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The behavior of private entrepreneurs in an imperfect financial market

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Abstract

In this paper, we investigate the behavior of private entrepreneurs when an instrument that mitigates financing constraints is introduced in an imperfect financial market. If entrepreneurs face limitations on renting capital, it is optimal to accept the relaxation of financing constraints to overcome this obstacle to growth. However, acceptance involves a reduction in the efficiency of production. In this simulation exercise, we show that private entrepreneurs are likely to accept the relaxation of financing constraints to enable rapid growth in the early stages of the reform; however, they will reject it when the deterioration in production dominates the benefit from capital financing.

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1. Introduction

The Chinese economy has experienced rapid economic growth since economic reform initiatives commenced in December 1978. According to the China Statistical Yearbook (2018), the average real annual growth rate of per capita gross domestic product (GDP) was 8.6% from 1978 to 2017; thus, China was the most rapidly growing economy in the world during this period. However, Chinese economic growth has slowed recently. The real annual growth rate of per capita GDP in 2014 was 6.8%, which was the first time since the turn of the century that a growth rate below 7% had been recorded. Many consider this slower growth to be the "new normal" in China's economic development. A striking feature of the Chinese macroeconomy was the decrease in capital investment. The real average growth rate of total investment in fixed assets for the whole country was 19.8% during 2000–2010, 11.0% during 2011–2017, and almost 0% in 2017.

The purpose of this paper is to provide a theoretical explanation of the tendency for fixed capital investment to decline in China's recent economic development history. For this task, we concentrate on the change in the composition of investment between the state sector and the nonstate sector. First, according to Figure 1, the ratio of real fixed asset investment between Private and State was below 1 until 2003, which means the main investor before 2003 was the state sector.[1] However, after 2003, this picture changed completely. The private sector's fixed asset investment rapidly exceeded that of the state sector; the magnitude of investment by the private sector was nearly 3.5 times larger than that of the state sector in 2017. In other words, the private sector has become the main source of fixed asset investment in China. Second, the real growth rate of fixed asset investment differs between these two sectors. In particular, the real growth rate was extremely high in the private sector during the 2000s; however, this momentum declined from the end of that decade, and the growth rates of these two sectors have been very close after 2010. Therefore, the nonstate sector initially contributed most to high investment levels, followed by a cooling down of that sector leading to total investment of a relatively low level in recent years.[2]

To capture the evolution of fixed asset investment between the state and nonstate sectors, we focus on resource reallocation from the state sector to the private sector under China's imperfect financial markets. Our main assumption in the model is that, in the context of imperfect financial markets, there exists an instrument that assists private enterprises when they face collateral constraints. However, acceptance of the instrument comes at the cost of productivity deterioration. The theoretical prediction of the model is that in the early stages of reform, private entrepreneurs tend to respond to the relaxation of financial constraints to achieve rapid growth, but they will reject it when deterioration in profitability dominates the benefits from capital financing. That is, in the initial stages, the private sector will expand rapidly because of the easier access to loans. However, when the sector reaches a certain size,

