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Competitive Neutrality of State-owned Enterprises in China's Steel Industry: Causal Inference on the Impacts of Subsidies[1]

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Abstract

This study investigates whether subsidies to state-owned enterprises (SOEs) in China's steel industry are distorting competitive neutrality. The Subsidy and Countervailing Measures Agreement of the World Trade Organizations defines "specific" and "harmful" subsidies as being subject to discipline, because they distort the allocation of resources. During the recession in the steel industry between 2008 to 2015, China produced excessively and exported aggressively at a lower price. This study hypothesizes that subsidies given by local governments to specific SOEs with undefined conditions softened the budget constraints of these SOEs and that the market equilibrium price would have been lower had no subsidy been provided. Using data from the financial statements of listed steel and iron firms and other relevant sources, I find that firms with operating deficits received subsidies that were large enough to compensate for their deficits. This preferential treatment of these specific SOEs induced them to engage in price cutting behavior, harming competitiveness in the market.

Keywords: steel industry, subsidy, state-owned enterprises, competitive neutrality, difference in differences
JEL Classification: L44, M21, L61, H71

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1 Introduction

This study attempts to identify whether state-owned enterprises (SOEs) or government involvement are neutral to market competition, a controversial and critical research question. Abuse of competitive neutrality occurs when certain enterprises or types of enterprises are permitted to exclusively enjoy a preferential status and their status distorts market competition. I focus on the mechanisms behind subsidies to SOEs and market competition to understand whether such subsidies reduce welfare in a market or industry. To do so, I build a model and test it empirically.

I focus on China's steel industry, which has attracted significant attention worldwide. Subsidies to SOEs in the steel industry are thought to have generated overcapacity and overproduction, lowered equilibrium prices, and caused Chinese exports to flood the steel market worldwide during the recession from 2008 to 2015.

Although this subsidy and industrial policy on competition and welfare issues attracted so many focus, rigorous empirical studies are very limited mainly because the problem has an exactly endogenous nature. In order to address this endogenous problem, one possible approach is to control observable characteristics and data generating process as much as possible, then measures effects of treatments. The other approach is to estimate behavior of related parties, .structural estimation. This type of research is very few: Kalouptisidi (2018), Barwick Kalouptsidi and Zahur(2019) are the exceptions.

This study took the first approach : estimating the impact of subsidy on firm's profit and price at market equilibrium by difference in difference estimation. After controlling observable, rescue by subsidy in the previous period shows negative impact on profit and price. As potential sources of bias in coefficient of the rescue conduct could not explain the result, our finding is the lower bound of the impact of rescue conduct on profit and prices[1].

The remainder of the paper proceeds as follows. Section 2 reviews the literature on competitive neutrality and the relationship between market competition and SOEs. Section 3 describes the institutions and background of this study and explains that the Subsidy and Countervailing Measures (SCM) Agreement under the World Trade Organization system and the Chinese accounting system are comparable. Section 4 formally analyzes the impact

[1]Differentiated demand estimation and supply function are feasible on the current database and are conducting in the other paper. Steel industry an material industry, but in fact, has a highly differentiated nature following very popular and diversified demand as a substantial material of human being.

of a soft budget constraint caused by a subsidy on the price and output volume in the market. Section5 provides descriptive statistics and difference-in-difference estimations of the impact of a subsidy to cover a deficit on prices and profits. This section tests the causal relationship between a subsidy and the market price and output. Section 7 discusses the results and implications for understanding the characteristics of Chinese markets and then concludes.

2 Literature: SOEs and Competition

The motivation of this study is understanding whether subsidies to SOEs affect the outcomes of market competition. Based on the literature surveyed here, I use a framework of price distortion due to a subsidy in this analysis.

In this section, I first review criticisms of China's subsidies or SOEs to clarify the relevant points. Second, I review legal and practical studies to develop a concept of "competitive neutrality." The Organisation for Economic Corporation and Development (OECD) began to propose a framework for SOEs' competitive neutrality. Finally, I review the mixed market literature, which originally studied this issue.

2.1 Criticisms of China's Subsidies and SOEs

Since the mid 2010s, policymakers in the international trade practice have criticized China's industrial subsidies. Policy papers and case studies have tried to investigate the basis for this criticism, such as the nexuses between subsidies and overcapacity and low prices. Criticisms of subsidies in China generally take one of four different perspectives.

The first perspective, which primarily comes from the US, is that Chinese industry benefits from implicit subsidies, such as subsidized electricity, bank loans, and so on (Brun, 2016: Haley and Haley, 2008, 2013; Price, 2016; Steel Industry Coalition, 2016).

