

Goals of Chinese Competition Policies

Muling Si

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Faculty Advisor: Professor Jun Ishii

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Abstract

The provisions of China’s Anti-Monopoly Law (AML) are partially consistent with competition frameworks of Western economies in that they both consider the impact of firm anti-competitive conducts on competition and consumer welfare. However, the Chinese law also explicitly considers “national economic development” and “national interest” in its assessment of anti-competitive conduct. This divergence in competition framework by China may be thought as being motivated by the significant presence of state-owned enterprises (SOEs) in many Chinese markets. Unlike traditional private firms, SOEs are at least partially owned and controlled by the government. As such, SOEs may pursue objectives that differ from pure profit-maximization. In turn, the presence of SOEs may induce the government to pursue goals in addition to protecting consumer welfare. Specifically, the government may seek to use the AML to protect SOEs in order to enjoy greater shared profits as well as help advance the SOEs’ more socially aligned objectives. The government may also use the AML to help mitigate principal-agent problems that plague SOE governance. This thesis models the tension between these traditional and additional goals to help explain how Chinese antitrust policy decisions may differ from those under Western competition frameworks.

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1 Introduction

China adopted its Anti-Monopoly Law in 2007. The provisions of this law are partially consistent with competition frameworks of Western economies in that they both consider the impact of firm anti-competitive conducts on competition and consumer welfare. However, the Chinese law also explicitly includes ‘national economic development’ and ‘national interest’ into its assessment of anti-competitive conduct.¹ This divergence in competition framework by China may be thought as being motivated by the significant presence of state-owned enterprises (SOEs) in many Chinese markets. Unlike traditional private firms, SOEs are at least partially owned and controlled by the government. As such, SOEs may pursue objectives that differ from pure profit-maximization. In my thesis, I explore how the presence of SOEs may help explain the particular variant of competition policy pursued by the Chinese government. Specifically, I hypothesize that the Chinese government may use competition policy to address two other objectives in addition to the standard objective pursued by Western economies with their competition policy. One objective is to adopt a pro-SOE framework in order to aid the SOEs pursue their more socially aligned objectives. The other objective is to encourage even more competition in order to mitigate principal-agent problems between the Chinese government (principal) and the SOEs (agent). I model the tension between the traditional and additional objectives to help explain how recent Chinese antitrust policy decisions may differ from those under Western competition frameworks.

Competition policies in industrialized countries (e.g. U.S. and E.U.) have important impacts on firm behavior, industrial structure, and corporate governance. They are important policy instruments for promoting competition in market economies to maximize economic efficiency and consumer welfare. They are enacted not to directly change market structure

¹Anti-monopoly Law of the People’s Republic of China, Article 7, 27, 28, 31 http://www.china.org.cn/government/laws/2009-02/10/content_17254169.htm

but to constrain anti-competitive conducts that would potentially inhibit a more competitive market structure. Firm behaviors that may cause those concerns include mergers that lead to significant market concentrations, practices that inhibit horizontal or vertical competition (e.g. cartels, bundling, etc.), and other exclusionary acts such as predatory pricing.

In the cases of U.S. and the European Union, competition policies operate within market economies. The first competition policy in Canada (1889) and the Sherman Act in U.S. (1890) marked the origin of modern anti-trust legislations. Almost a hundred years later, China has also begun to build actively its competition policy framework, starting with its first competition law in 1993. One distinct difference between China and the other industrialized countries is that China is still in transition from a communist, centrally planned economy to a more free market economy. Since the introduction of private ownership in the 1980s, China has been in a transitional economy with a mix of private and state-owned firms. The presence of the state-owned enterprises (SOEs) that dominate most industries, a distinctive component of the Chinese economy, makes the context in which competition policies are applied different from that of other industrialized market economies.

The state-owned enterprises differ from classical private firms because they have ties to the state. They are either fully or partially owned by the government. Their objectives are not solely to maximize profits: the SOEs share profits with the government, and often pursue social welfare goals. At the same time, significant asymmetric information between the state and the managers of SOEs introduces principal-agent problems. Therefore, SOEs are widely associated with problems such as administrative and productive inefficiencies. The private firms, on the other hand, do not have explicit ties with the government and can be either domestic or foreign. They operate similarly to the classical firms in market economies and seek to maximize profits.

The implications on competition policies due to the presence of SOEs are hence two-fold. On one hand, competition policies in China could favor state-owned enterprises over traditional private firms because the SOEs operate under objectives that are more aligned with the interests of the state: both through profit-sharing and providing certain social functions. On the other hand, such policies could be used to favor the rivals of SOEs for consumer welfare concerns when the SOEs are very inefficient. Moreover, as the managers are appointed by the government and their jobs are relatively stable, they may shirk at work as they lack incentives to exert costly effort, leaving the SOEs operating with inefficient high costs. SOE managers could be incentivized to strategically exert more effort to lower the overall costs of production to maximize their utility levels depending on changes in the market structure. In certain markets, more competition would induce higher effort of managers, serving as a discipline device to help alleviate the principal-agent problem between the state and the SOEs. In other cases, a less competitive yet more lucrative market structure would incentivize SOE managers to exert higher effort. Principal-agent considerations further complicate the considerations under the Chinese competition framework.

This thesis focuses specifically on regulations that review mergers and acquisitions under antitrust/competition law. The classical argument for merger review is that the government should stop mergers that lead to sizable market concentrations that harm total consumer welfare. However, with two additional objectives, the merger review decision may be different under the Chinese antitrust framework. For example, a merger that harms total consumer welfare could be approved to the extent that the effect of increased shared profits and social welfare generated by the SOE from a less competitive environment outweigh the combined loss from consumer surplus and weakened discipline effect on the principal-agent problem.

Through modeling the private and state-owned firms with different total factor productivity,

input intensity, and operating objectives, I evaluate the government's traditional and additional goals under different merger scenarios. To incorporate the principal-agent problem into the analysis, I allow the total factor productivity of SOEs to vary with the managers' effort level. This thesis explores the implications of a Chinese competition framework that pursues more goals than just protecting consumer welfare. The goals aside from safeguarding consumer welfare are to realize social welfare functions, guarantee more transfer of profit to the state, and address principal-agent problems in SOE management.

2 Background and Literature Review

China's transition from a centrally planned economy to a market economy started with Deng Xiaoping's economic reform and opening-up policy in 1978. Private ownership was gradually introduced into the economy that used to be dominated by the state. The pace of the reform significantly accelerated since the 14th Congress of the Chinese Communist Party in 1992 that set establishing a "socialist market economy" the central goal of the reform.² Almost four decades after the onset of the reform, China's economic structures changed significantly, marked by the relative decline of SOEs and other state-controlled enterprises and the emergence of the private sector. Concurrent with the economic reform, the Chinese government also actively engaged in constructing legal systems compatible with the reform. Figure 2.1 summarized the key legislative steps of the Chinese government since the introduction of its first competition law in 1993.³

The legislative experiments started with piece-wise regulations dealing with individual competition issues as they arose. As competition issues become more prominent with the emergence of private enterprises, attention is being paid to the importance of competition as

²Owen et al. (2008)

³Bergeijk et al. (2011), p.13

Year	Law	Year	Law
1993	Law against unfair competition	2004	The Foreign Trade Law
1997	Price law	2006	Provision on Mergers and Acquisitions of Domestic Enterprises by Foreign Investors
		2007	Anti Monopoly Law
1999	Law on Bid Invitation and Bidding		
2003	Interim provisions on Mergers and Acquisitions of Domestic Enterprises by Foreign Investors	2011	Rules on the Prevention and Restriction of Price-related Monopoly Conduct (the NDRC Rules)
2003	Tentative Provision on Prohibition of Acts of Price Monopolization		SAIC Monopoly Agreements Rules
			SAIC Dominant Position Rules
			Rules on the Prohibition of Abuse of Administrative Power resulting in the elimination or restriction of competition.

Figure 2.1: Introduction of competition laws in China

an institution.⁴ In 2007, China adopted its first comprehensive antitrust legislation, the Anti-Monopoly Law (AML), after a protracted legislative process of thirteen years. The AML became effective on August 1, 2008. The enactment of the AML marked China's move toward a modern competition framework, which, compared with the first competition policy that was introduced in Canada or the Sherman act in U.S. over 100 years ago, is relatively young and is still in development.

The drafting of the AML substantially built on experiences of European Union and United States. Much of the its fifty-seven articles are similar to the provisions of antitrust laws in typical market-oriented economies. However, it also contains provisions atypical of Western antitrust laws, such as provisions regarding state-owned enterprises (SOEs) in important economic sectors, trade associations, and monopolies created by government agencies. These provisions not only reveal interesting ambiguities and uncertainties regarding some basic antitrust issues but also reflect Chinese political and economic concerns.⁵ The variations in the AML and its unusually long legislative process are rooted in China's historic transformation

⁴See Bergeijk et al. (2011), Owen et al. (2008), and Zhang (2011)

⁵See Wu and Liu (2012), and Sokol (2013)

from a centrally-planned economy to a market economy, specifically because of the existence of the state-owned enterprises. The ties of the government with the SOEs make it both the regulator of the market and the owner of a market player. The dual roles of the government hence complicate the goals that the Chinese competition framework pursues.

The primary goal of enacting antitrust laws in China is to promote competition to facilitate the reform of the economy that lacked competition, especially in state-owned sectors. However, the Chinese government also aims to strengthen the role of SOEs in ‘key sectors’. Even though the private sector is gaining increasingly more importance in the economy, SOEs still have overwhelming presence and remain the largest enterprises in China. They are dominant in important industries such as utilities, oil and gas, transportation infrastructure, telecommunications, insurance, and banking. The seemingly contradictory objectives of encouraging competition and maintaining SOE control pose challenge to the drafting of AML.

In addition to the three pillars of the competition policy framework in modern economics: rules against monopolistic/collusive agreements, merger control, and rules against abuse of dominance, the AML also addresses issues related to administrative monopolies.⁶ Of these four areas, merger control was involved in all administrative enforcement decisions during the AML’s first year.⁷ It is the focus of discussion for the rest of the thesis.

China’s merger control regime was shaped by considerations unique to its stage of economic development. One trigger for the establishment of the Chinese merger review system was China’s accession to the WTO in 2001, which further opened up its economy to the world. To address concerns regarding acquisitions of domestic companies and more competition

⁶Qian (2010)

⁷Mitnick et al. (2008)

brought about by foreign firms, the *Provisional Regulations on Mergers with and Acquisitions of Domestic Enterprises by Foreign Investors* (“Provisional M&A Regulations”)⁸ was adopted in 2003. Jointly endorsed by six government agencies, the regulations was revised to *Regulations on Mergers and Acquisitions of Domestic Enterprises by Foreign Investors* (“M&A Rules”)⁹ in 2006. Even though these prototype merger regulations were enacted to target foreign firms, transactions could be exempted from merger review if they lead to “(1) improvements of conditions for market competition; (2) restructure of failing firms and contribution to employment; (3) introduction of advanced technology, managerial expertise, and enhancement of firms’ international competitiveness; and (4) environmental improvements.”¹⁰ This shows in markets with foreign firms, mergers of foreign firms with domestic enterprises could be beneficial to the Chinese government’s considerations.

Article 27 of the AML introduces a more comprehensive and neutral merger control regime that applies generally to both foreign and Chinese companies. The Ministry of Commerce (MOFCOM) is primarily responsible for enforcing the AML’s merger control regime. Considerations by the MOFCOM regarding whether to approve a merger include: (1) market share and market power; (2) market concentration; (3) the effect of market concentration on entry and technological innovation; (4) effects on consumers and other related undertakings; (5) effect on the development of the national economy; (6) other factors as determined by the State Council Anti-Monopoly Enforcement Authority.¹¹ The first four considerations are largely consistent with Western merger controls, in which consumer welfare is the major focus of evaluation. The fifth and sixth factors, however, could allow MOFCOM to impose

⁸<http://tfs.mofcom.gov.cn/aarticle/date/i/s/200509/20050900366385.html>

⁹<http://english.mofcom.gov.cn/aarticle/policyrelease/domesticpolicy/200610/20061003434565.html>

¹⁰ARTICLE 22. *Provisional M&A Regulations*

¹¹Anti-monopoly Law of the People’s Republic of China, Article 27, http://www.china.org.cn/government/laws/2009-02/10/content_17254169.htm

conditions that are not based on traditional antitrust economics factors. This thesis explores how such additional considerations could make Chinese merger review decisions different.

