growth model, studied the transmission mechanism of economic institutions affecting economic growth, and analyzed the influence of economic institutions on economic growth.

3. Theoretical Model

3.1 Household sector

A representative household consists of a single individual whose descendants continue indefinitely; the family derives its utility from consumption, and its preferences can be expressed by the constant relative risk aversion utility function, whose utility function is:

$$U(C_t) = \frac{C_t^{1-\theta}}{1-\theta} \quad (1)$$

Here, C_t denotes household consumption in period t , $1/\theta$ the replacement elasticity of the intertemporal consumption, $\theta > 1$.

The initial capital stock of the household sector is zero, and its income is derived from the wages by providing effective labor to the firm sector and the provision of monetary capital to the financial sector. In the period t , the household provides $H_{t,\chi}$ effective labor to different ownership firms, and obtains labor income $w_{t,\chi}$, or engage in economic institutional improvement $H_{t,\vartheta}$, and obtain labor income according to wage rate $w_{t,\vartheta}$; and lends M_t currency capital to the financial sector at the interest rate r_t . Labor and capital income are used to consume C_t and savings M_t , which is reflected in the accumulation of monetary capital in the household sector. The household problem is to maximize (1) subject to the following budget constraint:

$$\dot{M}_t = w_{t,S}H_{t,S} + w_{t,P}H_{t,P} + w_{t,\vartheta}H_{t,\vartheta} + r_tM_t - C_t \quad (2)$$

Maximization the household sector long-term utility, and its consumption path is:

$$\frac{\dot{C}_t}{C_t} = \frac{r_t - \rho^H}{\theta} \quad (3)$$

As formula (3) shows that the main influencing factors affecting the consumption path of the household sector are the deposit interest rate r_t , the time preference ρ^H , and the intertemporal substitution elasticity θ of consumption.

3.2 Finance sector

This section builds a financial sector credit decision model, which derives the mechanism of “price discrimination” in financial markets under the Chinese characteristics economic institutions.

To simplify the analysis, the financial sector is assumed to be a frictionless intermediary. Its role is to absorb the savings of the household sector at a certain deposit rate per period, fully convert it into firms' credit capital ($M_t = I_t$), and allocate credit capital to different ownership firms at a certain loan interest rate. As an agent of the household sector, its decision-making objective is to maximize financial services, but is influenced by policy factors¹.

When constructing the utility function of the financial sector, considering the influence of institutional factors, the loan income $\pi_{t,S}$ obtained from the state-owned enterprise and the loan income $\pi_{t,P}$ obtained from the private enterprise are differentiated, that is, the two cannot be completely replaced, the corresponding utility evaluation weight (utility elasticity) is μ and $1 - \mu$, $0 < \mu < 1$. With the continuous improvement of the economic institutions, the influence of policy factors on the credit decision of the finance sector is decreasing. The policy factor is a dynamic variable and an endogenous

¹ Refer to Becker (1957), economic agents are concerned about political demands in addition to profits.

variable. G_t is the influence of policy factors on the utility evaluation of the finance sector, which is related with the economic institutions. To ensure that the model has a stable equilibrium solution, the policy factors is expressed as the function $G_t = G(\vartheta_t)$, let G_t be a convex function, $0 \leq G_t < 1$, $G' < 0$, indicating that the more perfect the economic institutions, the smaller the impact of policy factors on the finance sector, the higher the independent decision-making of the finance sector. The following is the utility function of finance sector:

$$U = \pi_{t,S}^{\mu+G_t} \pi_{t,P}^{1-\mu} \quad (4)$$

Here, $\pi_{t,\chi} = (1 - e_{t,\chi})r_{t,\chi}I_{t,\chi}$, $\chi = \{S, P\}$, S denotes state-owned firm, and P private firm. $r_{t,\chi}$ indicates the interest rate of the financial sector loan to the firm sector. The loan interest rate is a function of the loan amount, which satisfies the following relationship: when the financial sector expands the scale of lending, the willingness of the firm sector to pay the loan interest rate will decrease, and vice versa, $\partial r_{t,\chi} / \partial I_{t,\chi} < 0$. $I_{t,\chi}$ indicates the amount of funds that the financial sector lends to the firm sector. $e_{t,\chi}$ indicates the default rate of the firm sector. The higher the financial sector's mastery of firm credit qualification information or the closer the financial sector's business relationship with the firm sector, the lower the probability of firm sector default rate. In particular, state-owned firms are mostly large-scale, long-term business, complete financial statements, and long-term cooperation with the financial sector, all of which reduce the degree of information asymmetry between the financial sector and state-owned firms. As a result, the financial sector has a high level of convenience in gathering information and monitoring compliance. Most of China's private enterprises are small and medium-sized enterprises, not only financial institutions and information disclosure mechanisms are not perfect. Under the same conditions, the probability of default of private firms is higher than that of state-owned firms, that is, $e_{t,P} > e_{t,S}$.

