Anticommons approach to China's reform of state-owned enterprises

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AN ANTICOMMONS APPROACH TO CHINA'S REFORM OF STATE-OWNED ENTERPRISES

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SUMMARY

Institutional innovation of state-owned enterprises (SOEs) has been the focus of Chinese economic reform. Although various theories have been formulated, there has been no unanimous conclusion for the main cause of SOEs' performance and institutional arrangement. We apply an anticommons approach in this paper to explain the observed pattern of institutional reform for SOEs in China and its economic implications.

The tragedy of commons makes resources overused due to the lack of exclusion towards multiple users, while the tragedy of anticommons is a new concept in that too many exclusion rights exercised by multiple excluders result in the resources underused. First we elucidate the theory of commons and anticommons. Next a commons model is introduced to explain the SOEs performance in reform. Then we develop a new anticommons model encompassing a general function form, two-period time factor for a multi-player game with mixed strategy, which is used to explain the rationale of the State-owned Assets Supervision and Administration Commission (SASAC) in China. The main proposition from the theoretical model is that the negative externality between exclusion rights of complementary resources can lead to players behaving strategically and delaying the input of resources for projects with profits and social benefits. We provide policy suggestions from the commons-anticommons analysis for SOEs performance improvement and discuss some directions for further research.

Key Words: Commons, Anticommons, Externality, SOEs, China, SASAC

Chapter 1 Introduction

China's GDP grew by an average rate of 9.71% between 1978 and 1999 (Lin and Liu 2000). Since then rapid economic growth has continued despite the Asian Financial Crisis. This successful performance has dramatically transformed China's economic structure and greatly improved the lives of its 1.3 billion people. One of the most important issues for China is the reform of its large sector of state-owned enterprises (SOEs) that still employ more than half of urban workers and possess the majority of industrial fixed assets, although the SOEs share of Gross Value of Industrial Output had fallen from 48 percent in 1992 to 28 percent in 2000 (Howe, Kueh and Ash 2003). The portion of loss-making SOEs increased from 23.9% in 1978 to 43.9% in 1997 (China Financial Yearbook 1998). In the first quarter of 1996, for the first time, SOEs as a whole incurred losses. The debt ratio of SOEs rose from 11% in 1978 to 79% in 1994, significantly above the normal level (Lardy 1997), which is shown in Table 1.

Table 1: Liabilities of SOEs, 1978-95 in Percent of Assets

Year	All SOEs	Manufacturing SOEs
1978	N.A	11
1980	N.A	19
1988	N.A	45
1989	55	N.A
1990	58	N.A
1991	61	N.A
1992	62	N.A
1993	72	68
1994	75	79
1995	85	N.A

Source: Naughton (1995), Zhang (1996)

N.A: Not available.

According to the data of 2004 from the Chinese State Statistics Bureau, China is the sixth largest economy by GDP, the second largest FDI recipient, the third largest importer and the fourth largest exporter, and in 2006 it has owned the highest foreign exchange reserves in the world. Since China's entry into World Trade Organization in 2001, its integration with global market has been further strengthened. Therefore the success or failure of China's economic reform will have a significant effect not only on the fortune of its 1.3 billion people but also on the regional and world economy. For instance, China's decision not to devalue its currency RMB was pivotal for reducing the severity and duration of the Asian Financial Crisis in 1997 and 1998, and China's strong growth and import demand were quite helpful for the recovery of Southeast and East Asian economies out of this crisis. The lessons from China's economic reform can be useful for the transition from command economy to market economy in other countries, mainly those former Soviet Union republics and Eastern Europe countries. Because of its status as the largest developing country in the world, China's experiences of economic reform may also shed some lights to the reform process of other developing countries in Asia, Africa and Latin America.

Although the reform of SOEs in China has been studied by many economists, no unanimous and clear-cut conclusion for its main cause has been reached so far. Many observers of Chinese economy are puzzled by three paradoxes:

(1) In contrast to the reform in other transitional economies and most economists' idea of what constitutes an effective set of market institutions, China's reform of industrial SOEs has been partial and piecemeal. Such practice leads to the

underdevelopment of key market institutions, such as the enterprise bankruptcy mechanism, the commercial banking system, the capital investment system and the social security system. However, China's industrial growth has been robust and it continues at a fairly rapid rate.

(2) China's economy has been dominated by public enterprises, including both state-owned and collective-owned enterprises. Although these enterprises display many negative characteristics of public ownership, they accounted for most of the extraordinary growth of Chinese industry during the critical early years of transition.

(3) Most literature on productivity after economic reform in China reports that the productivity of SOEs has been growing continuously. Yet the profitability of SOEs as a whole is declining, and the number of loss-making SOEs is on the rise.

Conventional theories explained the performance of SOEs in China by a framework of opaque property right arrangement, principal-agent problem and insufficient market competition, emphasizing such factors as soft budget constraints, unfair policy burden, poor corporate governance and incentive system. But as this thesis will show below, SOEs in China also exhibit characteristics of both tragedy of commons and tragedy of anticommons, and the poor performance and economic inefficiency of SOEs in both the pre-reform and reform period can be partly if not completely explained by a commons-anticommons framework, which provides some important policy analysis in addition to conventional ones for performance improvements and further reform of SOEs in China.

Besides Chapter 1 of introduction, the remainder of this thesis contains four chapters. Chapter 2 presents a historic overview of pre-reform SOEs in China as an institutional background, and the stages of SOEs reform are then introduced. In Chapter 3 existing literature on China's SOEs reform and relevant economic theories is examined. A theoretical and historical analysis for commons and anticommons is elaborated in Chapter 4, which includes linear models of commons and anticommons as basic theoretical model. In Chapter 5 we summarize a commons model and construct a new two-period anticommons model with mixed strategy to be applied to SOEs reform in China, and this part is the core of the thesis. Then in Chapter 6 we provide the economic policy implication from the analysis by commons-anticommons framework and discuss the further research direction.

Chapter 2 Background of SOEs Reform in China

In this chapter, the pre-reform history of institutional change and reform stages for SOEs in China are overviewed as the necessary background knowledge and basic facts for further discussion. Since China has adopted an experimental and incremental strategy for its economic reform, historical initial conditions and path dependence are important factors for understanding the process and result of SOEs reform in China.

China's enterprises fall into mainly three categories when classified according to ownership except for enterprises of foreign or mixed ownership, and the differences in growth rates by form of ownership in reform period is shown as Table 2.

(1) State-owned enterprises (SOEs). Prior to the 1978 introduction of reform policies, these enterprises were directly managed and supervised by the state. According to the relationship of administrative subordination, SOEs could be grouped into central SOEs, which were usually large and medium enterprises supervised directly by ministries of the central government, and local SOEs with a majority of small enterprises supervised by bureaus of local governments. During the economic reform, decentralization has delegated more administrative power to local governments and enterprise subordination relationship has been changed, but the basic pattern whereby SOEs are subordinate to various government agencies has remained intact.

(2) Collective-owned enterprises (COEs). These enterprises are collectively owned by the laboring mass. Township and village enterprises (TVEs) are the COEs in rural areas, and they have made rapid progress during the period of economic reform.

(3) Individual-owned enterprises (IOEs). They are established and managed by individuals or households, so they are private enterprises. Compared with SOEs and COEs, individual-owned enterprises enjoy full autonomy in decision-making, and as long as they observe laws and regulations and pay tax, legally nobody is allowed to interfere with their business operation.

Table 2: Growth of Real Output in Chinese Industry, Selected Years. (1980=100)

Type of Enterprise	1985	1990	1996	Average Annual Growth Rate	
				1980-96	1990-96
State-owned	148	210	329	7.7%	7.8%
Collective-owned	247	554	2246	21.5%	26.3%
Individual-owned	21,752	126,057	1670,724	80.0%	44.9%
Other	492	3,530	46,615	46.8%	53.7%
Total	176	328	1,040	15.8%	21.2%

Source: China State Statistical Bureau 1997 (pp.411, 424).

2.1 History of Pre-reform SOEs in China

(1) 1949-1957 The Period of Economic Recovery and the First Five Year Plan

After taking power in 1949, the Chinese Communist government began to nationalize industrial enterprises by confiscating 2858 state firms of the Nationalist government (Gao 1992), and subsidiaries of foreign companies, or by purchasing private firms from their owners. With this rapid process of nationalization, industrial output proportion of SOEs increased from 35% in 1949 to 57.5% in 1953 when the First Five Year Plan started and further to 67.5% in 1956 (Ten Great Years 1960).

During the 1950s China built a central planning system oriented to heavy industry with economic and technological aids from the Soviet Union. In 1952 the State Planning Commission was established for formulating development plans, and the State Construction Commission for overseeing capital investment. In 1956, the State Economic Commission was set up to take over short-term planning from the State Planning Commission. Also born in 1956 were the State General Bureau for Supply of Raw Materials, to handle materials allocation, and the State Technological Commission, to plan long term technological development. This planning system was highly centralized in that numerous economic targets, such as total national capital investment and output of important commodities etc (Donnithorne 1967), were drawn up by central commissions, and their fulfillment in SOEs was directly supervised by central branch ministries and local industrial bureaus with 12 mandatory targets¹, although the central control of China's industrial SOEs was never as tight as that in Eastern Europe and the Soviet Union (Granick 1990). The number of centrally allocated commodities rose from 28 in 1952 to 235 by 1956 (Lardy 1978).

(2) 1958-1961 The Great Leap Forward

To solve the inefficiency of over-centralization, Mao Zedong launched the Great Leap Forward in 1958 on a theoretical ground of his speech "Ten Major Relationships" back in 1956. The Great Leap Forward rejected the model of central

¹ The 12 mandatory planning targets were: the value of total product, quantities of main products, new experimental products, technical rates of input and output, rate of decreasing costs, volume of decreasing costs, number of employed workers, number of workers at the end of a year, volume of wages and salaries, average wage, labor productivity, and profit. See Ma (1982) and Zhou (1984) for more details.

administrative planning in two fundamental ways. First, it substituted spontaneously initiated, mass economic activities by the public for the blueprints worked out by professional planners. Second, it gave greater economic and political authority to local government by administrative decentralization. With three consecutive years of natural disasters in 1959-1961 and the withdrawal of Soviet Union aids, the Great Leap Forward caused a collapse for the national economy. Annual growth rate of National Income of 1958-1962 was -3.1%, while it had been 8.9% for 1953-1957, and total value of industrial output grew by only 3.8% annually, much slower than the annual growth rate of 18% during 1953-1957.

(3) 1962-1966 "Readjustment, Consolidation, Filling out, Raising Standards"

The deep economic depression of the Great Leap Forward forced the central government to adopt a strategy of "readjustment, consolidation, filling out, raising standards" in 1961, in which the scale and growth rate of industrial investment was reduced, and central planning was resurrected on an annual basis. The number of mandatory targets for SOEs, which had been reduced from 12 to 4² in the Great Leap Forward, was increased back to 6³. During this period the policy of "market socialism" was propounded by economists like Sun Yefang and Wang Yanan, and supported by government officials like Chen Yun, then Minister of Commerce, and Xue Muqiao, then chief of the State Statistics Bureau, but not accepted by the

² The 4 mandatory planning targets were: quantities of products, number of employed workers, volume of wages and salaries, and profit. The other 8 targets were of guidance. Also see Ma (1982) and Zhou (1984).

³ The 6 mandatory planning targets were: quantity and variety of products, quality of products, fulfillment of contracts, main technical quota (such as raw material per unit of product), labor productivity, and cost reduction rate. See Schurmann (1968).

government as an alternative to a highly centralized planning economy. The major economic policy throughout the 1960s and 1970s in China was rather the policy of “self-reliance” (autarky) for each enterprise and region, to relieve the central government of investment responsibility outside the large-scale sector and cross-region economic coordination.

(4) 1966-1976 The Culture Revolution

During the Culture Revolution of 1966-1976, both the industrial model of Daqing oilfield and the agricultural model of Dazhai Brigade emphasized political enthusiasm and military discipline rather than economic calculation. Irrational targeting and lack of central coordination led to severe imbalances and consequent bottlenecks for national economy, while endless political campaigns disrupted the business operations of many SOEs. Living standard for most of the population had been static despite a large increase in the proportion of working population. For example, worker wages in 1976-1977 were lower than that of 1956-1957 (Journal of Economic Research, 1981 No.1). Annual growth rate of National Income was 4.9% in 1967-1976, which was much lower than the rate of 15.7% in the economic recovery period of 1962-1965. SOEs suffered from tremendous inefficiency, while total factor productivity (TFP) in state industry stagnated between 1958 and 1977, a poor record considering the rapid growth of Japan and the New Industrialized Countries in Asia during the same period (Tidrick 1986). Another estimate of TFP by Chen et al (1988) showed an annual growth rate of only about 1% in 1958-1977. Hence, China’s real annual industrial growth rate of 9.7% from 1957 to 1978 was

achieved primarily through factor input increase rather than efficiency improvements. Facing such a difficult situation, the Third Plenum of the Eleventh Central Committee of Chinese Communist Party (CCP) in December 1978 decided to change the priority of China from “class struggle” to “economic construction”, which set off the historic process of economic reform.

As a summary, Chinese SOEs operated along these planning economy principles in the pre-reform period:

- 1). SOEs were subjects to mandatory production plans and were furnished with most of their material inputs through administrative allocations.
- 2). Product prices were determined by pricing authorities, and government agencies controlled the circulation of products from producers to users,
- 3). Wages followed a national scale independent of enterprise productivity. Enterprises were responsible for employee pensions, medical and housing expenses, while they had little control over the size and composition of their employees.
- 4). Investment and working capital were mostly financed by state budget or bank loans according to government plans.
- 5). After the payment of commodity tax SOEs delivered all their profits, if any, to state budget and state budget covered all losses incurred by enterprises.

In this system of planning economy the budget of SOEs was integrated with that of the state and SOEs had little autonomy. Prices and tax were used for only accounting purposes and had no effect on enterprise behavior. The main goal of SOEs managers was to fulfill mandatory targets from planning authorities, not to maximize profits, and as SOEs remitted all their profits to state budget, they had no profit-based incentive to improve efficiency or increase profitability. Another serious problem for this system was that “centralization by the central government actually means decentralized control by its different economic departments” because of the sheer impossibility of centralizing the myriad decisions required by thousands of SOEs in a complex economy, and there existed “an administrative control which separates the inherent connections between economic operations-this is the basic defect in our economic management system” (Xue 1981). Most decisions were made by the commissions under the State Council, the branch ministries in central government, their corresponding commissions and bureaus in local governments. Each of these administrative agencies had its own particular interests, and there were no mechanism of forcing or inducing it to take account of the needs of other agencies. The administrative lines of authority were thus arbitrary and cut across natural economic lines of specialization and coordination.

By 1978 Chinese SOEs had already experienced two administrative centralizations (1949-1957 and 1962-1965) and two decentralizations (1958-1961 and 1966-1976), as the control of SOEs were shuttled back and forth between central government and local governments. This had mostly to do with the division of supervisory responsibility among different administrative levels without granting greater

autonomy to SOEs. The result, according to critics (for example, He 1980 and Xue 1982) was simply a cycling alternation between stultifying centralization and economic anarchy, as “centralized control caused lifelessness, decentralized caused chaos, chaos led to recentralization, which again produced lifelessness.”

2.2 Stages of SOEs Reform in China

Throughout the whole period of economic reform, the chief concern for SOEs policies and experiments was economic efficiency represented by outputs from limited inputs and financial profitability. In an important meeting of the CCP on reform and national economic strategy in the early 1979, Li Xiannian, the vice-premier and minister of finance at that time, pointed out some major problems in economic performance related to efficiency and profitability: 24.3% of SOEs were in deficit; the ratio of output to input for capital investment was 69% in 1978 as compared to 84% in mid-1950's; and about 20% total industrial production capacity were left idle due to the lack of electricity. On the other hand, efficiency was the main measurement to judge the experimental results of new reform policies. So improving the efficiency and financial performance of SOEs has been the persistent theme of industrial reform.