To understand this variant of merger review pursued by the Chinese government, we need to first understand the differences between state-owned and private enterprises. The SOEs are at least partially owned by the government, and pursue objectives that are not pure profit-maximizing.¹² Qian (1996) notes the high agency and political costs related to SOEs that hinder economic efficiency and social welfare, and proposes measures for enterprise reforms. The dual track regime adopted in SOE reform process sheds light on the major objectives the Chinese government pursues. The reform regroups SOEs by function into those dedicated to public welfare (public class, *gongyilei*) and profit (commercial class, *shangyelei*).¹³ Profitability is a secondary priority for those charged with public welfare or national security functions, while improving market competitiveness and delivering gains in financial performance are top priorities for the commercial class. Hence this thesis models the SOEs as pursuing dual objectives of maximizing a weighted combination of profit and social welfare, with the relative weights depicting the different characteristics of the types of SOEs.

Sappington and Sidak (2003) discuss the implications of the *Deutsche Post* (a German SOE) case in 2001 on US legal framework. Specifically, through modeling SOEs as pursuing not pure profit-maximizing objectives, they show SOEs have strong incentives to engage in anticompetitive activities that help expand the scale and scope of their operations. They also identify the agency problems in the corporate governance of SOEs, an area of much focus for the literature on state-owned enterprises. As the state cannot operate the SOEs by itself, it delegates the control of the enterprises to outside managers. The separation of ownership and

¹²Sappington and Sidak (2003)

¹³September 2015. ‘Guiding Opinions of the Communist Party of China Central Committee and the State Council on Deepening the Reform of State-Owned Enterprises’

control leads to issues of information asymmetry. It is desired that the state could oversee the managers' actions directly and reward them according to managerial efforts.¹⁴ However, complete observation of managerial effort is not realistic and could be prohibitively costly. Levy (1987) and De Fraja and Delbono (1990) discuss the principal-agent problems in public enterprises.¹⁵ There were management system reforms to help alleviate the principal-agent problem in China: the government first introduced a profit-retention program that shares 12% of profit growth with the SOE. Managerial autonomy was further deepened through contract-responsibility system and later modern corporate system that involves dividend on the shares of the SOE assets. This thesis considers the implications of these principal-agent concerns on the evaluation of potential mergers in later discussions.

3 Model

My model considers product markets that consist of a mixture of state-owned, private domestic, and private foreign firms. The three types of firms differ in both production capabilities and objectives. I first elaborate the objective and production function of each type of firm, and define the objectives of interest to the government. I then evaluate how potential mergers among the three types of firms affect the government's interests to compare how merger review decisions under the Chinese antitrust framework may differ from those made under Western antitrust frameworks that primarily consider consumer welfare.

3.1 Model setup

For tractability, I model market competition using the familiar Cournot setup. Firms produce identical goods and compete in quantity. I also assume firms of the same type (SOE,

¹⁴Alchian and Demsetz (1972)

¹⁵Levy (1987), p.77; De Fraja and Delbono (1990), p.3

private domestic, and private foreign) are identical. I use the following notations throughout the thesis:

(s, d, f) : subscript for SOE, private domestic, and private foreign firm;

(N_s, N_d, N_f) : the number of each type of firm in the market. (There are $N = N_s + N_d + N_f$ firms in the market);

(π_s, π_d, π_f) : the profits for each type of firm;

(q_s, q_d, q_f) : the quantity of production chosen by each type of firm;

(q_{-s}, q_{-d}, q_{-f}) : the total quantity of production chosen by the rest of the firms in the market (excluding one unit of a specific type of firm);

(C_s, C_d, C_f) : the marginal cost of the goods for each type of firm;

p : the price of the goods;

w, r : cost of labor and cost of capital;

I use a generalized linear demand function such that the price is determined by the total quantities supplied by the firms in the market, $p(Q) = a - b \times Q = a - b \times (N_s q_s + N_d q_d + N_f q_f)$. The demand function contains implicit information about the market. The maximum total quantities that could be supplied in a market with demand function $p(Q) = a - b \times Q$ is $Q = \frac{a}{b} - \frac{1}{b}P$. a indicates the size of the market. The larger the a , the more profitable the overall market. $\frac{1}{b}$ reflects the price elasticity: a large b indicates that the market is relatively price insensitive.

3.1.1 Production functions

I use the Cobb-Douglas production function with constant returns to scale (of labor and capital inputs) to model the production capability of the firms. There are two ways to categorize the three types of firms. One categorization is by domestic and foreign ownership. The SOEs and private domestic are domestic firms. I model the domestic and foreign firms with different input intensity: the domestic firms are more labor intensive, and the foreign firms

are more capital intensive.¹⁶ The input intensity of the domestic private firms and SOEs are modeled to be the same because domestic firms have similar production technologies.

Another categorization is by ownership structure: state-owned and private. Even though the state owns the SOEs, it needs to delegate control to the enterprises' managers. The separation of ownership and control makes the government unable to directly observe the effort level exerted by the delegated managers. The state hence compensates the managers using a second best contract based on the observed profits of the managed firms in hope to alleviate the asymmetric information problem. Since the profit of SOE is stochastic, information asymmetry still remains. I later incorporate the principal agent problem into the production function of SOEs. The effort the manager exerts determines the total factor productivity of the SOE such that $A_s = A(e)$. $c(e)$ is the cost function of the effort e exerted by the managers. The SOE managers are hence choosing both an optimal level of effort (e) and quantity (q_s). The principal-agent problem are less prominent in private firms - I thus model the total factor productivity of private domestic and private foreign firms as given.¹⁷

With $\alpha + \beta = 1$ and $0 \leq \delta \leq \alpha$, I define the production functions to be such that:

$$\text{Private foreign : } q_f = f_f(K, L) = A_f K^\alpha L^\beta, \quad (1)$$

$$\text{Private domestic : } q_d = f_d(K, L) = A_d K^{\alpha-\delta} L^{\beta+\delta}, \quad (2)$$

$$\text{SOE : } q_s = f_s(K, L) = A_s K^{\alpha-\delta} L^{\beta+\delta}. \quad (3)$$

where

α, β : input intensity of capital and labor ($\alpha + \beta = 1, \alpha, \beta \geq 0$);

K, L : capital and labor;

A_f, A_d, A_s : total factor productivity of private foreign, private domestic firms and SOE. $A_s = A(e)$

¹⁶Ma et al. (2014)

¹⁷Sappington and Sidak (2003), p.500

under principal-agent discussions, where e is the managers' effort level;

δ : difference in input intensity for domestic and foreign firms, $\delta \in [0, \alpha]$.

3.1.2 Objectives of firms

As the private firms do not have ties with the state through either shared ownership or profits, I model their objective as classical profit-maximization. The SOEs, however, are expected to undertake certain social-welfare functions, S . They aim to maximize a weighted sum of profit and social function. I model the SOEs' social function as $S = q_s$ to capture the state and SOEs' interest in producing more products and increasing employment.¹⁸ With stochastic actual realized profits, the firms make input choices to maximize expected objectives knowing the distribution of profits. This is a source of asymmetric information that I will discuss in later sections. The three types of firms' objectives are:

$$\text{Private domestic : } \max_{K,L} E[\pi_d] = E[p(q_d, q_{-d}) \cdot q_d - (rK + wL)]$$

$$\text{Private foreign : } \max_{K,L} E[\pi_f] = E[p(q_f, q_{-f}) \cdot q_f - (rK + wL)]$$

$$\text{SOE : } \max_{K,L} E[\gamma\pi_s + (1 - \gamma)S] = E[\gamma(p(q_s, q_{-s}) \cdot q_s - (rK + wL)) + (1 - \gamma)q_s]$$

where q_{-d} , q_{-f} , and q_{-s} denote the quantities supplied by firms other than the individual domestic/foreign/state-owned firm. Given that the production technology has constant returns to scale, the firms' objective can be re-expressed as:

$$\text{Private domestic : } \max_{q_d} E[\pi_d] = E[(p(q_d, q_{-d}) - C_d) \cdot q_d] \quad (4)$$

$$\text{Private foreign : } \max_{q_f} E[\pi_f] = E[(p(q_f, q_{-f}) - C_f) \cdot q_f] \quad (5)$$

$$\text{SOE : } \max_{q_s} E\left[\left(p(q_s, q_{-s}) - C_s + \frac{1 - \gamma}{\gamma}\right) \cdot q_s\right] \quad (6)$$

where C_d , C_f , and C_s are the constant marginal costs of production for the each type of the firms, and γ and $1 - \gamma$ indicates the relative weights the SOE places on profit and social functions (in this case, more output) in its objective. $\frac{1-\gamma}{\gamma}$ could also be interpreted

¹⁸Sappington and Sidak (2003)

as an “as-though” per-unit cost subsidy for the SOE -that is, because the SOE is pursuing additional objectives other than pure profit-maximization, it makes production decisions as if it has a lower marginal cost. Hence, we need $C_s - \frac{1-\gamma}{\gamma} > 0$ so that the SOE does not face negative cost when making production decisions. Therefore I assume $\gamma \in (\frac{1}{C_s+1}, 1]$. Firms with higher γ care more about profit, whereas those with lower γ consider providing social welfare a more important objective to pursue.

3.2 Marginal costs

With constant returns to scale, each type of firm has constant marginal costs. The marginal costs across firms could differ with different total factor productivity, input intensity, and costs of labor and capital. With objectives that are consistent with cost minimization, the derived marginal costs for the three types of firms are:

$$\begin{aligned} \text{Private foreign : } C_f &= \frac{1}{A_f} \left(\frac{w}{\beta}\right)^\beta \left(\frac{r}{1-\beta}\right)^{1-\beta}, \text{ Private domestic : } C_d = \frac{1}{A_d} \left(\frac{w}{\tilde{\beta}}\right)^{\tilde{\beta}} \left(\frac{r}{1-\tilde{\beta}}\right)^{1-\tilde{\beta}} \\ \text{SOE : } C_s &= \frac{1}{A_s} \left(\frac{w}{\tilde{\beta}}\right)^{\tilde{\beta}} \left(\frac{r}{1-\tilde{\beta}}\right)^{1-\tilde{\beta}}, \text{ where } \tilde{\beta} = \beta + \delta, \delta \in [0, 1 - \beta] \end{aligned} \quad (7)$$

It is clear that the greater total factor productivity, A , the lower the marginal cost for the firm. To compare the marginal costs for SOE and private domestic firms we have,

$$\frac{E[C_s]}{E[C_d]} = \frac{\frac{1}{A_s} \left(\frac{w}{\tilde{\beta}}\right)^{\tilde{\beta}} \left(\frac{r}{1-\tilde{\beta}}\right)^{1-\tilde{\beta}}}{\frac{1}{A_d} \left(\frac{w}{\tilde{\beta}}\right)^{\tilde{\beta}} \left(\frac{r}{1-\tilde{\beta}}\right)^{1-\tilde{\beta}}} = \frac{A_d}{A_s}$$

Therefore, whichever type of firm has a higher total factor productivity would have a lower marginal cost for production. When the SOE manager exerts a level of effort that yields $A_s = A(e) = A_d$, the marginal costs for the two types of firms would be the same. To compare the marginal costs for private foreign and private domestic firms we have,

$$\frac{E[C_f]}{E[C_d]} = \frac{\frac{1}{A_f} \left(\frac{w}{\beta}\right)^\beta \left(\frac{r}{1-\beta}\right)^{1-\beta}}{\frac{1}{A_d} \left(\frac{w}{\tilde{\beta}}\right)^{\tilde{\beta}} \left(\frac{r}{1-\tilde{\beta}}\right)^{1-\tilde{\beta}}} = \frac{A_d}{A_f} \left(\frac{r}{w}\right)^\delta \left(\frac{\tilde{\beta}}{1-\tilde{\beta}}\right)^\delta \left(\frac{\tilde{\beta}}{\beta}\right)^\beta \left(\frac{1-\tilde{\beta}}{1-\beta}\right)^{1-\beta}$$

Again, from the above equation we can see that the firm with higher total factor productivity would more likely have lower marginal costs. $\left(\frac{r}{w}\right)^\delta$ is also important in the relation-

ship between C_f and C_d : When capital is relatively more expensive than labor (that is, the higher $\frac{r}{w}$), it is more likely that the foreign firm would have a higher marginal cost because we modeled them as having more capital intensive production capability. When $\frac{w}{r} = [\frac{A_d}{A_f} (\frac{\tilde{\beta}}{1-\tilde{\beta}})^\delta (\frac{\tilde{\beta}}{\beta})^\beta (\frac{1-\tilde{\beta}}{1-\beta})^{1-\beta}]^{\frac{1}{\delta}}$, the foreign and domestic private firms would have the same marginal costs. Figure 3.1 shows the marginal cost comparison for the domestic and foreign