The credit capital constraint equation for the financial sector is as follows:

$$M_t = I_{t,S} + I_{t,P} \quad (5)$$

Maximizing the utility of the financial sector, then the investment²are:

$$I_{t,P} = M_t \frac{1 - \mu}{1 + G_t} \quad (6)$$

$$I_{t,S} = M_t \frac{\mu + G_t}{1 + G_t} \quad (7)$$

It can be seen from equations (6) and (7) that in the financial market environment with limited interest rate fluctuations, the scale of financial sector loans to state-owned firms and private firms is not affected by the interest rate of loans, nor the impact of firm loan default rates. It also shows that the finance sector chooses to provide more loans to low-risk, high-yield companies on the basis of comparing the default risks of different firms is a rational market behavior. However, from the equation (6), (7) it can also be seen that the scale of loans of state-owned firms and private firms are affected by policy factors. The scale of loans of state-owned firms is proportional to the inclination of their policies, $\partial I_{t,S} / \partial G > 0$. The relationship between the scale of loans of private firms is reversed, that is, $\partial I_{t,P} / \partial G <$

² For a long time, the floating rate of loan interest rates in China's financial sector has been controlled by the central bank, and it has not achieved full marketization, and its floating range is limited. Therefore, the loan interest rate has a small elasticity to the loan scale, which can be approximated to zero, that is, $\varepsilon_\chi = 0$.

0. In other words, the more obvious the government's policy tendency toward state-owned firms, the more the distribution of credit resources is biased toward state-owned firms. In the distribution of credit resources in China, there is indeed a phenomenon in which the government intervention replaces market for credit allocation. It is consistent with the situation of "zombie firms" in which the state-owned firm sector has a large number of loans to survive, and the private firms facing "funding difficulties".

PROPOSITION 1: When the economic institutions is gradually improved and the government's intervention in the finance sector is close to zero, that is, the parameter G_t , the credit resources allocation of the finance sector will be fully regulated by the market, and the credit resources will be allocated in accordance with marginal replacement rate in the evaluation of utility of the finance sector between different firms sectors. At the time, the development of finance markets tends to be perfect.

3.3 Firm sector

There are two types of property ownership firm in China's current economic institutions, state-owned and private-owned, and their business objectives are different. In view of the differences in business objectives of different ownership firms, this section separately constructs investment decision models for different ownership firms. In order to simplify the model, it is assumed that the products produced by different ownership firms are homogeneous, and the total human resources stock H_t is given. The proportion of human capital in state-owned firms and private firms depends on the composition of the two types of firm sector φ (the proportion of state-owned firm) or $(1 - \varphi)$ (the proportion of private firm).

3.3.1 Private firm

Assuming that the input-output relationship of private enterprises (P) satisfies the Cobb-Douglas form, it can be expressed as:

$$Y_{t,P} = K_{t,P}^{\alpha_P} ((1 - \varphi)H_t)^{1 - \alpha_P} \quad (8)$$

$Y_{t,P}$ indicates the output of private firm in period t ; $K_{t,P}$ indicates the capital stock input of private firm in period t , $(1 - \varphi)H_t$ indicates the human capital investment of private firm in period t , α_P and $1 - \alpha_P$ represent the output elasticity of physical capital $K_{t,P}$ and human capital $(1 - \varphi)H_t$, respectively.

As the agent of the owner, the operators of the private firm are committed to maximizing the profit of the company in the period of operation of the agent. The objective function of private firm is:

$$\pi_{t,P} = Y_{t,P} - r_{t,P}I_{t,P} - r_{t-1,P}K_{t-1,P} - w_{t,P}(1 - \varphi)H_t \quad (9)$$

Here, $\pi_{t,P}$ is the profit of private firm; $Y_{t,P}$ is the output of private firm; $(1 - \varphi)H_t$ and $K_{t-1,P}$ are the human capital input in period t and physical capital stock in the previous period; $I_{t,P}$ is the investment and financing scale of private firm in period t ; $r_{t,P}$ is the loan interest rate o; $w_{t,P}$ is the unit income of human capital.