Pursuit of higher efficiency could be directed in many ways, and one of the most important ways for China's reform of SOEs is to seek an institutional arrangement that could effectively and efficiently make use of resources. In promoting economic reform, all efforts and designs would have to deal with the constraint of available

resources, and successful reform means to put institutions in place under which available resources would yield most production and satisfaction. In sum, efficiency of resources utilization is the core for the evolution of economic institutions, which is also the focus of study for this thesis.

In a talk with Milton Friedman in 1988, Zhao Ziyang, the CCP's general secretary and premier at that time, outlined China's plan for the reform of SOEs as comprising five steps: (1) to expand the autonomy of SOEs; (2) to decrease the tax rate from SOEs and concede more profits to SOEs; (3) to carry out the policy of "tax for profit"; (4) to implement the contract system; (5) to transform China's SOEs into shareholding companies (Chen 1990). SOEs reform in China can be described as having gone through five stages between 1978 and 2002, which will be explained by both existing literature and a commons framework, and the latest reform from 2002 on with the State-owned Assets Supervision and Administration Commission (SASAC) will be explained by an anticommons framework.

(1) 1978-1980 the Experimental Period

During this period the priority of economic reform was "household responsibility system" in agriculture sector and developing rural enterprises. For industrial reform efforts were focused on granting greater decision-making power to SOEs and expanding financial incentives within the planning system to improve SOEs' performance. In October 1978, Sichuan province began experimenting by giving greater power to Chongqing Iron & Steel Co. and five other SOEs, which was

followed by similar experiments in Yunnan and Anhui province. By April 1979 Sichuan had extended this experiment to 100 other selected SOEs (Lin 1986). After an administrative decree of “Regulations Concerning the Extension of Decision-making Power in the Operation and Management of State-owned Enterprises” from the State Council in 1979, 6,600 SOEs nationwide had enjoyed greater decision-making power by 1980, representing 16% of SOEs, but 60% of total industrial output value and 70% of industrial enterprise profit (Wang 1982). These SOEs had more autonomy over material purchase, product marketing and wage determination. Mandatory targets for these enterprises were reduced from 8 technical and economic indicators to only 4 indicators: output, quality, profits and contract implementation. For export-oriented SOEs, implementation of export contracts and amount of foreign exchange earned were also examined. Complete state control over revenue and expenditure was replaced with a system of partial retention of profit by the SOEs to be used for production development, workers’ welfare and bonus to workers.

(2) 1981-1982 the Economic Responsibility System

The system of allowing SOEs to retain a portion of their profit led to a difficult problem. Due to the irrational pricing of industrial products, profit could not accurately reflect the efficiency of enterprise operation and management. This meant that it was necessary to define retained percentage of profit in accordance with the particular condition of each enterprise. By 1981 this situation had led to local governments introducing various forms of economic responsibility systems for trial. These systems held SOEs responsible for a quota of profit, for a quota of deficits, a

progressive profit growth rate and some allowed SOEs to pay tax rather than to remit profit to the state. The aim was to experiment widely in order to find the best available form for standard enterprise management. Also in 1981, price flexibility was extended to a large number of industrial inputs, and the government started to allow SOEs to market their products independently (Fan 1989).

(3) 1983-1984 the First Phase of Replacing Profit Remittance with Tax Payment

From 1984 on the emphasis of economic reform was turned from agriculture and rural areas to urban industrial SOEs. Experimental results from various forms of economic responsibility systems proved that it was much better to introduce a tax payment system for SOEs rather than to adopt a profit remittance system. There were two phases for this reform. In the first phase of 1983-1984, SOEs would pay a tax, and then remit a set percentage of profit to the state. Profit remittance percentage was based on state agencies assessing the specific conditions faced by each enterprise. For instance, when there was a difference in prices and conditions for acquiring raw materials, even when enterprises were producing the same type of product, percentage of profit remitted would be adjusted so as to provide enterprises with similar profit margins. Another important event during this period was that in October 1984, the third Plenum of the twelfth Congress of CCP passed “the Decision of Economic System Reform” to endorse “the Socialist Planned Commodity Economy”, further reducing mandatory and central planning targets, enlarging the role of local governments and SOEs, but still keeping public ownership as fundamental for the whole economic system.

(4) 1985-1986 the Second Phase of Replacing Profit Remittance with Tax Payment

In this phase SOEs paid only tax to the state without profit remittance. Tax rates were adjusted to match the actual conditions of each trade and each enterprise. The adopted solution was that each enterprise would pay a resource tax and a particular income adjustment tax after a flat income tax of 55%. Enterprises were then free to retain and use their after-tax profit. By the end of 1985, 81% of SOEs in China had switched to the tax payment system (China State Statistics Bureau 1986). From 1985 on SOEs were permitted to retain 70% of depreciation charges and in 1987 all depreciation charges were allowed to be retained in SOEs. It was at this stage that market transactions were formally introduced alongside traditional planning system to influence enterprise output decisions.

(5) 1986-1992 the Contract Responsibility Systems (CRS)

Though granting enterprises greater decision-making power and allowing the retention of a larger portion of profit played an important role in invigorating SOEs, but the problem of government interference with SOEs decision-making had not been solved. At the beginning of 1987, this problem started to be dealt with by a thorough reform of separating the ownership from management right in SOEs. There were three management modes commonly adopted: a leasing system, a joint-stock system, and a contract management responsibility system. The contract responsibility system took various forms. In the “Double-guarantee and One-link Contract Management Responsibility System”, for example, a SOE guaranteed to fulfill state-set quotas for

tax and technical transformation tasks, while one-link referred to linking the total wage bill of the SOE with its economic performance. Despite their variation and complexity, such schemes had some common elements. First, they all involved a contract-based relationship between a SOE or its director and the state agency. Second, SOE managers would assume risk with greater performance-linked variability for his rewards. Finally most of contract responsibility systems involved multiyear targets and incentives so as to ameliorate the ratchet effect under short-term contracts (World Bank 1989, and Koo 1990). One of the most prominent problems caused by the CRS was extensive bargaining behavior both before and after the contract, running counter to the intention of replacing discretion with rules in the relations between government and the SOEs. Another problem was that the CRS did not harden enterprise budget constraints as it had intended to do so, causing serious implications for government revenue (Blejer and Szapary 1990).

(6) 1993- 2002 Modern Enterprise System

After Deng Xiaoping's call for further market reform during his famous South Journey to the Special Economic Zones in spring 1992, the third Plenum of the fourteenth Congress of CCP endorsed "the Socialist Market Economy" to replace "the Socialist Planned Commodity Economy" in October. Establishing a modern enterprise system was put forward in 1993 as the overall reform strategy for SOEs. The modern enterprise system was summarized as "clarity of property rights, clearness of rights and responsibilities, separation of government and enterprise, and management by scientific methods". The key features for this initiative were its

approval of the development of enterprises with diversified forms of ownership, which would compete on equal terms in the marketplace, and the introduction of modern corporate governance to SOEs. In 1997 another important strategy was proposed to “hold on to large enterprises and let loose small enterprises” (zhua da fang xiao) by releasing small SOEs from state ownership while retaining those large and important SOEs under state control. In various ways, most of small SOEs effectively began to be privatized by conversion into non-state and non-collective ownership, especially stock cooperative companies, while large and medium-sized SOEs started to be converted into limited liability or shareholding companies, some of which got listed on stock exchanges in Shanghai, Shenzhen, Hong Kong, Singapore and New York. Property right markets were set up all over the country for decentralized exchange of ownership and control over industrial lands, plants, equipment, and whole companies. Mergers and acquisitions had become everyday occurrences in China’s industrial economy (Howson 1997).

In contrast with the rapid transformation of small SOEs, the transformation of large and medium-sized SOEs since the 1993 reform package has displayed several shortcomings. First, the conversion of large and medium-sized SOEs into limited liability or shareholding companies has been somewhat slower. One of the obstacles is that competing claimants including multiple government bureaus and ministries frequently can not reach a consensus as to who is the investor of the SOEs, which is required by the Company Law for the conversion to specify ownership. Second, there is little evidence of significant change in the corporate governance of large and medium-sized SOEs that have been converted to limited liability or shareholding

companies, which is caused by the form of wholly state-owned company and domination of insiders in the board of directors. The third shortcoming is the converted SOEs continue to bear some government functions and social services, and they are still vulnerable to administrative interferences from various state agencies. The last shortcoming for the enterprise reform program initiated in 1993 is that large and medium-sized converted SOEs still have an unbalanced capital structure with high debt and low equity financing. In following chapters we will concentrate on the analysis of these large and medium-sized SOEs.

2.3 Governance Reform of the Chinese Government

The governance of government or public governance refers to the institutional arrangement for government administration to maximize social welfare and solve the conflict of interest between different stakeholders. The essence of public governance is to represent citizens and the general public to deal with principal-agent problems in social affairs. As this paper will show in later chapters, the commons and anticommons tragedies for SOEs in China are rooted in the governance structure of the Chinese government that controls the resources of the SOEs, and the SOEs reform will be influenced from the administrative reform on the governance of the Chinese government itself. Any study on the SOEs reform in China without discussing government reform is incomplete and unable to reveal the whole and real essence of the SOEs problem. This section discusses the reform for the role and governance of the Chinese government so far and its influence on the SOEs reform.

In order to meet the holistic changes of politics, economy, technology and society, the Chinese government has pushed large-scale administrative reforms since the early 1980s for the effectiveness of governance (Zhang 1994). Large-scale Government Organizational Reform (GOR) throughout the country happened in four rounds after 1980, i.e., 1982, 1988, 1992 and 1998 (Qian 1998, Liu 1998). As we will discuss it in Chapter 5, although the 1998 GOR by the former Premier Zhu Rongji downsized the original 40 central ministries and commissions to 29, which aimed at constructing the model of “Small Government, Big Society”, it did not cure the problem of anticommons tragedy for SOEs inherent in the governance structure of the Chinese government itself. Other shortfalls for the government reform in China so far include the focus on efficiency at the expense of social justice, no value reorientation of civil servants, and the most fatal root of all problems, i.e. no substantial progress for political democracy and check for balance to prevent excessive interferences from the government towards social and economic areas. It has been widely accepted by researchers that the Chinese political reform has lagged far behind its economic reform. Without real political reform, SOEs in China will still suffer administrative interferences from the government and the Chinese communist party, and the danger of social unrest against authoritarian political ruling may hurt China’s economic development in the future.

Chapter 3 Literature Review of SOEs Reform in China, Relevant Economic Theories, Commons and Anticommons

3.1 China's Economic Reform Strategy and SOEs Reform

Economic reform of China has attracted the attention of economists because of its importance for world economy, structural complexity, and institutional innovations by an experimental approach. Voluminous literature has been devoted specifically to the reform of SOEs in China, and in this section only typical papers are reviewed, which summarizes the research fruits of economic scholars.

Some researchers focus on the general approach or strategy for China economic reform that constitutes the macroeconomic environment for SOEs reform. In Wu and Reynolds (1988), two kinds of overall reform strategy are compared. For the first reform strategy, the main defect of traditional socialist economic system is the over-concentration of decision-making power, and any measure that serves to break up this over-concentration and to stimulate local governments, enterprises and individuals will be an appropriate part of reform. Therefore measures to delegate power and strengthen material incentives should be undertaken or supported. According to the second reform strategy, in contrast, the main defect of the old planning system is that it allocates resources through administrative commands rather than the pricing mechanism of market. Such a command system cannot use resources efficiently. And the only system to substitute for administrative commands in allocating resources is the system of market economy. The development in China has proved that the second

strategy to nurture market mechanism system is much better than the first strategy of simple delegation of power.

Sachs and Woo (1997) discuss two schools of thought to interpret China's rapid growth since 1978 and predict its further direction of reform. The experimentalist school attributes China's success to the experimental and incremental nature of its reform without a clearly pre-set plan, which is described by Chinese officials as "crossing the river by groping for the stone". Specifically, the resulting non-capitalist institutions are claimed to be successful in SOEs where increased competition and increased wage incentive, but not privatization, have been emphasized. The convergence school holds that China's success are the consequences of its institutions being allowed to converge with those of capitalist market economies, and that China's economic structure at the start of reform is a major explanation for the rapid growth. China's gradualism results primarily from a lack of consensus over the proper course, and the "innovative" non-capitalist institutions are responses to China's political circumstances and not to its economic circumstances. The recent policy trend in China has been institutional harmonization with normal market economies rather than institutional innovation, suggesting the advantage of the convergence school over the experimentalist school.

Six lessons from China's reform experience has been identified by Chen et al (1992), which could shed lights on the reform in Eastern Europe and former Soviet republics: (1) the importance of a leading sector, an important element of the sequencing problem; (2) the efficacy of gradual and partial reform, relating to the speed and

comprehensiveness of reform; (3) importance of proximate, kindred economies as reform models and sources of resource transfer; (4) importance of the distinction between centrally managed reform and bottom-up reform; (5) the tendency for flawed institutions and bad policy to obstruct reform; and (6) the need for checks and balances on economic power.

Chow (1997) points out four major topics for the study of China's economic reform: private versus public ownership of assets; Western legal systems versus Eastern semi-formal legal system; individualism versus collective good; multiparty versus one-party political system. China is an interesting experimental station for both public and private enterprises, as SOEs coexist with collective-owned enterprises (mainly township and village enterprises, TVEs) and private enterprises (owned individually, by foreign corporations, or joint venture with foreign corporations). Once the ownership of an enterprise is separated from its management, as in a modern corporation, the incentive of the management to pursue profits for owners becomes problematic. Corporate governance issues in the context of public enterprises are important for further research.

Other researchers narrow their focus down on the reform of Chinese industrial enterprises, especially of those SOEs. In Perkins (1988), the government's efforts to enhance enterprise autonomy and raise productivity of SOEs are compared with the economic liberalization in developing countries ranging from India to Brazil in the 1980s. Enterprise success criteria, enterprise autonomy, and soft budget constraint (Kornai 1979, 1980) are tied tightly with the question of ownership. Perkins argues

that it is only naive to assume that private ownership always guarantees enterprise autonomy, because state bureaucracies can interfere with privately owned enterprises as well as public ones.

To the point of view of Jefferson and Rawski (1994), industry stands at the core of China's reform problem. Efforts to revitalize and restructure domestic industry are closely linked to the reform of pricing, banking, public finance, ownership, social welfare, and technological development. A paradigm of structure-conduct-performance used in the field of industrial organization is adopted to study the progress of SOEs reform in China. They show that greater enterprise autonomy has not eliminated intrusive interference from the government. State agencies sometimes refuse to allow enterprise to exercise their new "rights", especially with respect to foreign trade, employment and financial management. There are also complaints that SOE managers seek responsibility only for profits and expect the state to cope with financial losses.

Despite continuing support of loss-making SOEs and their employees from direct budgetary subsidies, flexible tax rates, and "soft" bank lending, new incentive arrangement has generated both penalties as well as rewards. One instance is that while subsidies rose in response to deteriorating profit performance during the late 1980s, there was a considerable reduction in the softness of budget constraints for SOEs. The recession initiated by the anti-inflation policies of 1988-1990 forced many SOEs to curtail bonuses, furlough some workers at a fraction of their basic wage, and pay others in kind rather than in cash. For the performance measure, market forces

create a tendency to equalize financial returns to factors employed in different lines of business. China has seen sharp reductions in the dispersion of profitability across different branches of industry and across different ownership types. There are also evidences of convergence in financial return to capital, labor and materials across ownership types and among large and medium-sized SOEs. The conclusion is that the reform has pushed SOEs in the direction of intensive growth based on higher productivity rather than expanded resource consumption. Despite these achievements, certain dysfunctional aspects of the former planning regime remain more or less intact. In particular, weakness in financial system perpetuates resource misallocation and threatens macroeconomic stability, while continued absence of well-defined property rights compromise incentives and autonomy.

