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A Rational Path towards A Pareto Optimum for Reforms of Large State-owned Enterprise in China, Past, Present and Future

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Abstract

Since Deng Xiaoping's historic move towards a market economy in post-Mao China during the 1980s, by far, the most challenging task in China's reforms has been that related to the moribund state-owned sector due to a range of ideological, political, as well as economic reasons. Such reforms have so far been slow and hesitant, moving forward and backward with mixed results. This paper tackles the pros and cons of such reforms and aims to square a rational strategy based on what has been done so far in the state sector. Unlike a narrow approach currently prevailing in the literature, this paper establishes a partial equilibrium model which incorporates the principal-agent problem into a mixed oligopoly model to explore an optimal strategy for state-owned enterprise reforms in China. We argue that *ceteris paribus* the current illnesses of low efficiency and rent-seeking commonly suffered by China's state-owned sector can be cured by a two-pronged strategy in which the importance of property rights holds the key. We have identified two 'Coase Property Right Points' in the commonly known choices of institutional changes in a reforming Soviet economy to firstly, make it more efficient, and then Pareto optimal. One institutional change is a 'joint-stock reform'; the other, a 'full privatisation reform'. In particular, this study regards 'social-extra policy burdens' as the main obstacle to improve much needed efficiency in the state sector. Coase Property Right Points show the necessity for a reduction of the social-extra policy burdens vis-à-vis the state sector's true comparative advantage.

Keywords: China, economic reforms, state-owned enterprises, efficiency, comparative advantage, Pareto optimum

JEL Codes: D86, L13, P20, P26, P31.

1. Introduction

State-owned enterprises (SOEs, *guoqi*) still play an important role in the economy by employing 40 percent of China's urban workforce; but 30 percent of them have run their businesses into the red (Sun and Tong, 2003). Hence, the issue of business viability arises.[1] Indeed, in the past several decades of economic reforms since Deng Xiaoping's new leadership, a burning issue has been how to improve the efficiency of SOEs that have become well-entrenched in the economy ever since their first introduction to Mainland China from the Soviet Union in the 1950s.[2]

Many scholars argue that ending government mandatory 'extra-economic policy burdens' (e.g. externally imposed targets beyond the healthy economic function of the enterprise), the main source of business uncertainty, is vital for the efficiency of SOEs. Reforms in ownership should be secondary.[3] According to Lin, Cai and Li (1996, 2003), government mandatory extra-economic policy burdens on SOEs include 'social burdens' and 'strategic burdens'. 'Social burdens' take the form of compulsory employment of excessive numbers of often unskilled and technically redundant workers together with their welfare entitlement packages. 'Strategic burdens' refer to compulsory extra investment, ignoring China's absolute or comparative advantages. As a result, China's state sector is excessively capital intensive for the functional workforce it hires.[4] Meanwhile, such 'extra-economic policy burdens' result in SOE managers not being solely responsible for enterprise performance. Thus, budget constraints for SOEs have to be soft. Soft budget has limited impact on poor performance and thus in turn encourages low efficiency. The highly distorting 'social and

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[1] The concept 'viability' of firms is investigated by Lin and Tan (1999). Their viability means socially expected profitability in a perfectly competitive open-market economy. In this paper, we relax the assumption of perfectly competitive open-market economy. Our viability operates in a mixed oligopoly with a certain degree of competition.

[2] In accordance with Lin, Cai and Li (1998), inefficiency of SOEs in China is an endogenous agency problem from the Soviet administratively planned economy. The symptoms include a lack of managerial autonomy in decision-making, a lack of incentives for profits, soft budget constraints, and so on. Of them, the problem of soft-budget constraints is one of the most entrenched and its causes are most debated in the literature, see e.g. Cao, Qian and Weingast (1997); Bai and Wang (1998); Lin and Tan (1999); Dewatripont and Roland (2000).

[3] As pointed out by Lin, Cai and Li (1998), policy-burden reforms are particularly relevant to meg-SOEs.

[4] It means that a considerable proportion of the state sector's workforce is technically redundant.

strategic burdens' contribute to the low efficiency of SOEs. The low efficiency of SOEs is financed by the soft budget which is economic rent by definition from the state monopoly under market-Leninism. The loop is thus complete and it becomes a vicious cycle despite China's much publicized managerial reforms over the past eighteen years.

Some argue that once the aforementioned burdens are removed, distortion will end, and market competition will terminate SOEs' monopoly and economic rent. In their view, it is the rent from monopoly that bails out inefficient SOEs from assured bankruptcy. Neo-classically, with market competition, SOE managers will be forced to improve efficiency with or without privatisation (Li and Lin, 2008).

Another group of scholars paid more attention to state-ownership reforms. Until the mid-1990s, such reforms were confined within managerial autonomy, i.e. power decentralization (*fangquan*), profit retention (*rangli*) and contractual responsibility (*chengbao zhi*) (Bai, Lu and Tao, 2006). Later, in 1998, Premier Zhu Rongji initiated a reform known as 'to invigorate large enterprises and let go small ones' (*zhuada fangxiao*) (Wu, 2003). The government concern was that in a communist country large state-owned enterprises (*yangqi*) ultimately determine and dictate the political colour of the economy. Small and medium firms were politically less important and their privatisation did no political harm to the communist government. About 4,000 SOEs were under the hammer. Consequently, by 2000 the number of loss-making SOEs was halved (Li, 2001).

A tiny minority believe that market competition, or too much of it, exists in the state sector. For example, using a static Cournot Duopoly Model, Zhang and Ma (2003) argued that distorted firm ownership leads to 'excessive competition' in sectors dominated by SOEs. They viewed such excessive competition as harmful and sub-optimal, and saw a way out in a joint-stock reform to control such market competition.

However, so far, the way in which the ownership of large SOE conglomerates, or 'meg-SOEs' (*da guoqi*) can be altered, has remained largely undecided by the ruling party.[5] In terms of theoretical possibilities, scholars incline to look at internal factors of SOEs that hinder firm efficiency. Zhang (2006) pointed out that SOE managers are selected by, for and composed of bureaucrats. So, there is no guarantee for firms to retain good managers or to refuse bad ones inside the Chinese state apparatus. Zhang's proposal is to replace bureaucrat-managers with real capitalists. To do that, privatisation is an obvious choice.

[5] Such as those in the energy, transport, telecommunication, defence, banking and finance sectors today.

Until now, the ‘burden-ownership dichotomy’ debate has failed to come up with a unified framework which tackles simultaneously all the major problems with China’s SOEs. This paper fills in this gap. In a partial equilibrium model, we integrate the principal-agent problem with a mixed oligopoly market. We argue that ‘policy burden reduction’ and ‘ownership reforms’ are complementary, not supplementary. What really matters therefore is a time sequence for the two reforms to be carried out. Such a sequence is determined by what we call the ‘Coase Property Right Point’ which optimizes a strategy for SOE reforms in China. The term is named after the Nobel Laureate Ronald Coase.[6]

In addition, there is an issue of excessive capital intensiveness in particular among meg-SOEs. The obsession with capital intensiveness is deeply rooted in the Soviet/Leninist development model of prioritising the military. As a result, China’s own comparative advantage in abundant labour is ignored, another source of inefficiency of meg-SOEs. This topic has not attracted sufficient attention in the economic reform literature.

We assume that (1) factor allocation always matters for firm efficiency; (2) a reduction of policy burdens on meg-SOEs is always necessary; (3) firm managers always respond to institutions (property rights). Our findings show that Coase Property Right Points can navigate institutional reforms of meg-SOEs to make them fit for the market, perhaps with a Pareto optimum.

The remainder of the paper is organized as the follows: Section 2 contains a review of the existing literature. Section 3 offers a theoretical framework for an optimal strategy for meg-SOE reforms. Section 4 makes final remarks.

2. A review of the existing literature

2.1. Policy burdens as a source of low efficiency

The most representative works regarding government mandatory extra-economic policy burdens and SOEs reform have been conducted by Lin et al. (1996, 1998, 1999, 2001). They believe that a change in the ownership type of SOEs in China is not a necessary condition to improve efficiency. Even if all SOEs are privatised, they argue, the soft-budget constraint still remains a problem. Their evidence comes from the track record of SOEs’ low efficiency after sweeping campaigns of privatisation in Eastern Europe and the former Soviet Union. In

[6] R. Coase, ‘The Problem of Social Cost’, *Journal of Law and Economics* 3/1 (1960), pp. 1-44; and his ‘The Institutional Structure of Production’, *American Economic Review* 82/4 (1992), pp. 713-19.

the same vein, Xu, Zhu and Lin (2005) found that a reduction in government mandatory extra-economic control increases performance of SOEs in China.

Zhang (1997, 1998) examined control deregulation in a principal-agent framework with in which decisions and economic gains are shifted from the government to firms. Firms' autonomy plus market incentives hopefully improve firms' efficiency. Studies by Kornai (1992), and Shleifer and Vishny (1994) also claim any efficiency improvement requires the reduction of bureaucratic control over SOEs.

These studies, however, ignore the fact that, unlike in China, most privatised SOEs in Eastern Europe and the Soviet Union were large and capital-intensive firms compatible with the existing comparative advantage in those countries. Most privatised SOEs in China have been small-medium and loss-making firms that were forced to adopt capital intensiveness against China's comparative advantage. Hence, it is misleading to regard the failure of privatisation in Eastern Europe and the Soviet Union as the destiny for China; full privatisation has not yet been tried out among meg-SOEs in China.

Moreover, Lin and Li (2008) adopted a Cournot Model in a free-entry market context and argued that that the soft-budget constraint of SOEs comes externally and leads to disincentives for efficiency among SOE managers. They argue that privatisation merely aggravates the soft-budget predicament as long as extra-economic policy burdens remain intact.[7]

A few empirical studies are worth mentioning. Li (2008) employs a panel dataset based on a survey of SOEs to tackle the soft-budget problem and has shown that government mandatory extra-economic policy burdens directly cause the soft-budget. This approach ignores, however, the multicollinearity that stems from the very same state ownership that generates the burdens in the first place. Other studies use a panel of SOEs and show that it is impossible for SOEs to 'harden' the budget constraint unilaterally because the state makes the budget 'soft' (Perotti et al., 1999; Bai et al., 2000; Dong and Putterman, 2003). As a result, the 'soft budget–poor performance' causality perpetuates. Although they reveal the origin of the policy burdens, these studies overlook its twin, the strategic burdens, that come also from the same state interference.