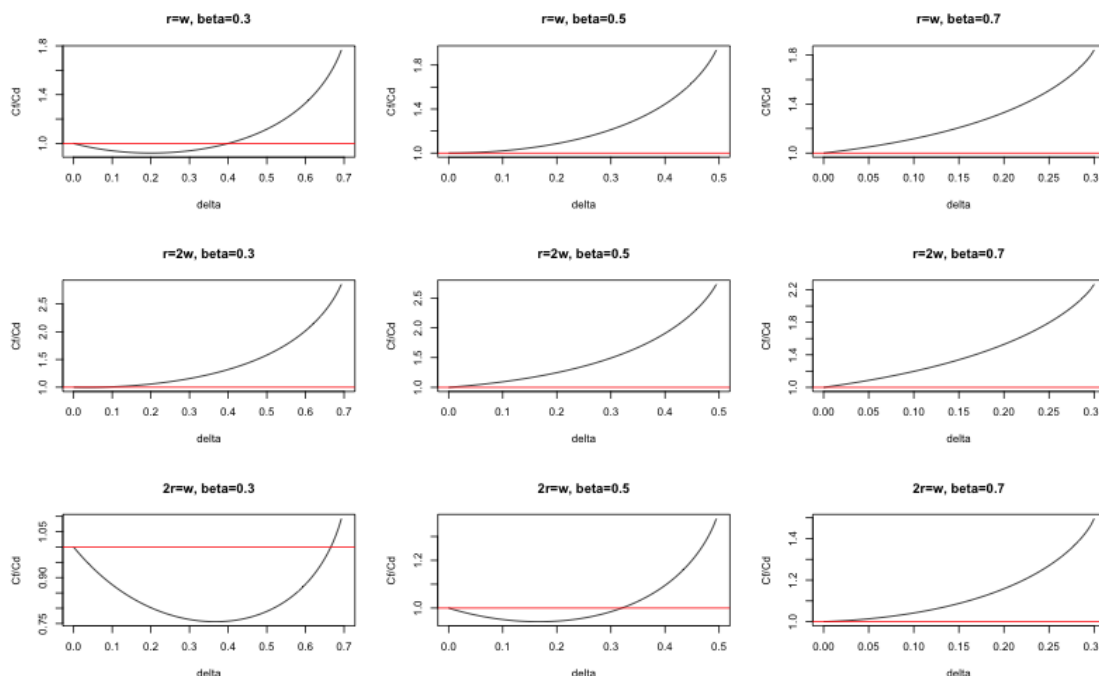


Figure 3.1: $\frac{C_f}{C_d}$ when $A_f = A_d$

private firm with same levels of total factor productivity ($A_d = A_f$). The black curve shows $\frac{C_f}{C_d}$, and the red horizontal line indicates when $\frac{C_f}{C_d} = 1$. Each column represents cases with the same factor intensity (β), and each row represents cases with the same relative costs of capital and labor. When the total factor productivity and the relative costs of capital and labor are the same for both firms and $\beta \geq 0.5$ (that is, when the industry the two firms are in has a more labor-intensive characteristic), the marginal cost for the foreign firm would be higher. But if $\beta < 0.5$, the foreign firm would have lower marginal cost when $\delta \in (0, 1 - 2\beta)$. When labor becomes relatively more expensive, the foreign firm would be more likely to have lower marginal cost because it is more capital intensive. The foreign firms tend to have lower marginal costs normally because they have more advanced technology that yields

higher total factor productivity, and often have more advantageous positions in industries that are more capital intensive.

Similarly, to compare the marginal costs for the SOE and foreign private firms we also have

$$\frac{E[C_f]}{E[C_s]} = \frac{A_s}{A_f} \left(\frac{r}{w}\right)^\delta \left(\frac{\tilde{\beta}}{1-\tilde{\beta}}\right)^\delta \left(\frac{\tilde{\beta}}{\beta}\right)^\beta \left(\frac{1-\tilde{\beta}}{1-\beta}\right)^{1-\beta}$$

Whether the SOE or the foreign private firm has lower marginal costs depends upon the total factor productivity of the firms, the relative costs of capital and labor, and the characteristic of the industry being more capital or labor intensive.

3.3 Best response strategies

The objective function of the SOE in (6) can be rewritten as

$$\max_{q_s} E\left[\gamma \left(p(q_s, q_{-s}) - C_s + \frac{1-\gamma}{\gamma} \right) \cdot q_s\right] = \max_{q_s} E\left[\left(p(q_s, q_{-s}) - \tilde{C}_s \right) \cdot q_s\right]$$

where $\tilde{C}_s = C_s - \frac{1-\gamma}{\gamma}$. Thus when making production decisions, the SOE behaves as though it is a pure profit-maximizing firm with a marginal cost \tilde{C}_s , while its actual marginal cost is C_s . Using $MR = MC$, the best response strategy for the three types of firms are

$$q_s^*(q_{-s}; w, r) = \frac{a - bq_{-s} - \tilde{C}_s}{2b} \quad (8)$$

$$q_d^*(q_{-d}; w, r) = \frac{a - bq_{-d} - C_d}{2b} \quad (9)$$

$$q_f^*(q_{-f}; w, r) = \frac{a - bq_{-f} - C_f}{2b} \quad (10)$$

3.4 Framing the principal-agent problem

In the previous sections on production functions and marginal costs, I had touched upon the principal-agent problem marring the corporate governance of SOEs. In this section, I borrow from the traditional efficient wage literature to formally frame this principal-agent problem within my model.

As shown in the previous sections, the firms have constant marginal costs. The SOE's profit depends on the effort level (e) and quantities (q_s) chosen by the manager such that $\pi_s(e, q_s) = (p - C_s(e)) \times q_s$ where $C_s(e) = \frac{1}{A(e)} (\frac{w}{\beta})^{\tilde{\beta}} (\frac{r}{1-\tilde{\beta}})^{1-\tilde{\beta}}$. To model the inability of the government to observe directly the effort level of SOE managers, I introduce uncertainty, ϵ , into the profits of the firms. With ϵ , firms can only maximize their expected objectives because ϵ is realized after the firms make their supply decisions. Thus, the state cannot perfectly infer effort of managers from market outcomes. With this profit uncertainty, each firm maximizes their respective expected profits $E[p_i(q_i - MC_i) + \epsilon]$, where $\epsilon \sim N(0, \sigma^2)$, and $\epsilon \perp K, L, e$. As described in the production functions section, the compensation of the managers are tied to the profit of the SOE to incentivize them to exert higher costly efforts at work. They receive $b(e) = f(\pi_s(e))$ as compensation, and it costs them $c(e)$ for the effort e they exert. Specifically, I define $A(e)$ and $c(e)$ to be

$$\frac{1}{A(e)} = \frac{1}{A} - \tau e, \quad c(e) = e^3, \quad \text{where } \tau \in [0, \frac{1}{Ae}] \quad (11)$$

so that the manager has increasing marginal costs for the effort he/she exerts. I discuss the compensation structures in more detail, derive and compare the optimal effort level the SOE managers would exert under different merger scenarios in the next chapter.

3.5 Objective of government

To understand the rationale behind the government's merger review decisions, I model the objective of the government as a linear combination of total consumer surplus and aligned objectives with the SOEs. Recall that I rewrite the objective of SOE by dividing its initial objective by a scalar γ , which represents the relative weight the SOE places on profit, to transform it to a variant of profit-maximization problem. Hence the actual objective of SOE should be $\gamma \cdot \tilde{\Pi}$. Therefore the government's objective follows the general form of:

$$G = E[(1 - \phi) \cdot TotalCS + \phi[\gamma\pi_s + (1 - \gamma)S]]$$

where

$TotalCS$: total consumer surplus in the market;

S : In the output subsidy case we consider now, $S = q_s$;

ϕ : proportion of the government's objective that is aligned with the SOE, $\phi \in [0, 1]$;

This setup captures the government's dual goal of both maximizing the consumer surplus from overall market, as well as profit-sharing with SOE and providing social welfare. Comparing the government's payoffs in different merger scenarios would explain the incentives for introducing particular competition policies.

4 Merger Scenarios

Following traditional oligopoly literature, I focus on pure-strategy, symmetric Cournot Nash equilibria when deriving equilibrium conditions under different market structures.

4.1 Market with domestic firms

First consider a domestic market with two domestic private firms and one SOE, which means $N_s = 1, N_d = 2, q_{-s} = 2q_d, q_{-d} = q_s + q_d$. The pure strategy symmetric equilibrium quantities chosen by each firm, total quantities, and price are:

$$q_d = \frac{a + \tilde{C}_s - 2C_d}{4b}, \quad q_s = \frac{a + 2C_d - 3\tilde{C}_s}{4b}$$

$$Q = 2q_d + q_s = \frac{3a - \tilde{C}_s - 2C_d}{4b}, \quad p = a - bQ = \frac{2C_d + \tilde{C}_s + a}{4}$$

The implicit condition for the market to have one SOE and two domestic firms is that the price should be greater or equal to the marginal costs of the two types of market participants:

$$p = \frac{2C_d + \tilde{C}_s + a}{4} \geq \tilde{C}_s \quad \text{and} \quad p = \frac{2C_d + \tilde{C}_s + a}{4} \geq C_d$$

$$2C_d + a - 3\tilde{C}_s \geq 0 \quad \text{and} \quad \tilde{C}_s + a - 2C_d \geq 0$$

Under this market structure, with $2C_d + a - 3\tilde{C}_s \geq 0$, the profit of the SOE is

$$\pi_s(e) = \left(\frac{2C_d + \tilde{C}_s + a}{4} - C_s \right) \times \frac{a + 2C_d - 3\tilde{C}_s}{4b} + \epsilon = \frac{(2C_d + a - 3\tilde{C}_s)^2}{16b} - \left(\frac{1 - \gamma}{\gamma} \right) \frac{a + 2C_d - 3\tilde{C}_s}{4b} + \epsilon$$

The total consumer welfare and government payoff in the market prior to the merger is

$$\begin{aligned} CS_{ex-ante} &= \frac{(a - p)Q}{2} = \frac{(3a - \tilde{C}_s - 2C_d)^2}{32b} \\ E[G_{ex-ante}] &= (1 - \phi) \cdot \frac{(3a - \tilde{C}_s - 2C_d)^2}{32b} + \phi\gamma \frac{(2C_d + a - 3\tilde{C}_s)^2}{16b} \end{aligned} \quad (12)$$

4.1.1 Welfare analysis without principal-agent consideration

Mergers normally leave the remaining firms with greater market power. However, a merger could also lead to lower costs when a low cost firm merges with a high cost one. Under Western competition frameworks that focus on consumer welfare, a merger would only be approved if the cost reduction effect is sufficient such that the merger leads to decreased price and enhanced consumer welfare. However, as shown in section 3.5, the Chinese framework also considers the aligned objectives with SOEs when evaluating mergers. Therefore, a merger that potentially hurts consumer welfare could still be approved under the Chinese framework if it improves either the profitability of or the social function served by the SOE when the government's concerns about such aligned objectives are strong.

I first evaluate the welfare implications of the government's dual objectives in merger scenarios without principal-agent considerations. This would allow us to better understand how the additional objectives the Chinese government pursues, per se, would make merger review decisions different from those made under pure consumer welfare considerations.