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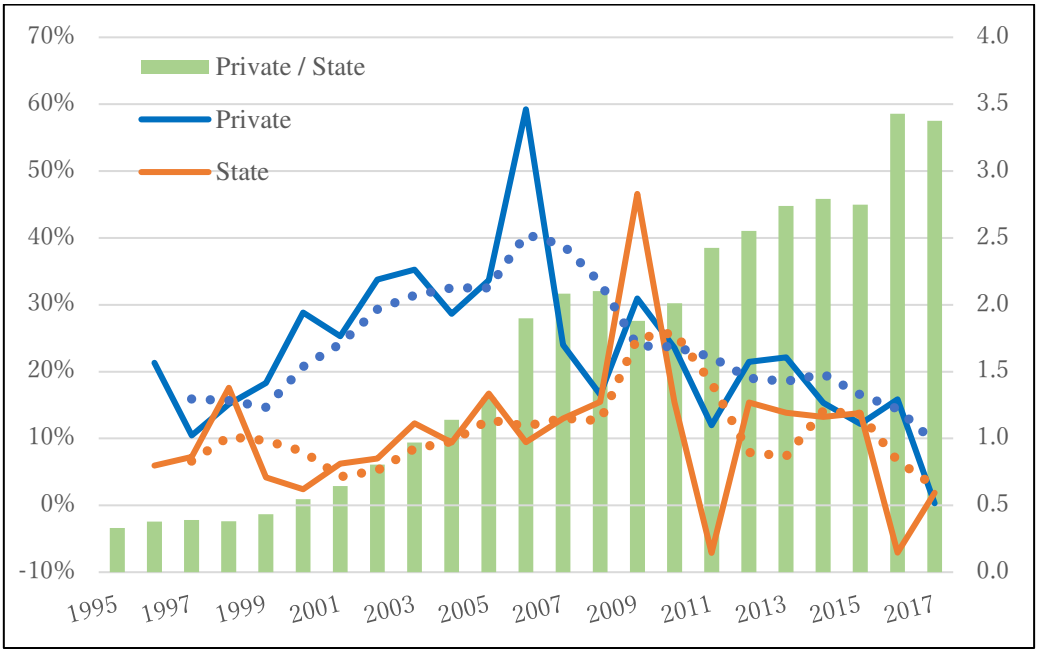
[1] We use the classification of the China Statistical Yearbook. The state sector is the "State-owned" category, while the private sector is total fixed asset investment excluding "State-owned", "Collective-owned", "Funds from Hong Kong, Macao, and Taiwan", and "Foreign Funded".

[2] Even when the private sector is dominant in terms of capital investment flows, some consider that the state sector continues to dominate in terms of capital stock. Brandt *et al.* (2013) estimate capital stock by province for 1978–2007 and find that the scale of the total capital stock in the private sector in 2007 was approaching the non-infrastructure capital stock in the state sector. Furthermore, as the phenomena of *Guo Jin Min Tui* (i.e., "the state advances and the private sector retreats") began to be discussed in the media and by academia from around 2010, this may indicate that the state capital stock continues to exceed that of the private sector.

it will shift to a management stance emphasizing efficiency and the speed of capital investment will decline. This result is consistent with the observation of China's macroeconomic data in recent years. In particular, it is a convincing theoretical interpretation of the development of strong capital investment in the private sector, even though the sector faces borrowing restrictions in China's imperfect financial markets.

Figure 1: Fixed asset investment by ownership



Note: The left axis represents the fixed asset investment growth rate. The right axis represents the Private to State share of fixed asset investment. The blue solid line plots the fixed asset investment growth of the private sector while the orange solid line plots the fixed asset investment growth of the state sector. The green bar is the Private to State ratio of fixed asset investment. The dotted lines are the 3-term moving average of fixed asset investment growth rates. Source: China Statistical Yearbook (several years).

The Chinese financial markets are still developing. As Allen et al. (2008) note, China's four largest state-owned banks largely continue to control the banking system. Huang (2004) notes that commerce banks have a political pecking order that gives preferential access to state-owned enterprises and collectively owned units. Barnett and Brooks (2006) and Knight and Ding (2010) show the importance of retained earnings and informal funds to Chinese enterprises. Guariglia et al. (2011) use panel data on Chinese firms and find evidence of discrimination in access to credit for private sector firms. Poncet et al. (2010) use firm-level data for China from the Oriana data set, which shows that private Chinese firms depend more on internally generated funds for their investments than do state-owned firms, and that they appear to be more credit constrained, which impedes their growth. Furthermore, it is paradoxical that strong capital investment is occurring despite the adverse lending environment in the private sector. For example, Ding et al. (2019) find that overinvestment is observed for all types of firms, even in the most efficient and profitable private sectors.