To simplify the model, this paper ignores physical capital depreciation. Physical capital accumulation meets the following conditions:

$$K_{t,P} = I_{t,P} + K_{t-1,P} \quad (10)$$

The first-order conditions for private firm to maximize profits are:

$$I_{t,P} = \frac{\alpha_P}{1 - \alpha_P} \frac{w_{t,P}(1 - \varphi)H_t}{r_{t,P}} - K_{t-1,P} \quad (11)$$

It can be known from equation (11) that the main factors affecting the investment scale $I_{t,P}$ of

private firm include capital output elasticity α_p , loan interest rate $r_{t,p}$, and unit human capital wage $w_{t,p}$. The greater the capital output elasticity α_p , the more firm tends to adopt capital-intensive production mode. At this time, the firm sector will expand investment; otherwise, the investment in the enterprise sector will decrease. $r_{t,p}$ has a negative effect on investment, while the rise of $w_{t,p}$ has prompted the investment of firm.

3.3.2 State-owned firm

Similar to private firm, the production function of state-owned firm can be expressed as:

$$Y_{t,S} = K_{t,S}^{\alpha_S} (\varphi H_t)^{1-\alpha_S} \quad (12)$$

$Y_{t,S}$ indicates the output of state-owned firm in period t ; $K_{t,S}$ indicates the capital stock input of state-owned firm in period t , φH_t indicates the human capital investment of state-owned firm in period t , α_S and $1 - \alpha_S$ represent the output elasticity of physical capital and human capital, respectively.

State-owned firm also have the characteristics of “profit” and “sociality”:

- 1) profit is that state-owned firm pay equal attention to profits in terms of their own development;
- 2) sociality is that state-owned firm are not only the foundation of the socialist economy with Chinese characteristics, but also have certain policy functions. Therefore, in pursuit of profits, they also pursue the expansion of total assets. The investment objective function of state-owned firm in period t can be expressed as:

$$\pi_{t,S} = Y_{t,S} - r_{t,S} I_{t,S} - r_{t-1,S} K_{t-1,S} - w_{t,S} \varphi H_t + \phi (I_{t,S} + K_{t-1,S}) \quad (13)$$

Here, $\pi_{t,S}$ is the profit; $Y_{t,S}$ is the added value; φH_t and $K_{t-1,S}$ are the human capital stock in period t and Physical capital stock in previous period; $I_{t,S}$ is the investment and financing scale; $r_{t,S}$ is the loan interest rate; $w_{t,S}$ is the wage of human capital. Relative to the profit target, the weight of evaluation of the asset size is ϕ ; when ϕ rises, firm will pay more attention to the expansion of asset scale; the change of ϕ also reflects that the business objectives of state-owned firm may be affected by national policy factors.

Similar to the treatment of private firm, this paper ignores the depreciation of physical capital. The physical capital accumulation of state-owned firm meets the following conditions:

$$K_{t,S} = I_{t,S} + K_{t-1,S} \quad (14)$$

Here, $I_{t,S}$ represents the investment of state-owned enterprises in period t .

The first-order conditions for state-owned firm to maximize profits are:

$$I_{t,S} = \frac{\alpha_S}{1 - \alpha_S} \frac{w_{t,S} \varphi H_t}{r_{t,S} - \phi} - K_{t-1,S} \quad (15)$$

As is shown in equation (15), similar to private firm, the investment scale of state-owned firm $I_{t,S}$ is not only affected by capital output elasticity α_S , loan interest rate $r_{t,S}$ and wage rate $w_{t,S}$, but also affected by the target weight ϕ of the state-owned firm assets. The greater the target weight ϕ , the more state-owned firm attention to the expansion of asset scale in period t , and the corresponding increase in investment. At this time, the investment scale of state-owned firm will be higher than the scale of investment when pursuing profit maximization; on the contrary, the investment scale of state-owned firm will approach the scale of investment with the objectives of maximizing profits.

3.4 Comparative static analysis

According to equations (11) and (15), then can conclude the main factors affecting the investment scale of state-owned firm and private firm as table 1 is shown.

Table 1 Comparative static analysis results

Exogenous variable \ Endogenous variable	α_p	$r_{t,p}$	$w_{t,p}$	
$I_{t,p}$	+	-	+	
Exogenous variable \ Endogenous variable	α_s	$r_{t,s}$	$w_{t,s}$	ϕ
$I_{t,s}$	+	-	+	+

Note: The “-” indicates negatively correlated; “+” indicates positively correlated.