(i) When $C_s = C_d$ When the marginal cost of the domestic private firm and the SOE are the same, that is, $A_d = A_s$, a merger between any of the two firms in the market involves no cost savings because the firms are identical. However, even when the SOE and the private domestic firm have the same marginal costs, the SOE produces more than the private firm

because it makes production decisions with an “as-if lowered/subsidized” marginal cost due to the additional social objective it pursues. Either the merger of one SOE with one domestic private firm, or the merger of two private firms, leads to a post-merger market structure of one SOE and one domestic private firm. The post-merger equilibrium is:

$$q_s = \frac{a + C_d - 2\tilde{C}_s}{3b}, \quad q_d = \frac{a + \tilde{C}_s - 2C_d}{3b}$$

$$Q = q_s + q_d = \frac{2a - C_d - \tilde{C}_s}{3b}, \quad p = a - bQ = \frac{\tilde{C}_s + C_d + a}{3}$$

The profit of the state-owned firm after the merger is hence $\pi_s = \frac{(a+C_d-2\tilde{C}_s)^2}{9b} - \frac{1-\gamma}{\gamma} \frac{a+C_d-2\tilde{C}_s}{3b} + \epsilon$, with $a + C_d - 2\tilde{C}_s \geq 0$. The consumer welfare and government objective in this scenario is

$$CS_{SD} = \frac{(2a - \tilde{C}_s - C_d)^2}{18b}$$

$$E[G_{SD}] = (1 - \phi) \cdot \frac{(2a - \tilde{C}_s - C_d)^2}{18b} + \phi\gamma \frac{(a + C_d - 2\tilde{C}_s)^2}{9b}$$
(13)

When $C = C_s = C_d$, the consumer surplus in the pre-merger and post-merger situations are:

$$CS_{ex-ante} = \frac{(3a - \tilde{C}_s - 2C_d)^2}{32b} = \frac{(3a - (C_s - \frac{1-\gamma}{\gamma}) - 2C_d)^2}{32b} = \frac{(3(a - C) + \frac{1-\gamma}{\gamma})^2}{32b}$$

$$CS_{SD} = \frac{(2a - \tilde{C}_s - C_d)^2}{18b} = \frac{(2a - (C_s - \frac{1-\gamma}{\gamma}) - C_d)^2}{18b} = \frac{(2(a - C) + \frac{1-\gamma}{\gamma})^2}{18b}$$
(14)

Therefore the consumer welfare would decrease if

$$\frac{CS_{ex-ante}}{CS_{SD}} = \frac{9}{16} \left(\frac{3(a - C) + \frac{1-\gamma}{\gamma}}{2(a - C) + \frac{1-\gamma}{\gamma}} \right)^2 \geq 1$$
(15)

As $a - C \geq 0$, $\frac{1-\gamma}{\gamma} \geq 0$, $\frac{3(a-C)+\frac{1-\gamma}{\gamma}}{2(a-C)+\frac{1-\gamma}{\gamma}} \geq 0$:

$$a - C \geq \frac{1}{\gamma} - 1$$
(16)

$\frac{1}{\gamma} - 1$ is monotonically decreasing with γ for $\gamma \in (\frac{1}{1+C_s}, 1]$, and because $C_s = C$ for this discussion, $0 \leq \frac{1}{\gamma} - 1 < C$. Therefore, the less the government cares about its social objective, the more likely the market structure before the merger would be more beneficial to the total consumer welfare. And when the market is sufficiently large, especially when $a \geq 2C$, the consumer welfare in the pre-merger market is always higher or equal to that in the post-merger market.

Under Western competition framework and in a market with all private firms, mergers of firms with identical marginal costs do not involve cost-saving, thus would always harm consumer welfare and hence not be approved. However, because the SOE remains in the post-merger scenario, the deviations in its production choice from pure profit-maximization lead it to produce more than the private firm with identical marginal cost, hence could drive down prices and make such mergers potentially consumer-welfare-enhancing. Consistent with the condition above, when $\gamma = 1$, that is, when the SOE cares only about profit and behaves like a private firm, $a - C \geq 1 - 1 = 0$ always holds and hence the merger could never improve consumer welfare. Yet when $\gamma < 1$ and when the market size is sufficiently small, a merger in a Chinese domestic market with a mixture of SOE and private firms could improve consumer welfare, even though no cost-saving is involved in the process.

In terms of the government's overall objective

$$\begin{aligned}
 E[G_{ex-ante}] &= (1 - \phi) \cdot \frac{(3a - 3C + \frac{1-\gamma}{\gamma})^2}{32b} + \phi\gamma \frac{(a - C + 3\frac{1-\gamma}{\gamma})^2}{16b} \\
 E[G_{SD}] &= (1 - \phi) \cdot \frac{(2a - 2C + \frac{1-\gamma}{\gamma})^2}{18b} + \phi\gamma \frac{(a - C + 2\frac{1-\gamma}{\gamma})^2}{9b}
 \end{aligned} \tag{17}$$

The condition under which the aligned objectives with SOE are higher before the merger is

$$\frac{\phi\gamma \frac{(a-C+3\frac{1-\gamma}{\gamma})^2}{16b}}{\phi\gamma \frac{(a-C+2\frac{1-\gamma}{\gamma})^2}{9b}} \geq 1 \rightarrow a - C \leq \frac{1}{\gamma} - 1 \tag{18}$$

Only when the market size is such that $a - C = \frac{1}{\gamma} - 1$ would the aligned objectives with SOE and consumer welfare in both scenarios remain unchanged. If market is sufficiently large such that $a - C > \frac{1}{\gamma} - 1$, the post-merger scenario would yield a higher SOE objective. As $\frac{1}{\gamma} - 1$ falls with higher γ , the less the government cares about its social objective of creating more output, the easier it is for the SOE objective to be higher in the post-merger case. Recall that when the market is sufficiently large such that $a - C > \frac{1-\gamma}{\gamma}$, the consumer welfare decreases after the merger (see equation 16). This shows a tension between the government's dual objectives: a merger in a relatively profitable market would harm total

consumer welfare but benefit in terms of its aligned objectives with SOE.

When the SOE and domestic private firms have same costs and the market size is at the threshold such that $a = C + \frac{1}{\gamma} - 1$, the government would be indifferent between approving and blocking a merger, and such a decision is the same as that made under a consumer-welfare based evaluation framework. However, because of the additional objective the Chinese government pursues through the aligned interests with the SOE, mergers that would normally be blocked in Western competition framework could potentially be approved. For example, when $a = 2C$, the consumer welfare and government overall objective in the pre- and post-merger scenario would be:

$$\begin{aligned}
 CS_{ex-ante} - CS_{SD} &= \frac{(3C + \frac{1-\gamma}{\gamma})^2}{32b} - \frac{(2C + \frac{1-\gamma}{\gamma})^2}{18b} = \frac{(C - \frac{1-\gamma}{\gamma})(17C + 7\frac{1-\gamma}{\gamma})}{288b} > 0 \\
 E[G_{ex-ante}] - E[G_{SD}] &= \frac{(C - \frac{1-\gamma}{\gamma})}{288b} \left((1 - \phi)(17C + 7\frac{1-\gamma}{\gamma}) - 2\phi\gamma(17\frac{1-\gamma}{\gamma} + 7C) \right)
 \end{aligned} \tag{19}$$

Recall that $\frac{1-\gamma}{\gamma}$ could be treated as an “as-if” cost subsidy when the SOE makes production choices, such that $\frac{1-\gamma}{\gamma} \in [0, C)$, and it decreases monotonically with values of γ . When $\gamma = 1$, that is, when government has no concern about the social benefit of creating more output and hence enhance employment, $E[G_{ex-ante}] - E[G_{SD}] < 0$ if $\phi > \frac{17}{31}$. This means when the government weighs its aligned interest (in this case, only profit sharing) with the SOE over a certain threshold, it may approve certain mergers that would otherwise be rejected under pure consumer welfare consideration.

Now consider a case in which the consumer surplus is enhanced after the merger. From the conditions above, we know post-merger consumer surplus would be higher if $a - C < \frac{1-\gamma}{\gamma}$, which would be the case for smaller markets. We have also shown that when $a - C < \frac{1-\gamma}{\gamma}$, the SOE’s objective would be lower after the merger. Hence it would be possible for a merger to be blocked even though the merger is consumer-welfare enhancing. As $\frac{1-\gamma}{\gamma} \in [0, C)$ and we need $a \geq C$ to keep the players in the market, consider $a = C + 0.5$ and $\gamma = 0.5$. In this

case, the consumer welfare and government overall objective in the pre- and post-merger scenario would be:

$$CS_{ex-ante} - CS_{SD} = \frac{(3(a - C) + \frac{1-\gamma}{\gamma})^2}{32b} - \frac{(2(a - C) + \frac{1-\gamma}{\gamma})^2}{18b} = -\frac{31}{1152b} < 0 \quad (20)$$

$$E[G_{ex-ante}] - E[G_{SD}] = -(1 - \phi)\frac{31}{1152b} + \phi\frac{41}{1152b} = -\frac{31}{1152b} + \phi\frac{72}{1152b}$$

To have $E[G_{ex-ante}] - E[G_{SD}] > 0$, we need $\phi > \frac{31}{72}$. When the government cares about its aligned objectives above a certain threshold, mergers in smaller markets that could improve consumer welfare could be blocked under the Chinese competition framework. In this specific example, the rejection stems from the government's concerns for sharing profit with SOE and the social benefits related to creating more output. A merger in an already small market would make the firms strategically produce less. And when the government cares about this particular social objective above the threshold in its overall objective function, it would prefer a more competitive market structure (with more participating firms) rather than a more concentrated one after merger even though such a merger enhances consumer-welfare.

(ii) When $C_s < C_d$ When the SOE has lower marginal cost than the domestic private firm, that is, $A_s > A_d$, a merger between a private firm with an SOE leads to a post-merger market structure of one SOE and one domestic private firm and involves cost saving because one domestic firm merges into an SOE with lower cost. The merger of two private firms, though does not involve cost-saving among the merging firms, can also lead to cost saving: there are one SOE and one domestic private firm after the merger, and the SOE with lower cost takes a larger market share. Such mergers may not be approved under Western framework because without sufficient cost-saving, they harm consumer welfare. However, they could be approved under the Chinese framework because with less firms in the market, the government's aligned objectives with the SOE could be enhanced.

(iii) When $C_s > C_d$ When the SOE has a higher marginal cost prior to the merger ($A_s < A_d$), the merged firm of one SOE with one domestic private firm becomes domestic

private, as the model assumes the merged firm takes the ownership structure of the merging firm with lower marginal cost. The post-merger market thus consists of two domestic private firms. The post-merger equilibrium is:

$$q_m = \frac{a - C_d}{3b}, \quad q_d = \frac{a - C_d}{3b}$$

$$Q = q_m + q_d = \frac{2a - 2C_d}{3b}, \quad p = a - bQ = \frac{a + 2C_d}{3}$$

Recall that the government interest is a weighted sum of total consumer surplus and aligned interest with SOE. In this case, the aligned interests with SOE (both profit-sharing and social objectives) are gone from the equation. The principal-agent problem, if considered, would also no longer be of concern because the merged firm is private. Hence the government will be evaluating the loss of the latter interest with the benefit to consumer surplus post-merger when deciding whether to approve the merger. The expected government payoff under the merger of SOE and domestic firm, when the SOE has a higher marginal cost, is thus equivalent to the pure consumer welfare consideration because the post-merger market consists only of two domestic firms with no SOE left. As the SOE and the private domestic firms have the same factor intensity in their production functions, the difference in marginal costs stems from the different total factor productivity. Assume $\frac{1}{A_s} = \frac{1}{A_d} + \nu$ and denote $M = (\frac{w}{\beta})^{\tilde{\beta}} (\frac{r}{1-\tilde{\beta}})^{1-\tilde{\beta}}$. Therefore $C_d = \frac{M}{A_d}$ and $C_s = (\frac{1}{A_d} + \nu)M = C_d + \nu M$, $\tilde{C}_s = C_d + \nu M - \frac{1-\gamma}{\gamma}$. The total consumer welfare and government payoff in the market prior to the merger is

$$CS_{ex-ante} = \frac{(3a - \tilde{C}_s - 2C_d)^2}{32b} = \frac{(3a - 3C_d - \nu M + \frac{1-\gamma}{\gamma})^2}{32b}$$

$$CS_{DD} = \frac{(2a - 2C_d)^2}{18b}$$

$$E[G_{ex-ante}] = (1 - \phi) \cdot \frac{(3a - 3C_d - \nu M + \frac{1-\gamma}{\gamma})^2}{32b} + \phi\gamma \frac{(a - C_d - 3(\nu M - \frac{1-\gamma}{\gamma}))^2}{16b}$$

$$E[G_{DD}] = (1 - \phi) \cdot \frac{(2a - 2C_d)^2}{18b}$$

To have higher consumer welfare after the merger we need $CS_{ex-ante} - CS_{DD} < 0$. To have a higher government payoff after the merger, we need $E[G_{ex-ante}] - E[G_{DD}] < 0$. Therefore, even though the government cannot pursue its aligned interests with the SOE after

the merger, because the SOEs have high costs, the merger of the SOE and the domestic private firm would be approved if the loss of shared interest with SOE is compensated by improvement in consumer welfare through the elimination of inefficiencies post-merger.

When the SOE has a higher cost than the private domestic firm, the merger of two domestic firms involves no cost saving among the merging firms and leads to a post-merger market with one SOE and one private domestic firm. Such a merger may not be approved under the Western framework. However, it could be approved under the Chinese framework if the aligned objective concerns are strong: facing less competition after the merger, the high cost SOE's profit and output could improve.

4.1.2 Principal-agent problem: exogenous compensation structure

Even consumer welfare based evaluations can differ in China due to principal-agent concerns. Mergers could incentivize managers to exert higher effort in many cases, because with one less competitor, the post-merger market is more profitable. Therefore mergers could effect cost change for SOEs. Thus mergers that would not be approved in the previous section may be approved due to this additional cost-saving factor.