Why can private sector growth be that fast even when the financial market was so imperfect? We rely on the political system in China. Blanchard and Shleifer (2001) and Zhou (2004, 2007), among others, mention that local government officials have strong political incentives to promote local economic growth in China. Chen et al. (2011) empirically

investigate government intervention and investment efficiency in China. Therefore, in this paper, we assume that private firms' financial constraints can be relaxed by their local government; however, financing in this way reduces productivity because this funding is diverted by the government to local economic growth.

The model setup in this paper is similar to those in Song et al. (2011), Buera and Shin (2013), and Curtis (2016), all of whom consider financial market imperfections. Song et al. (2011) focus on growth during the transition since China's 1992 reforms. Buera and Shin (2013) introduce entrepreneurial choice to study transitional economies facing imperfect financial markets. Curtis (2016) extends Buera and Shin (2013) to a two-sector model including state and private sectors. In this paper, motivated by the evidence discussed above, we introduce a new instrument that mitigates financing constraints for the private sector in an imperfect financial market. However, the relaxation of financing constraints is achieved at the expense of efficient production; therefore, there is a trade-off between the alleviation of financial constraints and productive efficiency in the private sector. The main contribution of this paper is that we, for first time, introduce an alternative mechanism by which firms are able to circumvent financial constraints, which was not mentioned in previous research.

The remainder of the paper is organized as follows. Section 2 describes the model. In Section 3, after explaining the simulation exercise, we provide discussions of the results. Finally, Section 4 concludes this paper.

2. The model

In this section, we describe the model used in this paper. The model setup is similar to Curtis (2016), but we introduce a new mechanism, as we explain below.

There are two sectors: i.e., state and private sectors. The state sector enjoys free access to financial markets, whereas the private sector faces imperfect capital rental markets. Therefore, the private sector entrepreneurs need to accumulate internal reserves when they encounter collateral constraints. Furthermore, this situation provides an incentive for the private sector entrepreneurs to accept the instrument that alleviates financial constraints if it assists in running their businesses.

All agents in the economy have heterogeneous individual levels of talent in operating a firm, e, drawn from a time-invariant distribution $\mu(e)$, which follows a Pareto distribution. In this model, we assume that the distribution of talent in both sectors is identical. In addition, agents have heterogeneous wealth levels, with wealth accumulated via savings.

In both sectors, an agent makes an occupational decision to work as an employee or to operate a business in every period. This decision depends on their talent in running a firm and their access to capital markets. Every agent has one unit of labor that can be utilized only in one activity. Employees are employed in firms in a common labor market and move freely between sectors.

In the state sector, if an agent optimally chooses to run a business, he or she becomes a manager; otherwise he or she works as an employee. In the private sector, there are two decisions to be made by an individual. In step one, as in the state sector, an individual decides whether to operate a business and become an entrepreneur or to work for a wage. In the second step, the entrepreneur decides whether to accept the alleviation of financing constraints. If he or she accepts, the entrepreneur receives greater financial support from the capital markets, but the company's production efficiency declines at the same time. If the entrepreneur rejects the option to alleviate the financing constraints, then he or she can only borrow a limited amount from the financial markets to run the business, but the company's production efficiency is higher.

2.1. The state sector

A representative state sector household is comprised of S members in the state sector. The household lifetime utility is given as:

$$E_t \sum_{t=0}^{\infty} \beta^t S \frac{(C_t/S)^{1-\sigma}-1}{1-\sigma} \tag{1}$$

where β is the subjective discount factor, σ is the coefficient of relative risk aversion, S is the member of the state sector household, and C_t denotes the total household consumption. Each household member consumes an equal share of the aggregate consumption in the state sector.

The production function follows the Lucas (1978) span-of-control production technology:

$$y_t = e k_t^{\alpha} (z_t l_t)^{\theta} \tag{2}$$

where y_t is the final good, k_t is capital, l_t is labor, α is the capital income share, and θ is the labor share of output. We assume that $\alpha + \theta < 1$, which implies that profit is $(1-\alpha-\theta)y_t$.[3] z_t indicates the productivity process, which is identical for all establishments, and evolves according to $z_t = g z_{t-1}$, where g is the exogenous growth.