In past reforms, property rights in SOEs were not clearly delineated. Zhang (1997) uses the theory of property rights and principal-agent theory to explain the reform of SOEs in China. He describes the reform strategy as “a reform doctrine”, in which both decision rights and residual claims should be shifted from the state to inside members (managers and workers) of SOEs, because decision made at the enterprise level are more efficient than at the state level for the reason of asymmetric information (Hayek 1948). The performance improvement of SOEs is attributed to both direct incentive effects and indirect hardening budget constraints. But one of the remaining problems is how to select competent managers for SOEs, which calls for the privatization of SOEs to avoid interference from the state.

Lin et al (1998) attribute the root of SOEs inefficiency to the separation of ownership and control, and the soft budget constraints arise from various state-imposed policy burdens, including retirement pensions, other social welfare payments, redundant workers, and some still distorted prices etc, which make the state accountable for the poor performance of SOEs. The transfer of social programs to state budget is under way but remains far from completed. Thus the key for a successful reform is to remove such policy burdens and to create a level playing field so that market competition can provide sufficient information for the managerial performance of SOEs and make managerial incentives compatible with those of the state.

An important theory of financial decentralization is proposed by Qian and Roland (1998) to explain the soft budget constraint of SOEs in China. They construct a three-tier hierarchy model involving the soft budget constraint in a macroeconomic context. Decentralization in China induces fiscal competition among local governments. The local governments compete vigorously in investing in infrastructure and establishing development zones to attract business into their regions. Also the competition of local governments shows in their restructuring and privatization of SOEs under their jurisdiction. The main proposition from the model is that the effect of hardening budget constraints of SOEs supervised by local governments should be stronger under monetary centralization, which was corroborated by stylized facts in China.

Besides theoretical research, empirical studies for Chinese SOEs reform are mainly concerned with the productivity and efficiency of SOEs. Because this thesis focuses

on theoretical model building rather than empirical test, this section of literature review for empirical study will be brief.

Because reform is an endogenous process and the problem of simultaneity and the time structure of available data confound regression results, the correlation between the reform and financial performance of SOEs is rather ambiguous. For example, while controversies exist regarding the accuracy of such measurements, Jefferson and Rawski (1994) conclude that most findings indicate impressive annual productivity gain from 2% to 4% realized by SOEs since the inception of the reform in the early 1980's, but Woo et al (1994) argue that the prevailing estimate of TFP growth is upwardly biased due to insufficient deflating of accounting outputs.

A growing number of empirical studies (Hay et al 1994, Yao 1997, Huang and Ducan 1997) confirm the view that SOEs reforms involving the reassignment of property rights between the state and the enterprise or individual parties within the enterprises have resulted in measurable, if not always robust, gains in efficiency.

Bai et al (1997) use a theoretical model to show that when enterprises are not maximizing profit for whatever reason, higher productivity may actually lead to greater distortion, lower profits, and lower economic efficiency. On the basis of empirical findings and institutional observations, they argue that these conditions held for many Chinese SOEs during the reform. Therefore, the concept of productivity, as conventionally defined, may not be the appropriate measure for SOE performance during the reform.

Xiao (1991) compares the efficiency of SOEs and collective-owned enterprises (COEs) by using a property rights analysis about the provision of fringe benefits and the dilemma of managerial autonomy in reforming Chinese industrial SOEs. He finds that SOEs are less efficient in production than COEs if adjusting for economies of scale from the results of an econometric production function analysis of the cross-section city level data on the Chinese industrial SOEs in 1985 and 1987. Therefore his conclusion is that for SOEs in China, the limited partial reform toward a market-oriented economy has given root to other problems such as the inefficient provision of fringe benefits and it has achieved little after a decade-long period.

In addition to the tragedy of commons and anticommons that will be analyzed in later chapters of the thesis, serious economic inefficiency of SOEs in China may also result from the state monopoly and rent-seeking in important sectors of national economy, such as banking, telecommunication, energy, railway and aviation etc.

The inefficiency of monopoly compared with competitive market has been well-established by economists, such as the welfare loss from reduced production (Harberger 1954), rent-seeking expenditures (Tullock 1967), and high cost of “X-inefficiency” (Leibenstein 1966). The capture of government regulatory agencies by regulated monopoly companies is studied by Peltzman (1976), which explains why monopoly causes inefficiency even under regulation by government agencies. On top of economic inefficiency, monopoly causes social injustice by transferring wealth from consumers to monopoly companies. For these economic and social reasons, from the late 1970s on, governments around the world have been promoting the

deregulation and privatization in more and more sectors, such as telecommunication, aviation, post services etc, which was formerly regulated in monopoly.

Theoretically economists have proposed several ways to deregulate sectors in monopoly, such as auction bidding of franchise right (Demsetz 1968) and principal-agent mechanism design (Seagraves 1984) etc. From the 1990s on, the research on monopoly and deregulation has been continuing to grow by taking the latest development from asymmetric information (Corts 1995), game theory (Dudey 1995), public choice and new institutional economics (Martimort 1999) and experimental economics (Soberg 2002).

There have been some empirical studies on the economic inefficiency in China caused by state monopoly in various sectors, such as in telecommunication (Lv and Chen 2003), banking and finance (Zhou 2004), and electricity network (Shen and Wang 2006). The general conclusion reached by these studies is that state monopoly still exists in some important sectors of China, which causes serious economic inefficiency through price or quantity distortion and calls for deregulation in these sectors by encouraging further privatization and competition.

3.2 Property Rights, Government, Externality and Institutional Economics

The theory of commons and anticommons is established on the basis of the general theory of property rights, externality and institutional economics. Property rights are an instrument of society as an owner of property right possesses the consent of fellowmen to act in particular ways, and the exercise of property rights or the use of

property gives rise to externalities (Demsetz 1967, Furubotn and Pejovich 1972). A primary function of property rights is guiding incentives to achieve a greater internalization of externalities. Demsetz argues that private ownership, compared to communal ownership, would internalize external benefits and costs.

Property rights are defined and enforced by the government including both legal system and administrative system, therefore a theory on government is needed for the research of property rights. Olson (1991) starts with the point that government replacing anarchy with order allows the creation of greater economic surplus and develops it extensively. He suggests that in small groups this order may be obtained and sustained by voluntary agreement. In larger groups, Olson points out that the difficulty of voluntary collective actions becomes too great, and there is a tendency to substitute coercion. In his term, this kind of coercion is the government as a "stationary bandit", as opposed to a roving bandit. The stationary bandit essentially monopolizes theft in his domain and this institution of government is better for the whole economy than competing roving bandits. Since the lord of the domain has an "encompassing interest" (Olson 1982), he will provide public goods such as law and order, up to the point where marginal cost of doing so is equal to his share of the marginal benefit in terms of social output. While this institutional arrangement is better than anarchy, war or bandit competition, it does not lead to a maximization of net social benefit, since the lord's marginal equation does not reflect the whole increment of social output.

Externality is defined in economics textbooks as the direct (non-market) link between the decision structures of two or more agents. It means that some agent A's utility or production function is directly influenced outside market channels by the actions of other agents without consideration of their effects on A. The general conclusion from mainstream economics is that in the presence of externality, the First Theorem of Welfare Economics does not hold and competitive market equilibrium will not be Pareto efficient. The cure for the inefficiency caused by externality in competitive market system includes traditional Pigouvian tax / subsidy (Pigou 1920) equal to marginal social damage / benefit, assignment of property rights to the generator or receiver of the externality (Coase 1960), direct quantity control of quota, or internalization by merger and acquisition.

An owner's property rights are determined by the property ownership he possesses as different types of ownership confer different property rights. In Dagan and Heller (2001), property ownership takes three different basic forms: state property, private property and commons property. Apart from the three basic types there are hybrid types of ownership such as anticommons property (Heller 1998), limited commons hybrids (Rose 2000) and other commons property (Ostrom 1990).

Mainstream neoclassical economics usually studies the issue of efficiency for resource allocation within institutions already in place. But the fact observed in real life is that the general equilibrium in neoclassical models is seldom attained, and the differences of economic performance among nations both in history and across contemporary world are too large to be satisfactorily explained by neoclassical

models because, if the models is true, competitive market forces would eventually eliminate such performance disparities, or at least narrow the gap to achieve economic convergence. After the path-breaking paper of Coase (1937), economists began to note that neoclassical models are based on the implicit assumptions of efficient property rights and zero transaction costs, and in a real world with inefficient property rights and positive transaction costs, institutions matter for efficiency and economic growth, which are defined by North (1981) as “ a set of rules, compliance procedures, and moral and ethical behavioral norms designed to constrain the behavior of individuals in the interests of maximizing the wealth or utility of principals”. Transaction costs are the costs for measuring, specifying, monitoring and enforcing property rights or contracts. Since transaction costs are positive rather than zero, marketplace abounds with opportunistic behaviors that result in economic loss to society. To reduce opportunism, institutions -firms, state, and other hierarchical organizations- are created to subsume some market transactions and replace them with a bundle of authoritative relations. Institution matters because different institutional arrangement affects transaction costs in the economy differently, and other things being equal, the further the property rights structure of an economy diverges from the neoclassical model, the poorer its performance will be.

There a two major branches of new institutional economics. The first branch, represented by the works of Williamson (1975), evolves around transaction costs and economic organization. The second, pioneered by Demsetz (1967), focuses on the issue of property rights. The policy prescription from both branches is the same: to secure private property rights, uphold a set of formal rules, and devise institutions in

such a way as to minimize transaction costs. North (1990), for example, perceived economic development as the evolution of an institutional framework “that permits the complex impersonal exchange necessary to maintain political stability and to capture the potential economic gains of modern technology”.

Transaction costs are the costs of all the resources required to transfer property rights from one economic agent to another. New institutional economists evaluate the efficiency of an institutional arrangement by measuring transaction costs involved. While admitting that transaction costs are high even under capitalism, these economists assert that private property owners have both the right and the incentive to reduce them. Yet, a socialism state-own economy has an inherent tendency to increase transaction costs by (1) preparing economic plans; (2) monitoring the execution of the plans; and (3) cheating and lying to bureaucratic superiors (Pejovich 1990). Such arguments were also echoed in criticisms towards state ownership by Chinese economists. For instance, the negotiation between the state and SOEs for a mutually acceptable tax rate or other favorable policies involved very high transaction costs (Yang and Xue 1989).

With new institutional economics, economists have increasingly been concerned with the creation of institutions rather than taking them as granted. The transition from planning economy to market economy in the countries of Eastern Europe and the former Soviet Union entails an experiment in establishing new institutions. The paper of Hoff and Stiglitz (2004) examines the interdependence between individuals' economic actions and political positions within a general equilibrium framework

under conditions favorable to the emergence of the rule of law. Their theory shows that asset stripping can cripple the demand for the rule of law because each individual, in attempting to influence society's choice of political environment, focuses on the impact on himself and not on others. In this way the political environment is a public good. The model can be viewed as a theory of anarchy to more general situations than transitional economies.

3.3 The Tragedy of Commons

Commons property is an institution for a property to which no single party holds exclusive title. In legal definition this can mean that the property is owned by no one (*res nullius*) or by everyone (*res communis*). For instance, commons property is defined by Michelman (1982) as the property regime where "there are never any exclusion rights. All is privilege. People are legally free to do as they wish, and are able to do, with whatever objects (conceivably including persons) are in the [commons]." This definition means that every individual may use any object of property and no individual has the right to exclude anyone else from using the object.

The tragedy of commons (Hardin 1968) as a kind of market failure has been long known to economists in that the overuse of resources in commons is caused by the lack of exclusion towards multiple users. Hence the resources in commons are often called free-access or open-access resources in economic literature. With free-access to a resource in commons, the benefit of overexploitation accrues to the individual

exploiter while the cost is borne by all exploiters. Notable examples for the tragedy of commons abound in real world, ranging from overgrazed fields to polluted air.

Economic research has made it clear that the tragedy of commons is caused by the negative externality of each user's action imposed on the productivity of other users due to the lack of exclusion for the access to commons property. The negative externality can be represented as reduced productivity or increased cost to other users. For instance, in a lake to which all fishermen have free access, the haul of one fisherman reduces the population of fish and the expected catch of the others, so negative externality is present among fishermen, and individual maximizing behavior in this setting will be an excessive level of fishing over the social optimal level. Fishermen will enter this fishery as long as the average product of fishing effort exceeds the average cost so that the rent attributable to the fishery is zero. Such inefficiency caused by input misallocation of fishing efforts is due to the fact that one input, the fishery itself, contributes to production but receives no payment because no one owns property rights for the fishery in commons. In other words, if instead of each user maximizing profits by setting individual marginal revenue equal to social average cost which he takes as his individual marginal cost, he sets social marginal revenue equal to social marginal cost, the resource would be used more efficiently. So after the assignment of property rights, individuals would have proper incentives to limit usage and improve economic efficiency and social welfare. It has been proved by Weitzman (1974) that a social optimum can be achieved if a single owner exploits the resource in commons and sells its output in a perfectly competitive market.

The theory of commons has been widely applied to issues such as environmental protection (O'Riordan and Turner 1983), capital flight (Tornell and Velasco 1992), and the North-South trade (Chichilnisky 1994).

3.4 The Tragedy of Anticommons

A great deal of literature on property rights focused on private property and commons property. Very little has been written on the anticommons property. As a mirror to the tragedy of commons in which lack of exclusion right towards multiple user leads to overuse of resources, the tragedy of anticommons is a relatively new concept in which exclusion rights exercised by multiple excluders lead to resource underuse.

Michelman (1982) coined the term anticommons, but it was Heller (1998) who explained the concept in detail and provided empirical applications. Heller defined "anticommons property as a property regime in which multiple owners hold effective rights of exclusion in a scarce resource". These owners may exercise their rights of exclusion such that a scarce resource can be underused. The guiding principle for anticommons is that each owner maximizes his individual return by restricting usage of the resource. For economic theory, in an ideal world of zero transaction cost, complete information, and no opportunistic behaviors, economic agents could always avoid commons or anticommons tragedy by trading their use right or exclusion right to the highest valued use. In real world, however, economic agents in market economy face positive transaction costs, incomplete information and difficult collective action problems. Therefore, once anticommons property arises, collecting

fragmented control rights into usable private property may be a very slow and difficult process.

Anticommons is prevalent in both developed and developing countries and very important for economic analysis in resource development, industrial organization and property usage for both real property and intellectual property. A typical example of anticommons happened in post-communist Russia (Heller 1998). After several years of reform towards market economy in Russia, storefronts in Moscow remained empty, while metal kiosks of retail occupied the streets (Harding 1995). Why did merchants not come in from the cold? Property theorists have offered partial explanation for this puzzle of empty stores and full kiosks, citing the ambiguity of new rights, local government corruption, and the lack of a legal infrastructure. Nevertheless, Heller (1998) put forward another argument that the cause of such phenomenon was that during the transition from socialism planning economy to market economy, Russian government endowed multiple parties with exclusion right of the storefronts to make them anticommons property. The parties included owners (local council or the property committee), users (usually worker collectives of SOEs assigned to the space), balance-sheet holders (SOEs or the housing maintenance council), and government agencies (the city architect, the committee on preservation of architecture and historical monuments, the bureau of technical inventory, the land-reform committee, the fire department and the sanitation/health department). Since the cost of obtaining the right to use the storefronts from all of those numerous parties was too high through market transactions, no entrepreneur could use these storefronts for commercial purpose, and the anticommons tragedy made storefronts remain empty.

In contrast, kiosk merchants negotiated around the anticommons regime through executing corruption contracts with a limited number of municipal officials and protection contracts with the easily identifiable mafia.

Heller and Eisenberg (1998) apply the anticommons theory to intellectual rights in biomedical research. Privatization of upstream research rights may lead to fewer downstream useful medical and biological products. They hold the view that anticommons in biomedical research may be more likely to endure than in other areas of intellectual property due to the high transaction cost of bargaining, heterogeneous interests among owners, and cognitive biases of scientific researchers. Policy makers should seek to ensure coherent boundaries of upstream patents and to minimize restrictive licensing practices that interfere with downstream product development.