Let us first consider a simpler version of the principal-agent problem in which the compensation structure is exogenous. That is, the managers receive a fixed proportion of the profits of SOE, such that the benefit $b(e)$ they get is denoted as $b(e) = \lambda\pi_s(e)$. To incorporate principal-agent problem into our discussion, we set the total factor productivity of SOE to be $\frac{1}{A_s} = \frac{1}{A(e)} = \frac{1}{A} - \tau e$. In a market with one SOE and two domestic private firms, the profit of the SOE is

$$\pi_s(e)_{ex-ante} = (p - C_s) \times q_s + \epsilon = \frac{(2C_d + a - 3\tilde{C}_s)^2}{16b} - \left(\frac{1 - \gamma}{\gamma}\right) \left(\frac{a + 2C_d - 3\tilde{C}_s}{4b}\right) + \epsilon$$

$$\text{with } 2C_d + a - 3\tilde{C}_s \geq 0$$

Using the notation in the previous welfare analysis section, denote $M = (\frac{w}{\beta})^{\tilde{\beta}}(\frac{r}{1-\beta})^{1-\tilde{\beta}}$. Therefore $C_d = \frac{M}{A_d}$ and $C_s = (\frac{1}{A} - \tau e)M$, $\tilde{C}_s = (\frac{1}{A} - \tau e)M - \frac{1-\gamma}{\gamma}$. The profit of SOE is hence

$$\pi_s(e)_{ex-ante} = \frac{(\frac{2M}{A_d} - \frac{3M}{A} + a + \frac{3-3\gamma}{\gamma} + 3M\tau e)^2}{16b} - \left(\frac{1-\gamma}{\gamma}\right) \frac{\frac{2M}{A_d} - \frac{3M}{A} + a + \frac{3-3\gamma}{\gamma} + 3M\tau e}{4b} + \epsilon$$

with $2C_d + a - 3\tilde{C}_s = \frac{2M}{A_d} - \frac{3M}{A} + a + \frac{3-3\gamma}{\gamma} + 3M\tau e \geq 0$

With $\epsilon \sim N(0, \sigma^2)$, and $\epsilon \perp K, L, e$, the benefit the manager receives is

$$b(e)_{ex-ante} = \lambda \pi_s(e)_{ex-ante}$$

$$= \lambda \left(\frac{(\frac{2M}{A_d} - \frac{3M}{A} + a + \frac{3-3\gamma}{\gamma} + 3M\tau e)^2}{16b} - \left(\frac{1-\gamma}{\gamma}\right) \left(\frac{\frac{2M}{A_d} - \frac{3M}{A} + a + \frac{3-3\gamma}{\gamma} + 3M\tau e}{4b}\right) + \epsilon \right)$$

For simplicity here denote $2C_d + a - 3\tilde{C}_s = \frac{2M}{A_d} - \frac{3M}{A} + a + \frac{3-3\gamma}{\gamma}$ as T_1 , we have

$$E[b(e)_{ex-ante}] = \lambda \left(\frac{T_1^2}{16b} - \frac{T_1}{4b\gamma} + \frac{T_1}{4b} \right) + 3\lambda M\tau \left(\frac{T_1}{8b} - \frac{1}{4b\gamma} + \frac{1}{4b} \right) e + \frac{9\lambda M^2 \tau^2}{16b} e^2$$

$$Var[b(e)_{ex-ante}] = \lambda^2 Var[\epsilon] = \lambda^2 \sigma^2$$

Assume the manager is risk averse with utility function that depends on his/her compensation whose constant absolute risk aversion parameter is R such that $R > 0$. Recall that $c(e) = e^3$. The expected utility for the manager and the first-order condition for the e maximizing the manager's expected utility gives¹⁹

$$E[U(e)_{ex-ante}] = E[b(e)_{ex-ante}] - \frac{R}{2} Var[b(e)] - c(e)$$

$$\frac{\partial E[U(e)_{ex-ante}]}{\partial e} = 0, \text{ which is, } \frac{\partial E[b(e)_{ex-ante}]}{\partial e} = \frac{\partial c(e)}{\partial e}$$

Setting the marginal expected benefit of effort equal to the marginal cost of effort,

$$\frac{\partial E[b(e)_{ex-ante}]}{\partial e} = \frac{3\lambda M\tau}{8b} \left(\frac{2M}{A_d} - \frac{3M}{A} + a + \frac{1-\gamma}{\gamma} \right) + \frac{9\lambda M^2 \tau^2}{8b} e, \quad \frac{\partial c(e)}{\partial e} = 3e^2$$

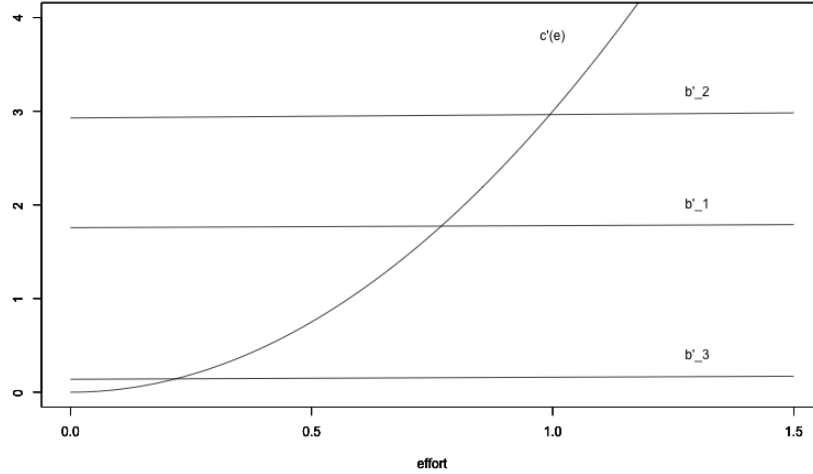
$$e_{ex-ante}^* = \frac{9\lambda M^2 \tau^2}{16b} + \sqrt{\frac{9\lambda M\tau}{8b} \left(\frac{2M}{A_d} - \frac{3M}{A} + a + \frac{1-\gamma}{\gamma} \right) + \left(\frac{9\lambda M^2 \tau^2}{16b} \right)^2} \quad (21)$$

From (21) we see that the optimal effort level is at the intersection of $b'(e)_{ex-ante}$ and $c'(e)$. Both the intercept and the slope of the $b'(e)$ line influences the optimal level. Specifically, parameters A_d, A, a and γ influence only the slope, and λ, τ, M and b influence both the

¹⁹Nicholson and Snyder (2012), p. 647

slope and the intercept. Figure 4.1 graphically shows how the optimal effort level is chosen. b'_1 shows the $b'(e)$ line with $\lambda = 0.12, a = 100, b = 1, \tau = 0.2, M = 1.9996, A = 1, Ad = 1.5$ and $\gamma = 0.5$. b'_2 has a higher $\lambda = 0.2$ while all other parameters are held the same, and b'_3 has $a = 10$ while all other parameters are held the same with b'_1 . It is clear that lower A_d and γ , higher a and A would lead to a higher intercept for the $b'(e)$ line and hence a higher effort level. And higher λ and τ , and a lower b would lead to higher intercept and steeper slope of $b'(e)$ and hence a higher effort level. Therefore, the higher the marginal cost of the rival firms and the lower the marginal cost of the SOE, the more the SOE and government care about the social objectives, the larger the size of and the more price sensitive the market, and the higher compensation proportion and the marginal effect of effort, the higher the optimal effort level would the manager choose.

Figure 4.1: Optimal effort level illustration



Again denoting $M = (\frac{w}{\beta})^{\tilde{\beta}} (\frac{r}{1-\tilde{\beta}})^{1-\tilde{\beta}}$ so that $C_d = \frac{M}{A_d}$ and $C_s = (\frac{1}{A} - \tau e)M$, $\tilde{C}_s = (\frac{1}{A} - \tau e)M - \frac{1-\gamma}{\gamma}$. In the post-merger scenario that results from either a merger between two domestic private firms or a merger between a lower cost SOE with a private domestic firm, the profit of the SOE is:

$$\pi_s(e)_{sd} = \frac{(\frac{M}{A_d} - \frac{2M}{A} + a + \frac{2-2\gamma}{\gamma} + 2M\tau e)^2}{9b} - \frac{1-\gamma}{\gamma} \frac{\frac{M}{A_d} - \frac{2M}{A} + a + \frac{2-2\gamma}{\gamma} + 2M\tau e}{3b} + \epsilon$$

with $\frac{M}{A_d} - \frac{2M}{A} + a + \frac{2-2\gamma}{\gamma} + 2M\tau e \geq 0$ (As $E[\pi_s] \geq 0$)

Solving the principal-agent problem under this post-merger market structure yields

$$\begin{aligned}\frac{\partial E[b(e)_{sd}]}{\partial e} &= \frac{2\lambda M\tau}{9b} \left(\frac{2M}{A_d} - \frac{4M}{A} + 2a + \frac{1-\gamma}{\gamma} \right) + \frac{8\lambda M^2\tau^2}{9b} e, \quad \frac{\partial c(e)}{\partial e} = 3e^2 \\ e^* &= \frac{4\lambda M^2\tau^2}{3b} + \sqrt{\frac{6\lambda M\tau}{9b} \left(\frac{2M}{A_d} - \frac{4M}{A} + 2a + \frac{1-\gamma}{\gamma} \right) + \left(\frac{4\lambda M^2\tau^2}{3b} \right)^2}\end{aligned}\quad (22)$$

The optimal levels of effort chosen by the managers are at the intersection of the expected marginal benefit lines in equations (21) and (22) with the expected marginal cost line of $c'(e) = 3e^2$.

As $\frac{9\lambda M^2\tau^2}{8b} > \frac{8\lambda M^2\tau^2}{9b}$, the slope of the pre-merger line is always steeper than that of the post-merger. Therefore, if the intercept of $b'(e)_{ex-ante}$ is at or above that of $b'(e)_{sd}$, the pre-merger market structure would have a higher effort level. Specifically, we need

$$\begin{aligned}\frac{3\lambda M\tau}{8b} \left(\frac{2M}{A_d} - \frac{3M}{A} + a + \frac{1-\gamma}{\gamma} \right) &\geq \frac{2\lambda M\tau}{9b} \left(\frac{2M}{A_d} - \frac{4M}{A} + 2a + \frac{1-\gamma}{\gamma} \right) \\ a &\leq \frac{1}{5} \left(\frac{22M}{A_d} - \frac{17M}{A} + 11 \cdot \frac{1-\gamma}{\gamma} \right)\end{aligned}\quad (23)$$

The above expression shows the condition to have the manager exert a higher effort in the pre-merger scenario. In this expression, $\frac{M}{A_d}$ represents the marginal cost for the private domestic firm, $\frac{M}{A}$ represents the marginal cost for the SOE when the manager exert zero effort, and $\frac{1-\gamma}{\gamma} \in [0, C_s)$. This condition requires the SOE to have lower marginal cost than the domestic private firm, that is $\frac{M}{A_d} > \frac{M}{A}$. Let $\frac{M}{A_d} = \frac{M}{A} + \eta$, and $\gamma=1$:

$$a \leq \frac{1}{5} \left(\frac{22M}{A_d} - \frac{17M}{A} + 11 \cdot \frac{1-\gamma}{\gamma} \right) = \frac{M}{A} + \frac{22\eta}{5} \rightarrow a - \frac{M}{A} \leq \frac{22\eta}{5}\quad (24)$$

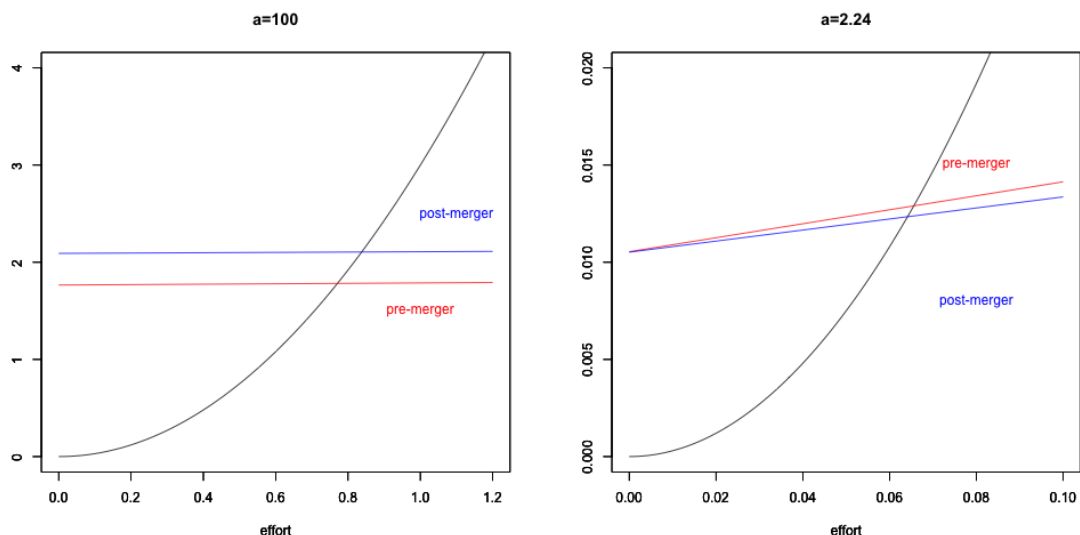
The above condition means when the difference between a and the lower marginal cost ($\frac{M}{A}$) is less than 4.4η (η is the difference between the high and low MC), the merger would lead to a lower effort level. The market needs to be sufficiently small: when the government cares more about the social objectives, the range of viable a values gets broader, yet still represents a fairly small market. This particular market structure corresponds to a higher effort level prior to the merger because the best response strategies of the firms (see section 3.3) depends on the quantities produced by the other firms in the market. With more high

cost rivals in the market, the SOE with a more advantageous production technology enjoys the accommodation from rival firms for the higher production associated with the higher effort.