The profit function is given as:

$$\pi_t^S(e; w_t, R_t) = \max_{k_t, l_t} \left\{ e k_t^{\alpha} (z_t l_t)^{\theta} - w_t l_t - R_t k_t \right\} \tag{3}$$

where R_t is the capital rental rate, r_t is the interest rate, δ is capital depreciation, and $R_t = r_t + \delta$. Each manager hires labor at wage w_t and rents capital from the freely accessible financial markets. The capital rental rate and wage are determined in the competitive factor markets.

Next, consider the individual's problem. In every period, individuals choose their occupation by comparing which occupation pays the most. An agent chooses to manage a firm if his or her talent is greater than or equal to $\underline{e}$, which implies that the indirect profit function is $\pi_t^S(\underline{e}; w_t, R_t) = w_t$. The budget constraint for each individual in the household is given by:

$$c_t + a_{t+1} \leq \int_{\underline{e}}^{\infty} \pi_t^S(e; w_t, R_t)\mu(de) + \int_0^{\underline{e}} w_t \mu(de) + (1 + r_t)a_t \tag{4}$$

and

$$a_{t+1} \geq 0 \tag{5}$$

where a is the individual's assets and $a_{t+1} \geq 0$ indicates that agents are not allowed to borrow from the financial markets.

2.2. The private sector

The private sector consists of N members who are heterogeneous in entrepreneurial talent e and wealth a. Each individual retains his or her entrepreneurial talent with probability γ and loses this ability with probability $1-\gamma$. After an entrepreneur loses his or her talent, a new ability is drawn from the distribution. However, in the state sector, the persistence of

[3] The lower-case letter variable represents the per capita notation.

talent is permanent, i.e., $\gamma = 1$, which allows the state sector to survive over time. Therefore, in the private sector, the time subscript t is attached to the entrepreneurial talent e_t, which is drawn from the same distribution as in the state sector.

Agents maximize their lifetime utility over a single consumption good:

$$E_t \sum_{t=0}^{\infty} \beta^t \frac{{c_t}^{1-\sigma}-1}{1-\sigma} \tag{6}$$

where the preference parameters are identical to those in the state sector.

As in the state sector, agents choose their occupation in every period, either working for a wage or running a firm as an entrepreneur. Private entrepreneurs can access the financial markets similarly to the state sector. However, in contrast to managers in the state sector, private entrepreneurs have a limited borrowing capability, given by the collateral constraint $k_t \leq \lambda a_t$, where the parameter λ dictates the magnitude of capital market imperfections. A higher λ means the entrepreneur can borrow more for investment via financial intermediaries, indicating that financial markets are more complete. Following the same production technology, the profit function is given by:

$$\pi_t(a_t, e_t; w_t, R_t) = \max_{k_t, l_t} \{ e_t k_t^{\alpha} (z_t l_t)^{\theta} - w_t l_t - R_t k_t \} \tag{7}$$

subject to:

$$k_t \leq \lambda a_t \tag{8}$$

In the private sector, an individual chooses sequences of consumption c and saving in a risk-free asset a. If the individual becomes an entrepreneur, he or she has two decisions to make. In step one, he or she decides whether to work as an employee or to run a business as an entrepreneur. The decision rule depends on his or her entrepreneurial talent e_t and the asset he or she holds. The indirect profit function $\pi_t^S \left(\underline{a_t}(e_t), e_t; w_t, R_t \right) = w_t$ implies that an individual with talent e chooses to operate an establishment only if his or her current assets are greater than or equal to $\underline{a}(e)$.