The second type of argument claims that explicit subsidies, mostly from local municipal governments, cause the problem. The alleviation of local protectionism by local municipal governments has been criticized (EU Chamber of Commerce in China, 2016). Listed medium-sized SOE steel firms have soft budget constraints (Ministry of Economy, Trade and Industry, Government of Japan, 2018; Watanabe, 2017).

The third perspective is that state ownership may be neutral to competition. An OECD

report claims that SOEs mostly invest in capacity rather than in research and development and that SOEs borrow much more than private enterprises (PE) do even though SOEs and PEs have the same financing costs in the steel industries of emerging economies, including China (OECD, 2018). Watanabe (2017) also claims that ownership matters.

The fourth perspective refers to overcapacity and competitive neutrality. Some studies argue that overcapacity in an industry is irrelevant to asymmetry across firms; the phenomenon occurs owing to excessive entry due to the nature of large fixed-cost industries and not necessarily because of violations of competitive neutrality (Kawabata, 2005, 2017; Marukawa, 2019; Sugimoto, 2000). Some make arguments following the studies from the third perspective.

Based on this review, it is clear that whether implicit or explicit subsidies affect overproduction or overcapacity and whether ownership affects the related mechanism both remain controversial topics in the literature.

2.2 SOE Governance and Competitive Neutrality

Competitive neutrality is the notion that SOEs should not enjoy a competitive advantage owing to their ownership or any other type of relationship with the government. Competition should be independent and neutral to the type of ownership.

This concept has evolved as follows. At the beginning of the 2000s, the OECD and international trade regulators began to discuss the impact of SOEs' presence on the neutrality of market competition. Under their framework, SOEs are regarded as special entities in the following ways. First, such enterprises are burdened with fulfilling public welfare rather than only pursuing their own private profits. This mandate is facilitated through public ownership because such decision power (regarding the ultimate objective) is allocated to the owners. As long as SOEs produce public benefits, subsidies to SOEs from the government are legitimate. This perspective is called the " burdened SOEs view." From this perspective, the problem to be solved is how to alleviate the inefficiency of SOEs due to the public welfare burden.

However, the definition of public welfare is not clear, and it is difficult to determine whether SOEs' actions really serve public welfare. In this context, enterprises can ask the government to exercise power to favor them against their rivals in the market even if their

actions do not serve public welfare. This perspective is called the "not legally constrained SOEs view."

From this perspective, the problem is to how to control SOEs' unconstrained behavior. Chapribianco and Christiansen (2011) describe the historical development of the SOE governance code for competitive neutrality principles and discuss the competitive neutrality frameworks. They catalogue the various "anti-competitive practices" of SOEs as (1) predatory pricing, (2) raising rivals' costs, (3) cross-subsidization, and (4) strategic adoptions of inefficient technology. They then discuss the remedies that competitive agencies can take, including (1) ex-post enforcement of competition rules on unilateral conduct, (2) using merger controls to level the playing field, and (3) exemptions from antitrust liabilities for SOEs. The OECD (2012) makes a proposal following Chapribianco and Christiansen's (2011) argument. Kawashima (2015) introduces the Australian "Market Neutrality Principle" and discusses its applicability to international trade regulations. This study follows Chapribianco and Christiansen's (2011) classification of anti-neutrality actions, particularly distorted pricing behavior.

2.3 Mixed Markets

The literature on mixed markets is also relevant to the competitive neutrality of SOEs. Public economics began to analyze the outcomes of competition in mixed markets, along with the development of the privatization of SOEs in public utility industries, in the 1990s. Differences in the purposes or constraints of public (state) and private enterprises may generate different outcomes from those in the case of firms with homogeneous or similar constraints. Most of these theoretical studies share the assumption that SOEs are constrained to maximize social welfare rather than profits. These studies assume that only private firms are permitted to maximize profits, which is different from the Chinese institutional context.

Under these assumptions, theoretical models of mixed oligopoly competition have been developed, leading to the following outcomes. Matsuura and Matsushima (2004) claim that the private firm's cost will be less than the public firm's cost because the private firm engages in excessive strategic cost-reducing activities. Privatizing the public firm would improve welfare because it would mitigate the losses arising from these excessive cost-reducing investments. Luts and Pezzioni (2009) review a mixed oligopoly with a differentiated mar-

ket in which it is possible that not all of the market is covered. They argue that mixed competition is more socially plausible than a private duopoly and seems to produce more efficient regulatory instruments than merely adopting the minimum quality does. Ghosh, Mitra, and Saha (2015) argue that SOEs will set prices below their marginal costs when they form a duopoly that competes with foreign profit-maximizing firms. The partial privatization of domestic public firms improves welfare by decreasing the deficits of the public firms competing against the foreign firms.