There is also the possibility that even when the intercept of $b'(e)_{ex-ante}$ is below that of $b'(e)_{sd}$, the intersection with $c'(e)$ still could yield a higher e for the pre-merger scenario. As the algebra is quite complicated and yields even stricter conditions than the one we just derived, I omit the details of that derivation. The conditions derived above means the SOE managers would exert higher effort without the merger if the market is sufficiently small, and the rivals of the SOE (the domestic private firms) are very inefficient: they should have higher than or comparable levels of marginal costs to the SOE even when the SOE manager exerts zero effort. In such situations the merger leads to a lower effort level. However, if the market is considerably large and profitable, the merger would lead to higher post-merger effort level even when the rivals of SOEs are inefficient.

To graphically illustrate the above intuition, I show two scenarios in which the SOE has lower marginal cost than the private firm even with zero effort, with different market sizes. Let the SOE place a weight of $\gamma = 0.9$ on profits and a weight of $1 - \gamma = 0.1$ on the social function. Also let the private domestic firm have a total factor productivity of 1 and the state-owned enterprise have a zero-effort total factor productivity of 1. I consider a case in which the manager of SOE receives $b(e) = \lambda\pi_s(e) = 0.12\pi_s(e)$ as compensation, and that each additional unit of effort leads to a 0.2 unit decrease in the inverse of the SOE's total factor productivity. That is, $\tau = 0.2$, where $\frac{1}{A(e)} = \frac{1}{A} - \tau e$ for the SOE. Hence the effort level is feasible between $[0,5)$. With identical costs of labor and capital ($w = 1, r = 1$) for both firms, at labor intensity of $\beta + \delta = 0.5 + 0.01 = 0.51$, the marginal cost for the private domestic firm and the marginal cost for SOE at zero cost are both around 1.9996.

Figure 4.2: Pre- and post-merger effort level illustration



Recall the conditions derived to have higher effort level at the pre-merger scenario. I plot the $b_1(e)$, $b_2(e)$, and $c'(e)$ in markets with inverse demand function $P = 100 - Q$ and $P = 2.24 - Q$ in Figure 4.2. In the larger, more profitable market on the left, the merger leads to a higher effort level in the post-merger scenario even though the SOE has a relative advantage in marginal costs. When the market is large and profitable, the SOE manager still would exert higher effort level to capture greater market share through its relative cost advantage - with the additional effort they could generate more profits whose benefit to his/her utility outweighs the cost of effort he/she exerts. The graph on the right shows that the red pre-merger line has an intercept with the first order cost function that corresponds to a higher effort level than that of the post-merger. This is because the model assumes that both firms make decisions knowing the marginal costs of the other firms in the market. Thus a merger of either one SOE with one private domestic firm, or of two private domestic firms lead to a post-market structure of one SOE and one private domestic firm. Knowing that the rival firm has a higher marginal cost (when making production decisions), in the small market, the SOE manager exerts higher effort level to exploit the accommodation effect from the private firms with higher marginal cost. Normally, mergers lead to higher effort levels except in small markets where the SOE has lower marginal costs.

Numerical Illustrations

I evaluate how the objective of the government changes under the different merger scenarios in the domestic market, and show how the merger-review decisions made under such considerations could be different from those made under the pure consumer welfare perspective through some numerical illustrations.

Recall that the government places a weight of ϕ to its aligned objective with the SOE. The government payoff under the merger of SOE and domestic firm, when the SOE has a higher marginal cost, is equivalent to the pure consumer welfare consideration because the post-merger market consists only of two domestic firms. There is neither principal-agent issues of concern, nor profit sharing and social function consideration because there is no SOE in the market. The government payoff under the merger of SOE and domestic firm, when the SOE has a lower marginal cost, and that under the merger of two domestic firms, are the same.

The relative marginal costs of the private and the state-owned firm has a tension in its impact on the government's objective: one one hand, lower marginal costs for SOE and private firm could enhance consumer welfare; on the other hand, higher marginal cost for private firm would give the SOE more relative advantage in getting more profits. The results also depend on the size of the market, as implied by the demand function $p(Q) = a - bQ$. As discussed in the principal-agent problem section, if the market is large and profitable, the marginal cost for SOE would be lower after the merger. If the market is small, the marginal cost for SOE could be higher after the merger.

As there are many model parameters, I evaluate the welfare analysis through a few numerical illustrations that demonstrate the implications of the model. I consider the following cases:

(i) **When the SOE has a higher pre-merger marginal cost than the private domestic firm.** Let $w = 1, r = 1, \beta = 0.5, \delta = 0.01, \gamma = 0.9, Ad = 1.5, A = 1, \tau = 0.2, \lambda = 0.12$. The marginal cost for the private domestic firm is around 1.3331, and the marginal cost for the SOE with zero effort is around 1.9996.

First consider the case in which the market has demand $p(Q) = 100 - Q$, and evaluate the government objective with two different weights ($\phi = 0.5$ and $\phi = 0.8$). The following two tables summarizes the results from the merger between the SOE and one domestic firm, and the merger between two domestic firms.

Table 4.1: Merger of SOE and Domestic Private, $C_s > C_d$

Scenario	Effort	C_d	\tilde{C}_s	C_s	Price	Total Consumer Surplus	Profit	$\phi = 0.5$	$\phi = 0.8$
Pre-merger	0.7655	1.3331	1.5823	1.6934	26.0621	2733.405	596.5399	1636.370	978.1482
Post-merger	N/A	1.3331	N/A	N/A	34.2220	2163.370	N/A	1081.685	432.6739

$w = 1, r = 1, \beta = 0.5, \delta = 0.01, \gamma = 0.9, Ad = 1.5, A = 1, \tau = 0.2, \lambda = 0.12, p(Q) = 100 - Q$

Table 4.2: Merger of Two Domestic Private Firms, $C_s > C_d$

Scenario	Effort	C_d	\tilde{C}_s	C_s	Price	Total Consumer Surplus	Profit	$\phi = 0.5$	$\phi = 0.8$
Pre-merger	0.7655	1.3331	1.5823	1.6934	26.0621	2733.405	596.5399	1636.370	978.1482
Post-merger	0.8350	1.3331	1.5546	1.6657	34.2959	2158.516	1068.3553	1561.655	1203.5383

$w = 1, r = 1, \beta = 0.5, \delta = 0.01, \gamma = 0.9, Ad = 1.5, A = 1, \tau = 0.2, \lambda = 0.12, p(Q) = 100 - Q$

Both tables show that the SOE has a higher marginal cost in the pre-merger market, hence the merger of SOE with one domestic firms leads to a post-merger market with two domestic private firms. Total consumer surplus is hurt in both cases: in the merger of the SOE and private domestic firm, the cost-saving effect is not sufficient to lower the price; in the merger of the two domestic private firms, there is also cost-saving involved because of the principal-agent consideration. Table 4.2 shows that the merger induces a higher effort level for the manager of the SOE, however the marginal cost for SOE after the merger with higher effort is still higher than that of the private domestic firm. The increase in effort could be augmented with higher values of λ to create stronger incentives for the managers. The cost saving again, is not sufficient to lead to a lower price after the merger. However, at $\phi = 0.5$, the loss in government objective is less than that shown in Table 4.1, because the additional market power gained by the SOE and thus the aligned objectives partially transfers to the government, compensating for the loss in consumer welfare.

Both of the mergers are unlikely to be approved under considerations of the Chinese competition framework with $\phi = 0.5$ and that of the consumer welfare perspective, even though the merger slightly alleviates the principal-agent problem. However, when the government values its aligned objective with SOE (profit sharing and the social objective of producing more output and providing employment) more, for example at $\phi = 0.8$, the government objective after the merger of two domestic firms in the post-merger scenario is higher than that of the pre-merger due to the different weights the governments places on its two objectives.

The merger of the two domestic firms makes the market less competitive. But as the high cost SOE still gains market share after the merger, both the profit-sharing and social objective of creating more output are advanced by the merger. The principal-agent problem would also be slightly alleviated because the potential profit in a less competitive market incentivizes the managers to work harder. In this case, when the SOE has a higher marginal cost than the private firms, depending on how the two objectives are weighted, the Chinese government may approve a merger between two domestic firms even though the merger would harm the total consumer surplus if it values its aligned objective with the SOE more.

(ii) When the SOE has a lower pre-merger marginal cost than the private domestic firm. A relatively lower marginal cost for the SOE could be achieved through setting a higher A or lower A_d . I compare the results from mergers in which the SOE has a lower marginal cost in the pre-merger scenario, through a lower A_d ($A_d = 1$) for the private firm, making the private firm have a higher cost. I keep the other parameters the same as in the previous example: $w = 1, r = 1, \beta = 0.5, \delta = 0.01, A = 1, \tau = 0.2, \lambda = 0.12$. (This is the scenario plotted by the graph on the left of Figure 4.2.) As the SOE has lower marginal cost than the private domestic firm even before the merger, the post-merger scenario of one SOE merging with one private domestic is the same as that of two domestic private firms merging. The following table shows the results for a market with demand $p(Q) = 100 - Q$,

in which the government objectives are evaluated at $\phi = 0.5$ and $\phi = 0.8$.

Table 4.3: Merger Results, $C_s < C_d$

Scenario	Effort	C_d	\bar{C}_s	C_s	Price	Total Consumer Surplus	Profit	$\phi = 0.5$	$\phi = 0.8$
Pre-merger	0.77078	1.9996	1.5802	1.6914	26.3949	2708.858	613.0082	1631.524	985.1227
Post-merger	0.8378	1.9996	1.5534	1.6645	34.5177	2143.967	1082.9786	1560.972	1211.1752

$w = 1, r = 1, \beta = 0.5, \delta = 0.01, A_d = 1, A = 1, \tau = 0.2, \lambda = 0.12, p(Q) = 100 - Q$

The merger still induces the manager to exert higher effort to strategically gain more market power in the more profitable post-merger market, hence leads to a cost-reduction. However, the cost-reduction effect is still not sufficient to improve consumer welfare. The government objective could increase with weights that favors its aligned interests with the SOE. Similar to the discussions when the SOE has a higher marginal cost, the Chinese government could approve merger in the domestic market even if it is hurting total consumer surplus - as long as the benefits from the SOE gaining more market power dominate, the merger could be approved. In such cases, the Chinese competition policy is favoring SOEs - through approving certain mergers that otherwise would not be approved under consumer surplus considerations, the government uses mergers to incentivize the SOE managers to work harder and to facilitate the SOEs gaining more market power through mergers.

(iii) When the merger leads to lower effort levels Now consider the government's considerations of mergers that lead to lower effort levels. In the scenario depicted by the graph on the right of Figure 4.2, with $\beta = 0.5, \delta = 0.01, w = 1, r = 1, \gamma = 0.9, \lambda = 0.12, \tau = 0.2, A = 1, A_d = 1$, the marginal cost for the private domestic firm is 1.9996 - same as in Table 4.3. When $p(Q) = 2.24 - Q$ the pre-merger scenario has a higher effort level. I revisit this example, and again compare the results with different objective weighting schemes: $\phi = 0.1, \phi = 0.5$, and $\phi = 0.9$.