Define $D\alpha^{PS} = \alpha_p(1 - \alpha_s)/(1 - \alpha_p)\alpha_s$ indicates the difference in capital output elasticity; $Dw_t^{PS} = w_{t,p}/w_{t,s}$ the difference in unit human capital wage; and using $Dr_t^{PS} = r_{t,p}/(r_{t,s} - \phi)$ the difference in unit financing cost. At this time, equations (3-23) and (3-29) can be rewritten as:

$$Dk_t^{PS} = D\alpha^{PS}Dw_t^{PS}/Dr_t^{PS} \quad (16)$$

It can be known from equation (16) that the main factors affecting the efficiency of capital allocation include the difference in capital output elasticity, the difference in unit financing cost and the difference in unit human capital wage. The greater the difference in capital output elasticity between state-owned firm and private firm, the more credit capital of the finance sector flowing to state-owned firm. However, as the marginal returns of state-owned firm gradually decrease, the investment scale of state-owned firm will gradually shrink. At the same time, the investment of private firm will gradually increase. After market regulation, the distribution of credit capital between state-owned firm and private firm will reach the market clearing. The greater the difference in loan interest rates between state-owned firm and private firm, the greater the flow of credit funds from the finance sector to state-owned firm. However, due to the pursuit of asset size by state-owned firm, the marginal output of state-owned firm will be lower than the loan interest rate of the finance sector. In China’s socialist economic institutions, state-owned firm have both “profit” and “sociality” characteristics. As a result, state-owned firm do have rapid accumulation of physical capital, excessive investment, and low physical efficiency using the economic measurement indicators. Private firm faced with the difficulty of financing and limited capital accumulation.

PROPOSITION 2: Target difference and loan interest rate difference are the main factors affecting the difference in capital allocation efficiency between state-owned firm and private firm. If only used economic indicators to measure the efficiency of capital allocation, as long as the state-owned firm have the target weight of the asset size, the above-mentioned differences in capital allocation efficiency will always exist. Moreover, the marginal output of state-owned firm will be lower than the lending rate of the finance sector. However, state-owned firm’s loss of physical capital allocation can be compensated by institutional objectives gains. This phenomenon is determined by the characteristics of the Chinese economic institutions.

3.5 Economic equilibrium

Since it is assumed that there is no friction in the finance sector and only intermediary services are provided, its function is to completely convert the monetary capital from the household sector into credit capital, and allocate the credit capital to different ownership firm with different loan rate. When the financial market is cleared, the finance sector’s loan income from different ownership firm is equal to the sum of the household sector’s monetary capital interest income, which satisfies the following

conditions:

$$\begin{aligned} r_t M_t = & (1 - \tau)(1 - e_{t,S})(\alpha_S K_{t,S}^{\alpha_S - 1} (\varphi H_t)^{1 - \alpha_S} + \phi) I_{t,S} \\ & + (1 - e_{t,P}) \alpha_P K_{t,P}^{\alpha_P - 1} ((1 - \varphi) H_t)^{1 - \alpha_P} I_{t,P} \end{aligned} \quad (17)$$

Combining the equations (6), (7), (11), and (15) into (17), then can obtain:

$$\begin{aligned} r_t = & \frac{\mu + G}{1 + G} (1 - e_{t,S})(\alpha_S K_{t,S}^{\alpha_S - 1} (\varphi H_t)^{1 - \alpha_S} + \phi) \\ & + \frac{1 - \mu}{1 + G} (1 - e_{t,P}) \alpha_P K_{t,P}^{\alpha_P - 1} ((1 - \varphi) H_t)^{1 - \alpha_P} \end{aligned} \quad (18)$$

When the finance market is clear, the marginal output of capital and the loan interest rate between different ownership firms meet the following conditions:

$$r_{t,P} = r_{t,S} + \phi \quad (19)$$

The growth path of household sector consumption obtained by dynamic optimization is:

$$\begin{aligned} \frac{\dot{C}_t}{C_t} = & \left\{ \frac{\mu + G}{1 + G} (1 - e_{t,S})(\alpha_S K_{t,S}^{\alpha_S - 1} (\varphi H_t)^{1 - \alpha_S} + \phi) \right. \\ & \left. + \frac{1 - \mu}{1 + G} (1 - e_{t,P}) \alpha_P K_{t,P}^{\alpha_P - 1} ((1 - \varphi) H_t)^{1 - \alpha_P} \right\} \frac{1}{\theta} - \frac{\rho^H}{\theta} \end{aligned} \quad (20)$$