The cause of anticommons has been identified as the positive externalities between the complementary resources with exclusion rights exercised by separate owners towards each other (Schultz et al 2002). In Buchanan and Yoon (2000), a model was constructed to prove that the extent of the opportunity loss will depend on the number of person assigned simultaneous rights. In their model of anticommons, owners might reduce the rents available to others who also exercise potential exclusion rights by reducing inputs to the common facility. And in the anticommons regime, exclusion rights may be assigned to persons who cannot or may not desire to capture directly pecuniary gains. Conflict may also arise among excluders who may have different objectives for facility development. Moreover, there may be owners who are not interested in compensations.

Although there are few econometric studies for anticommons tragedy so far, Stewart and Bjornstad (2002) provide an experimental test for Buchanan and Yoon's symmetric model of the commons and anticommons. The experimental result support the theoretical predictions of symmetry and the Nash coefficient predictions for two agents, but for four rights-holding agents the results show greater efficiency losses than under a Nash mechanism. This suggests that anticommons tragedy is reproducible in the experimental lab, but exhibits less than full Nash coordination as the number of agent increases. The implication of these results is further discussed for the intellectual property right policy.

Another experiment test for Buchanan and Yoon's model has been conducted by Vanneste et al (2004), and their results reveal an asymmetry that anticommons situations generate greater opportunistic behavior than an equivalent commons situation and yield a greater risk for underuse compared to commons dilemmas. It was therefore concluded that anticommons might be considered as having even more severe and problematic consequences than the commons dilemma.

Chapter 4 Economic Analysis of Commons and Anticommons

4.1 Analysis of Commons

Economic analysis of commons can be traced back to Gordon (1954) and Scott (1955), both studying the issue of depleted fisheries. Gordon constructed models to explain the difference between rent dissipation under commons property and economic rent as well as social welfare maximization under private property. His basic assumption is that in a static model, the average product (product-per-unit-of-fishing-effort) is a decreasing function of fishing effort due to the reduction of fish population by fishing. Because each fisherman take industrial average product as his own private marginal product, ignoring the negative externality of his action to other fishermen that reduces average product, fishing effort in commons property will be expanded to the intersecting point of average product curve and average cost curve, which is more than the social optimal level at the intersecting point of marginal product curve and marginal cost curve stipulated in the theorem of welfare economics. This over expansion of fishing effort leads to total dissipation of economic rent that should have been the value imputed to the fishery in commons. The geometric demonstration is shown below as Figure 1, where MC = Marginal Cost, AC = Average Cost, MP = Marginal Product, AP = Average Product. Gordon's derivation of rent dissipation for resource in commons has been proved to be valid with general sufficient conditions by game-theoretic method (Brooks et al 1999).

Figure 1

There are several points in Gordon's simple static model of commons that need to be made clear or rather corrected. The first point is that the commons model is for the final product market, in this case the market of landed fish, not for input or factor market. This distinction is quite important because in welfare economic analysis of social efficiency or optimality, the final product market can be studied by its own in a partial equilibrium analysis, while the input or factor market should be analyzed together with it associated final product market to get the welfare effect in a general equilibrium analysis.

The second point is that the commons model is for the supply side of market rather than the demand side of market. It focuses on the production function relationship between fishing efforts and the quantity of landed fish rather than the demand for landed fish, assuming away the problem of maximizing the sum of consumer surplus and producer surplus in demand welfare analysis.

The third point comes from the contradiction between the static nature of Gordon's model and his dynamic assumption of decreasing average product function caused by reduced fish population. In the same period of time as in a static model, all fishermen face just the same fixed fish population, so their average product will not be influenced by the reduced fish population, which can only influence the production in the future. This influence is referred as stock externality and it should be analyzed in appropriate dynamic models, not in static models. However, Gordon's static model can be salvaged by replacing the assumption of stock externality with congestion externality, which is a static relation between fishing effort and average product function. Congestion externality refers to the phenomenon that as fishing effort increase, more fishing vessels will crowd together for fixed fish population so they negatively interfere with the productivity of each other and make the average product of whole fishing industry decrease in the same period of time, which can keep Gordon's original static model of commons intact for analysis.

Scott (1955) argues that Gordon's conclusion is true only for long run, and in short run there is little difference between the efficiency of commons and private property. His view is that in short run the supply curve of fishery with the price given by the world market will be made up by the summation of the supply curves of individual fisherman. These curves will slope upward because with a fixed number of boats, if the crew is worked long hours, or the boat is kept running without maintenance time, the cost per landing will rise. Each boat will increase its landing until its supply price (marginal cost) is equal to the going price. The surplus captured in this situation is the quasi-rent available to each boat by operating at the point where marginal costs are

equal to marginal revenue. If the fishery in commons is converted to private property controlled by a sole owner, in short run he face the same situation as original competing fishermen, so the maximization of economic quasi-rent and social efficiency is the same as the fishery in commons. In long run the sole owner will treat the fishery as capital and try to extract the maximum present value by fixing output where marginal current net revenue is equal to marginal user cost. Such treatment of exploitation as capital utilization is first modeled by Hotelling (1931) and it is applied to dynamic model of fishery and other natural resources by Smith (1968).

Figure 2

Scott's argument is presented in Figure 2, where TC = Total Cost, TR = Total Revenue. In short run, economic quasi-rent is maximized at the level of x where the

difference between TR and TC is largest. In long run, economic surplus is maximized at the level of w' where the difference between net revenue and user cost is largest.

The main difference between Gordon's result and Scott's result focus on the efficiency result in short run, while Gordon's model doesn't extend to the situation in long run. The biggest problem for Scott's short-run result is his erroneous conclusion that fishery in commons exploited by competing fishermen will achieve the same efficient result as in the situation of a sole owner for the fishery as private property. The essence of commons tragedy is the negative externality from individual fisherman's activity towards each other but not taken into account by individual fisherman's benefit-cost calculation. As shown in the first graph of Figure 2, in short run, because of this neglected negative externality as elaborated by Gordon, the landings (and fishing effort) of competing fishermen will not stop at level x as argued by Scott, since even the equipment and number of boats are fixed, landings can be increased in short run by increasing the working hour of crew and boats, which is induced by the economic surplus between the difference of total revenue and total cost, or the difference between average cost and average revenue for the whole industry but taken as private individual marginal revenue for individual fisherman. So even in short run in a static sense, the landings for fishery in commons will be expanded to the level of z and make economic surplus completely dissipated in equilibrium, which is over the social efficient level of landings at the level of x that can be achieved by sole ownership of the fishery. Scott's erroneous result comes from his confusion for individual fisherman's maximizing behavior that neglect externality effect and industrial aggregate behavior of fishing that must allow for externality

effect between all fishermen. Scott has emphasized that his assumption of non-linear cost curve is different from Gordon's assumption of linear cost curve, but this difference is just minor and it will not alter the essential conclusion for the commons tragedy in a static model. Similar to ensuing commons models in Gould (1972), Haveman (1973), Cornes and Sandler (1983), both Gordon's and Scott's simple static model of commons abstract from complicating factors of transaction costs, imperfection of competition and problems of second best.

Gould's (1972) discussion of free-access resource exploitation is one of the earliest economic literatures that identified the causal relationship between externality and commons tragedy. His basic model with one variable factor for free-access resource exploitation is similar to Gordon's fishing model, reaching the same conclusion that free-access resource in commons will be over-exploited as long as net externality from the action of individual exploiter is negative in equilibrium. In his more general model with two variable factors, the over-exploitation theorem from previous model no longer holds since the resource in commons can be over-exploited or under-exploited when factor proportion is changed.

Haveman (1973) obtains another important result of the constraint on resource misallocation present in the common property resource case, which means that although the equilibrium output level of resource exploitation exceeds the optimum, the extent of resource misallocation and inefficiency for the loss of producer surplus is bounded by the gains in consumer surplus. In Figure 3, x is the recovery rate from the resource in commons, while TR = Total Revenue, TC = Total Cost, TWP = Total

Willingness to Pay. In the same way of logic deduction as Gordon and Gould, Haveman reach the same conclusion of resource over-exploitation in commons. However, his method is different from that of Gordon and Gould. Gordon and Gould assume a decreasing average production or average revenue function for variable input or exploitation level with a constant function for both marginal and average cost, while Haveman assumes a constant average revenue function represented by the linear total revenue function with an increasing function for marginal and average cost. The social efficient exploitation rate for resource under sole ownership is x^* , which maximize the difference between the TWP and TC, which is lower than the equilibrium exploitation rate for competing exploiters of resource in commons x^{**} , which is the intersecting point of TC and TR' . TR shifts down to TR' because the producer surplus or quasi-rent bc will attract more exploiters to enter so total supply increases and the price decreases. The total surplus of resource exploitation is reduced from ab to $a'b'$. The reduction of producer surplus bc is made up by the increase of consumer surplus ($a'b' - ac$).

Figure 3

Although Haveman's model of resource over-exploitation is just another correct way of formulating the commons problem, his conclusion of bounded resource inefficiency is mistaken. The increase of consumer surplus from ac to $a'b'$ comes from the reduction of price represented by the shifting down of TR curve to TR', which is not explained by Haveman but rather assumed. However in a static model, if price decreases when exploitation rate x increase, the total revenue should be represented as a non-linear curve with decreasing slope rather than the linear form in Haveman's model. So the shape of TR is just like the shape of TWP in Figure 3. In this changed version, as pointed out by the note 4 in Haveman's paper, movement from the optimal to the equilibrium output level will completely eliminate the economic surplus attributable to the resource in commons, and there is no bounded resource inefficiency because both producer surplus and consumer surplus will be eliminated. Haveman's error results from his inconsistent assumption for the price and total revenue function.

The theory of commons tragedy is further studied by Cornes and Sandler (1983) using oligopoly analysis of conjecture variation. They point out that traditional commons analysis has demonstrated the over-exploitation of the scarce fixed resource in commons where the average product of the variable input, not its marginal product, is equated to the input's rental rate when access is free and the number of exploiter is large. This result relies on the zero conjecture variation assumption of Nash equilibrium for non-cooperative games. Cornes and Sandler (1983) extend the study of commons to allow for a non-zero conjecture variation so non-Nash behavior is applied in their model. Their most significant conclusion for the extended model is

that consistent conjectures that conform to reality cannot characterize standard Nash equilibria, while non-Nash behavior is shown to be inconsistent in all but one case, which corresponds to zero profits even in the instance of a finite number of firms. The main contribution of Cornes and Sandler's paper is its clear analysis of the relationship between individual exploiter's action and the aggregate result for the whole industry of all exploiters towards resources in commons, and their static commons model with conjecture variation is further improved by dynamic commons models of exploitation with conjecture variations in Sinn (1984), which follow the path-breaking dynamic models of resource exploitation and storage in Khalatbari (1977). However, Cornes and Sandler's model does not mention the externality of individual exploiter's action towards each other that leads to the divergence between private and social benefit and cost, which is the root cause for the commons tragedy of resource exploitation and utilization.

4.2 Analysis of Anticommons

Michelman (1982) coins the term anticommons as a "regulatory regime" to be a type of property "in which everyone always has rights respecting the objects in the regime, and no one, consequently, is ever privileged to use any of them except as particularly authorized by the others". However, it has been pointed out by Heller (1998) that Michelman's definition of anticommons is only an abstract legal term and has no counterpart in real world property relationship. Heller offers a more useful definition of anticommons as a property regime in which multiple owners hold effective rights of exclusion in a scarce resource. These owners may exercise their rights of exclusion

such that a scarce resource can be underused. The guiding principle for anticommons tragedy is that each owner maximizes individual's return by excluding and restricting others from the usage of the resource.

There have been several kinds of classification for anticommons. In Heller (1998) anticommons can be classified into spatial and legal anticommons. In spatial anticommons, an owner may have a relatively standard/unified bundle of rights but too little space for ordinary use such as a communal apartment in Russia. By contrast, in legal anticommons, substandard/fragmented bundles of rights are allocated to competing owners in a normal amount of space such as a storefront in Moscow. Therefore, the difference between spatial and legal anticommons is the nature of property fragmentation. Schultz et al (2002) provide other two kinds of classification for anticommons. First one is between horizontal and vertical anticommons. In horizontal anticommons owners exercise exclusion rights on the same level of a value chain, while in vertical anticommons, owners exercise exclusion rights on different level of a value chain. In this kind of analysis, the difference between horizontal and vertical anticommons results from the relation of positions on a value chain for exercising exclusion rights. The second classification is between the simultaneous and sequential anticommons, in which exclusion rights are exercised simultaneously or sequentially, so the difference focuses on the time order of players' actions in the bargaining game. Horizontal anticommons is often but not necessarily associated with simultaneous anticommons, while vertical anticommons is often but not necessarily associated with sequential anticommons.

Since the use of resource in anticommons needs to get approvals from all exclusion right holders, and individual exclusion right has no value if it is not combined with other exclusion rights, each exclusion right is complementary to each other. When one owner exercises his exclusion right, the resource cannot be used to produce value and all owners lose, so anticommons tragedy is caused by negative externality between exclusion rights of fragmented property with multiple owners toward each other (Buchanan and Yoon 2000, Schultz et al 2002). On this theoretical basis the definition of anticommons has been enlarged from Heller's fragmentation of property for just one resource to include fragmented control of property for complementary resources, which was first modeled as complementary duopoly in Cournot (1838).

In Buchanan and Yoon (2000), a linear model is constructed to assert that the extent of value loss in both commons and anticommons will depend on the number of owners with assigned simultaneous rights. In anticommons, owners might reduce the rents available to others who also exercise exclusion rights by reducing inputs to the common facility, and exclusion rights may be assigned to persons who cannot or may not desire to capture directly pecuniary gains. Conflict may also arise among excluders who may have different objectives for resource development. Moreover, there may be owners who are not interested in compensations.

One of the most important propositions in Buchanan and Yoon (2000) is their assertion of the symmetry of value loss for commons and anticommons tragedy. The anticommons tragedy, as measured in non-realized economic value, takes the form of resource underuse, while the commons tragedy, as measured in the loss of realized

economic value, takes the form of resource overuse. The basic logic is equivalent for both cases of commons and anticommons. The inefficiency arises because separate decision makers, who exercise assigned usage or exclusion rights, impose negative externality on others who hold similar rights. The size of value loss in both commons and anticommons depends on the number of agents with assigned simultaneous rights. A geometric model is illustrated by the Figure 4 below for commons and anticommons tragedy.

Figure 4

According to Buchanan and Yoon, average value for resource usage is assumed to be a linear decreasing function of the quantity of resource usage and cost is assumed to be zero. If the resource is owned by a sole owner with whole usage and exclusion right as in private property, then resource usage is restricted to the level Q_m where marginal value is zero with maximized value of economic rent imputed to the resource. If the resource is owned by two owners both of whom have usage right as in the case of commons, then Nash equilibrium achieved through independent quantity

adjustment will be the point of E_2 on the average value line, and the value represented by the rectangle $wQ_2 E_2 P_2$ is less than the value at the quantity of usage Q_m in the case of sole ownership for private property. This analysis of commons is a specific case of Gordon's model for free-access fishery with constant cost which is the basic static model of commons. If the resource is owned by two owners both of whom have exclusion rights as in the case of anticommons, then Nash equilibrium achieved through independent price adjustment will be point E_2^* on the average value line, and the value represented by rectangle $wQ_2^* E_2^* P_2^*$ is less than the value at the quantity of usage Q_m in the case of sole ownership for private property too. If the number of owners increases, the limit case of commons will be zero average value and zero total value, while the limit case of anticommons will be zero quantity of resource usage and zero total value. Therefore, Buchanan and Yoon argue that value loss will be symmetric for commons and anticommons with linear relationship when the number of owners increases as in Figure 5.