In this paper, in contrast to Curtis (2016) and Buera and Shin (2013), we introduce a new decision choice for an entrepreneur in the private sector. In China, financial markets are incomplete and state-owned commercial banks comprise a large share of lending operations. Local governments tend to support projects that contribute to regional economic growth, which they want to prioritize. Private companies have a high demand for funds in the early stages of entrepreneurship and loans from banks are valuable. State-owned banks, which facilitate the governments' policy intentions, give priority to projects that contribute to regional economic growth, regardless of whether a project is delivered by state-owned or private-owned enterprises. However, loan acceptance for the private enterprises is accompanied by a loss of production efficiency. For example, in return for state bank loans, the enterprises may be required to make investments that boost GDP, or to hire executives who lack corporate management experience but have connections to government, or to spend money to build a better relationship with the government. As a result, there is a trade-off between the alleviation of financing constraints and production efficiency in the private sector.[4] If the entrepreneur accepts the relaxation of financial constraints, then he or she can

[4] As managers have free access to the financial markets, we assume there is no such trade-off in the state sector.

rent more capital from the financial market $\widetilde{k_t} = \lambda_2 a_t,\ \lambda_2 > \lambda$, where λ_2 indicates the degree of financial relaxation. Meanwhile, the product function becomes $\widetilde{y_t} = Ae\tilde{k}^{\alpha}\left(z_t\widetilde{l_t}\right)^{\theta}$, where $A < 1$, which implies that productivity deteriorates by A. If $\tilde{\pi}_t > \pi_t$, where $\tilde{\pi}_t$ is the profit when accepting the alleviation of financial constraints, then choosing financial alleviation is rational for the private entrepreneurs in period t.

The budget constraint in the private sector is:

$$c_t + a_{t+1} \leq \max\{\Pi_t(a_t(e_t), e_t; w_t, R_t), w_t\} + (1 + r_t)a_t \tag{9}$$

and

$$a_{t+1} \geq 0 \tag{10}$$

where $\Pi_t(a_t(e_t), e_t; w_t, R_t) = \begin{cases} \tilde{\pi}_t & if\ \tilde{\pi}_t > \pi_t \quad accepting\ the \text{ financing relaxation} \\ \pi_t & if\ \tilde{\pi}_t \leq \pi_t \quad rejecting\ the \text{ financing relaxation} \end{cases}$ and the *max* operator captures the choice between operating an establishment as an entrepreneur or becoming an employee.

2.3. Competitive equilibrium

For a given sequence of prices $\{w_t^*, r_t^*, R_t^*\}$ for all $t \geq 0$, a competitive equilibrium is defined as one that 1) solves the individual's (household's) problem; and 2) causes all markets to clear.

3. Simulation results and discussion

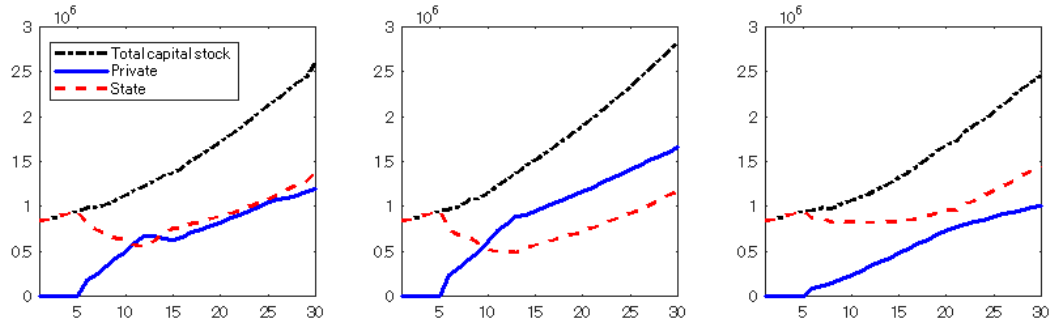
The main purpose of this simulation exercise is to determine the effect on capital accumulation in the state and private sectors from the introduction of the new mechanism that relaxes financing constraints. Therefore, we adopt the model parameter values from Curtis (2016), except for the degree to which financing constraints are alleviated, λ_2, and the productivity inefficiency, A.[5] As there is little literature regarding appropriate values for λ_2 and A, in this simulation exercise, we experimentally set three cases as follows: $\lambda_2 = 3$ and $A = 0.94$ in case 1; $\lambda_2 = 3$ and $A = 1$ in case 2; and $\lambda_2 = 1.435$ and $A = 1$ in case 3, which is based on the original case of Curtis (2016). In case 1, if the entrepreneur accepts the alleviation of financing constraints, he or she can borrow capital equivalent to three times the value of the firm's internal reserves but, as a trade-off, production efficiency will decline by 6%. In case 2, the private entrepreneur can enjoy the same degree of alleviation of financial constraints as in case 1, but he or she can avoid the production inefficiency. For simplicity, if the entrepreneur rejects the relaxation of financing constraints, he or she can finance investment only from his or her own internal reserves, i.e., $\lambda = 1$. In case 3, entrepreneurs can borrow 1.435 times their internal reserves from the financial markets, with no reduction in production efficiency.