According to equation (2) and the perpetual inventory method of physical capital accumulation, the capital accumulation equations of state-owned firm and private firm are:

$$\dot{K}_{t,S} = \frac{\mu + G}{1 + G} (K_{t,S}^{\alpha_S} (\varphi H_t)^{1 - \alpha_S} + K_{t,P}^{\alpha_P} ((1 - \varphi) H_t)^{1 - \alpha_P} - C_t) \quad (21)$$

$$\dot{K}_{t,P} = \frac{1 - \mu}{1 + G} (K_{t,S}^{\alpha_S} (\varphi H_t)^{1 - \alpha_S} + K_{t,P}^{\alpha_P} ((1 - \varphi) H_t)^{1 - \alpha_P} - C_t) \quad (22)$$

Define $c_t = C_t/H_t$ as the unit human capital consumption; $k_{t,S} = K_{t,S}/\varphi H_t$ state-owned firm unit human capital physical capital; $k_{t,P} = K_{t,P}/(1 - \varphi)H_t$ private firm unit human capital physical capital. According to (3-34), (3-35), and (3-36), then can obtain:

$$\frac{\dot{c}_t}{c_t} = \left\{ \frac{\mu + G}{1 + G} (1 - e_{t,S})(\alpha_S k_{t,S}^{\alpha_S - 1} + \phi_t) + \frac{1 - \mu}{1 + G} (1 - e_{t,P}) \alpha_P k_{t,P}^{\alpha_P - 1} \right\} \frac{1}{\theta} - \frac{\rho^H}{\theta} \quad (23)$$

Then, the capital accumulation equations of state-owned firm and private firm are:

$$\dot{k}_{t,S} = \frac{\mu + G}{1 + G} (k_{t,S}^{\alpha_S} + \frac{1 - \varphi}{\varphi} k_{t,P}^{\alpha_P} - \frac{1}{\varphi} c_t) \quad (24)$$

$$\dot{k}_{t,P} = \frac{1 - \mu}{1 + G} (\frac{\varphi}{1 - \varphi} k_{t,S}^{\alpha_S} + k_{t,P}^{\alpha_P} - \frac{1}{1 - \varphi} c_t) \quad (25)$$

The economic system can be described by three differential equations of equations (23), (24), and (25) containing $k_{t,S}$, $k_{t,P}$ and c_t .

3.6 Balanced growth path

The economic system satisfies the condition at steady state, $\dot{c}_t/c_t = 0$, $\dot{k}_{t,S}/k_{t,S} = 0$ and $\dot{k}_{t,P}/k_{t,P} = 0$. At this time, the solution is that the economic system is in equilibrium when consumption is c_t^* , the state-owned firm unit human capital physical capital stock $k_{t,S}^*$ and the private enterprise unit human capital physical capital stock $k_{t,P}^*$:

$$k_{t,S}^* = \left(\frac{\alpha_S(1 - e_{t,P} + \frac{\mu + G}{1 + G}(e_{t,P} - e_{t,S}))}{\rho^H - \phi(1 - e_{t,P} + \frac{\mu + G}{1 + G}(e_{t,P} - e_{t,S}))} \right)^{\frac{1}{1-\alpha_S}} \quad (26)$$

$$k_{t,P}^* = \left(\frac{\alpha_P(1 - e_{t,P} + \frac{\mu + G}{1 + G}(e_{t,P} - e_{t,S}))}{\rho^H} \right)^{\frac{1}{1-\alpha_P}} \quad (27)$$

$$c_t^* = \varphi(k_{t,S}^*)^{\frac{\alpha_S}{1-\alpha_S}} + (1 - \varphi)(k_{t,P}^*)^{\frac{\alpha_P}{1-\alpha_P}} \quad (28)$$

PROPOSITION 3: Only when the parameter satisfies the following condition $0 < \rho^H - \phi(1 - e_{t,P} + \frac{\mu + G}{1 + G}(e_{t,P} - e_{t,S}))$, there may be a balanced growth path in the economic system.

Proposition 3 states: (i) appropriate policy objectives can help resolve market failures and promote economic growth; (ii) state-owned firm should aim at the asset weights in coordination with policy objectives. If Proposition 3 is not met, there is no stable equilibrium point in the economic system, or even if there is an economic equilibrium point, the equilibrium point is extremely unstable, and any slight disturbance will cause the economic system to permanently deviate from the equilibrium point.