Figure 5

Although the symmetry of value loss between commons tragedy and anticommons tragedy can be derived by Buchanan and Yoon's linear model, there are several fundamental mistakes in their assumptions and conclusion that must be corrected properly to illustrate the symmetric relation between commons and anticommons.

The first issue is that Buchanan and Yoon have put commons and anticommons in the same model of linear average value function. Because commons tragedy occurs in the supply side of final product market, in a partial equilibrium analysis it is suitable to focus on the relationship between average value and resource usage. But anticommons results mainly from the pricing behavior in the demand side of factor market, so it should focus on the relationship between inverse demand/price and resource usage, and it is unacceptable to confuse demand function in factor market with average value function in product market as in Buchanan and Yoon's model. If the average value function is different from the inverse demand function, then there is no symmetry of value loss for commons and anticommons even in linear models.

The second issue is the conclusion of welfare analysis reached by the linear model. Buchanan and Yoon's result for commons is correct because in the supply side of the final product market without distortion in other parts of economy, value maximization achieved in the case of sole ownership for private property is social efficient as standard assumption of profit maximization for producers requires it in the First Theorem of Welfare Economics, while resource in commons property with multiple owners will be used or exploited over the social efficient level to cause value loss. In this way only producer surplus or value is considered and the problem of

consumer surplus is abstracted away by assumption. However, as it is pointed out by Coloma (2004), if anticommons tragedy is modeled by a linear demand function in Buchanan and Yoon (2000), then both consumer surplus and producer surplus must be taken into account and social efficient solution is not a solution of sole ownership for private property, which only maximize producer surplus, but a perfect competition solution with unlimited number of owners and without any exclusion right, which maximize the sum of both consumer surplus and producer surplus as required by welfare analysis of social efficiency. This error in welfare analysis lies in the confusion of supply side with demand side of market and it makes incorrect the symmetry of value loss for commons and anticommons asserted by Buchanan and Yoon. This lack of symmetry is demonstrated by the experiment test of Buchanan and Yoon's model in Vanneste et al (2004). Their experiment results reveal an asymmetry that anticommons situations generate greater opportunistic behavior than an equivalent commons situation and yield a greater risk for underuse compared to commons tragedy. It was therefore concluded that the anticommons tragedy might have more severe consequences than the commons tragedy.

Since there is no symmetry of value loss for commons and anticommons modeled in Buchanan and Yoon (2000), there are two ways to retain the meaning of the symmetry between commons and anticommons. First, as Parizi et al (2003) point out, the symmetrical features of commons and anticommons result from a misalignment of the private and social incentive of multiple owners in the use of a common resource. The unitary basis of the problem is to treat the traditional structure of a property right as the normal case in which owners enjoy a bundle of rights over their

property including both the right to use their property and the right to exclude others from it. In such a unified ownership, the owner’s rights of use and exclusion are exercised over the same domain so they are complementary attributes of a unified bundle of property rights. In this way, the commons and anticommons are viewed as deviations in symmetric directions to the above defined normal case of unified bundle of property rights. In commons situation, the right to use stretches beyond the effective right to exclude others. Conversely, in anticommons situation, the right of use is compressed or eliminated by the overshadowing right of exclusion held by other owners. The lack of conformity to the normal case causes a welfare loss from the forgone synergies between the complementary features of a unified property right.

Second, the symmetry between commons and anticommons as mirror images to each other can be understood to mean the duality of price and quantity between complements and substitutes in a linear model structure. It has been proved that it is a dominant strategy for each firm to choose quantity/price as the strategy variable provided the goods are substitutes/complements (Singh and Vives 1984), so it is appropriate to use quantity/price as strategy variable for modeling commons/anticommons.

Table 3: Commons and Anticommons

	Commons	Anticommons
Product market / factor market	Product market	Factor market
Supply side / demand side	Supply side of market	Demand side of market
Usage right / exclusion right	Usage right	Exclusion right
Substitutes / completments	Substitutes	Complements

The cause of commons is the negative externality posed by use rights toward each other, and the cause of anticommons is the negative externality posed by exclusion rights toward each other, as it is pointed out by Steward and Bjornstad (2002), the modeling structure for commons and anticommons is the same as Cournot oligopoly duality in quantity of substitute for commons and in price of complements for anticommons (Sonnenschein 1968, Singh and Vives 1984). Quantity adjustment by resource users imposes the negative externality of reduced price to other users and reduces total profit, but in commons situation this negative externality is not internalized by separate users. In a similar way, price adjustment by resource excluders imposes the negative externality of reduced quantity to other excluders and reduces total profit, but in anticommons situation this negative externality is ignored in the benefit-cost calculation of each individual excluder. The consistency of Cournot solution for equilibrium is provided by Daughety (1985), and the necessary and sufficient conditions for the existence of Cournot equilibrium are discussed in Novshek (1985). Linear models have been constructed to demonstrate the effect of commons and anticommons tragedy.

4.3 Linear Models of Commons and Anticommons

Assume that n firms are exploiting a resource in commons (such as fish) by using the input (fishing effort such as the number of fishing ships). The marginal and average cost of fishing effort is assumed to be constant at c , and the quantity of fishing effort of firm i is assumed to be q_i . Because of negative externality imposed by the firms toward each other, the marginal physical productivity of fishing effort will decrease

as the amount of fishing effort input $q = \sum q_i$ increases. When marginal productivity decreases in the whole range of production, the average productivity will decrease if it is lower than the marginal productivity. The quantity of each firm's input q_i is the strategy variable in this modeling of oligopoly game. The negative externality means the increase of input from one firm will cause the reduction of productivity for all other firms, which is not included in the calculus of the original firm. We focus on the case of decreasing average productivity in the case of commons discussed in the literature. Let average productivity in value term be p , and the linear average productivity function is: $p = a - b q$, $a > 0$ and $b > 0$. For simplification without losing generality, the coefficient b is normalized to be one (so $b=1$), and the linear average productivity function becomes: $p = a - q$.

When $n=1$, the single firm will choose the quantity of input q to maximize its own profit: $\pi = p q - c q = (a - q) q$.

The solution is: $q^* = (a - c) / 2$, $p^* = (a + c) / 2$, $NV^* = p^* q^* - c q^* = (a - c)^2 / 4$.

NV^* is the net social value produced from fishing by using q^* , which should be maximized for social efficiency assuming that there is no distortion in other markets and no income effect.

When $n > 1$, firm i will choose q_i to maximize its profit: $\pi_i = pq_i - c q_i = (a - \sum q_i) q_i$. As in Cournot oligopoly, Nash equilibrium solution is: $\hat{q}_i = (a - c) / (n + 1)$, $\hat{p} = a - \sum q_i = (a + cn) / (n + 1)$, and $\hat{NV} = \hat{p} \hat{q} - c \hat{q} = n (a - c)^2 / (n + 1)^2$.

After further calculation, we get the result that q is an increasing function of n , p is a decreasing function of n , and NV is a decreasing function of n . Therefore we have $q^* < \hat{q}$, $p^* > \hat{p}$, and $NV^* > \hat{NV}$. This means that compared with the case of single firm in the exploitation of resource, in the commons case of multiple competing firms, the equilibrium input is higher, the average productivity is lower, and net value is lower when the number of firms n increases, so the resource in commons is excessively exploited over the level of social efficiency.

Using the duality of Cournot oligopoly in price for complements and in quantity for substitutes, the duality in structure for linear function model of commons and anticommons can be established if the cost is normalized to be zero. Assume that n firms own exclusion rights for a resource in anticommons. The marginal and average cost of exploitation is assumed to be constant at c , and the price charged by firm i is assumed to be p_i . The quantity of resource approved by firm i to be supplied to the market is q_i . In the case of anticommons, the quantity of resource supplied to the market q is the minimum quantity among q_i , which gets the approval from all firms for supply. The demand function clearing the output market for the resource exploited is linear: $q = \alpha - \beta p$, $p = \sum p_i$, while both α and β are positive constants. For

simplification without losing generality, the coefficient β is normalized to be one (so $\beta = 1$), and the linear demand function becomes: $q = \alpha - p$.

Because each unit of resource supplied to market must get approval from every firm with price p_i charged, so the final price of resource output is the summation of p_i from all firms. Price is the strategy variable in the anticommons, while quantity is the strategy variable in the commons. The negative externality between exclusion rights is caused by such a mechanism. When one firm exercises its exclusion right, the firm increase its own price charged p_i in the model of choosing price as strategy variable. Other things being equal, the increase of p_i makes the final price p higher and the whole quantity demanded q lower for all firms, so the profit of other firms is reduced by the exercise of exclusion right of the original firm, who does not take this effect into its calculation.

If $n=1$, the single firm in the output market will choose the price p to maximize its own profit: $\pi = pq - cq = (p-c)(\alpha - p)$. The solution is: $p^* = (\alpha + c) / 2$, $q^* = (\alpha - c) /$

$$2, TW^* = \int_0^{q^*} (p - c) dq = 3(\alpha - c)^2 / 8.$$

TW^* is the total welfare produced from supplying q^* , which is the sum of consumer surplus and producer surplus. By the assumption that the buyer's utility function is quasi-linear there is no income effect in the demand for the good and consumer surplus can be used to measure the buyers welfare.

If $n > 1$, firm i will choose the price p_i to maximize its profit: $\pi_i = p_i q - c q = (p_i - c) (\alpha - \sum p_i)$. So the Nash equilibrium solution is: $\hat{p}_i = (\alpha + c) / (n+1)$, while $\hat{p} = n (\alpha + c) / (n+1)$, $\hat{q} = \alpha - \hat{p} = (\alpha - nc) / (n+1)$, $\hat{TW} = \int_0^{\hat{q}} (p - c) dq = (2n+1) (\alpha - nc)^2 / 2 (n+1)^2$.

By further differentiation we can get that $\hat{p}$ is an increasing function of n , and $\hat{q}$ is a decreasing function of n . With the condition $\hat{q} > 0$, we have $\alpha - nc > 0$, and $(\alpha - nc)^2$ is a decreasing function of n , and because $(2n+1) / 2 (n+1)^2$ is a decreasing function of n too, we obtain the result that $\hat{TW}$ is a decreasing function of n . After further calculation of inequalities, we get the result that when $n > 1$, $p^* < \hat{p}$, $q^* > \hat{q}$, and $TW^* > \hat{TW}$. This means that compared with the case of single firm with exclusion right in resource output market, in the anticommons case of multiple firms with exclusion rights, the equilibrium price is higher, the quantity is lower, and total welfare is reduced as the number of firm n increases, which means more underuse of the resource below the level of social efficiency.

Chapter 5 Commons-Anticommons Models for Chinese SOEs

5.1 A Commons Model for SOEs

As the saying goes, “everyone’s property is no one’s property”, which is a quite realistic description of the system for SOEs in section 2.1, and this system has not changed much during the reform process of section 2.2.

Cauley et al (1999) apply the commons theory to explaining the performance of SOEs in China. They argue that SOEs reform has failed because incentive mechanisms confronting the key stakeholders did not elicit efficient behavior.

Under socialist principles, the people were the ultimate owners of SOEs (in China SOEs were conventionally called “the whole people enterprises”). Thus the people were the bearers of residual risk and they, in principle, entrusted the state to manage these SOEs. So in this system everyone owned everything, but no one was responsible for anything; that is, no one possessed explicit property rights, so that no one had incentive to run these enterprises efficiently. The enterprise manager’s main responsibility was to fulfill the plan handed down by the state and to negotiate with state bureaucrats over planned targets. Because managers’ reward was relatively fixed with no link to efficiency and increasing efficiency might generate contentiousness with workers, there was no incentive for managers to increase the efficiency of SOEs.

The economic reform focused on changing the improper incentives, whereas the state ownership remained essentially unchanged. The enlargement of enterprise autonomy and the contract responsibility system were designed to curb interventions by state bureaucrats so that SOEs managers could have unfettered decision-making power with responsibility for profit or loss. However, as SOEs managers negotiated with state bureaucrats over the amount of retained profits for the SOEs, a problem of upper-tier collusion between these two kinds of agents emerged (Lee 1991), which seriously weakened the enterprise autonomy and the link between managerial bonus and enterprise performance. On the other hand, a problem of lower-tier collusion emerged between managers and workers, so that workers' bonuses became generalized wage supplements rather than performance-linked incentives (Cauley and Sandler 1992). To a certain extent the contract responsibility system can improve the enterprise's performance because it can partly confer private residual rights on the contractors who manage inside units of the enterprise. However, since the private residual rights of the entire enterprise owned by the state cannot be well specified or cannot be enforced under state ownership, the incentive mechanism for the state bureaucrats supervising the enterprises cannot be efficient. This implies that the contract responsibility system will still generate significant X inefficiencies (Leibenstein 1966) although it can slightly reduce X inefficiency because the incentive mechanism at the level of managers has more important performance effects than that at the level of workers. The development of private enterprises and partial privatization of SOEs through converting them into joint stock companies or public holding companies may reduce X inefficiency significantly in China.

The Cauley et al (1999) model of commons concentrates on the relation between inside stakeholders (managers and workers) of SOEs, in the situations of homogeneous and heterogeneous agents. As the writers point out, the model can be transformed by appropriate assumptions to study the behaviors of outside stakeholders (state agencies) which will be used in the anticommons model of section 6. The commons model is an appropriate description for Chinese SOEs where stakeholders, including managers, workers and state bureaucrats, vie for profits by making claims on a common-pool resource of the SOE and its assets. The manner in which these stakeholders share the fruits of the SOE determines the stakeholders' incentives and their efforts. Thus small difference in the sharing formula can have a significant impact on the efficiency of the SOE. By analyzing alternative sharing or incentive systems and highlighting the interdependency among property rights, incentives and enforcement, the commons model shows that alternative property right assignments have complex configurations of positive and negative externalities.

In the case of homogeneous agents with same inherent productivity, an equal sharing rule results in a classic free-riding problem, in which as each stakeholder decides whether to provide more effort to the SOE, he counts only the fraction $1/n$ of any extra profit for himself and ignores the share $(n-1)/n$ that his effort benefits others. An increase in the number of stakeholder n will worsen this situation. If some stakeholders, such as SOE managers and state bureaucrats, receive more of the SOE profit as a result of upper-level collusion, the disincentive to the remaining stakeholders to internalize the positive externality of their efforts will be even greater. An alternative rule is to base the distribution of enterprise output for the proportion of

one's effort to total efforts. As the model shows, this sharing rule will cause more effort supply than the Pareto-optimal result, which is due to each stakeholder's ignorance of negative externality that his increased effort imposes on others' shares (Cornes and Sandler 1996).

For heterogeneous agents with different inherent productivity, the incentives embodied by alternative sharing arrangements are tied to the manner in which these productivities are related to the reward structure. In Cauley et al (1999), two cases of sharing are considered: (1) sharing based on effective effort and (2) sharing based on actual effort. If shares are proportional to effective effort, then for a production function of homogeneous degrees, if it is diminishing returns to scale, then there are universal negative externalities leading to oversupply of effort; if constant return to scale exists, then Pareto optimality follows; in the case of increasing returns to scale, undersupply of effort arises as the positive externality of increased effort is not internalized. If, however, effective effort could be monitored, then the rule of proportional sharing is the same as the effort-sharing rule for the homogeneous stakeholder case.

Because of the difficulty of determining effective effort, a more likely sharing rule is based on actual effort such as hours worked. The derived result is that stakeholders with high inherent productivity confer a positive externality on others and should be encouraged to supply more effort. In contrast, stakeholders whose productivities are low relative to others impose a negative externality to others by decreasing other stakeholders' share on average.

The major conclusion is that incentive mechanisms favoring more equal distribution are the most inefficient, whereas those differentiating among heterogeneous stakeholders based on effective, rather than actual, effort are more promising.