Table 4.4: Small markets

Scenario	Effort	C_d	\bar{C}_s	C_s	Price	Total Consumer Surplus	Profit	$\phi = 0.1$	$\phi = 0.5$	$\phi = 0.9$
Pre-merger	0.0497	1.9996	1.8686	1.9797	2.0270	0.0227	0.0075	0.0227	0.0226	0.0226
Post-merger	0.0488	1.9996	1.8690	1.9801	2.0362	0.0208	0.0094	0.0212	0.0230	0.0247

$\beta = 0.5, \delta = 0.01, w = 1, r = 1, \gamma = 0.9, \lambda = 0.12, \tau = 0.2, A = 1, A_d = 1, p(Q) = 2.24 - Q$

The results from the above tables are largely consistent with previous discussion: even though

mergers in such concentrated markets in which the SOE has a relative advantage could lead to lower effort levels and harm total consumer surplus, the government could approve mergers in this market to favor the SOE when ϕ is sufficiently high ($\phi = 0.5$ or 0.8).

When the SOE's relative advantage in marginal cost is even stronger, mergers could potentially be total consumer surplus enhancing. I change the baseline total factor productivity of the SOE to be $A = 1.5$ to increase the difference between the marginal cost of the SOE and the private domestic firm. Holding other parameters to be the same, the marginal cost for the domestic private firm is now 1.9996, and the zero-effort marginal cost for the SOE remains 1.3331. The results under the three weighting schemes are again summarized below:

Table 4.5: Small Markets, Larger MC difference

Scenario	Effort	C_d	\bar{C}_s	C_s	Price	Total Consumer Surplus	Profit	$\phi = 0.1$	$\phi = 0.5$	$\phi = 0.9$
Pre-merger	0.1224	1.9996	1.1730	1.2841	1.8531	0.0749	0.3869	0.1090	0.2455	0.3821
Post-merger	0.1105	1.9996	1.1778	1.2889	1.8058	0.0943	0.3246	0.1203	0.2246	0.3289

$\beta = 0.5, \delta = 0.01, w = 1, r = 1, \gamma = 0.9, \lambda = 0.12, \tau = 0.2, A = 1.5, Ad = 1, p(Q) = 2.24 - Q$

In this example, even though the effort level is lower after the merger, total consumer surplus is improved because there is cost-saving from the high cost firm merging with the SOE, hence a lower price after the merger. Such a merger would be approved under the Western framework because the market power of the lower cost firm enhances consumer welfare through lowered prices. Under a weighting scheme that favors consumer surplus considerations ($\phi = 0.1$), the merger could be approved by the government to favor the consumers even though it is not alleviating the principal agent problem. However, if the government values the aligned objectives with SOE more, such mergers would not be approved.

4.1.3 Principal-agent problem: endogenized compensation structure

Suppose the SOE managers' compensation structure consists of a fixed salary, h , and a variable component tied to the profit, such that $b(e) = h + \lambda\pi_s(e)$. Before the merger:

$$E[b(e)_{ex-ante}] = h + \lambda \left[\frac{(2C_d + a - 3\tilde{C}_s)^2}{16b} - \frac{1 - \gamma}{\gamma} \frac{a + 2C_d - 3\tilde{C}_s}{4b} \right]$$

$$Var[b(e)_{ex-ante}] = \lambda^2 Var[\epsilon] = \lambda^2 \sigma^2$$

Assume the manager is risk averse with utility function that depends upon his/her compensation whose constant absolute risk aversion parameter is R such that $R > 0$. Recall that $c(e) = e^3$. The expected utility for the manager is

$$E[U(e)_{ex-ante}] = E[b(e)_{ex-ante}] - \frac{R}{2} Var[b(e)] - c(e)$$

$$= h + \lambda \left[\frac{(2C_d + a - 3\tilde{C}_s)^2}{16b} - \frac{1 - \gamma}{\gamma} \frac{a + 2C_d - 3\tilde{C}_s}{4b} \right] - \frac{R}{2} \lambda^2 \sigma^2 - e^3 \quad (25)$$

The first-order condition for the e maximizing the manager's expected utility gives the same result as derived in the previous section through solving

$$\frac{\partial E[U(e)_{ex-ante}]}{\partial e} = 0, \text{ which is, } \frac{\partial E[b(e)_{ex-ante}]}{de} = \frac{\partial c(e)}{\partial e}$$

Setting the participation constraint such that the manager's utility is non-negative and rearranging the terms in (25),

$$h \geq e^3 + \frac{R}{2} \lambda^2 \sigma^2 - \lambda \pi_s$$

Then solving the maximization problem for the owner's surplus

$$\max_{\lambda} \pi_s(1 - \lambda) - h = \pi_s - e^3 - \frac{R}{2} \lambda^2 \sigma^2$$

we would be able to derive the optimal λ , h , and e values. The optimal compensation structure and effort level for the post-merger case are derived in the same fashion. As the results are algebraically complicated, I compute sets of results using numerical simulations: the results are qualitatively consistent with those in the discussion of principal-agent problem with exogenous compensation.

Numerical simulations also show that the values of optimal λ are relatively stable. For example, consider the same case as in the exogenous example when the SOE has a higher pre-merger marginal cost than the private firms. Let $w = 1, r = 1, \beta = 0.5, \delta = 0.01, \gamma = 0.9, Ad = 1.5, A = 1, \tau = 0.2$. Consider the case in which the market has demand $p(Q) = 100 - Q$. I change the risk aversion and uncertainty parameters to see how changes in those two would impact the results. The following table summarizes optimal λ values under different R and σ values.

Table 4.6: Comparison of λ values

λ	$R = 0.5, \sigma = 1$	$R = 1, \sigma = 1$	$R = 0.5, \sigma = 2$
$\lambda_{ex-ante}$	0.113096	0.113053	0.112965
λ_{sd}	0.111079	0.111048	0.110984

The results are pretty clear: the higher the uncertainty in the profit of SOE (the harder it is for the government to infer the effort level put in by the manager), and the more risk averse the manager, the lower the λ values in both the pre- and post-merger cases. As shown in the section with exogenous compensation structure, the lower the λ values, the lower the effort the managers would be putting in. Hence the more risk averse and the greater the uncertainty, the lower the effort and hence higher marginal costs the SOEs would have. Note that the endogenized λ values are still pretty close in the pre- and post-merger cases. The values of pre- and post- merger optimal λ values are around 11.3% and 11.1%, relatively consistent with the 12% used in the profit-retention program used in SOE reform history and the exogenous λ values used in the previous subsection. The intuition shown in the exogenous compensation structure section still applies, even with endogenous compensation.

4.2 Market with foreign firms

Now consider a market with one SOE, one domestic private, and one foreign firm. Assume that the foreign firm has lower marginal cost than the domestic firms, such that $C_f \leq C_s$, $C_f \leq C_d$, so that we could further explore the implication of mergers in markets with firms of different costs. The market equilibrium, as solved in the previous section, is

$$q_s = \frac{C_f + C_d + a - 3\tilde{C}_s}{4b}, q_d = \frac{C_f + \tilde{C}_s + a - 3C_d}{4b}, q_f = \frac{\tilde{C}_s + C_d + a - 3C_f}{4b}$$

$$Q = q_s + q_d + q_f = \frac{3a - \tilde{C}_s - C_f - C_d}{4b}, p = a - bQ = \frac{\tilde{C}_s + C_f + C_d + a}{4}$$

The profit of the SOE, total consumer welfare and government objective in the market prior to the merger are

$$\pi_{s-ex-ante} = \frac{(C_f + C_d + a - 3\tilde{C}_s)^2}{16b} - \frac{1 - \gamma}{\gamma} \frac{C_f + C_d + a - 3\tilde{C}_s}{4b} + \epsilon$$

$$CS_{ex-ante} = \frac{(a - p)Q}{2} = \frac{(3a - \tilde{C}_s - C_d - C_f)^2}{32b} \quad (26)$$

$$E[G_{ex-ante}] = (1 - \phi) \cdot TotalCS + \phi[\gamma\pi_s + (1 - \gamma)S]$$

$$= (1 - \phi) \cdot \frac{(3a - \tilde{C}_s - C_d - C_f)^2}{32b} + \phi\gamma \frac{(C_d + C_f + a - 3\tilde{C}_s)^2}{16b}$$

4.2.1 Welfare analysis without principal-agent consideration

I consider the case in which $C_s = C_d$ for this discussion to see the implications of cost-reduction through mergers of domestic firms with foreign firms on merger review decisions. When the domestic private firms and SOE have the same efficiency level, and the private foreign firm has lower cost than the domestic firms such that $A_s = A_d, A_f > A_d(\frac{r}{w})^\delta (\frac{\tilde{\beta}}{1-\tilde{\beta}})^\delta (\frac{\tilde{\beta}}{\beta})^\beta (\frac{1-\tilde{\beta}}{1-\beta})^{1-\beta}$, we denote $C = C_s = C_d > C_f = C - \kappa$. A merger of a domestic private firm and an SOE or a merger of a domestic and a foreign private firm both yields a post-merger market structure of one SOE and one foreign firm. The merger of one SOE and one foreign firm leads to a post-merger market structure of one domestic private and one foreign private firm.

The consumer surplus in the pre-merger and post-merger situations are

$$\begin{aligned}
CS_{ex-ante} &= \frac{(a-p)Q}{2} = \frac{(3a - \tilde{C}_s - C_d - C_f)^2}{32b} = \frac{(3a - 3C + \kappa + \frac{1-\gamma}{\gamma})^2}{32b} \\
CS_{SF} &= \frac{(2a - \tilde{C}_s - C_f)^2}{18b} = \frac{(2a - 2C + \kappa + \frac{1-\gamma}{\gamma})^2}{18b} \\
CS_{DF} &= \frac{(2a - C_d - C_f)^2}{18b} = \frac{(2a - 2C + \kappa)^2}{18b}
\end{aligned} \tag{27}$$

As $\tilde{C}_s = C_s - \frac{1-\gamma}{\gamma} < C_d$, $CS_{SF} \geq CS_{DF}$ - the consumer welfare in a post-merger market with one SOE and one foreign firm is always higher or equal to that of one private domestic and one foreign firm. Even though the SOE's marginal cost is the same as the domestic private firm, it is making production choices (choosing how much to produce) as though it has a lower marginal cost (\tilde{C}_s) because of the SOE's social objective that favors greater output. Now compare the consumer welfare in the pre-merger market and in a market with an SOE and a private foreign firm. The consumer welfare would decrease if

$$\begin{aligned}
\frac{CS_{ex-ante}}{CS_{SF}} &= \frac{9}{16} \left(\frac{3(a-C) + \kappa + \frac{1-\gamma}{\gamma}}{2(a-C) + \kappa + \frac{1-\gamma}{\gamma}} \right)^2 \geq 1 \\
a - C &\geq \kappa + \frac{1}{\gamma} - 1
\end{aligned} \tag{28}$$

Section 4.1.1 identifies that the SOE's deviation from pure profit-maximization in making production choices could lead to enhanced consumer welfare: overproduction lowers the price. In addition to that, mergers in the market with low cost foreign firms could also improve consumer-welfare through cost-reduction. If the foreign firm has much lower cost than the domestic firms, it is likely a merger that leads to only one SOE and one foreign firm in the market could enhance consumer welfare because the post-merger price is lower. When the market is sufficiently large such that $a \geq 2C + \kappa$, the consumer welfare in the pre-merger market is always higher or equal to that in the post-merger market. This shows that the existence of low cost foreign firms makes mergers more likely to enhance consumer welfare.

In terms of the government's overall objective, we have:

$$\begin{aligned}
E[G_{ex-ante}] &= (1 - \phi) \cdot \frac{(3a - 3C + \eta + \frac{1-\gamma}{\gamma})^2}{32b} + \phi\gamma \frac{(a - C + 3\frac{1-\gamma}{\gamma} - \eta)^2}{16b} \\
E[G_{DF}] &= (1 - \phi) \frac{(2a - 2C + \eta)^2}{18b} \\
E[G_{SF}] &= (1 - \phi) \cdot \frac{(2a - 2C + \eta + \frac{1-\gamma}{\gamma})^2}{18b} + \phi\gamma \frac{(a - C + 2\frac{1-\gamma}{\gamma} - \eta)^2}{9b}
\end{aligned} \tag{29}$$

Again, similar to the consumer welfare discussion, the expected government payoff in the post-merger market with one private domestic and one private foreign firm would always be lower than that of one SOE and one foreign firm. The reason is two-fold: first, due to SOE's second objective, the SOE produces more than its profit-maximizing quantity. Hence the market price is lower than compared with that in a market of a domestic private and foreign firm. Consequently the consumer surplus is higher. Second, in a market with private domestic and foreign firm, the government would not be able to pursue its aligned objectives with the SOE, both in terms of profit sharing and realizing social objectives. Therefore the government's objective is always going to be lower in a post-merger market with both types of private firms than in one with an SOE and a foreign firm, when the domestic firms are at the same efficiency level.