[7] They pointed out that managers in private firms may demand more subsidies *ex post* from the state than their SOE counterparts.

2.2. Ownership reforms

It has been fashionable to link ownership reforms to efficiency improvement of SOEs in transitional economies (Kornai, 1992; Shlefier and Vishny, 1997, Zhang, 1997, 1998; Zhang and Ma, 2003; Estrin et al., 2009). Most studies regard market-oriented ownership reforms as the cure for low efficiency of SOEs in an administratively planned economy. Tong (2009) established a panel dataset composed of 50,000 Chinese SOEs from 1998 to 2003 and argues that the speed and scale of privatisation improved SOEs' performance in China. Bennet, Maw and Estrin (2005) also suggest that changes in state ownership do not necessarily compromise government's revenue objectives and thus the state had little to lose. However, privatisation did not seem to improve performance of SOEs in post-Soviet Russia. This raises the issue of whether privatisation is the sufficient condition for a firm to experience better performance.

There is also an issue of the nature of the market during economic transition; if there is a monopoly or oligopoly which does not favour efficiency, privatisation of SOEs alone is not enough to upgrade performance. In other words, market mechanisms and incentives, so enshrined by classical and neo-classical economics, do not always lead to efficiency in reality.

2.3. Other approaches

There are other approaches to SOE reforms in transitional economies. Estrin et al. (2009) argue that the efficiency gain from privatisation of SOEs in Eastern Europe was smaller than a benchmark of Western firms. They observe that the gain in total factor productivity from privatisation was sometimes insignificant or even negative in post-Mao China. In their view, privatisation *per se* does not warrant better performance. Estrin (2002) thus saw the importance of initial conditions in transitional economies as a factor that determines the route, scale and scope of efficiency improvement.

Meanwhile, many works regard SOEs as a symbol of state capitalism in China (e.g. Szamosszegi and Kyle, 2011). Wang et al. (2013) have developed a general equilibrium model to feature such state-capitalism and explain why SOEs in China yield more profits than non-SOEs. They argue that SOEs monopolise 'upstream' industries whereas non-SOEs are concentrated in 'downstream' industries. Upstream SOEs extract rents from downstream non-SOEs. This is a story of SOEs' exploitation of the private sector. They conclude that the current prosperity of SOEs in China only reflects price distortion and rent-seeking.

We partially agree with their views. Undoubtedly, a quasi-market with systematic price distortion is the legacy of Soviet/Leninist ideology and growth model adopted by the ruling party in China. The Leninist state lives on price distortion, commonly known as 'scissors' pricing' (*jiandao cha*), to accumulate capital for large-scale heavy industry mainly for the military; this price distortion is the stick. The carrot is the government policy burden on privileged SOEs as a way to deliver social welfare for the sake of social and political stability. Clearly, such a growth model has not yet been abandoned since the leadership of Deng Xiaoping in the 1980s.

For our purpose, it is better to define SOEs as a phenomenon of 'market Leninism' rather than 'state-capitalism' to capture both the origin and essence of the 'SOE economy'.[8] This is because the legacy of the Soviet/Leninist model lives on. The state still ruthlessly exerts its administrative power to manipulate the market and milk the economy for rent. In this context, SOEs are merely a means for the state's end, whatever it might be.

Generally speaking, scholarly opinions are divided into two camps. One sees a change in firms' ownership (hence privatisation of meg-SOEs) as the panacea for reversing poor performance among meg-SOEs; the other, a reduction of government policy burdens on meg-SOEs. Unlike these, we have developed a dual process to address the issues of ownership and policy burdens.

2.4. Capital intensiveness or labour intensiveness

So far, very few scholars have considered a change in factor allocation at the firm level in meg-SOEs' reforms. This study aims to fill this gap in research. We argue that at the firm level the market allocates production factors more effectively than top-down government plans. As state ownership has a strong tendency to block the function of the market, a reform is imperative, too.

3. A model of partial equilibrium

Our model of partial equilibrium has several necessary assumptions. Assumption 1: In a market mixed with oligopoly under market-Leninism, the economy has at least one meg-SOE. The SOE manager's benefit is a part of the net revenue at the end of each production

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[8] The concept of 'market Leninism' was coined in 1993 by the American journalist Nicholas Kristof who argued that the key feature of market Leninism in China is that the state uses its centralised administrative power to promote the economic growth with a degree of liberalisation of a planned economy. The influence of SOEs, currently prevailing in the Chinese economy, illustrates such market Leninism in full swing.

cycle;[9] social welfare, i.e. the sum of producer surplus and consumer surplus, is also a part of the revenue: $W = ps + cs$.

Here, to differentiate a Leninist economy from a market economy, where the conventional term is 'net revenue', we define net revenue as 'Net Social Benefit' (NSB) minus all production costs. An SOE manager (agent) maximises his/her benefit from his/her personal control over a firm whereas the state (principal) maximises 'social welfare' for society, at least constitutionally.

Assumption 2: The demand curve of an SOE is linear and downward-sloping. When the demand is 0, the price level is $P(0)$. The state regulates/fixes price P. So, under the market-Leninist economy, a change in output does not move the price, at least in the short run.[10]

Definition 1: NSB is the sum of revenues for the state, the firm manager, and the economic rent:

$$S = \underbrace{TR^{m}(ps + cs)^{n}}_{\text{Social benefit for direct effects}} - \underbrace{R}_{\text{Net effect of externalities}} \qquad \text{where } m + n = 1 \tag{1}$$

Where S denotes NSB; TR, a total revenue; *m*, the parameter of the decision-making right of the firm manager; *n*, the amount for the general public via the state; *R*, the *de jure* rent extracted by state monopoly and meant for the state to keep (the value of *R* having no relation with the output level, either).

We have two more assumptions here. Assumption 3: The power division between the state (principle) and the firm manager (agent) determines how social benefit is shared between the two parties. Assumption 4: The Cobb-Douglas Production Function $Q = L^{\alpha}K^{\beta}$ is valid. In the short run, capital *K* remains constant, and hence $\overline{K}$. It is assumed here that labour is homogeneous in skills, but the quantity of labour can vary.

Lemma 1: If a centralised planner maximises the net social benefit, the following is satisfied: $P_1 = \left(m + \frac{n}{\alpha}\right)wL + mr\overline{K}$, where $P_1 = \frac{1}{2[P(0) + P]}$.

[9] The benefit for managers due to their 'control rights' is explained by Baumol (1959) who argued that managers without ownership of their firms still maximise total sales.

[10] According to S. L. Aranoff (2007), until 2001 China ran a list of products and services subject to price control, affecting pharmaceuticals, tobacco, natural gas, and telecommunications.

Our proof of Lemma 1: Let $\mathbf{TR = PQ}$, $\mathbf{cs} = \dfrac{\mathbf{1}}{\mathbf{2}[P(\mathbf{0}) - P]Q}$, $\mathbf{ps = TR - C = PQ - wL - r\bar{K}}$ and plug these three into Equation (1) to obtain NSB:

$$\mathbf{S} = (\mathbf{PQ})^m \left\{\frac{\mathbf{1}}{\mathbf{2}}[P(\mathbf{0}) - P]Q + PQ - wL - r\bar{K}\right\}^n - R \tag{2}$$

Since $P_1 = \dfrac{\mathbf{1}}{\mathbf{2}[P(\mathbf{0}) + P]}$, according to Assumption 4, it can be written as $\mathbf{L} = \left(\dfrac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}}\right)$. We plug this into Equation (2), and thus have NSB:

$$\mathbf{S} = (\mathbf{PQ})^m \left[P_1 Q - w\left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}}\right) - \mathrm{r}\bar{K}\right]^n - R \tag{3}$$

We take the derivative of Equation (3) by Q:

$$\frac{\partial S}{\partial Q} = m(PQ)^{m-1}\left[P_1 Q - w\left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}}\right) - \mathbf{r}\bar{K}\right]^n + \mathbf{n}(\mathbf{PQ})^m \left[P_1 Q - w\left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}}\right) - \mathrm{r}\bar{K}\right]^{n-1}\left[P_1 - \frac{\mathbf{1}}{\alpha}\mathbf{w}\left(\frac{Q^{\frac{1}{\alpha}-1}}{\bar{K}^{\frac{\beta}{\alpha}}}\right)\right] \tag{4}$$

We let $\dfrac{\partial S}{\partial Q} = \mathbf{0}$. The resulting maximum value of the net social benefit is:

$$m(PQ)^{m-1}\left[P_1 Q - w\left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}}\right) - \mathbf{r}\bar{K}\right]^n + \mathbf{n}(\mathbf{PQ})^m \left[P_1 Q - w\left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}}\right) - \mathrm{r}\bar{K}\right]^{n-1}\left[P_1 - \frac{\mathbf{1}}{\alpha}\mathbf{w}\left(\frac{Q^{\frac{1}{\alpha}-1}}{\bar{K}^{\frac{\beta}{\alpha}}}\right)\right] = \mathbf{0}$$

Then,

$$\mathbf{m}(P_1\mathbf{Q} - \mathbf{wL} - \mathrm{r}\bar{K}) + \mathbf{n}\left(P_1\mathbf{Q} - \frac{\mathbf{1}}{\alpha}\mathbf{wL}\right) = \mathbf{0} \tag{5}$$

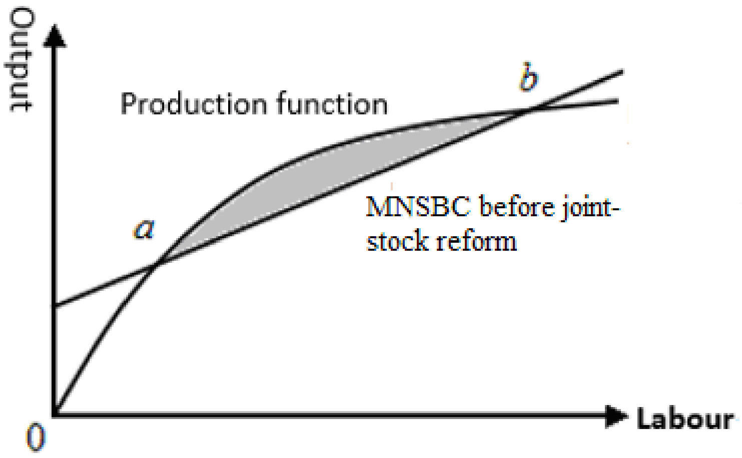
We re-arrange Equation (5), it becomes:

$$P_1 = \left(m + \frac{n}{\alpha}\right)wL + mr\bar{K} \quad (6)$$

Equation (6) defines the mathematical relationship between output Q and labour L. This curve can be called the 'Net Social Benefit Curve'.