5.2 The State-owned Assets Supervision and Administration Commission

The model of anticommons in this section is constructed to explain the inefficiency of SOEs as the administration of SOEs in China has changed in the cycle of centralization and decentralization. In the pre-reform period of Chapter 2, there were two rounds of centralization, 1953-1957 and 1962-1965, and two rounds of decentralization, 1957-1961 and 1966-1976, all within the planning system. During the reform period, the same pattern continued, and the centralization tendency was strengthened after the political upheavals of June 1989.

Although as far back as in 1992, the State Council promulgated a decree “Regulations on Transforming the Management Mechanism of State-owned Industrial Enterprises”, in which SOEs could enjoy the autonomy of fourteen rights, such as the rights of production and management decision making, import and export rights, the right to sell product and purchase goods and materials. Nevertheless, in reality because state agencies resisted such relegation of authority to SOEs, few SOEs in China have enjoyed the complete set of these fourteen rights, and they are still subject to administrative controls from state agencies. For example, most SOEs still need to rely on state-owned foreign trade corporation for their imports and exports.

After a new round of reform on streamlining state agencies led by prime minister Zhu Rongji in 1998, the SOEs in China became more subject to controls from multiple government and Communist Party agencies: State Development and Reform Commission (the former State Planning Commission) for the approval of major investment projects and annual production plan; State Economic and Trade Commission for the supervision of day-to-day operation; the Ministry of Finance for the administration of assets and funds; the Ministry of Labor and Social Security for the control of wages and welfare. Appointment of senior managers must get approvals from three agencies: the Ministry of Personnel, the Organization Department and the Work Committee of Enterprises under the Central Committee of Chinese Communist Party. Both Ministry of Commerce (the former Ministry of Foreign Trade and Economic Cooperation) and State Administration of Foreign Exchange controlled SOEs' foreign trade and overseas investment. In such a complex system, administrative powers were widely dispersed and no single agency was solely responsible for bad-performing SOEs, while every agency would want to extract maximum benefit from well-performing ones. If a wrong decision had been made, each agency could evade responsibility by claiming that it was forced to comprise with other agencies in the decision making process. This problem was graphically described as "multi-headed administration" in Chinese economic literature, and its history can be traced back to pre-reform period (Byrd 1991).

One good example of "multi-headed administration" for SOEs is the Anshan Iron and Steel Company (refer to as Anshan below), one of the largest SOEs in China with an annual production capacity of more than ten million tons of iron and steel. After

several rounds of centralization and decentralization, Anshan's relationship with its supervisory agencies became very complicated. It was subject to both the central branch ministry, in this case the Ministry of Metallurgy (abolished later in government reform) and the local industrial bureau, the Metallurgy Bureau of Liaoning Province. But numerous other government agencies were involved in supervising various aspects of Anshan's operations, including the State Planning Commission, the Ministry of Finance, the tax authority, the material supply system, labor and personnel departments etc. Hence Anshan functioned in a complex administrative environment and interacted with numerous bureaucratic agencies that often had conflicting agendas.

Another example of anticommons tragedy caused by "multi-headed administration" of SOEs is the failure of investment project for Zhongyuan Pharmaceutical Corporation (Zhongyuan Co. below) in 1990s. Zhongyuan Co. is located in the new and high-tech development district of Zhengzhou, the capital city of Henan province in central China. It is a big state-owned enterprise and has been the largest investment project for the industry of pharmaceuticals in China. Zhongyuan Co. introduced foreign technologies to annually produce 5000 tons of Vitamin C, 43000 tons of starch, and 2500 tons of glucose from maize. The investment funds for this project came from the World Bank loan of 117.5 million US dollars and domestic credits. At the end of 1998, the total investment loan amounted 3.37 billion RMB yuan (about 400 million US dollars) for the sum of principal and interest with 1.57 billion yuan of the World Bank loan and 1.8 billion yuan of loans from domestic banks. Zhongyuan's planned annual profit was 220 million yuan with export of 60 million US dollars. However, it

made tremendous financial loss after its pilot production in 1992, resulting accumulated loss of 1.15 billion yuan (about 140 million US dollars).

There are several reasons for the failure of Zhongyuan Co. project, including the fall of Vitamin C price in international market, much competition from other domestic VC producers, and poor internal management system. However, the anticommons tragedy from the “multi-headed administration” was a very serious problem for the project. As a SOE in the industry of pharmaceuticals, Zhongyuan Co. was subjects to administrative controls from State Planning Commission for investment project approval, National Material Investment Corporation for supply of investment materials, State General Administration of Medicine for production plan approval, State Economic and Trade Commission, Henan provincial government and Zhengzhou municipal government for day to day administration and supervision. This dispersal of fragmented control rights in multiple state agencies created a typical situation of anticommons tragedy. Because of the anticommons problem, there was no sole owner and decision maker for the project, and in last ten years five general managers had been dismissed without a stable management team. Because no one really had the sole authority and incentive for Zhongyuan’s profitability, the ensuing financial failure matched the theoretical hypothesis from the anticommons tragedy.

In order to solve the “multi-headed administration” problem, as far back as in 1988, the State Administration of State-owned Asset Management (SASAM) was set up under the Ministry of Finance to try to supervise SOEs in a unified way. Nevertheless, because its administrative level was lower than those state ministries and party

agencies aforementioned, the Bureau of State-owned Assets could not obtain unified authority of control towards SOEs from them, and in 1998 itself was dissolved into the Ministry of Finance, reflecting the difficulty of SOEs reform in China.

The governance of local SOEs largely mirrored that at the center, even though there was considerable variation across the country. Starting in 1990s, many provinces, cities, and other sub-provincial levels of government established state asset management bureaus (SAMBs) and state asset management companies (SAMCs) (also called investment or holding companies) in order to manage local SOEs on behalf of their nominal owners, local government. The central SASAM had little authority over these local SAMBs and SAMCs, which were overseen by provincial-level government agencies known as state asset management commissions. Some local arrangements, such as Shenzhen and Shanghai, were more unified in terms of SOE supervision than those of the central government.

In 2002, Chinese government began to transfer the authority towards SOEs from multiple agencies to newly established State-owned Assets Supervision and Administration Commission (SASAC). Because of the continuous inefficiency and financial losses from SOEs, the SASAC can be seen as the latest attempt of Chinese government to solve the chronic problem of SOEs. The central SASAC is a special agency with a rank of ministry in the State Council so that it can unify authorities dispersed in other agencies. The authority of SASAC towards SOEs is comprehensive, including the control of SOEs' personnel, funds and goods. The central SASAC is responsible for the supervision of 187 central SOEs except for financial institutions,

which are large enterprises in key industries including telecommunication, transportation, electronics, energy and chemistry, with totally 11598 subsidiary enterprises, while in the same way local SASACs have the unified authority for local SOEs. The worth of gross assets controlled by these SOEs supervised by the central SASAC amounted to 6.9 trillion RMB (833 billion US dollars) in September 2003. Except for war, natural disaster or other abnormal and urgent conditions, the State-owned assets will only be owned and supervised by the SASAC at the appropriate level of government without arbitrary transfer and allocation.

Former Chinese President Jiang Zemin's Working Report to the Sixteenth Congress of CCP in 2002, laid down the foundations of this new arrangement of SASAC when he called for central and local government to present the state in undertaking both the rights and responsibilities of state asset ownership. The relevant part of report was "Continuing to adjust the structure of the state sector and reform the state property management system is a major task for deepening economic restructuring. We should give full play to the initiative of both the central and local authorities on the precondition of upholding state ownership. The state should make laws and regulations and establish a state property management system under which the Central Government and local governments perform the responsibilities of investor on behalf of the state respectively, enjoying owner's equity, combining rights with obligations and duties and *administering assets, personnel and other affairs*. The Central Government should represent the state in performing the functions as investor in large state-owned enterprises, infrastructure and important natural resources that have a vital bearing on the lifeline of the national economy and state security while local

governments should represent the state in performing the functions as investors with regard to other state property. The central government and the provincial and municipal government should set up state property management organizations. Government at all levels must strictly abide by the laws and regulations concerning the management of state property, persisting in the separation of government functions from enterprise management and separation of ownership from management so that enterprises can operate independently, assume sole responsibility for their profits or losses, and preserve and increase the value of state property.”

5.3 A Strict Anticommons Model

In the following model, it is assumed that anticommons has happened with multiple state agencies holding exclusion rights towards complementary resources of a SOE, so the implication of anticommons rather than its cause is studied.

The model is an extension of the static linear anticommons model with a general function form, two-period factor and mixed strategy. As Heller and Eisenberg (1998) point out, the anticommons inefficiency will be aggravated by players’ strategic behaviors, heterogeneous interests, and cognitive biases. This model will capture the dynamic inefficiency of anticommons due to players’ strategic behaviors.

A preliminary model is for the case of strict anticommons, which means that complementary resources must be combined together to produce positive values, otherwise the resources have no value separately.

There are risk-neutral three players in this game model with perfect information. A SOE (player 0) has just found out that a positive value v will be produced when two of its resources are used together. For simplification, as in the case of strict anticommons, it is assumed that these two resources have no value if not used together. The two resources are controlled exclusively by two state agencies (player 1 and 2) respectively. It is also assumed that only the SOE rather than the two state agencies 1 and 2 knows how to combine the two resources to produce the value v , so the SOE must participate in the bargaining game with the two state agencies, otherwise there will be no transaction that can produce the value v .

It is assumed that there are two periods of time during which each state agency i can bargain with the SOE, $t_i = N$ (Now) and $t_i = L$ (Later), $i = 1, 2$. Both agencies 1 and 2 are assumed to simultaneously choose p_i in a non-cooperative way, p_i being the probability of bargaining with the SOE at time of Now, and $(1 - p_i)$ being the probability of bargaining at time of Later. So this is a multi-player two-period bargaining game with mixed strategy. Such way of choosing bargaining probability results in four possible events: both agencies bargain with the SOE now, probability $p_1 p_2$; only agency 1 bargains now, and agency 2 will bargain later and vice-versa, probabilities $p_1 (1 - p_2)$ and $p_2 (1 - p_1)$; both agencies choose to bargain later, probability $(1 - p_1) (1 - p_2)$.

The players bargain efficiently over the trade of resource usage rights by a multi-player bargaining game. A generalized form of Nash bargaining solution (Nash 1950, 1953) is assumed to determine the payoffs to each player (Muthoo 1999):

Net payoff = threat point payoff of the player + (bargaining share) (surplus available – sum of threat point payoffs of all bargaining players).

The threat point payoff is just the disagreement payoff that the players can get if the bargaining breaks down. In this way the total payoff is the sum of the threat point payoffs of all bargaining players and a share of the gains from the transaction.

As pointed out by Muthoo (1999), the advantage of Nash bargaining solution over other cooperative game solutions such as “core” or “Shapley value” lies in its simplicity as a formula of solution and wide applicability to a large class of bargaining situations with axiomatic properties, including invariance to equivalent utility representations, Pareto efficiency, and independence of irrelevant alternatives.

The bargaining share is the function of each player’s bargaining power and other parameters in the model. It is assumed that the SOE cannot threaten not to bargain at time N because the threat is not creditable and such practice would not be sub-game perfect. So we only need to focus on the payoffs to two state agencies 1 and 2, for only they can take strategic actions.

We denote $S_j(t_j, t_k)$ as the payoff to agency $j \in \{1, 2\}$, when the two agencies j and k choices of bargaining probability p_j and p_k are $t_j \in \{N, L\}$ and $t_k \in \{N, L\}$

respectively. If all three players are bargaining now, so that $t_1 = t_2 = N$, then for agency $j, j = 1, 2$, each receives the payoff $S_j(N, N) = \alpha_j v$ in present value, where $\alpha_i \geq 0, \sum_{i=0}^2 \alpha_i = 1$, is the bargaining share of the gain from transaction v for player $i = 0, 1, 2$, in a three-player bargaining game. For agency $j, j = 1, 2$, its threat point payoff is zero as assumed in the case of strict anticommons, the value placed on the next best use of the resource. The payoffs at time L are assumed to be discounted by a one-period discount factor $\delta \in (0, 1)$, so the payoff to agency $j, j = 1, 2$, in present value from the three-player bargaining game at time L is: $S_j(L, L) = \delta \alpha_j v$.

If player 1 chooses to bargain with player 0 now and commits itself while player 2 chooses to bargain later, player 1 will face the risk that the negotiation may fail later and cause loss to player 1. This subjective risk assessed by player 1 is denoted as R_1 , which reduces the payoff to player 1 $S_1(N, L)$. In a similar way, R_2 represents the subjective risk assessed by player 2 which reduces the payoff $S_2(N, L)$.

Following these conditions, we have such payoffs to player 1 for bargaining now and later, which are the expected values weighted by corresponding probabilities:

$$S_1(N) = S_1(N, N)p_2 + S_1(N, L)(1 - p_2) = \alpha_1 v p_2 + (\alpha_1 v \delta - R_1)(1 - p_2)$$

$$S_1(L) = S_1(L, N)p_2 + S_1(L, L)(1 - p_2) = \alpha_1 v \delta p_2 + \alpha_1 v \delta (1 - p_2) = \alpha_1 v \delta$$

After some calculation, we derive the result that if the subjective risk assessed by player 1 is too much, i.e. $R_1 > [(1 - \delta) \alpha_1 v p_2] / (1 - p_2)$, then for player 1 the payoff of

bargaining now is lower than the payoff of bargaining later, $S_1(N) < S_1(L)$. In such a case player 1 will choose to bargain with the player 0 later rather than now, which delays the input of resource and causes economic inefficiency.

As a numerical example, we assume $\alpha_0=0.3$ for the SOE, $\alpha_1=0.3$ for agency 1, and $\alpha_2=0.4$ for agency 2. The discount parameter is assumed to be $\delta=0.8$ and the value from resource combination is assumed to be $v=1$. The expected payoffs to player 1 for bargaining now and later are:

$$S_1(N) = S_1(N, N)p_2 + S_1(N, L)(1 - p_2) = \alpha_1 v p_2 + (\alpha_1 v \delta - R_1)(1 - p_2) = 0.3 p_2 + (0.24 - R_1)(1 - p_2)$$

$$S_1(L) = S_1(L, N)p_2 + S_1(L, L)(1 - p_2) = \alpha_1 v \delta p_2 + \alpha_1 v \delta (1 - p_2) = \alpha_1 v \delta = 0.24$$

In this case, as analyzed before, we derive the result that if the subjective risk assessed by player 1 is too much, i.e. $R_1 > [(0.06 p_2) / (1 - p_2)]$, then for player 1 the payoff of bargaining now is lower than the payoff of bargaining later, $S_1(N) < S_1(L)$. As a result, player 1 will choose to bargain with the player 0 later rather than now, which delays the input of resource and causes economic inefficiency. Of course the numerical result will change accordingly if the specific values assumed for exogenous parameter $(\alpha_0 \alpha_1 \alpha_2 \delta v)$ changes as in the comparative statics analysis.

In the same way, we have the following payoffs to player 2:

$$S_2(N) = S_2(N, N)p_1 + S_2(N, L)(1 - p_1) = \alpha_2 v p_1 + (\alpha_2 v \delta - R_2)(1 - p_1)$$

$$S_2(L) = S_2(L, N)p_1 + S_2(L, L)(1 - p_1) = \alpha_2 v \delta p_1 + \alpha_2 v \delta (1 - p_1) = \alpha_2 v \delta$$

And we get the symmetric conclusion. When the subjective risk assessed by player 2 is too much, i.e. $R_2 > [(1-\delta)\alpha_2vp_1] / (1-p_1)$, then for player 2 the payoff of bargaining now is lower than the payoff of bargaining later. Under such condition player 2 will choose to bargain with the player 0 later rather than now, which also delays the input of resource and causes economic inefficiency.

5.4 A Two-period Anticommons Model with Mixed Strategy

From this simple model of strict anticommons we see the effect of subjectively assessed risk on the inefficiency of two-period anticommons tragedy. Now we expand our model to consider the situation of non-strict anticommons by including the players' positive threat point payoffs and excluding the effect of subjectively assessed risk for simplification. The following assumptions are similar to those for the strict anticommons model.