The conditions in which the SOE's objective would be higher before the merger is

$$a - C \leq \frac{1-\gamma}{\gamma} + \kappa \tag{30}$$

Only when the market size is such the $a - C = \frac{1-\gamma}{\gamma} + \kappa$ would the SOE's objective in both scenarios be the same. If the market is sufficiently large such that $a - C > \frac{1-\gamma}{\gamma} + \kappa$, the SOE's objective would be higher in the post-merger case. Note that the threshold for higher post-merger SOE objective is higher in this case, compared with that in the domestic market ($a - c > \frac{1-\gamma}{\gamma}$). With the presence of a lower cost firm in the market, we need a larger and more profitable market to ensure that the SOE would have a higher overall objective post-merger. The other intuitions remain the same: the less the government cares about its social objective (lower γ), the easier it is for the SOE's objective to be higher in the post-merger

case. This result again shows a tension between about consumer welfare concerns and the aligned objectives with the SOE in the overall objective of the government: conditions that would lead to a higher consumer welfare often lead to lower objective of the SOE. Depending on the weights (ϕ) by which the government values its goals, the government may approve mergers that harm total consumer welfare but promote the aligned objectives, or block consumer welfare enhancing mergers that harm the overall objective of the SOE.

4.2.2 Principal-agent problem: exogenous compensation structure

Similar to the domestic market, let us consider the principal-agent problem when the SOE managers' compensation structure is exogenous. Assume for our discussion that the foreign firm has a lower marginal cost of production than either types of domestic firms. Similar to the domestic market, the optimal levels of effort chosen by the managers are at the intersection of the marginal expected benefit of effort lines in the pre- and post-merger market with the marginal cost of effort line $c'(e) = 3e^2$, and the slope of the pre-merger line is always steeper than that of the post-merger. Again, if the intercept of $b'(e)_{ex-ante}$ is at or above that of $b'(e)_{fd}$, the pre-merger market structure would have a higher effort level. Specifically, we need

$$\begin{aligned} \frac{3\lambda M\tau}{8b} \left(C_f + \frac{M}{A_d} - \frac{3M}{A} + a + \frac{1-\gamma}{\gamma} \right) &\geq \frac{2\lambda M\tau}{9b} \left(2C_f - \frac{4M}{A} + 2a + \frac{1-\gamma}{\gamma} \right) \\ a &\leq \frac{27M}{A_d} - 5C_f - \frac{17M}{A} - 11 \frac{1-\gamma}{\gamma} \end{aligned} \quad (31)$$

The above expression shows the condition needed to have the manager exert a higher effort in the pre-merger scenario. In this expression, $\frac{M}{A_d}$ represents the marginal cost for the private domestic firm, $\frac{M}{A}$ represents the marginal cost for the SOE when the manager exert zero effort, $\frac{1-\gamma}{\gamma} \in [0, C_s)$, and C_f represents the marginal cost for the foreign firm, which is assumed to be less than either $\frac{M}{A}$ or $\frac{M}{A_d}$. This condition requires a looser condition compared with that specified in (23) because a low C_f (compared with $\frac{M}{A}$) allows the market size, a , to be in a larger range in this market with foreign firms.

Considering the principal-agent problem, I now discuss the welfare implications of mergers in markets with foreign firms. Recall in the section on welfare analysis without principal-agent consideration, I have shown that when the market is sufficiently large, consumer welfare will be higher in the pre-merger scenario. This directs us to the opposite direction of the conditions we had just derived. A small market will ensure that the manager exerts higher effort level before the merger, yet a large market will ensure that the consumer surplus is higher before the merger. This tension implies that a merger that enhances consumer welfare may not be approved out of principal-agent problem concerns that indirectly impacts the aligned objectives of SOE and the government.

I use numerical illustrations to demonstrate the above intuition. Assume the foreign firm has lower cost than the domestic firms, and that $\beta = 0.5, w = 1, r = 1, \delta = 0.01, A = 1, Ad = 1$. Consider a relatively small market such that $a = 3, b = 1$. With $\lambda = 0.12, \gamma = 0.5, \tau = 0.2$, table 4.7 and 4.8 summarize equilibrium under $\phi = 0.1, \phi = 0.5$ and $\phi = 0.9$ for the foreign firm with $A_f = 2$ and $A_f = 1.5$:

Table 4.7: with Foreign firms situation 1

Scenario	Effort	C_d	C_f	\tilde{C}_s	C_s	Price	Total Consumer Surplus	$\phi = 0.1$	$\phi = 0.5$	$\phi = 0.9$
Pre-merger	0.0298	1.9996	1	1.8766	1.9877	1.9690	0.5314	0.4791	0.2696	0.0601
Post-merger	0.0231	1.9996	1	1.8793	1.9904	1.9598	0.5411	0.4875	0.2734	0.0594

$\lambda = 0.12, a = 3, b = 1, \beta = 0.5, w = 1, r = 1, \delta = 0.01, g = 0.9, \tau = 0.2, A = 1, Ad = 1, Af = 2, p(Q) = 3 - Q$

Table 4.8: with Foreign firms situation 2

Scenario	Effort	C_d	C_f	\tilde{C}_s	C_s	Price	Total Consumer Surplus	$\phi = 0.1$	$\phi = 0.5$	$\phi = 0.9$
Pre-merger	0.0554	1.9996	1.3333	1.86633	1.97744	2.0498	0.4514	0.4093	0.2409	0.0724
Post-merger	0.0556	1.9996	1.3333	1.86627	1.97738	2.0665	0.4357	0.3957	0.2359	0.0761

$\lambda = 0.12, a = 3, b = 1, \beta = 0.5, w = 1, r = 1, \delta = 0.01, g = 0.9, \tau = 0.2, A = 1, Ad = 1, Af = 1.5, p(Q) = 3 - Q$

Merger between a domestic private and a foreign firm, or between one SOE and a domestic private firm under this scenario enhances consumer welfare when $A_f = 2$ and harms consumer welfare when $A_f = 1.5$. The merger (shown in Table 4.7) enhances consumer welfare even though it induces a lower effort level of SOE manager. This is because the cost saving from the merger that leads to the low cost foreign firm taking a greater market share is sufficient to enhance consumer welfare despite the induced higher cost of the remaining

SOE. Similarly, when the relative cost advantage of the foreign firm is not as significant, the merger (shown in Table 4.8) harms consumer welfare even though it induces a higher effort level of SOE manager because the combined cost saving effects from the remaining SOE and foreign firm are not sufficient to lead to a lower post-merger price.

The different A_f makes the results of the mergers different because when the foreign firm has significantly lower cost than the SOE, the SOE could exploit the accommodation effect from the private domestic firm with highest cost more through exerting higher effort in the pre-merger scenario. As the SOE has a higher cost than the foreign firm, when the existing market is small, its rival getting more market power through the merger would leave less room for profit to the SOE. When the foreign firm's marginal cost is not a lot lower than the SOE, the accommodation effect the manager could get is less in the pre-merger scenario, hence the manager is induced to exert higher effort in the less competitive post-merger scenario instead. Depending on how the government weighs its aligned objectives with the SOE, mergers that improves consumer welfare may be blocked and mergers that harm consumer welfare may be approved under the Chinese framework.

5 Conclusion

This thesis explores the implications of a Chinese competition framework that is motivated by the significant market presence of state-owned enterprises and pursues more goals than just protecting consumer welfare. There are three main results from my model.

First, there is a tension between the conditions that make a merger consumer-welfare enhancing and aligned-objective enhancing. Mergers can be particularly aligned-objective enhancing in larger markets with SOEs, although such mergers are often likely to harm consumer welfare. Therefore mergers that do not improve consumer welfare could still be approved in

the Chinese context if a state-owned enterprise is present in the post-merger scenario, due to gains in the additional goals of the Chinese competition policy. Similarly, the same additional considerations of profit-sharing and creating more output (hence employment) may make consumer welfare-enhancing mergers less likely to be approved in the Chinese context, especially in cases that lead to an SOE being absorbed.

Second, in small markets, the additional social objective pursued by the state and SOEs can mitigate the mergers' damage on consumer welfare. Because the SOEs are incentivized to produce more than under pure profit-maximization, even though some mergers with SOE surviving do not involve de facto cost-saving, they could still lead to improved consumer welfare in sufficiently small markets because a larger share of supply are controlled by SOEs who overproduce.

Lastly, the principal-agent extension shows some counterintuitive results about the role of competition and effort incentivization, and could be used to address some concerns raised by various news articles about the contradiction between the Chinese government's recent and past SOE reform regimes.²⁰ Past SOE reform focused on the privatization of SOEs as attempts to address the inefficiencies in SOE management. The rationale behind privatization could be partially explained by the principal-agent model: privatization is similar to cases of managers having exogenous compensation structure with higher λ values. The model shows higher λ incentivizes higher managerial effort, hence serving the purpose of addressing the moral hazard problem.

In recent years, however, rather than aiming to reduce the role of SOEs in the national economy, the Xi administration has made statements on state champions to make SOEs "bigger, stronger and better". This is exemplified through extensive government led mergers

²⁰Huang (2016)

among SOEs in industries such as steel, coal, power, food processing, railroad, and shipping. For example, China National Cereals, Oils, and Foodstuffs Corporation (COFCO), one of the state-owned food processing holding companies, has engaged in three mergers since 2013 with China Grain & Logistics Corporation, China Huafu Trade & Development Corporation, and Chinatex Corporation, all of which were state-owned. The merger of Wuhan Iron and Steel Corporation and Shanghai Baosteel Group Corporation in 2016 again drew much attention to the enhanced state presence in the steel sector. Such mergers were explained by Chinese officials as attempts to consolidate and eliminate inefficient SOEs in their respective industries. It is expected that the number of central SOEs would decrease from 104 to 80 by 2020 through mergers that involve either one SOE being absorbed into another or vertical consolidations to form new conglomerates.²¹ This current trend of active SOE mergers in large markets is consistent with two aspects of our results.

The principal-agent consideration of my model shows the extent to which competition serves as effort inducement for SOE managers depends on the market structure. In large markets, mergers, rather than more competition, incentivize SOE managers to exert higher effort levels because the post-merger market is more lucrative, adding another cost-saving factor that makes the mergers more likely to be approved. Both the food processing and steel sectors involve large markets with huge profit potentials. Mergers of SOEs in these markets could on one hand absorb inefficient SOEs into stronger state-controlled conglomerate, while on the other hand incentivize the SOE managers to exert higher effort after the consolidatory mergers that lead to a more profitable market.

In addition, the government weighs its aligned objectives with SOEs more heavily in the above-mentioned industries. My model shows that even though SOE mergers in these large markets may easily harm consumer welfare, the less competitive yet more profitable en-

²¹Leutert and Godement (2016)

vironment after the mergers could both enhance the government's aligned objectives with SOEs and aid in ongoing reforms that focus on improving SOE management. Therefore, the Chinese government adopts a more pro-merger regime in these cases that would often be blocked under Western considerations. Through the lens of my model, both privatization and ongoing mergers of SOEs are seemingly different approaches toward the same end of improving the corporate governance of inefficient state-owned enterprises.

At the same time, my model also shows more competition would induce higher effort levels only when the market is sufficiently small and when the SOE has relative cost advantages to its rival firms. It is thus reasonable to expect the Chinese government to encourage more competition, hence adopting a stricter merger-control regime in smaller markets with SOEs that have lower costs in wish to keep SOE managers exerting higher effort at work.

Even though most of the recent mergers are among large SOEs, it is reasonable to expect more mergers among SOE, domestic and foreign private firms when the progresses of SOE reform and the transition to market economy further deepen after the industry consolidation phase in China. More merger cases involving foreign firms are expected because they could introduce new technology into the domestic market, adding in more cost saving factors that could improve consumer welfare. The recent Didi-Uber deal, for example, involves both surging new forms of domestic ownership and the expanding access to technology and business structures from abroad. The merger of the two online ride-sharing platforms challenges the traditional taxi markets in China that used to be a state enterprise-controlled profit center that also provided much local employment. The antitrust concerns for this merger mostly reside in potential impact on consumer welfare and the weakened aligned interests with the state-owned taxi sector. The merger was realized partially because it involved sufficient cost saving and helped to address the principal-agent issue in SOE management.

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