Proposition 1: In the short run, the optimal output of a meg-SOE is determined by both Production Function and Maximum Net Social Benefit. Plotting Maximum Social Benefit Curve $P_1 = \left(m + \frac{n}{\alpha}\right)wL + mr\bar{K}$ and Production Function $Q = L^{\alpha}K^{\beta}$, we have two intersections Point *a* and Point *b*, where NSB is maximised. These points represent the optimal outputs for meg-SOEs (see Figure 1).

Figure 1. Maximum Net Social Benefit and Production Function



Notes: Points *a* and *b* represent two optimal outputs for meg-SOEs. The shaded area represents the efficiency loss of meg-SOEs. For details, please see Appendix A. MNSBC = Maximum Net Social Benefit Curve.

Before Point *a*, the output is below the maximum revenue. After Point *b*, the output is over the maximum revenue. The shaded area represents efficiency loss. Hence, *a* and *b* are also 'Maximum Net Social Benefit Points'. [11] On the left-hand side of Point *a*, firms are inclined to decrease production to stay at Point *a*. On the right-hand side of Point *a*, firms tend to increase production to stay at Point *b*. At Point *b*, more labour input is required.

[11] We assume that all the loss-making SOEs operate within the shaded area.

According to the Lagrange mean theorem, between Point *a* and Point *b*, there must be a point on Production Function which makes the gradient of Production Function, whose marginal product of labour equals to the gradient of the Net Social Benefit Curve, expressed as:

$$\frac{\partial Q}{\partial L} = \frac{\left(\mathrm{m} + \frac{n}{\alpha}\right) w}{P_1} \tag{7}$$

There are other conditions. Assumption 5: There are no transaction costs between state and private shareholders. Assumption 6: With joint-stock reforms, the state share is a_1, the private share collectively is a_2 , $a_1 + a_2$. The private shareholders pursue maximum profit. Assumption 7: After a joint-stock reform, the state remains the majority shareholder, hence $a_1 \geq 0.5$. The division of power between the state and firm managers remains exogenous and unchanged.

Lemma 2: Before and after the ownership reform, Net Social Benefit Curve and Production Function intersect at (L_k, Q_k). At $L_k = \frac{mr\bar{K}}{\frac{wP_1}{\alpha P} - \left(m + \frac{n}{\alpha}\right) w}$, L_k is independent from the initial ownership condition (a_1, a_2).

Our proof of Lemma 2: Now, according to Assumption 5, NSB can be rewritten as:

$$\mathbf{S} = [TR^m (ps + cs)^n]^{a_1} (\mathbf{TR} - \mathbf{C})^{a_2} - R \tag{8}$$

We let $\mathbf{TR} = \mathbf{PQ}$, $\mathbf{cs} = \frac{\mathbf{1}}{\mathbf{2}[P(\mathbf{0}) - P]Q}$, $\mathbf{ps} = \mathbf{TR} - \mathbf{C} = \mathbf{PQ} - \mathbf{wL} - \mathbf{r\bar{K}}$, plug them into Equation (8) and obtain

$$\mathbf{S} = [\{(\mathbf{PQ})]^m \left\{ \frac{\mathbf{1}}{\mathbf{2}} [P(\mathbf{0}) - P] Q + PQ - wL - r\bar{K} \right\}^n \Big\}^{\alpha_1} (PQ - wL - r\bar{K})^{\alpha_2} \tag{9}$$

Given $P_1 = \frac{1}{2[P(0) + P]}$, according to Assumption 4, it becomes $\mathbf{L} = \left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}} \right)$.

We plug this into Equation (9) to get

$$\mathbf{S} = (\mathbf{PQ})^m \left\{ \left[P_1 Q - w\left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}} \right) - r\bar{K} \right]^n \right\}^{\alpha_1} \left[PQ - w\left(\frac{Q^{\frac{1}{\alpha}}}{\bar{K}^{\frac{\beta}{\alpha}}} \right) - rK \right]^{\alpha_2} - R \qquad (10)$$

We take the derivative of Equation (10) by Q, the maximum value of NSB can be obtained at $\frac{\partial S}{\partial Q} = \mathbf{0}$. Therefore,

$$m a_1 (P_1 Q - wL - r\bar{K})(PQ - wL - r\bar{K}) + n a_1 \left(P_1 Q - \frac{1}{\alpha} wL\right)(PQ - wL - r\bar{K}) + a_2 (P_1 Q - wL - r\bar{K})\left(PQ - \frac{1}{\alpha} wL\right) = \mathbf{0} \qquad (11)$$

We plug Equation (5) into Equation (11) and obtain

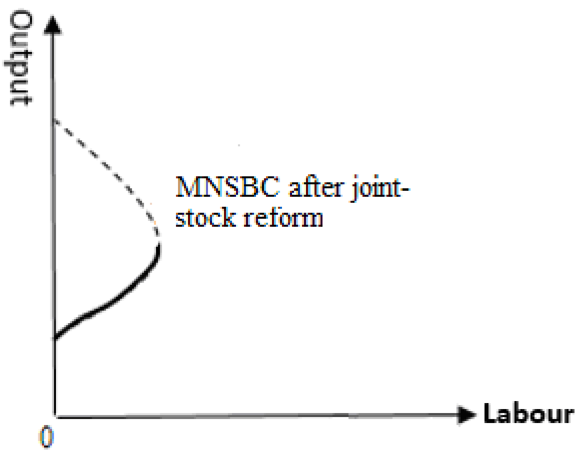
$$a_2 (P_1 Q - wL - r\bar{K})\left(PQ - \frac{1}{\alpha} wL\right) = \mathbf{0}$$

Also, from Equation (4), we get $P_1 Q - wL - r\bar{K} = \mathbf{0}$

Hence, $PQ - \frac{1}{\alpha} wL = 0$ (12)

After a joint-stock reform, the Net Social Benefit Curve changes, as shown in Figure 2.

Figure 2. Maximum Net Social Benefit Curve after a Joint-Stock Reform

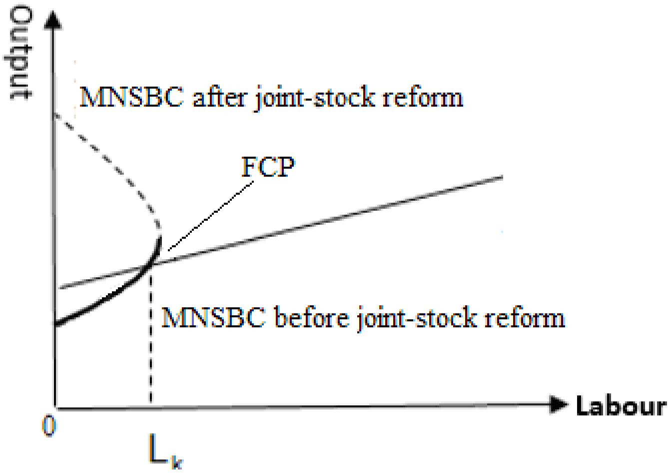


Notes: MNSBC = Maximum Net Social Benefit Curve. The reason this curve is divided into dashed and solid lines is explained in Appendix A.

According to Equations (12) and (5), the intersectional point can be obtained where $L_k = \frac{mr\bar{K}}{\frac{wP_1}{\alpha P} - \left(m + \frac{n}{\alpha}\right)w}$, $Q_k = \frac{mr\bar{K}}{P_1 - mP\alpha - nP}$.

With Q = 0, we plug them into Equation (11), a quadratic curve intersects at the L axis with coordinates $Q_1 = \frac{r\bar{K}}{P}, Q_2 = \frac{mr\bar{K}}{P}\frac{a_1P_1}{a_1P_1+a_2P}$ with the following Figure 3:

Figure 3. Maximum Net Social Benefit Curve and the First Coase Point



Notes: For the detail, please see Appendix A. MNSBC = Maximum Net Social Benefit Curve.

Proposition 2: Before a joint-stock reform, a meg-SOE produces at (L_k, Q_k), a point that always indicates the optimal output, regardless of the ownership type. Proof of Proposition 2: Before a joint-stock reform, Production Function intersects with Net Social Benefit Curve at (L_k, Q_k), meaning that NSB can be maximised before any change in ownership. After a joint-stock reform, Production Function still intersects Net Social Benefit Curve at (L_k, Q_k), suggesting that the maximum NSB can be reached after the reform. In addition, since L_k is independent from the initial ownership composition (a_1, a_2), regardless of the ownership type, this point will always be the equilibrium.

We call (L_k, Q_k) the 'First Coase Property Right Point' (FCP) in relation to a joint-stock reform. This concept is derived from the Coase theorem that, regardless of how ownership is constructed, the firms work towards an optimum with the assumption of zero transaction costs (Coase, 1960). Therefore, the factor allocation at the FCP can be expressed as

$\frac{\bar{K}}{\bar{L}} = \frac{\frac{wP_1}{\alpha P} - \left(m + \frac{n}{\alpha}\right)w}{mr\bar{K}}$ with which an optimal factor input combination under market-Leninism after a joint-stock reform resembles a market of mixed-oligopoly.

At FCP, meg-SOEs can achieve both optimal factor allocation as well as the maximum NSB,[12] we call that point the 'most efficient point for SOEs under a joint-stock reform'. If meg-SOEs do not initially perform at FCP, they will move towards equilibrium as much as possible with a joint-stock reform, given that they seek the maximum NSB. Thus, a joint-stock reform helps meg-SOEs' resource allocation move towards an optimum.

We have our Definition 2: In market-Leninism, the state imposes policy burdens on meg-SOEs in the form of hiring excessive labour L_p.[13] Even so, this is our Definition 3: at FCP, meg-SOEs are viable.