According to equation (26) and (27), the factor of influence on the scale of investment in the equilibrium state $k_{t,\chi}^*$ is not only affected by the elasticity of capital output α_χ , but also by the cost of default of the enterprise $e_{t,\chi}$, the maturity of the financial market μ and the impact of the policy factor G . The greater the capital output elasticity α_χ , the more the firm sector tends to adopt capital-intensive production mode, and then the firm sector will expand investment to accumulate capital. The higher the enterprise's default cost $e_{t,\chi}$, the higher the financing cost set by the finance sector for its loans, the lower the investment scale, and the lower the unit's human capital physical capital stock. The closer the maturity of the finance market μ to 1/2, the less evaluation difference of the finance sector between different ownership firm. The smaller the difference in investment scale obtained by the enterprise sector, the smaller the difference in capital stock between different ownership enterprises. The higher the policy influencing factor G , the more finance sector investment will be biased towards state-owned firm. The investment scale of state-owned firm will continue to expand. The balance of human capital and physical capital will increase during the equilibrium, while the scale of investment obtained by private firm will continue to decrease, the stock of capital physical capital decreased. In addition to the above-mentioned common factors affecting the physical capital stock of unit human capital in the equilibrium of different ownership firm, the object weight ϕ of the pursuit of asset scale expansion in the decision-making of state-owned firm is also positive for the physical capital stock. If ϕ increases, state-owned firm will expand the current investment, and the investment scale will be higher than the single target profit maximization; on the contrary, state-owned firm will reduce the current investment scale. From the perspective of economic indicators, there is indeed a loss of economic efficiency in state-owned firm investment. However, from the perspective of policy and institutional indicators, the economic efficiency loss of state-owned firm can be compensated by their policy efficiency and institutional efficiency. It is worth noting that the scale of firm investment $k_{t,\chi}^*$ in equilibrium state has no relationship with the distribution share of human capital between state-owned firm and private firm. All the results are shown in table 2.

PROPOSITION 4: Under the environment of the current economic institutions, when the market is clear, the physical capital stock of the private firm is equal to the capital stock when profit maximization;

while the state-owned firm pursues the maximization of profit and takes into account the expansion of the asset scale, the physical capital stock is greater than the capital stock when the profit is maximized. From the economic indicators, the state-owned firm do have economic efficiency losses, but from the perspective of policy and institutional indicators, the economic efficiency loss of state-owned firm can be compensated through their policy efficiency. When the parameters meet the following conditions: when the goal of state-owned firm is gradually simplistic, that is, the pursuit of asset size by state-owned firm approaches zero when $\phi \rightarrow 0$. At this time, the investment objective of state-owned firm is consistent with that of private firm, and they are all pursuing profit maximization. The model is standard firm sector in new classic economic growth.

Table 2 Comparative static analysis results

Exogenous variable	α_p	$e_{t,p}$	μ	G	
Endogenous variable					
$I_{t,p}$	+	-	+	-	
Exogenous variable	α_s	$e_{t,s}$	μ	G	ϕ
Endogenous variable					
$I_{t,s}$	+	-	+	+	+

Note: The “-” indicates negatively correlated; “+” indicates positively correlated.

4. Regression analysis

4.1 Econometric model

In order to simplify the model, this section makes the following assumptions: 1) Whether state-owned firm or private firm, the output elasticity of physical capital and human capital is constant; 2) the human capital of state-owned firm and private firm is homogeneous, besides the change in the share of human capital is approximately zero. Based on the above assumptions, the Taylor series expansion of the equation (3-30), taking its constant term and the approximation of the first term, can obtain the difference equation of the per capita investment of the firm sector:

$$\Delta Dk_t^{PS} = a_0 + a_1 \Delta Dr_t^{PS} + a_2 \Delta Dw_t^{PS} \quad (29)$$

Then, the regression econometric model as follows:

$$\Delta Dk_t^{PS} = a_0 + a_1 \Delta Dr_t^{PS} + a_2 \Delta Dw_t^{PS} + \varepsilon_t \quad (30)$$

4.2 Data description

The research sample of quantitative analysis in this paper is private industrial enterprises and state-owned industrial enterprises. The main data used in this paper are taken from the “China Statistical Yearbook”, “China Labor Statistics Yearbook”, “China Industrial Economics Statistical Yearbook” and “China Financial Statistics Yearbook”. Other parts of the data are further measured based on available data. The years of the time series data in this paper was 1999-2017, because the starting year of the hierarchically education employee data was available from 1998. In the statistical yearbook, the statistics of the industrial enterprise sector are divided into three categories: state-owned and state-controlled industrial enterprises, private industrial enterprises, foreign investment industrial enterprises including Hong Kong, Macao and Taiwan. This paper selects the statistical data of state-owned and state-controlled industrial enterprises and private industrial enterprises as the approximation of the data of state-owned

industrial enterprises and private industrial enterprises.