There are three players in this game model. A SOE (player 0) has just found out that a value v will be produced when two of its resources are combined together. But the two resources are controlled exclusively by two state agencies (player 1 and 2) respectively, who value the resources at w_i , $i = 1, 2$, which they can obtain by directing the resources to other uses. So w_i can also be seen as the opportunity cost of the resource concerned for the two state agencies. The SOE values the i th resource at v_i , $i = 1, 2$, if it uses the i th resource separately without combination with the other resource. So v_i can also be seen as the opportunity cost of the resource concerned for the SOE. It is assumed $v > (v_1 + v_2)$ to represent the positive externality between

the two complementary resources, and $v_i \geq w_i$, otherwise no transaction between the players will take place. It is assumed that only the SOE rather than the two state agencies can combine the two resources to produce the value v , so the SOE must participate in the bargaining game with the two state agencies, otherwise there is no transaction that can produce value v .

Under the ideal circumstance of perfect information without any transaction cost or strategic behavior, the SOE would like to engage with each of the two state agencies now, make a take-or-leave-it offer w_i , $i = 1, 2$, and realize the value $(v - w_1 - w_2)$ without the tragedy of anticommons. But state agency 1 or 2 may perceive an advantage from not bargaining with the SOE when the other agency is present. It might be advantageous for this agency to delay the release of resource it controls, hoping for obtaining a higher price later. Resource under-use in static anticommons is, therefore, compounded by the inefficiency from players' strategic behaviors in such dynamic anticommons.

It is assumed that there are two periods of time during which each state agency i can bargain with the SOE, $t_i = N$ (Now) and $t_i = L$ (Later), $i = 1, 2$. Both agencies 1 and 2 simultaneously and non-cooperatively choose p_i , the probability of bargaining with the SOE now, with probability $(1 - p_i)$ of bargaining later. So this is a multi-agent bargaining game with mixed strategy. Such choice of bargaining probability leads to four possible events: both agencies bargain with the SOE now, probability $p_1 p_2$; only agency 1 bargains now, and agency 2 will bargain later and vice-versa,

probabilities $p_1 (1 - p_2)$ and $p_2 (1 - p_1)$; both agencies choose to bargain later, probability $(1 - p_1) (1 - p_2)$.

The players bargain efficiently over the trade of resource usage rights by a multi-player cooperative game. A generalized form of Nash bargaining solution is assumed to determine the payoffs to each player:

Net payoff = threat point payoff + (bargaining share) (available surplus – sum of threat point payoffs).

The bargaining share is the function of each player's bargaining power and other parameters in the model. The application of Nash bargaining solution to economic modeling is justified by Binmore et al (1986). Since Nash bargaining solution is Pareto efficient, this model of anticommons will formulate the inefficiency from non-cooperative strategic actions of players in choosing the time of bargaining rather than from the cooperative solution of bargaining. It is assumed that the SOE cannot threaten not to bargain at time N because the threat is not creditable and doing so would not be sub-game perfect. So we only need to focus on the payoffs to two state agencies (player 1 and 2), since only these two agencies are able to make strategic choices in the model.

Denote $S_j(t_j, t_k)$ the payoff to agency $j \in \{1, 2\}$, when the two agencies j and k choose bargaining probability p_j and p_k are $t_j \in \{N, L\}$ and $t_k \in \{N, L\}$ respectively. If all three players are bargaining now, so that $t_1 = t_2 = N$, then agency i ,

$i = 1, 2$, each receives the payoff $S_i(N, N) = w_i + \alpha_i (v - w_1 - w_2)$ in present value, where $\alpha_j \geq 0$, $\sum_{j=0}^2 \alpha_j = 1$, is the bargaining share of the gain from trade $(v - w_1 - w_2)$ for player $j = 0, 1, 2$, in a three-player bargaining game. For agency i , $i = 1, 2$, w_i is its threat point payoff, the value placed on the next best use of the resource. The payoffs at time L are assumed to be discounted by a one-period discount factor $\delta \in (0, 1)$, so the payoff to agency i , $i = 1, 2$, in present value from the three-player bargaining game at time L is: $S_i(L, L) = \delta [w_i + \alpha_i (v - w_1 - w_2)]$.

Suppose that agency j is at the bargaining table at time L , when agency $k \neq j \in \{1, 2\}$ has made a deal with the SOE. The total available surplus at time L is v . However, the SOE can threaten not to purchase the usage right of agency j 's resource, and just use agency k 's resource, i.e. the SOE's threat point payoff is v_k . Nash solution formula yields a present value payoff to agency j of $S_j(L, N) = \delta [w_j + \beta_j (v - v_k - w_j)]$ where $\beta_j \in (0, 1)$ is the bargaining share of agency j versus the SOE in a two-player game. The SOE is potentially advantaged because it can extract a threat point payoff of $v_k > 0$, due to the fact that it now holds usage right of resource from agency k .

Suppose agency j is at the bargaining table now, and agency k bargains later. The SOE's threat is not to deal with agency j now, wait until later, and receive $\delta (1 - \beta_k) (v_k - w_k)$, being its discounted share $\delta (1 - \beta_k)$ of the gains from trade with agency k $(v_k - w_k)$. At this point it is assumed that both the SOE and agency j anticipate that

the bargaining is efficient and the bargaining game at time L will lead to an agreement at time N that yields the total value v . This yields a payoff at time N to agency j of $S_j(N, L) = w_j + \beta_j [v - w_j - \delta(1 - \beta_k)(v_k - w_k)]$. In this way the SOE's future payoff from dealing with agency k at time L affects the surplus in the bargain with agency j at time N. Thus, the payoff structure captures the inter-temporal externality effects between the two agencies.

The agency j 's expected payoff is calculated by weighting the payoffs with the probability of each event:

$$\begin{aligned} \pi_j = & p_j p_k [w_j + \alpha_j (v - w_j - w_k)] \\ & + p_j (1 - p_k) [w_j + \beta_j (v - w_j - \delta(1 - \beta_k)(v_k - w_k))] \\ & + (1 - p_j) p_k [\delta (w_j + \beta_j (v - v_k - w_j))] \\ & + (1 - p_j) (1 - p_k) [\delta (w_j + \alpha_j (v - w_j - w_k))] \end{aligned} \quad (1)$$

Nash equilibria can be derived for the first-order condition in the model by examining the derivative of (1). By some simplification the derivative becomes:

$$\partial \pi_j / \partial p_j = p_k X + (1 - p_k) Y \quad (2)$$

$$\begin{aligned} X = & S_j(N, N) - S_j(L, N) \\ = & (1 - \delta) w_j + (\alpha_j - \delta \beta_j) (v - w_j - w_k) + \delta \beta_j (v_k - w_k) \end{aligned} \quad (3)$$

$$\begin{aligned} Y = & S_j(N, L) - S_j(L, L) \\ = & (1 - \delta) w_j + (\beta_j - \delta \alpha_j) (v - w_j - w_k) + \beta_j [w_k - \delta(1 - \beta_k)(v_k - w_k)] \end{aligned} \quad (4)$$

Proposition 1: There is inefficient delay if $X < 0$ and $Y > 0$ in multiple equilibria $(p_1, p_2) \in \{(1, 0), (0, 1), (p_1^*, p_2^*)\}$, while $p_k^* = \{(1-\delta)w_j + (\beta_j - \delta\alpha_j)(v - w_j - w_k) + \beta_j[w_k - \delta(1 - \beta_k)(v_k - w_k)]\} / \{(1+\delta)(\beta_j - \alpha_j)(v - w_j - w_k) + \beta_j[w_k - \delta(2 - \beta_k)(v_k - w_k)]\}$ $j \neq k \in \{1, 2\}$ (5)

Proof: From equation (2), it can have $\partial \pi_j / \partial p_j = 0$ where $p_k = p_k^* = Y/(Y-X) \in (0, 1)$ as $X < 0, Y > 0$. On substitution, p_k^* is given by equation (5). The response correspondences of the agencies are given by:

$$\begin{aligned} 0 & \quad \text{for } p_k > p_k^* \\ p_j & \in [0, 1] \quad \text{for } p_k = p_k^* \quad j \neq k \in \{1, 2\} \\ 1 & \quad \text{for } p_k < p_k^* \end{aligned}$$

This is because if $p_k > p_k^*$, $\partial \pi_j / \partial p_j = p_k X + (1 - p_k) Y < 0$, as $X < 0, Y > 0$. Similarly, if $p_k < p_k^*$, $\partial \pi_j / \partial p_j > 0$ as $X < 0, Y > 0$. To calculate the equilibria, suppose first that $p_2 = 0 < p_2^*$. Player 1's best response is $p_1 = 1$. Player 2's best response to $p_1 = 1 > p_1^*$ is $p_2 = 0$. Thus, $(1, 0)$ is a Nash equilibrium, as is $(0, 1)$ by a symmetrical argument. Neither agency increases its payoff from deviating at (p_1^*, p_2^*) , so that this point is also a Nash equilibrium. There are no other Nash equilibria, since agency 2 will deviate from any point (p_1, p_2^*) if $p_1 \neq p_1^*$, and vice versa for agency 1.

Since Pareto efficiency can only be achieved by both agencies bargaining with the SOE at time N , i.e. $(p_1, p_2) = (1, 1)$, the result is that delay of bargaining and resource release is always inefficient, because the total surplus from trade $(v - w_1 - w_2)$ will be discounted.

For proposition 1 agency 1 and 2 are playing an inter-temporal coordination game. The term X is the difference between agency j 's payoff from bargaining now and bargaining later, conditional on agency k bargaining now ($X = S_j(N, N) - S_j(L, N)$). $X < 0$ means that for agency j , its expected payoff from bargaining now is lower than the expected payoff from bargaining later, which is determined by the specific values of exogenous parameters in the model $(\delta, v, v_j, v_k, w_j, w_k)$. Since $X < 0$, agency j prefers to be absent now when agency k is present. The term Y is the difference between agency j 's payoff from bargaining now and bargaining at time L when agency k bargains at time L ($Y = S_j(N, L) - S_j(L, L)$). Agency j prefers to bargain now in this case. So both agencies would prefer to be absent from the bargain if the other player is present, i.e., they wish to coordinate to be apart.

Proposition 2: Suppose that for both agencies, discounted bilateral bargaining yields a larger share of surplus than trilateral bargaining (i.e. $\delta\beta_i > \alpha_i$, $i = 1, 2$). Then there is inefficient delay in the equilibrium outcome if resources are sufficiently complementary, i.e. if either (i) $v_k = w_k$, and δ is sufficiently large ($\delta > [w_j + \alpha_j(v - w_j - w_k)] / [w_j + \beta_j(v - w_j - v_k)]$ and $\delta > \beta_j$) $j \neq k \in (1, 2)$; or (ii) v is quite large.

Proof: For case (i), it can be derived that $X < 0$ if $\delta > [w_j + \alpha_j (v - w_j - w_k)] / [w_j + \beta_j (v - w_j - v_k)]$ and $Y > 0$ if $\delta \beta_j > \alpha_j$. For case (ii), $\delta \beta_j > \alpha_j$ implies from equation (3) that X is monotonic decreasing in v , so that $X < 0$ for v sufficiently large. Since $\delta \beta_j > \alpha_j$, it is from equation (4) that Y is monotonic increasing in v , so $Y > 0$ for sufficiently large v . From proposition 1, there is delay of resource input in equilibria of both cases (i) and (ii).

For case (i), the SOE's value of a single resource is just equal to the value to the agency ($v_i = w_i$). Thus, the SOE does not gain much of an advantage if it purchases a resource. This is true when the SOE bargains with only one agency at either time N or at time L . In a deal with one agency at time N , the SOE anticipates that it does not have much inter-temporal bargaining power from a future deal. In a deal with one agency at time L , the SOE holds a resource that doesn't give it much immediate bargaining power. The lack of a strong threat point on the part of the SOE, when there is only one agency at the table, means that the agency is negotiating over a larger net surplus. In addition, the anticipated share of the net surplus to agency j , when agency k is absent, is larger, even agency j must delay its going to the bargaining table (i.e. as it is assumed $\delta \beta_j > \alpha_j$). Consequently, both agencies would prefer to be at the table alone. From proposition 1, there is delay in all three equilibria. With part (ii), there is inefficient delay for analogous reasons. The total available surplus v is high, so the gain to agencies from being alone is also high.

In both cases (i) and (ii), the driving force behind delay by economic intuition is the degree of positive externality or complementarity of resources and the fact that for agencies, bilateral bargaining power exceeds trilateral bargaining power. Since $v > (v_1 + v_2)$, and $\delta\beta_j > \alpha_j$, $j = 1, 2$, each agency has an increased incentive to not coordinate with the other agency. In this way, by negotiating separately – at least with some probability – there is a sunk component to the time N agreement. The agencies seize a larger share $\delta\beta_j > \alpha_j$ of a large gain from trade. For example, if state agency 1 bargained at time N, and received share β_1 , then state agency 2 bargains with the SOE at time L and receives $\delta\beta_2$. By bargaining separately with the SOE, both state agencies extract a larger share of an expected payoff than if they bargain with the SOE at the same time N to obtain shares α_1 and α_2 respectively.

Propositions of comparative statics analysis can also be derived, in which the changes of equilibrium behavior resulting from changes in some of exogenous parameters are examined. The derivative $\partial \pi_j / \partial p_k$ is a function of p_k and exogenous parameters, that is: $\partial \pi_j / \partial p_k = f(p_k, \Psi)$, where $\Psi = (\delta, v, v_j, v_k, w_j, w_k)$ is the vector of exogenous parameters.

In this case the function $f(p_k, \Psi)$ is decreasing in p_k under the assumptions $X < 0$ and $Y > 0$ in proposition 1, since $\partial f / \partial p_k = X - Y < 0$. Thus, the change in the equilibrium value p_k^* that results from a change in the parameter $\psi \in \Psi$ depends on how f changes with respect to ψ . If f increases with ψ for all values of p_k , the

equilibrium value of p_k^* (for which $f=0$) increases with ψ as well, which will reduce the probability of inefficiency from input delay. Only the sign of the derivative ($\partial f / \partial \psi$) needs to be computed to determine the comparative statics effects.

Consider the effect of an increase in the discount factor δ on the equilibrium value p_k^* , which intuitively will lead to an increase in delay and decrease in p_k^* . The derivative is: $\partial f / \partial \delta = -2 w_j - (\alpha_j + \beta_j) (v - w_j - w_k) - \beta_j (1 - \beta_k) (v_k - w_k) < 0$ as it is intuitively expected. When δ rises, not only does the gain from future payoffs increase, but the SOE's threat point payoff from not dealing with agency j at time N is rather improved (i.e. $s(N, L)$ falls).

The comparative statics effect of v on p_k^* is more complicated. Differentiating f with respect to v yields: $\partial f / \partial v = p_k (1 + \delta) (\alpha_j - \beta_j) + \beta_j - \delta \alpha_j$, which is of ambiguous sign under the assumption that discounted two-player bargaining power exceeds undiscounted three-player bargaining power ($\delta \beta_j > \alpha_j$). When $p_k^* = 0$, $\partial f / \partial v = \beta_j - \delta \alpha_j > \delta \beta_j - \delta \alpha_j > \delta \beta_j - \alpha_j > 0$. When $p_k^* = 1$, $\partial f / \partial v = \alpha_j - \delta \beta_j < 0$. Because $\partial [\partial f / \partial v] / \partial p_k = (1 + \delta) (\alpha_j - \beta_j) < (1 + \delta) (\alpha_j - \delta \beta_j) < 0$ as assumed, it follows that $\partial f / \partial v$ is increasing in p_k when p_k is below the value $\hat{p}_k$ where $\partial f / \partial v = 0$, and is decreasing in p_k when p_k is above $\hat{p}_k$. Therefore, p_k^* is increasing for $p_k^* < \hat{p}_k$ and decreasing for $p_k^* > \hat{p}_k$. With this definition of $\hat{p}_k$, there is the following proposition:

Proposition 3: Suppose that for both agencies, discounted bilateral bargaining yields a larger share of surplus than trilateral bargaining (i.e. $\delta\beta_j > \alpha_j$, $j = 1, 2$). Then inefficiency delay decrease (increase) with v if the following condition is satisfied:

$$\hat{p}_k = [(\beta_j - \delta\alpha_j) / (1 + \delta)(\beta_j - \alpha_j)] > (<) p_k^* = \{[(1 - \delta)w_j + (\beta_j - \delta\alpha_j)(v - w_j - w_k) + \beta_j(w_k - \delta(1 - \beta_k)(v_k - w_k))] / [(1 + \delta)(\beta_j - \alpha_j)(v - w_j - w_k) + \beta_j(w_k - \delta(2 - \beta_k)(v_k - w_k))]\}$$

This $v > v_1 + v_2$ represents the extent of positive externality between complementary resources, so under the condition of Proposition 3 the inefficiency of delayed inputs will change with the change of v , causing more or less serious anticommons tragedy.