As in Curtis (2016), we assume that there is a sudden reform in the economy that allows private companies to enter in period 5; therefore, the capital stock of a private enterprise is zero from periods 0 to 5 and capital formation starts after period 5. The left panel of Figure 2 plots the simulation result for case 1. The state sector's share of capital stock is declining, whereas that of the private sector is expanding. The speed of capital accumulation is very

[5] Our purpose is to determine the qualitative effect of introducing the new mechanism in the private sector. In future, we will extend the model and undertake more detailed investigations to build on this first step.

high in the early stages immediately after the reform. However, it becomes slower and the capital scale between the two sectors is reversed again around period 13.[6] The middle panel of Figure 2 shows the result for case 2. As there is no production inefficiency, the private sector increases rapidly in the early stages after the reform, and the capital stock in the private sector consistently exceeds that in the state sector after period 10. The right panel in Figure 2 shows the original case of Curtis (2016), in which the state sector shrinks gradually and the private sector expands slowly, but never has the chance to surpass the state sector.

Figure 2: Capital accumulation after economic reform



case 1: $\lambda_2 = 3,\ A = 0.94$ case 2: $\lambda_2 = 3,\ A = 1$ case 3: $\lambda_2 = 1.435,\ A = 1$

Note: The economy implements a sudden reform that allows private companies to enter in period 5. The figure plots the simulation results of cases 1, 2, and 3 (discussed in the text) in the left, middle, and right panels, respectively.

Why do the private entrepreneurs tend to accept the relaxation of financing constraints in the early stages after the reform and reject it in later periods? The reason relates to the properties of the Cobb–Douglas production function. The marginal product of capital is high when the capital stock is low, which means that, in the early stages after the reform, the increment of the marginal product of capital is higher than the production loss from accepting the alleviation of financing constraints. However, when the scale of capital stock increases, the increment of the marginal product of capital declines, and becomes dominated by the loss of production efficiency. Table 1 shows this circumstance (simulation case 1). In the first period after the economic reform, all entrepreneurs accept the alleviation of financing constraints. Entrepreneurs who refuse to accept it begin to appear from the second period and, as time goes on, their numbers increase.

According to our assumption, there is a trade-off between the relaxation of financial constraints and productive efficiency in the private sector. Therefore, productivity is lower during the early stage of a firm's growth because firms accept financial support at the cost of losing productivity. After entrepreneurs overcome financial constraints, they will choose efficiency over financial support. Several previous researches support our assumption. For example, Brandt et al. (2013), using province data, compared TFP by region and sector in China and found that aggregate total factor productivity to be higher in 2007 than 1987 and 1997 in all regions. Further, they show that the estimated TFP is clearly higher in 2007 than 1987 and 1997 in the East, Middle, Northeast, and West regions in the nonstate sector. Although ownership is not clearly distinguished, Brandt et al. (2012), by analyzing the

[6] If the degree to which financing constraints are mitigated is large enough, for example $\lambda_2 = 10$, the capital accumulation of the private sector constantly surpasses that of the state sector, and this is not reversed. There results are available upon request.