3.1. A joint-stock reform and firm efficiency

From the start, meg-SOEs have been obliged to employ excessive labour, thanks to policy burdens. So, the absence of such burdens necessarily reduces labour employed by meg-SOEs, narrows the distance to the optimal FCP, and improves meg-SOEs' efficiency. If so, a joint-stock becomes optional.

For those firms that do not produce at the FCP, if a joint-stock reform narrows the gap between the firm's factor allocation and FCP, such a reform is justified. If the gap remains the same after a joint-stock reform, the reform is not justified. This leads to Proposition 3: When the gap between the firm's factor allocation and the optimal FCP reduces, a joint-stock reform is justified.

Definition 4 : Let $d_1 = \left|\frac{\bar{K}}{L_k} - \frac{\bar{K}_0}{L_0}\right|$ be a factor-allocation deviance away from the optimal factor allocation before a joint-stock reform; and let $d_2 = \left|\frac{\bar{K}}{L_k} - \frac{\bar{K}_0}{L'_0}\right|$ be a factor-allocation deviance away from the optimal factor allocation after the reform. Proposition 4: If $d_1 > d_2$, an SOE becomes more efficient, a joint-stock reform becomes necessary; and vice versa, if $d_1 \leq d_2$.

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[12] Proposition 7 proves SOEs' possible performance at FCP.

[13] As argued before, 'market Leninism' captures the way how the government intervenes in the market and SOEs.

Assumption 8: In terms of which reform goes first, there exist two sequences: (1) to reduce policy burdens first, and then to convert SOEs to joint-stock firms, or (2) to convert SOEs to joint-stock firms in one go to allow policy burdens to be removed automatically in the same process.

Lemma 3：Based on the value of FCP with joint-stock conversion, there are two scenarios. Scenario 1 To remove policy burdens first, and to carry out a joint-stock reform afterwards, either when $L_0 > L_k, L_0' < L_k$, or, $L_0 > L_k$, $L_0' > L_k$. Assumption 9: Scenario 1 works when $d_1 > d_2$.[14] Scenario 2 To remove policy burdens first, and to carry out a joint-stock reform afterwards, if $L_0 < L_k$, $L_0' < L_k$. For the proof of Lemma 3, please see Appendix B.

Our Proposition 5: We use utility function of the government to indicate the optimal reform sequence. In Scenario I, labour input is cut back after either a joint-stock reform or a policy burden reduction. Workers lose their jobs: $\Delta L_t = L_p - L_0'$. This can be a social problem. In Scenario II, after a joint-stock reform, labour input increases from L_p to L_0. More jobs are created. This is more acceptable politically.[15]

Lin et al. (1996) argued that a reform of meg-SOE ownership is not essential for efficiency gain if policy burdens remain. Such a view is partial. Conceptually, some meg-SOEs may unintentionally produce at FCP. For such meg-SOEs, a joint-stock reform is unnecessary, but a reduction of policy burdens will improve efficiency. However, their number must be trivial. For those meg-SOEs that do not already produce at FCP, a joint-stock reform may decrease efficiency because the reform may not get rid of policy burdens. Moreover, a joint-stock SOE may not be fully market-oriented (Sheng and Zhao, 2013). If so, full privatisation is the answer.

3.2. Full privatisation

After a joint-stock reform, the next logical stage is to privatise meg-SOEs. Assumption 8: Full privatisation allows the SOE manager to own shares and maximise profit like any private owner. NSB will change, along with the Net Social Benefit Curve, rewritten now as

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[14] This is because labour input before and after a joint-stock reform is located on both sides of FCP. As a result, whether a joint-stock reform is necessary depends on the values of d_1 and d_2.

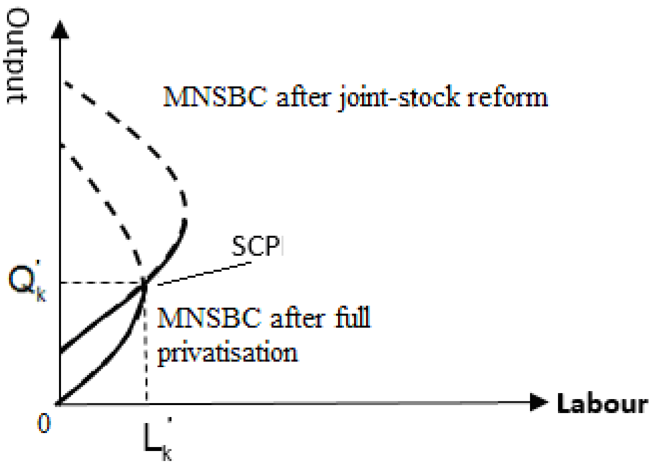
[15] For the proof of Proposition 5, please see Appendix C

$\mathbf{S} = (\mathbf{ps} + \mathbf{cs})^{\alpha_1}(\mathbf{TR} - \mathbf{C})^{\alpha_2} - R$

Thus, the output is determined by two Maximum Net Social Benefit Curves due to independent α_1 and α_2 (see Figure 4). We set $\alpha_1 < \alpha_2$ to reflect full privatisation.

Lemma 4: Net Social Benefit Curve after a full privatisation reform will intersect with Maximum Net Social Benefit Curve at (L_k', Q_k'), where $L_k' = \frac{\alpha}{1-\alpha}\frac{r\overline{K}}{w}$, $Q_k' = \frac{r\overline{K}}{(1-\alpha)P}$; L_k' being independent from an ownership change. A new Coase point between two curves emerges with the optimal factor allocation at $\frac{\overline{K}}{L} = \frac{1-\alpha}{\alpha}\frac{w}{r}$. We call it the 'Second Coase Property Right Point' or SCP,[16] qualified as the 'most efficient point' for both the maximum NSB and the 'optimal point of factor allocation' (see Figure 4).

Figure 4. Maximum Net Social Benefit Curves and the Second Coase Point



Notes: (1) L_k' is the optimal labour input at SCP. (2) Q_k' is the optimal output at SCP. Please see the Appendix for the further details. MNSBC = Maximum Net Social Benefit Curve.

Proposition 4: Prior to full privatisation, if an SOE's output is already at (L_k', Q_k'), the firm's production will remain unchanged.[17] If an SOE dose not produce at the optimal point of factor allocation, full privatisation brings the firm close to that optimal point.

[16] For the proof for the existence of SCP, please see Appendix D.

[17] The proof is similar to that of Proposition 2.

Definition 5: Let $d_3 = \left|\frac{\bar{K}}{L'_k} - \frac{\bar{K}_0}{L'_0}\right|$ be a factor-allocation deviance away from the optimal SCP before full privatisation; and let $d_4 = \left|\frac{\bar{K}}{L'_k} - \frac{\bar{K}_0}{L''_0}\right|$ be a factor-allocation deviance away from SCP after full privatisation. Proposition 5: If $d_3 > d_4$, an SOE becomes more efficient. Full privatisation benefits all parties.

Definition 6: SCP with full privatisation is the point at which SOEs' performance is optimal, regardless of the initial ownership types.

With two Coase points, a paradox occurs: in a joint-stock reform, a factor-allocation deviance away from FCP may be larger than that away from SCP. Our explanation is that with joint-stock reform meg-SOEs still function under a mixed-oligopoly. FCP serves distorted market-Leninism. With full privatisation SFCP now works for a market free from Leninism.

3.3. Joint-stocks and full privatisation in succession

To elaborate the two-step reforms, we have Proposition 6: (1): Regardless of increasing or decreasing returns to scale, if a meg-SOE's capital satisfies $\bar{K} = \left(\frac{mr}{P_1 - mP\alpha - nP}\right)^{\frac{1-\alpha}{\alpha+\beta-1}} (\alpha wP)^{-\frac{\alpha}{\alpha+\beta-1}}$, it will produce at FCP. (2): With constant returns to scale, if a meg-SOE's wage is set at $\mathbf{w} = \left(\frac{mr}{P_1 - mP\alpha - nP}\right)^{\frac{1-\alpha}{\alpha}} \frac{\mathbf{1}}{\alpha P}$, it will also produce at FCP.

Proof of Proposition 6: We obtain the amount of capital at FCP $(\mathbf{L_k}, \mathbf{Q_k})$, plug $L_k = \frac{mr\bar{K}}{\frac{wP_1}{\alpha P} - \left(m + \frac{n}{\alpha}\right)w}$, $Q_k = \frac{mr\bar{K}}{P_1 - mP\alpha - nP}$ into Production Function $\mathbf{Q} = L^{\alpha}K^{\beta}$ to get

$$\bar{K}^{\alpha+\beta-1} = \left(\frac{mr}{P_1 - mP\alpha - nP}\right)^{1-\alpha} (\alpha wP)^{-\alpha} \qquad (12)$$

When returns to scale is either increasing or decreasing, i.e. $\alpha + \beta \neq 1$, and the amount of capital is set at Equation (13), a meg-SOE producing at FCP:

$$\bar{K} = \left(\frac{mr}{P_1 - mP\alpha - nP}\right)^{\frac{1-\alpha}{\alpha+\beta-1}} (\alpha wP)^{-\frac{\alpha}{\alpha+\beta-1}} \qquad (13)$$

If a meg-SOE has constant returns to scale, i.e. $\alpha + \beta = 1$, it produces at FCP, if the following conditions are met:

$$\left(\frac{mr}{P_1 - mP\alpha - nP}\right)^{1-\alpha} (\alpha w P)^{-\alpha} = 1 \tag{14}$$

As well as

$$\mathbf{w} = \left(\frac{mr}{P_1 - mP\alpha - nP}\right)^{\frac{1-\alpha}{\alpha}} \frac{1}{\alpha P} \tag{15}$$

Similarly, we have Proposition 7: (1) With increasing or decreasing returns to scale, a meg-SOE will produce at SCP, if it satisfies $\overline{K} = \left[\frac{r}{(1-\alpha)P}\right]^{\frac{1}{\alpha+\beta-1}} \left(\frac{1-\alpha}{\alpha}\right)^{\frac{\alpha}{\alpha+\beta-1}} \left(\frac{w}{r}\right)^{\frac{\alpha}{\alpha+\beta-1}}$. (2) With constant returns to scale, a meg-SOE will produce at SCP if its wage rate is set at $\mathbf{w} = \left(\frac{\beta \mathbf{P}}{\mathbf{r}}\right)^{\frac{1}{\alpha}} \left(\frac{\alpha^2}{\beta}\right)$. The proof of Proposition 7 is similar to that of Proposition 6.