The comparative statics effect of δ and v have been calculated, and here we complete the study of other parameters (v_j, v_k, w_j, w_k).

(1) $\partial f / \partial v_j = 0$, so the change in v_j has no effect on p_k^* , the equilibrium probability of player k .

$$(2) \partial f / \partial v_k = p_k \delta \beta_j - (1 - p_k) [\beta_j \delta (1 - \beta_k)] = \delta \beta_j [(2 - \beta_k) p_k - (1 - \beta_k)]$$

We have $\partial (\partial f / \partial v_k) / \partial p_k = \delta \beta_j (2 - \beta_k) > 0$, so $(\partial f / \partial v_k)$ is an increasing function

of p_k . Let $\hat{p}_k$ be the p_k where $(\partial f / \partial v_k) = 0$, we have $\hat{p}_k = (1 - \beta_k) / [\delta \beta_j (2 - \beta_k)]$.

In a similar way to the effect of change in v , the effect of change in v_k on p_k^* is

ambiguous. When $p_k^* < \hat{p}_k$, $\partial f / \partial v_k < 0$, so as v_k increase, p_k^* will decrease, and the extent of delay and economic inefficiency will increase. When $p_k^* > \hat{p}_k$, $\partial f / \partial v_k > 0$, so when v_k increase, p_k^* will increase, and the extent of delay and economic efficiency will decrease.

$$(3) \quad \partial f / \partial w_j = p_k [(1 - \delta) + (\delta \beta_j - \alpha_j)] + (1 - p_k) [(1 - \delta) + (\delta \alpha_j - \beta_j)]$$

$$= p_k (1 + \delta)(\beta_j - \alpha_j) + (1 - \delta) + (\delta \alpha_j - \beta_j)$$

We have $\partial (\partial f / \partial w_j) / \partial p_k = (1 + \delta)(\beta_j - \alpha_j) > 0$, so $(\partial f / \partial w_j)$ is an increasing function of p_k . Let $p_k^\times = [(1 + \delta)(\beta_j - \alpha_j)] / (\delta + \beta_j - \delta \alpha_j - 1)$, where $\partial f / \partial w_j = 0$. In this way we can see that the effect of change in w_j is similar to that in v_k . When $p_k^* < p_k^\times$, $\partial f / \partial w_j < 0$, so as w_j increase, p_k^* will decrease, and the extent of delay and economic inefficiency will increase. When $p_k^* > p_k^\times$, $\partial f / \partial w_j > 0$, so when w_j increase, p_k^* will increase, and the extent of economic efficiency will decrease.

$$(4) \quad \partial f / \partial w_k = p_k (\delta \beta_j - \alpha_j - \delta \beta_j) + (1 - p_k) [(\delta \alpha_j - \beta_j) + \beta_j + \delta(1 - \beta_k)]$$

$$= \delta(1 + \alpha_j - \beta_k) + p_k [\delta(\beta_k - 1) - \alpha_j(1 + \delta)]$$

We have $\partial (\partial f / \partial w_k) / \partial p_k = \delta(\beta_k - 1) - \alpha_j(1 + \delta) < 0$, so $(\partial f / \partial w_k)$ is a decreasing function of p_k . Let $p_k^\vee = [\delta(1 + \alpha_j - \beta_k)] / [\delta(1 - \beta_k) + \alpha_j(1 + \delta)]$ where $\partial f / \partial w_k = 0$. Then the effect of change in w_k is, in a sense, opposite to those effects

of change in v_k and w_j . When $p_k^* < \check{p}_k$, $\partial f / \partial w_k > 0$, as w_k increase, p_k^* will increase, and the extent of delay and economic inefficiency will decrease. When $p_k^* > \check{p}_k$, $(\partial f / \partial w_j) < 0$, so when w_j increase, p_k^* will decrease, and the extent of delay and economic efficiency will increase.

Proposition 4: The extent of economic inefficiency caused by the delay is limited, lower than (3/4) in probability.

Proof: This result can be derived by studying the subjective probability in the equilibrium of mixed strategy $p_k^* = \{(1-\delta)w_j + (\beta_j - \delta\alpha_j)(v - w_j - w_k) + \beta_j[w_k - \delta(1 - \beta_k)(v_k - w_k)]\} / \{(1+\delta)(\beta_j - \alpha_j)(v - w_j - w_k) + \beta_j[w_k - \delta(2 - \beta_k)(v_k - w_k)]\}$ $j \neq k \in \{1, 2\}$.

Denote the numerator of p_k^* as $A = Y = (1-\delta)w_j + (\beta_j - \delta\alpha_j)(v - w_j - w_k) + \beta_j[w_k - \delta(1 - \beta_k)(v_k - w_k)]$, and the denominator of p_k^* as $B = Y - X = (1+\delta)(\beta_j - \alpha_j)(v - w_j - w_k) + \beta_j[w_k - \delta(2 - \beta_k)(v_k - w_k)]$. If we have $2A - B > 0$, then it means $p_k^* = (A / B) > (1/2)$.

$$2A - B = Y + X =$$

$$2(1-\delta)w_j + (v - w_j - w_k)[(2\beta_j - 2\delta\alpha_j) - (1+\delta)(\beta_j - \alpha_j)] + \beta_j w_k + \beta_j(v_k - w_k)[\delta(2 - \beta_k) - 2\delta(1 - \beta_k)] \\ = 2(1-\delta)w_j + (v - w_j - w_k)(1-\delta)(\alpha_j + \beta_j) + \beta_j w_k + \delta\beta_j\beta_k(v_k - w_k)$$

> 0 (every term is positive)

Therefore, Y and X cannot be both negative. Under the condition of $X < 0$ and $Y > 0$, $B = Y - X > 0$. So that we have $p_k^* = (A / B) > (1/2)$ and in the same way $p_j^* > (1/2)$.

We can see immediately that $p_k^* > (1 - p_k^*)$ and $p_j^* > (1 - p_j^*)$. Now we get the magnitude order for the equilibrium probability of each event:

$$p_k^* p_j^* > p_k^* (1 - p_j^*) \text{ \& } p_j^* (1 - p_k^*) > (1 - p_k^*) (1 - p_j^*)$$

Since the probability of both players 1 and 2 bargain with the player 0 in the first period now is the largest, i.e. $p_k^* p_j^* > (1/4)$, the extent of dynamic inefficiency caused by the delay is limited, lower than $(3/4)$ in probability. The extent of economic inefficiency is limited because if the delay of resource input is too great then it may reduce the payoff to the agencies because it will discount the value v .

Chapter 6 Policy Analysis and Conclusion

6.1 Privatization of SOEs

Generally, the solution to the tragedy of commons is privatization of the common property, such as the “Enclosure Movement” in England. In the pre-reform period privatization of SOEs is ideologically unacceptable for the Communist government in China. During economic reform, especially after the strategy of “hold on to large enterprises and let loose small enterprises” in 1997, converting small SOEs from state ownership to shareholding companies and private firms represents this trend of privatization. Prominent examples of such conversion include Zhucheng in Shangdong province and Zhongshan in Guangdong province. Nevertheless, wholesale privatization of large and medium-sized SOEs in China is still an ideologically sensitive issue.

Theoretical discussions of privatization of SOEs often argue that institutional restructuring should precede privatization (Tirole 1991). Restructuring is required both to create private firms with reasonably efficient organizational, managerial and governance structures, as well as to create institutional structures that will support competitive markets. This recommendation to “restructure before privatize” is based on the sensible observation that it is likely to be easier to shuffle assets around and to accommodate wealth transfers before rather than after clear ownership rights are established. In principle, the learning of transaction cost economics (Williamson 1991, 1993) should provide useful insights into how industrial restructuring should occur.

Transaction cost economics develops a framework for understanding the organization of firms, the boundaries between firms and markets, and the nature of inter-firm relationship, all from a perspective of comparative institutional choice. From the mass privatization program of Russia and other Eastern Europe countries in the 1990s, two important corporate governance consequences of this approach to distribute the ownership interests in enterprises are worth noting. First, as studied in Boycko et al (1993), generous benefits given to workers and managers to buy their support for the privatization program have translated into strong insider control of most newly privatized firms. They presented data from two surveys showing that, for at least two samples of privatized firms, post auction acquisitions had raised insider ownership shares to 60-70 per cent on average. Second, heavy reliance on voucher auctions has led to highly dispersed share ownership, so that privatized firms generally lack large outside shareholders who can effectively oversee the actions of managers and workers.

Another problem for privatization of SOEs is corruption, especially in the form of asset stripping, and this can cause severe social unrest in China like the political events in 1989. The danger comes from the corruption in the process of privatization rather than privatization per se, which is evident from the experience of Eastern Europe and Russia. So the privatization should be a law-based process, and take place over a number of years with necessary patience.

6.2 New Institutions, Mergers and Acquisitions, and Bankruptcy for SOEs

The solution of anticommons has been pinpointed by Heller (1998) as bundling the dispersed property rights into one single owner, while the bundling can be conducted by market, legal or administrative means. Some industries in advanced countries have developed market mechanisms like patent pool, cross-licensing, and standard setting organizations to solve the tragedy of commons in intellectual property field. Principle of touch and concern in common law, and principle of prediality in civil law have been adopted to solve the tragedy of commons for real property (Schulz et al 2002). In China, however, the inadequate legal system and immature market mechanism may not achieve the bundling effectively, whereas transaction costs, strategic behaviors (as modeled in chapter 4), and cognitive biases of players can make market transaction for anticommons stalled. Hence, the use of administrative innovations, such as SASAC, might be the second-best policy solution to anticommons.

Another important administrative measure adopted to deal with the loss-making SOEs problem in China is the formation of enterprise group by mergers and acquisitions (M&A). The main purpose of M&A activities in market economies is to reap the benefit from the economy of scale and scope, cutting costs and boosting profits according to the principle of profit maximization. In China, however, M&A activities between SOEs are often administratively directed by state agencies to force profitable SOEs to take over loss-making SOEs so that the number of loss-making SOEs can be reduced without privatization. Due to heavy administrative interferences from state agencies without sufficient consideration of business relations between

SOEs, the outcome of many M&A activities is often weakening the performance of acquiring SOEs without improving the performance of acquired SOEs.

The bankruptcy law of China was enacted in the latter half of the 1980s but had not been enforced. In the early 1990s loss-making enterprises, instead of being declared bankrupt, were forced to merge with other enterprises. By the end of 1992 over 10,000 enterprises had been merged. The number of enterprises declared bankrupt, however, soared in the first half of the 1990s. By the end of 1994 it had reached 1,000. But fewer than half of these were SOEs (Chai 1997). So the forced M&A activities and rare bankruptcies of SOEs are just typical examples of soft budget constraint by lack of effective and efficient ways of market exit for SOEs. However, as the economy has been considerably diversified, a rudimentary social security system is put in place, and the people are better prepared ideologically and psychologically, the full implementation of the bankruptcy law and massive lay-off of SOE workers has become a more acceptable practice, especially for small SOEs controlled by local governments. For instance, in 2005 the SASAC drafted a four-year plan for policy-arranged bankruptcy to let more poor-performing SOEs withdraw. Under the scheme, around 2,800 SOEs would go bankrupt in the next four years.

6.3 Discussion and Conclusion

The research of China's economic reform has achieved positive effects on the measures taken by the Chinese government to reform the ownership structure of enterprises, open up its economy with world market, set up social security system,

restructure its financial system, and adopt other business practices prevalent in normal market economies. As China's reform takes a different path from that of former Soviet Union republics and Eastern Europe countries, and China's importance increase with its entry into World Trade Organization, research of China economic reform also provides great impetus and new data for the research in areas of macroeconomic stability, microeconomic incentive design, and institutional reform.

This paper presents a commons-anticommons framework for China's SOEs reform. During the reform period, the property right of state-ownership for SOEs remained relatively unchanged. In the commons situation, multiple stakeholders including state bureaucrats, enterprise managers and workers, vie for the profits and assets of SOEs as a common property pool, and the negative externality between their actions causes the SOEs' inefficiency compared with Pareto-optimality.

The anticommons theory is relatively new in the area of law and economics, and the institutional economics. It deals with a special kind of property rights neglected by previous research. However, as pointed by Heller (1998), it is a useful analytical framework to study wide-ranging economic issues, and can lead to suitable solutions or policy advices. In my personal point of view, the anticommons theory is promising for the study of state owned enterprises reform in China.

In the anticommons situation, due to administrative decentralization, exclusion rights for complementary resources of the SOEs are controlled by different state agencies,

the positive externality between these exclusion rights leads to the underuse of SOEs' resources and inefficiency.

A two-period uncertain price model is constructed for the anticommons situation. The important implication is that because the positive externality between complementary resources, strategic behaviors of agencies will result in the delay of bargaining and resource input, causing greater economic inefficiency.

Another result from the model is that the probability of economic inefficiency from dynamic anticommons tragedy is limited to an extent, but the magnitude of such economic inefficiency may be quite huge considering the total assets of SOEs in China. As discussed in section 3.4, in addition to dynamic economic inefficiency upon SOEs in China analyzed in this thesis, anticommons tragedy is quite widespread and it creates other economic wastes that are important subjects of further research.

The thesis focuses its study on the reform of just industrial SOEs in China, excluding non-industrial types of SOEs like state-owned financial institutions and commercial enterprises. However, because the problem of commons and anticommons is widespread in Chinese SOEs, the author believes that with necessary change of relevant assumptions the framework of commons and anticommons in this thesis can be extended suitably to non-industrial SOEs in China too.

Since the thesis is directed towards the external relationship of SOEs with their administrative supervisory agencies, it doesn't study the internal structure of SOEs, especially the issue of corporate governance and relationship between the manager of

SOEs and the enterprise secretary of CCP, which are also important factors for understanding the performance of SOEs in China during the era of economic reform.

In the previous anticommons model, several important factors have been assumed away for simplification and mathematical tractability. These factors include non-linear function form, asymmetric information, non-monetary incentive, wealth constraints, and behavioral assumptions such as bounded rationality. If we consider the situation of incomplete information and noisy signaling, then the formulation of global games applies. With strategic complementarities situation like anticommons, global games often have a unique equilibrium, not the multiple equilibria in other coordination games. In the selection of single equilibrium from multiple equilibria, usually subjective assessment of risk will play important role, like the illustration in the example of strict anticommons. More theoretical research on anticommons is needed to extend along these directions. Another important part for further research would be designing empirical tests for the significance of anticommons. A further hypothesis can be explored, which state that multiple state agencies will try to seek the controlling power towards profitable SOEs and make these SOEs the tragedy of commons, while those state agencies controlling those unprofitable and risky SOEs will exercise their veto power (exclusion right) to reduce cost and risk and make these SOEs the tragedy of anticommons. In such a unified framework, a comprehensive model including both commons and anticommons may be built to explain the performance of SOEs in China.

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