For the *economic output*, this paper used value added tax of industrial added value as a substitute for the output of the industrial sector. About the data of *physical capital stock* and *human capital stock* details see Li et al. (2018)

Per capita capital stock difference. The difference in the per capita capital stock of the enterprise sector is equal to the per capita physical capital of the private industrial enterprises compared with the per capita physical capital of the state-owned industrial enterprises.

Per capita wage difference. The wage difference in the enterprise sector is equal to the per capita wage of private industrial enterprises compared with the per capita wage of state-owned industrial enterprises. As the data on per capita wages of private and state-owned industrial enterprises is not available, this paper selects the “*Annual Survey of Urban Non-Private Units and the Index-State-owned Units*” in the “*China Statistical Yearbook*” as the proxy variable of the per capita wage of state-owned industrial enterprises. The average wages and indices of non-private units in cities and towns-other units are similar to the proxy variables of per capita wages of private industrial enterprises. According to the data of agency variables, the wage difference of enterprise departments is further calculated.

Financing price difference. The difference in financing prices of the finance sector between different firm sectors is not only affected by the respective credit qualification information of the enterprises, but also by the maturity of the financial market. As the development of China’s financial market is not mature enough, the direct financing channels of the finance sector are subject to many restrictions, resulting in the financing mainly by indirect financing, which makes the financial intermediary structure such as banks play an important role in the financial market. China’s banking sector is dominated by large state-owned commercial banks, supplemented by other commercial banks. Large state-owned commercial banks have a monopoly position in large-scale assets, and market competition often lacks market competition, which leads to low efficiency of the financial system; non-state-owned joint-stock commercial banks have small assets, and daily investment activities are full of market competition, thereby improving the financial system. Based on the above considerations, this paper selects the ratio of the total assets of large state-owned commercial banks and joint-stock banks as the proxy variable of the difference in financing prices. All the data of each variable is shown in Appendix.

4.3 Regression result

4.3.1 Financing constraint difference

The regression results of the econometric model (Equation 30) are shown in Table 3. The results of the gradual regression of Model 1-3 show that the difference in financing constraints and the difference coefficient of wage levels are both above the 1% level. The goodness of fit of Model 1-3 are all above 80%, indicating that the overall interpretation of the model is better.

Among them, the difference of financing constraints has a significant negative impact on the difference of per capita capital stock of industrial enterprises. The difference of per capita wages of enterprises has a significant positive impact on the difference of per capita capital stock of industrial enterprises. The results verify the conclusions of the previous method. The third column of Table 3 shows that the elastic coefficient of Dt^{PS} to Dk^{PS} is -0.10, that is, when the difference in financing constraints is reduced by 1%, the difference in per capita capital stock of industrial enterprises will be reduced by 0.1%. That is to say, the asset size of large state-owned banks is lower than that of joint-stock banks, and the competition between banks is strengthening. The difference in financing prices between private industrial enterprises and state-owned industrial enterprises in financial markets is also gradually

decreasing. It helps to reduce the difference in the per capita capital stock of industrial enterprises. The elastic coefficient of Dw^{PS} to Dk^{PS} is 0.63, that is, when the per capita wage difference increases by 1%, the difference in per capita capital stock of industrial enterprises will increase by 0.63%. That is to say, if the per capita wage of private industrial enterprises continues to expand relative to the per capita wages of state-owned enterprises, private industrial enterprises will turn to capital-intensive investment, which will increase the per capita capital stock of private industrial enterprises, which also reflects the relationship between capital and labor. An alternative role in the production process of an enterprise.