The difference between FCP and SCP is contingent on the values of $\frac{\mathbf{P_1}}{\mathbf{P}}, \mathbf{m}, \mathbf{n}, \alpha$ (i.e. the market price of the output, the demand curve, division of rights between the state and firm managers, as well as the output elasticity of labour).

If capital is set constant as $\overline{\mathbf{K}}$, there are two possibilities: (1) With constant returns to scale, a meg-SOE's wage rate changes (see Appendix E); or (2) with increasing or decreasing returns to scale (see Appendix E), the wage rate becomes:

$$\mathbf{w} = \left(\frac{\mathbf{m}}{\mathbf{P_1} - (\mathbf{m}\alpha + \mathbf{n})\mathbf{P}}\right)^{\frac{1-\alpha}{\alpha}} \mathbf{P}^{-\frac{1}{2}} \mathbf{P}_1^{\frac{1}{2\alpha}} (1-\alpha)^{\frac{1-\alpha}{2\alpha}} \tag{16}$$

This is because

$$L'_k - L_k = \frac{r\overline{K}}{w}\left[\frac{\alpha}{1-\alpha} - \frac{m}{\frac{P_1}{P\alpha} - \left(m + \frac{n}{\alpha}\right)}\right] = \frac{r\overline{K}}{w} \frac{\frac{P_1}{P} - 1}{(1-\alpha)\left(\frac{P_1}{P\alpha} - \left(m + \frac{n}{\alpha}\right)\right)} \tag{17}$$

Since $P_1 > P$ and $L'_k > L_k$, the optimal allocation of labour in a full market economy becomes smaller than that under market-Leninism: $\frac{\bar{K}}{L'_k} < \frac{\bar{K}}{L_k}$.

Proposition 8: When the reform moves from joint-stocks (L_k, Q_k) to full privatisation (L'_k, Q'_k) with the amount of capital remaining unchanged, more labour gets employed, $L'_k > L_k$. This is because in market competition $P_1 = P$, hence $\frac{\bar{K}}{L_k} = \frac{\bar{K}}{L'_k} = \frac{1-\alpha}{\alpha}\frac{w}{r}$. Ultimately, $L'_k > L_k$ meg-SOEs will reverse their capital intensiveness and become more labour intensive, at least in the short run.

Thus, we make several propositions: Proposition 9: Both joint-stock reform and full privatisation enable meg-SOEs to adjust their factor allocation as closely as possible to the optimal factor allocation under full privatisation. Proposition 10 (Zhang's proposition):[18] SCP enables SOEs to achieve a Pareto optimum under full privatisation. SCP can thus be qualified as a Pareto Optimum Point.[19] Our Proposition 11: Fully-privatised SOEs can achieve Pareto optimum in the short run so long as their capital input remains unchanged. Our Proposition 12: Fully-privatised SOEs operating in a market of perfect competition can reach a Pareto optimum in both the short and long run. Proposition 13 (Lin's complete proposition):[20] SOEs operating in a market of perfect competition without privatisation can achieve a Pareto optimum if SOEs already have an optimal factor allocation before a privatisation reform.

4. Final remarks

This paper identifies a rational path with two reform-cum-efficiency points that correspond to Pareto optimums for meg-SOEs' reform challenges from the Leninist developmental model and legacy since the 1980s.

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[18] Zhang argued that SOEs only improve efficiency by full privatisation. Zhang did not consider an imperfect market.

[19] A Pareto optimum can only be achieved in a market of perfect competition. Here, we do not focus on market structure in the economy. Conceptually, firms can still achieve a Pareto optimum as long as they operate at SCP.

[20] According to Lin (2001), in a perfectly competitive market, SOEs can be viable without full privatisation. This is inadequate because for Lin's hypothesis to work an SOE has to already produce at SCP, a tall order in the Leninist reality.

The Leninist developmental model and legacy has created two problems of inefficiency. First, it has made meg-SOEs in China opt for a capital intensive production model despite China's undisputed comparative advantage in its abundant labour *hitherto*. Second, it has also made meg-SOEs hire excessive labour for social welfare beyond production. The effect of this is two-fold.

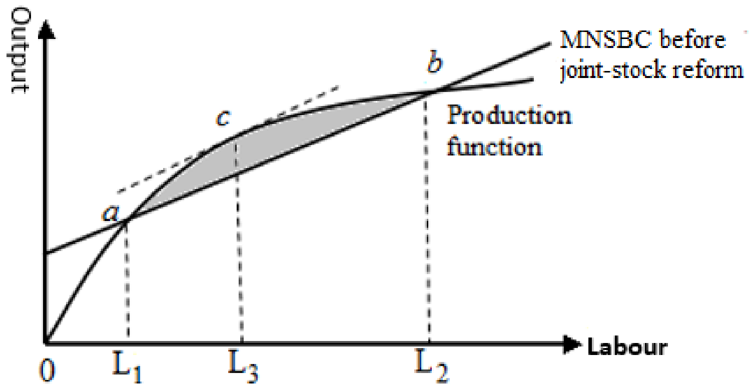
The way out is through institutional change. Joint-stock and full privatisation reforms reduce price distortion and policy burdens. The final aim is to make SOEs as efficient as private firms that do not have policy obligations, but fully exploit China's comparative advantage. Indeed, in the past few decades, most private firms have been concentrated in labour-intensive sectors of the Chinese economy. Moreover, the result of privatisation of small-medium size SOEs in China since the late 1990s has positively proved this point.

Appendix A. Net Social Benefit Curve

A.1. Maximum Net Social Benefit Curve

Figure A.1 illustrates the mechanisms of output, net social benefit and firm efficiency. Both Points *a* and *b* intersect with Production Function to mark the optimal efficiency points. Point *c* is a tangential point for the maximum efficiency loss. L_1 is the first optimal labour input level before a joint-stock reform; L_2, the second optimal labour input level before a joint-stock reform; L_3, the labour input corresponding to the maximum efficiency loss.

Figure A.1. Maximum Net Social Benefit Curve with Production Function



Notes: MNSBC = Maximum Net Social Benefit Curve.

A.2. Elaboration of Net Social Benefit Curve

Equation (11) can be rewritten as the following:

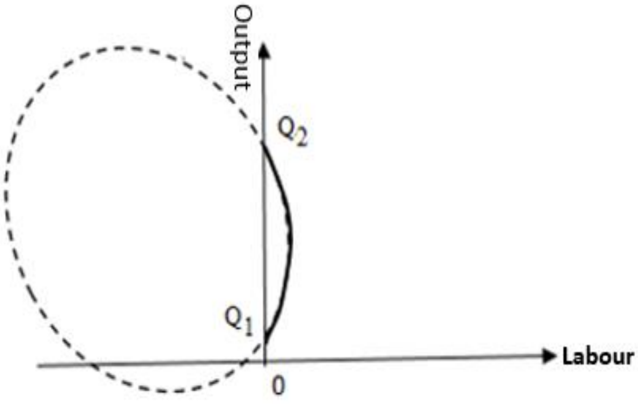
$$ma_1(P_1Q - wL - r\overline{K})(PQ - wL - r\overline{K}) + na_1(P_1Q - \frac{1}{\alpha}wL)(PQ - wL - r\overline{K}) +$$

$$a_2(P_1Q - wL - r\overline{K})(PQ - \frac{1}{\alpha}wL) = 0 \qquad \text{(A.1)}$$

Where the coefficient for Q, $(ma_1 + na_1 + a_2)pp_1$, has a positive value; as does the coefficient for L, $\left(ma_1 + \frac{na_1}{\alpha} + \frac{a_2}{\alpha}\right)w^2$. If there is no interactional term for QL, then this quadratic curve is an ellipse.

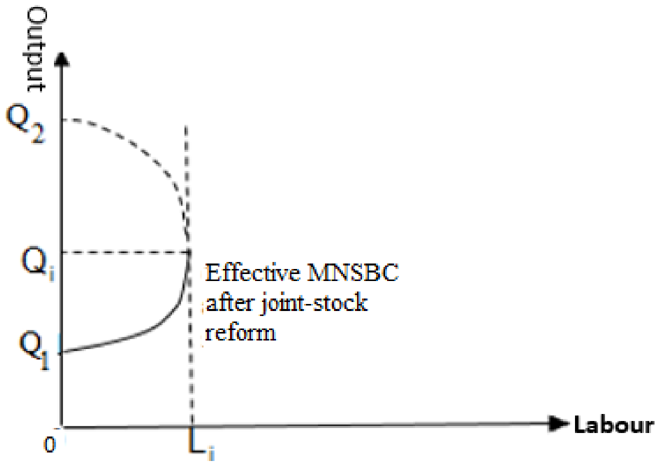
Let L = 0, plug it to Equation (10), the intersectional points are $Q_1 = \frac{r\bar{K}}{p}$, $Q_2 = \frac{mr\bar{K}}{p_1}\frac{a_1 p_1}{a_1 p_1 + a_2 p}$. Q_1 and Q_2 are the minimum and maximum outputs for meg-SOEs, respectively, after a joint-stock reform (see as Figure A.2).

Figure A.2. The Making of the Maximum Net Social Benefit Curve



For the current purpose, we enlarge the parts lying within the first quadrant (see Figure A.3). L_i is the maximum labour input for SOEs after a joint-stock reform. Q_1 is the minimum output for SOEs after joint-stock reform (when L = 0); Q_i, the maximum output for SOEs after joint-stock reform. Q_2 is the hypothetical output beyond SOEs' capacity.