firm-level data in China, found that entrants are initially less productive than incumbents, but they quickly close the gap in only about three to four years, and they show that TFP growth was higher in 2001–2007 than in 1998–2001. Yang (2015), based on Brandt et al. (2012), used the Annual Survey of Industrial Firms in China during 1998–2009 to investigate the dynamic changes of Chinese manufacturing enterprises in TFP, and also found that TFP was higher in 2007 than 1998 for all ownership classes.[7]

Table 1: The choices regarding the alleviation of financing constraints

	$t = 1$	$t = 2$	$t = 3$	$t = 10$	$t = 30$
Accept alleviation of financial constraints	11,507	11,454	11,500	11,280	6,243
Reject alleviation of financial constraints	0	10	16	231	1,429
Released from financial constraints*	0	0	3	90	397
Employee	138,493	138,536	138,481	138,399	141,931
Total persons in private sector	150,000	150,000	150,000	150,000	150,000

*: Firms that are released from financial constraints have experienced sufficient growth and no longer require external funds to finance investment.

Note: The numbers in the cells represent the number of individuals who selected each choice in the simulation of case 1. Time t indicates the time periods after the economic reform.

Given the magnitude of the production losses, is more private capital induced when financing constraints are alleviated to a higher degree? According to our simulation results, the answer is no. The private capital accumulation has an inverted U-shaped pattern in terms of λ_2.[8] The intuitive interpretation is that if the degree to which financing constraints are alleviated is relatively high, then the rational entrepreneur will accept the alleviation of constraints to achieve rapid growth in the early stages after the reform. If the degree to which constraints are alleviated is extremely high, then the entrepreneurs could borrow all the capital that they required to optimize the size of the firm in just one period. However, if they do so, then the loss from production inefficiency will dominate the increment of the marginal product of capital. As a result, the entrepreneurs will never accept the alleviation of financing constraints in this circumstance.[9]

4. Conclusion

This paper has investigated the behavior of private entrepreneurs when an instrument to mitigate financing constraints is introduced in an imperfect financial market. We found that in the early stages of the reform, private entrepreneurs tend to accept the alleviation of financing

[7] Other previous researches estimating the TFP in China using firm-level data included Brandt et al. (2017), Shang et al. (2018), Jin et al. (2019), and Li et al. (2018), among others. It is meaningful to empirically test the implications of our model in future work.

[8] If the degree of production inefficiency is increasing, entrepreneurs tend to reject the mitigation of financing constraints; therefore, given the decline in production efficiency, private sector capital investment is uniformly decreasing.

[9] In our exercise, maintaining $A = 0.94$ when $\lambda_2 = 1$, the ratio of private to state capital in the stationary steady state is 0.27. When $\lambda_2 = 3, 5, 7, 10, 1 \times 10^4, \text{or } 1 \times 10^7$, the capital stock ratios of the private sector to state-owned sector in the stationary steady state are around 0.61, 0.87, 1.05, 1.13, 0.53, and 0.27, respectively. The stationary steady state share is obtained from the average value over the last 10 periods of the simulation. The simulation covers 110 periods, but the results are similar when it is extended to 300 periods.

constraints to achieve faster growth. However, they reject it when the associated reduction in production efficiency dominates the benefit from capital financing.

There are several tasks that remain for future research. The transition process of the economy after the reform in our model is quite rapid and it may be meaningful to introduce a capital investment adjustment cost. The degree to which financing constraints are mitigated and the magnitude of the production efficiency losses are crucial elements in the model in this paper. It would be desirable to calibrate the model to better capture recent Chinese economic data. Furthermore, it would be interesting to conduct a welfare analysis. If financial markets are imperfect, companies with inherently high productivity cannot participate in the market and this distorts the allocation of capital stock and labor. In addition, in this paper, as well as alleviating the restrictions on borrowing, we introduced a mechanism by which there was a deterioration in production efficiency. This will affect the scale of production and lead to reductions in household welfare. In future research, it would be interesting to measure the degree of the welfare loss as a result of the resource allocation distortions that arise from these two channels.

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