Table 3 Regression results

Independent Variable	ΔDk^{PS}		
	1	2	3
ΔDk^{PS}	-0.21*** (-8.9)		-0.10** (-3.2)
ΔDw^{PS}		1.06*** (10.0)	0.63*** (4.0)
Cons	0.99*** (12.5)	-0.90*** (-7.3)	-0.08 (-0.3)
N	20	20	20
R ²	0.8136	0.8466	0.9037
AdjR ²	0.8033	0.838	0.8924
F 值	82.7	99.3	79.78

Notes: ***, **, * are the 0.1%, 1% and 5% of the statistical significant level

4.3.2 Investment effect difference between different ownership enterprise

The regression results are shown in Table 4. The results of the gradual regression of Model 1-5 show that the input and output elasticity coefficients of physical capital and human capital are significantly positive at the significant level of 0.1%, indicating that physical capital investment and human capital investment have significant promotion effect on economic output of industrial enterprises. The goodness of fit of Model 1-5 are all above 92%, indicating that the overall interpretation of the model is better.

Table 4 Regression results

Independent Variable	lnY				
	1	2	3	4	5
lnK ^S	1.78*** (18.8)			0.92*** (11.2)	0.90*** (13.1)
lnK ^P		0.53*** (19.4)		0.28*** (11.5)	0.20*** (5.6)
lnH			1.61*** (14.7)		0.29** (3.0)
Cons	-10.89*** (-10.4)	3.86*** (14.8)	-6.67*** (-8.8)	-3.94*** (-5.6)	-5.70*** (-6.9)
N	20	20	20	20	20
R ²	0.9517	0.9541	0.9226	0.9945	0.9965

AdjR ²	0.9490	0.9516	0.9183	0.9939	0.9958
F	354.4	374.4	214.5	1538	1498

Notes: ***, **, * are the 0.1%, 1% and 5% of the statistical significant level

As is show in econometric model 5 the output elasticity of human capital investment in industrial enterprises during the period of 1998-2017 is 0.29, the elasticity of input and output of physical capital in state-owned industrial enterprises is 0.90, and the output elasticity of physical capital investment in private industrial enterprises 0.20. The total output of physical capital is more effective than human capital, which also verifies the investment-driven economic development model of China's industrial enterprises in the past 20 years. Besides, the sum of human capital and capital output elasticity is greater than 1, reflecting the current economic expansion of industrial enterprises has increase in the scale of returns. The economic output of industrial enterprises still has a certain expansion space. However, in terms of subdivision, state-owned industrial enterprises have the highest capital output elasticity, human capital's output elasticity is in the middle, and private industrial enterprises have the lowest capital output elasticity, indicating that state-owned industrial enterprises adopt capital-biased production methods, which further verify state-owned industrial enterprises undertake more basic investment and strategic infrastructure for stable economy. While private industrial enterprises adopt human capital-biased production methods. The reason may be that private industrial enterprises are more constrained under the condition that financing is strictly restricted. It tends to maximize short-term economic profits while human capital is the short-term optimal variable.

5. Conclusion

“Price discrimination” related to property ownership in China's financial market is main financing problem. Compared with the private firm sector, the investment scale of the state-owned firm sector is obviously more expansionary, which corresponds to the problem of overcapacity and low return on investment. According to economic indicators, the efficiency of factor allocation is obviously “sub-optimal” or low. However, from another perspective, since the reform and opening up, the Chinese economy has maintained a long-term, medium- and high-speed growth ahead of the world, and national income has continued to increase. The coexistence of medium- and high-speed economic growth and inefficient factor allocation is not convincingly explained by the popular neoclassical economic theory. On the one hand, the difference in financing conditions between state-owned firm and private firm is undeniably related to property ownership factors, which is related to institutional factors. On the other hand, one of the characteristics of China's economic operation is government-driven and policy-led. In reality, the impact of government services related to China's economic institutions on economic operations can often be observed. These institutional factors may be one of the reasons for the rapid growth of China's economy.

This paper considered economic institutions as exogenous variables affecting economic growth and added financial sector, state-owned and private firm sectors with different operation objectives under the framework of new classical economic growth model, which expands the new classical economic growth method. Based on above framework, this paper studied how the operation objectives affect the investment of different ownership enterprises, and analyzes the impact of economic institutions on long-term economic growth on a balanced growth path. In order to test the above expanded economic growth model, this paper used the data from 1997 to 2017 to empirically verify the results of theoretical analysis. The study found that under the frame of China's economic institution the differences in ownership and financing costs between state-owned firm sector and private firm sector were the main factors affecting the efficiency of capital allocation. In addition to the impact of input on factors of production, the path

of economic growth was also affected by economic institutions.

Compliance with Ethical Standards:

Conflict of Interest: I declare that I have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of the manuscript entitled

Ethical approval: This article does not contain any studies with human participants performed by any of the authors.

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