Figure A.3. Fine-tuning the Maximum Net Social Benefit Curve

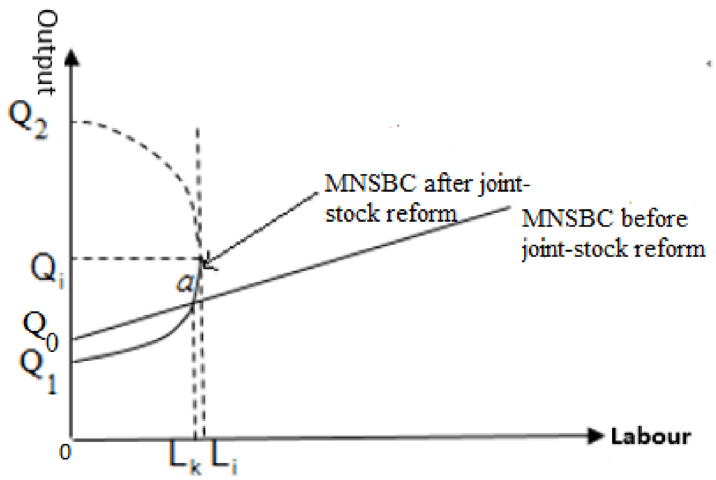


A.2. Maximum Net Social Benefit and Ownership Reforms

We now divide the quadratic curve into two parts at the point $x = L_1$ which is the tangential point of the curve. The upper dashed line represents an increasing output as L decreases, which is not meaningful in reality. The lower solid line symbolises Net Social Benefit.

Before a joint-stock reform the output is at $Q_0 = \frac{mr\bar{K}}{p_1}$. The location of FCP falls in where $Q_1 > Q_k$ or $L_1 > L_k$. This is shown in Figure A.4.

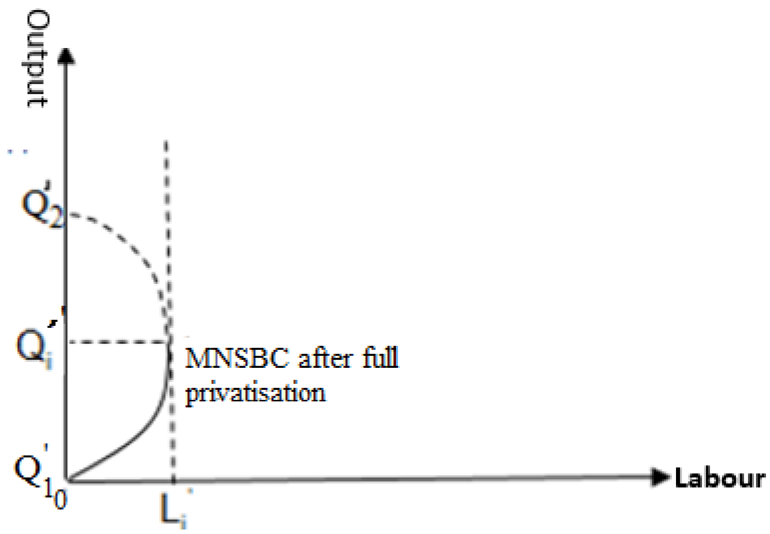
Figure A.4: Locating FCP



A.3. Equation (16) and Maxmum Net Social Benefit Curve

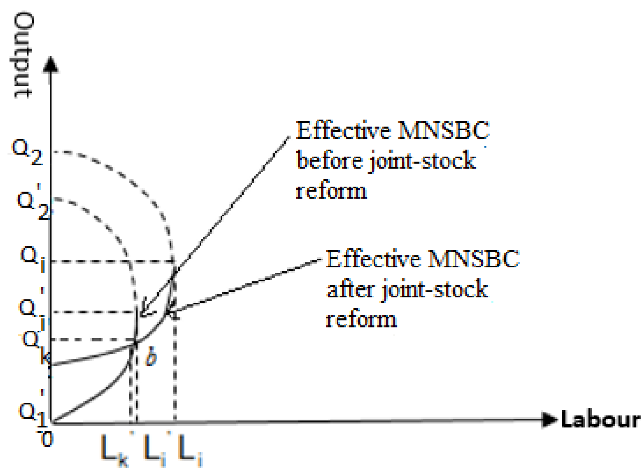
Similarly, we illustrate Maxmum Net Social Benefit Curve with full privatisation in Figure A.5.L_i' is the maximum labour employed by SOEs after full privatisation. Q_i' is the maximum output of SOEs after full privatisation. Q_2' is the hypothetical maximum output irrelevant to SOEs.

Figure A.5. Maxmum Net Social Benefit Curve with Full Privatisation



In order to make SCP meaningful, we set $Q'_1 > Q'_k$ or $L'_1 > L'_k$. The second quadratic curve and output intersects at $Q'_1 = 0$, $Q'_2 = \frac{r\bar{K}a_1p_1 + a_2p}{p_1 \quad p_1}$. Q'_2 lies between the two intersectional points of the first quadratic curve and the output axis Q_1, Q_2, as illustrated in Figure A.6 where Point *b* is SCP. L_i and L'_i are the same as Figure A.5. L'_k is the optimal labour input at SCP. Q_i and Q'_i are the maximum outputs for SOEs with a joint-stock reform and with full privatisation, respectively. Q_2 and Q'_2 are the hypothetical maximum outputs irrelevant to SOEs with a joint-stock reform and with full privatisation, respectively.

Figure A.6. Locating SCP



Appendix B. Proof of Lemma 3

In Figure A.7, Q_o and Q'_o are optimal outputs before and after a joint-stock reform, respectively. Q_p is the optimal output with policy burdens. Q_k is the optimal output at FCP.

L_o and L_o' are the optimal labour inputs by SOEs before and after a joint-stock reform, respectively. L_k is the optimal labour input at FCP. L_p is excessive labour employment imposed on SOEs by the state.

Before a stock-joint reform, the optimal labour input L_o is bigger than the optimal labour input L_k at the FCP. The optimal labour input L_0' after the reform is smaller than the optimal labour input L_k at FCP. Two Net Social Benefit Curves move in the opposite directions because one is a quadratic function (after a joint-stock reform) and the other a linear function with a gradient $(m + \frac{n}{\alpha})w$.

Figure A.7. Reforms and Net Social Benefit (1)

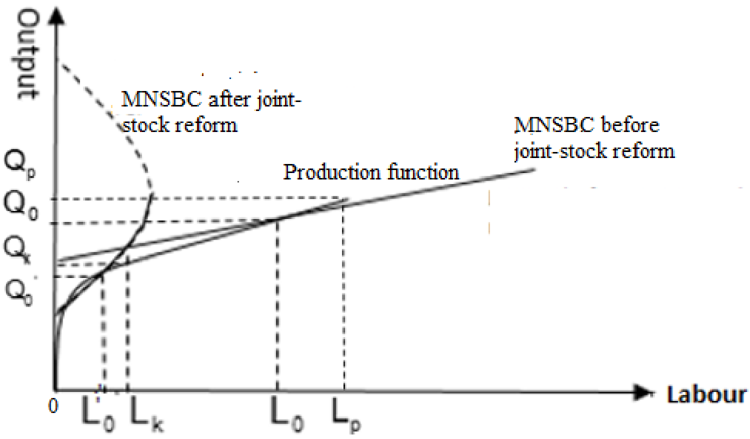
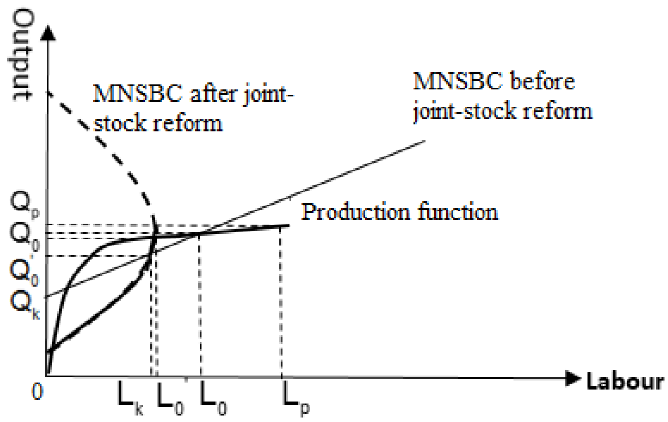


Figure A.8 illustrates that before the reform the optimal labour input L_o is bigger than the optimal labour input L_k at the FCP. The optimal labour input L_0' after the reform is bigger than the optimal labour input L_k at FCP.

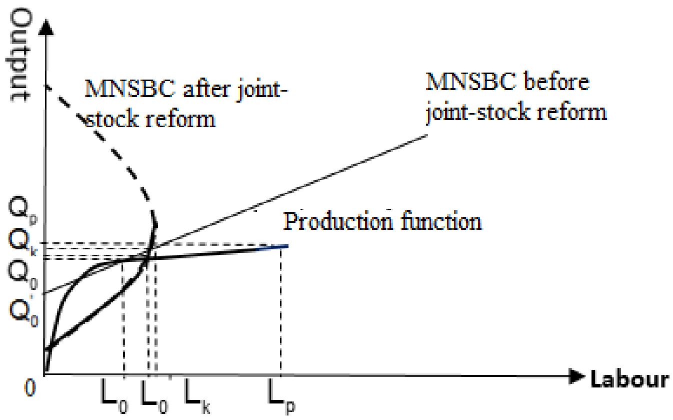
Q_o and Q_o' are the optimal outputs before and after a joint-stock reform, respectively. Q_p is the optimal output with policy burdens. Q_k is the optimal output at FCP. L_o and L_o' are the optimal labour inputs before and after the reform, respectively. L_k is the optimal labour input at FCP. L_p is the excessive labour employment imposed by the state.

Figure A.8. Reforms and Net Social Benefit (2)



Moreover, in Figure A.9 before a stock-joint reform, the optimal labour input L_o is smaller than the optimal output L_k at FCP. The optimal labour input L'_0 after the reform is smaller than the optimal labour input L_k at FCP. All the labels are the same as in Figure A.8.

Figure A.9. Reforms and Net Social Benefit (3)



Notes: (1)

Appendix C. Proof of Proposition 4

We plug L'_0 into Cobb-Douglas function to obtain the explicit function form for Q'_0:

$$Q'_0 = (L'_0)^{\alpha} \bar{K}^{\beta} \tag{C.1}$$

Compare the value of optimal output before and after the joint-stock reform, it could be obtained, thus

$$Q_0 - Q'_0 = \bar{K}^{\beta}\left[(L_0)^{\alpha} - (L'_0)^{\alpha}\right] \tag{C.2}$$

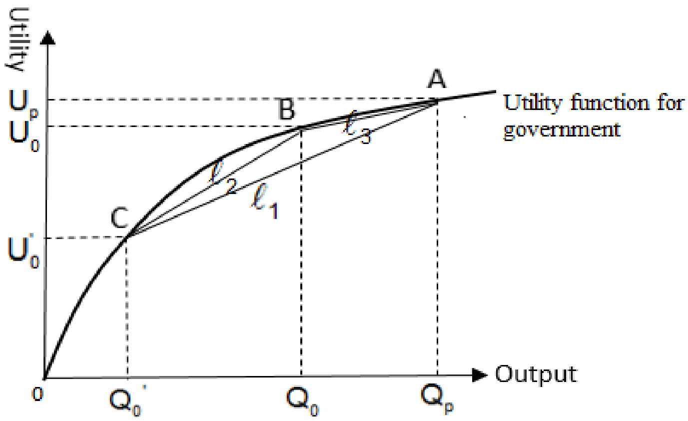
Based on (C.2):

$$Q_0 - Q_0' \begin{cases} > 0 \; if \; L_0 > L_0' \\ = 0 \; if L_0 = L_0' \\ < 0 \; if L_0 < L_0' \end{cases} \tag{C.3}$$

Assumption C.1: The joint-stock reform decision-maker (the government) is risk averse with a concave utility function: $U = U(Q), U'(Q) > 0, U''(Q) < 0.$

Reform Sequence 1: $L_0 > L_k$, we get $L_0 > L_0'$. From (C.3), we get $Q_0 > Q_0'$. Then we have Figure A.10 in which ℓ_1 is the line segment connecting Points A and C; ℓ_2 , connecting Points B and C; ℓ_3 , connecting Points A and B. If SOEs produce at Q_P government utility reaches U_P at Point A. If SOEs produce at Q_0 , government utility reaches U_0 at Point B. If SOEs produce at Q_0' , government utility reaches U_0' at Point C.

Figure A.10. Government Utility Function (1)



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We denote t = 0 as the time at which SOEs produce at Point A; t = 1 as the time at which SOEs produce at Point B; and t = 2 as the time at which SOEs produce at Point C. Prior to a joint-stock reform, SOEs bear policy burdens and produce Q_P .

If policy burdens are removed first and a joint-stock reform comes second, the output will decrease from Q_P to Q_0 first and then decrease again from Q_0 to Q_0' . Government utility will decrease from U_P to U_0 after the removal of policy burdens, therefore the utility function of the government U ($t_1 1, t_1 2$) can be written as:

$$U(0,1) = aU_p + (1-a)U_0 \qquad (0 \leq a \leq 1) \tag{C.4}$$

Where the government put weight on its utility when t = 0; (1 – a) shows how much the weight is when t = 1. Regardless of the value of a, U (0,1) stays in line with ℓ_3.

At t = 1, policy burdens on SOEs are removed, government utility reaches Point B. Now, the government realizes that its utility can move to U_0' corresponding to Point C after a joint-stock reform. So, government utility function can be expressed as:

$$U(1,2) = bU_0 + (1-b)U'_0 \qquad (0 \leq b \leq 1) \tag{C.5}$$

Where (b) stands for the weight that the government puts on its utility when t = 1; (1 – b), the weight that the government puts on its utility when t = 2. Regardless of the value of (b), U (1,2) stays in line with ℓ_2.

If a joint-stock reform is carried out alone, the optimal output decreases from Q_p to Q_0'. The government utility moves to U_0' corresponding to Point C. U $(t_1 1, t_1 2)$ can be written as:

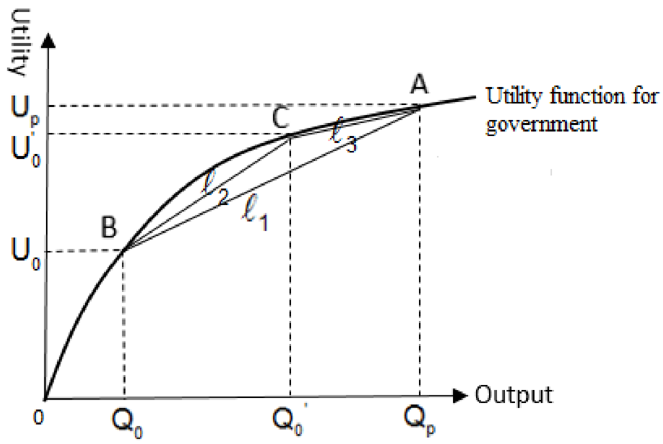
$$U(0,2) = cU_p + (1-c)U'_0 \qquad (0 \leq c \leq 1) \tag{C.6}$$

Where c is the weight that the government puts on its utility at t = 0; (1 – c) is the weight that the government puts on its utility at t = 2. Regardless of the value of c, U (0.2) stays in line with ℓ_1.

Since government utility function is concave, t$\epsilon(0,2)$, all the utility values corresponding to possible values of optimal output Q $\epsilon(Q_0', Q_p)$ lying on ℓ_3 and ℓ_2 are higher than the utility values on ℓ_1. At t = 2, utilities are equal for both reform sequences. To maximize the utility, the government is better off to remove policy burdens first and then carry out a joint-stock reform (i.e. Reform Sequence 1).

Reform Sequence 2. $L_0 < L_k$, we get $L_0 < L_0'$. From C.3, we get $Q_0 < Q_0'$. Then we have Figure A.11. All the descriptions of Q_p versus U_p, Q_0 versus U_0, Q_0' versus U_0', and ℓ_1, ℓ_2 and ℓ_3 remain the same.

Figure A.11. Government Utility Function (2)



Again, we denote t = 0 as the time at which SOEs produce at Point A; t = 1 as the time at which SOEs produce at Point B; and t = 2 as the time at which SOEs produce at Point C. Prior to a joint-stock reform, SOEs bear policy burdens and produce Q_p .

Now, if policy burdens are removed first and a joint-stock reform comes second, the output will decrease from Q_p to Q_0 first but then increase from Q_0 to Q_o'. Government utility will decrease from U_p to U_0 after the removal of policy burdens. This time, U $(t_\downarrow 1, t_\downarrow 2)$ can be written as:

$$\mathbf{U(0,1) = aU_p + (1-a)U_0} \qquad (0 \le \mathbf{a} \le \mathbf{1}) \qquad \text{(C.7)}$$

Where (a) denotes the weight that the government puts on its utility at t = 0; (1 - a) is the weight that the government puts on its utility at t = 1. Regardless of the value of (a), U (0,1) stays in line with ℓ_1 .

At t = 1, policy burdens are removed, and government utility reaches Point B. Now, the government realizes that its utility moves to U_0' after the reform, the government utility function is U $(t_\downarrow 1, t_\downarrow 2)$, or:

$$\mathbf{U(1,2) = bU_0 + (1-b)U'_0} \qquad (0 \le \mathbf{b} \le \mathbf{1}) \qquad \text{(C.8)}$$

Where (b) represents the weight that the government puts on its utility when t = 1; (1 – b) is the weight that the government puts on its utility when t = 2. Regardless of the value of the (b) is taken, U (1,2) stays in line with ℓ_2 .

If China adopts Reform Sequence 2 (a joint-stock reform in one go), the optimal output of SOEs decreases from Q_p to Q'_o. Now, at Point A, and the government utility moves to U'_0 after the reform. Government utility function, $(t_1 1, t_1 2)$, can be written as:

$$\mathrm{U}(0,2) = c\mathrm{U_p} + (1-c)\mathrm{U'}_0 \qquad (0 \le c \le 1) \tag{C.9}$$

Where (c) represents the weight that the government puts on its utility at t = 0; (1 – c) represents weight that the government puts on its utility at t = 2. Regardless of the value of (c), U (0.2) stays in line with ℓ_3 .

In short, if China adopts Reform Sequence 1, from t = 0 to t = 1, government utility lies along ℓ_1. From t = 1 to t = 2, government utility lies along ℓ_2. If China adopts Reform Sequence 2, from t = 0 to t = 2, government utility lies along ℓ_3. The utility value along ℓ_3 is higher than either along ℓ_1 or ℓ_2. To maximize government utility, China should adopt Reform Sequence 2.

Appendix D. Proof of Lemma 4

Let $\mathrm{TR} = \mathrm{PQ}$, $cs = \frac{1}{2[P(0)-P]Q}$, $ps = \mathrm{TR} - \mathrm{C} = \mathrm{PQ} - \mathrm{wL} - \mathrm{r}\bar{\mathrm{K}}$, plug into Equation (13), then,

$$\mathrm{S} = \left\{\frac{1}{2}[\mathrm{p}[0]-\mathrm{p}]\mathrm{Q} + \mathrm{pQ} - \mathrm{wL} - \mathrm{r}\bar{\mathrm{K}}\right\}^{a_1}(\mathrm{pQ} - \mathrm{wL} - \mathrm{r}\bar{\mathrm{K}})^{a_2} - \mathrm{R} \tag{D.1}$$

As $P_1 = \frac{1}{2[P(0)+P]}$, and according to Assumption 4, we obtain $\mathrm{L} = (Q^{\dagger}(1/\alpha)/K^{-\dagger}(\beta/\alpha)$, then

$$\mathrm{S} = \left[\mathrm{P_1Q} - \mathrm{w}\left(\frac{\mathrm{Q}^{\frac{1}{\alpha}}}{\bar{\mathrm{K}}^{\frac{\beta}{\alpha}}}\right) - \mathrm{r}\bar{\mathrm{K}}\right]^{a_1}\left[\mathrm{PQ} - \mathrm{w}\left(\frac{\mathrm{Q}^{\frac{1}{\alpha}}}{\bar{\mathrm{K}}^{\frac{\beta}{\alpha}}}\right) - \mathrm{rK}\right]^{a_2} - \mathrm{R} \tag{D.2}$$

Take derivative of Equation (D.2) by Q, the maximum Net Social Benefit can be obtained if $\frac{\partial S}{\partial Q} = 0$. Hence,

$$a_1(PQ - wL - r\overline{K})(P_1Q - \frac{1}{\alpha}wL) + a_2(P_1Q - wL - r\overline{K})(PQ - \frac{1}{\alpha}wL) = 0 \quad \text{(D.3)}$$

Equation (D.3) represents the maximum Net Social Benefit. Plug Equation (D.3) into Equation (11), then,

$$a_1(P_1Q - wL - r\overline{K})(PQ - wL - r\overline{K}) + a_2(P_1Q - wL - r\overline{K})(PQ - \frac{1}{\alpha}wL) = 0 \quad \text{(D.4)}$$

According to Equations (D.3) and (D.4), the intersectional point is at $L'_k = \frac{\alpha}{1-\alpha}\frac{r\overline{K}}{w}$, $Q'_k = \frac{r\overline{K}}{(1-\alpha)P}$. When Q = 0, plug into Equation (12), this quadratic function intersects with the L axis at $L_1 = 0$, $L_2 = -\frac{r\overline{K}}{w}$.

Moreover, when L = 0, plug into Equation (12), this quadratic curve intersects with the Q axis at $Q'_1 = 0$, $Q'_2 = \frac{a_1 p_1 + a_2 p}{p_1}\frac{r\overline{K}}{p_1}$, and $Q'_2 < Q_2$.

Appendix E. Proof of Proposition 8

Plug L'_k, Q'_k into Production Function to obtain $\overline{K}'$. Plug $L'_k = \frac{\alpha}{1-\alpha}\frac{r\overline{K}'}{w}$, $Q'_k = \frac{r\overline{K}'}{(1-\alpha)w}$ into $Q = L^\alpha \overline{K'}^\beta$ to get

$$\overline{K'}^{\alpha+\beta-1} = \frac{r}{(1-\alpha)P}\left(\frac{1-\alpha}{\alpha}\right)^\alpha \left(\frac{w}{r}\right)^\alpha \quad \text{(E.1)}$$

$$\overline{K'} = \left[\frac{r}{(1-\alpha)P}\right]^{\frac{1}{\alpha+\beta-1}} \left(\frac{1-\alpha}{\alpha}\right)^{\frac{\alpha}{\alpha+\beta-1}} \left(\frac{w}{r}\right)^{\frac{\alpha}{\alpha+\beta-1}} \quad \text{(E.2)}$$

Equation (E.1) indicates that when SOEs have increasing or decreasing return to scale, $\alpha + \beta \neq 1$, and when the initial capital satisfies Equation (E.2), Production Function interests FCP. SOEs will produce at the Coase Point $(L_{\downarrow}k^{\uparrow\prime}, Q_{\downarrow}k^{\uparrow\prime})$.

If SOEs have constant return to scale, $\alpha + \beta = 1$, and if the following is satisfied:

$$w = \frac{\alpha^2}{\beta}\left(\frac{\beta p}{r}\right)^{\frac{1}{\alpha}} \quad \text{(E.3)}$$

SOEs will always produce at CPRP $(L_{\downarrow}k^{\uparrow\prime}, Q_{\downarrow}k^{\uparrow\prime})$, regardless of the initial capital.

Equation (E.3) indicates also that when P, r, α remain unchanged, the amount of labour input can be determined. Regardless of the capital, SOEs will always produce at $(L_{\downarrow}k^{\uparrow\prime}, Q_{\downarrow}k^{\uparrow\prime})$. The output Q_k still depends on the amount of capital.

References

Aranoff, S. L., 2007, 'China: Description of Selected Government Practices and Policies Affecting Decision-making in the Economy', US International Trade Commission, Washington, DC, No. 20436, 2007.

Bai, Chong-En, D. Li, Z. Tao, and Y. Wang, 2000, 'A Multitask Theory of State Enterprise Reform', *Journal of Comparative Economics*, 28/4 (2000), pp. 716-38.

Bai, Chong-En, Jiangyong Lu and Zhigang Tao, 2006, 'The Multitask Theory of State Enterprise Reform: Empirical Evidence from China', *The American Economic Review*, 96/2 (2006), pp. 353-7.

Bai. Chong-En, Yijiang Wang, 1998, 'Bureaucratic Control and the Soft Budget Constraint', *Journal of Comparative Economics*, 26/1 (1998), pp. 41-61.

Baumol, William J., 1959, *Business Behavior, Value and Growth*. Princeton: Princeton University Press, 1959.

Bennett, John, James Maw and Saul Estrin, 2005, 'Why Did Transition Economies Choose Mass Privatisation?', *Journal of the European Economic Association*, 3/2-3 (2005), pp. 567-75.

Cao, Yuanzheng, Y. Qian, and B. R. Weingast, 1999, 'From Federalism, Chinese Style, to Privatisation, Chinese Style', *Economics of Transition*, 7/1 (1999), pp. 103-31.

Coase, R., 1960, 'The Problem of Social Cost', *Journal of Law and Economics*, 3/1 (1960), pp. 1-44.

Coase, R., 1992, 'The Institutional Structure of Production', *American Economic Review*, 82/4 (1992), pp. 713-19.

Dewatripont, Mathias and Gerard Roland, 2000, 'Soft Budget Constraints, Transition and Financial Systems', *Journal of Institutional and Theoretical Economics*, 156/1 (2000), pp. 245-60.

Dong, Xiao-yuan and Louis Putterman, 2003, 'Soft Budget Constraints, Social Burdens, and Labour Redundancy in China's State Industry', *Journal of Comparative Economics*, 31/1 (2003), pp. 110-33.

Estrin, Saul, 2002, 'Competition and Corporate Governance in Transition', *The Journal of Economic Perspectives*, 16/1 (2002). pp. 101-24.

Estrin, Saul, Jan Hanousek, Evzen Kovenda and Jan Svejnar, 2009, 'The Effects of Privatisation and Ownership in Transition Economies', *Journal of Economic Literature*, 47/3 (2009), pp. 1-30.

Feldstein, Martin S., 1964, 'Net Social Benefit Calculation and the Public Investment Decision', *Oxford Economic Papers, New Series*, 16/1 (1964), pp. 114-31.

Kornai, J., 1992, *The Socialist System: The Political Economy of Communism.* Oxford: Clarendon Press, 1992.

Kristof, Nicholas, 1993, 'China Sees Market-Leninism as Way to Future', *The New York Tim*es, September 6, 1993, pp. 1, 5.

Li, Lixing, 2008, 'Employment Burden, Government Ownership and Soft Budget Constraints: Evidence from a Chinese Enterprise Survey', *China Economic Review*, 19/2 (2008), pp. 215-29.

Li, R., 2001. 'Three-year Target for SOE Reform Reached', *Beijing Review*, 44 (2001), pp. 19–21.

Lin, Justin and Li, Zhiyun, 2008. 'Policy Burden, Privatization and Soft Budget Constraint', *Journal of Comparative Economics*, Elsevier, 36/1 (2008), pp. 90-102.

Lin, Justin Guofu Tan, 1999, 'Policy Burdens, Accountability, and the Soft Budget Constraint', *American Economic Review*, 89/2 (1999), pp. 426-31.

Lin, Justin, 2003, 'Development Strategy, Viability, and Economic Convergence', Economic Development and Cultural Change, University of Chicago Press, 51/2 (2003), pp. 276-308.

Lin, Justin, Fang Cai and Zhou Li, 1996, 'The Lessons of China's Transition to a Market Economy', *Cato Journal*, 16/2 (1996), pp. 201-31.

Lin, Justin, Fang Cai and Zhou Li**,** 1998, 'Competition, Policy Burdens and State-Owned Enterprise Reform', *The American Economic Review*, 88/2 (1998), pp. 422-7.

Lin, Justin, Fang Cai and Zhou Li, 2001, *State-owned Enterprise Reform in China*. Hong Kong: The Chinese University of Hong Kong Press, 2001.

Lin, Justin, Fang Cai and Zhou Li, 2003, *The China Miracle: Development Strategy and Economic Reform*. Hong Kong: The Chinese University of Hong Kong Press, 2003.

Ma, J, and W. Zhang, 1999, 'Ownership distortion as a cause of excessive competition', *Economic Research Journal*, June 1999, pp. 11-20.

Perotti, EC, Sun L, and Zhou L., 1999, 'State-owned versus Township and Village Enterprises in China', *Comparative Economic Studies*, 41/2-3 (1999), pp. 151-79.

Sheng, Hong and Zhao Nong, 2013, *China's State-owned Enterprises: Nature, Performance and Reform*. Singapore: World Scientific Press, 2013.

Shleifer, Andrei and R. W. Vishny, 1997, 'A Survey of Corporate Governance', *The Journal of Finance*, LII/2 (1997), pp. 1-47.

Shleifer, Andrei and Robert W. Vishny, 1994, ‘Politicians and Firms’, *The Quarterly Journal of Economics*, 109/4 (1994), pp. 995-1025.

Sun, Qian, and Wilson H. S. Tong, 2003, ‘China Share Issue Privatisation: The Extent of Its Success’, *Journal of Financial Economics*, 70 (2003), pp. 183-222.

Szamosszegi, Andrew and Cole Kyle, 2011, ‘An Analysis of State-owned Enterprises and State Capitalism in China’, U.S.-China Economic and Security Review Commission, October 26, 2011.

Tong, Sarah Y., 2009, ‘Why Privatize or Why Not? Empirical Evidence from China’s SOEs Reform’, *China Economic Review*, 20/3 (2009), pp. 402-13.

Wu, J., 2003, *Contemporary China’s Economic Reforms*; Shanghai: Shanghai Far East Press, 2003.

Xi, Li, Xuewen Liu, and Yong Wang, 2015, ‘A Model of China’s State Capitalism’, *HKUST IEMS Working Paper*, February 2015.

Xu, Lixin Colin, Tian Zhu and Yi-min Lin, 2005, ‘Politican Control, Agency Problems and Ownership Reform: Evidence from China’, *Economics of Transition*, 13/1 (2005), pp. 1-24.

Zhang, W., 1997, ‘Decision Rights, Residual Claim and Performance: A Theory of How the Chinese State Enterprise Reform Works’, *China Economic Review*, 8/1 (1997), pp. 67-82.

Zhang, W., 1998, ‘A Principal-agent Theory of the Public Economy and Its Applications to China’, *Economics of Planning*, 31/2 (1998), pp. 231-51.

Zhang, W., 2006, ‘China’s SOE Reform: A Corporate Governance Perspective’, *Corporate Ownership and Control*, 3/4 (2006), pp. 132-50.

Zheng Song, Kjetil Storesletten and Fabrizio Zilibotti, 2011, ‘Growing Like China’, *American economic Review*, 101/1 (2011), pp. 196-233.