Again, note that all of these theoretical analyses assume that SOEs or public firms are constrained to maximize welfare, whereas private firms can maximize profits. The reality is that China's SOEs have never been constrained to maximize social welfare but instead have been allowed to simply pursue private profits (Unirele, 2012; Watanabe, 2014).

Thus, this study focuses on the possible abuse of SOEs' relationship with the government via subsidies. This study investigates whether price distorting behavior occurs because of the softened budget constraint created by subsidies.

2.4 Industrial Policy Studies

Possible approach to measures the impact of subsidy on market outcome is to conduct a structural estimation on demand and supplies sides of a industryit conducted dynamic structural estimation, and found production and investment subsides can be justified but entry subsidies are wasteful in China's shipbuilding industries.

3 Institutions Related to Subsidies and Background

To set up the analytical framework, I describe the institutions relevant to subsidies and ownership in China. First, I refer to the definition of a subsidy and harm caused by subsidies under the SCM Agreement and China's accounting principles. Second, I summarize ownership discrimination in China's economic institutions. Third, I briefly describe the development of the steel industry and the policy to set up an analytical framework

3.1 Definition of a Harmful Subsidy under the WTO Rules

First, I confirm the definition of a harmful subsidy that distorts competition according to the SCM Agreement of the WTO. Then, I compare this definition to the definition of

Table 1: Definitions of a Subsidy under the WTO Rule and Chinese Accounting Principles

	SCM Agreement	**Chinese Accounting Principles**
Subsidy	(1) Governments or public bodies provide (2) Financial contributions that generate, (3) Profits	(1) Governments transfer (2) Assets or cash free of charge
	Section 1.1	No. 16 Accounting Principle
Profits	Favorable compared to market price	contributions free of charge
Specificity	(a) explicitly provided to a specific firm or industry (b) No explicitly provided objective conditions or standards (c) implicitly provided to a specific firm or industry	Selective provision of subsidies may occur
	Section 2	
Negative effects	1. Damage to the domestic industry 2. Violation or invalidation of profits based on GATT 3. Outstanding damage (a)Import substitutions or export restraints in the domestic market.	Distorted pricing due to the subsidy?
	(b)Import substitutions or export restraints in the third market (c) Substantially lower prices of subsidized products than of competitor products.	Need to distinguish whether due to efficiency or distorted pricing due to subsidy?
	Sections 5 and 6.3	Author's comment

(Source) Subsidy and Countervailing Measures Agreement, Chinese Accounting Principle, and the author.

a subsidy under Chinese accounting principles. Based on these definitions, I investigate whether the subsidized firms' pricing behavior correlates with subsidies and ownership.

To define an action that violates competitive neutrality, I focus on distorted pricing behavior by subsidized firms. This definition follows the WTO SCM Agreement and the SOE corporate governance principles of the OECD. Specifically, the SCM Agreement says that that a **"specific" and "profitable" subsidy is subject to discipline as it "distorts" the allocation of resources**.

The SCM Agreement further defines a subsidy as (1) a government or public body providing (2) cash or a financial contribution that, furthermore, (3) generates profits for any specific recipient, firm, or industry without explicit and objective standards or conditions. (4) Moreover, it should create some damages. The definition of a subsidy in the SCM Agreement is comparable to China's accounting principles, as shown in Table 1.

3.2 Subsidies in Chinese Accounting Principle

Chinese Accounting Rules provide a definition of a subsidy. This definition states that **a subsidy is a free-of-charge cash or asset transfer from the government** . This

Table 2: Position of SOEs: The Communist Party Code

Charter	Chinese Communist Party Agenda (revised on October 24, 2017)
Item 15	The Chinese Communist Party shall lead the people and develop a socialist market economy. **It shall develop a strong public economy and shall also guide, encourage, and support the development of an equally strong non-public economy**. It shall allow the market to play a decisive role in resource allocation, make the government more effective, and establish a macro control system. It shall advance urban and rural development, regional development, economic and social development, harmonious development of people and nature, domestic and external development, adjustment of economic structures, change of economic development, and structural reform on the supply side. It shall simultaneously promote new industrialization, computerization, urbanization, and modernization of agriculture and shall create a new socialist rural village, a unique new industrialization path, and an innovative nation and world-class science and technology power.

Source Chinese Communist Party Code (Communist Party Member Network *http* : *//www*.12371.*cn/special/zggcdzc/zggcdzcqw/*) English translation by the author.

definition satisfies harmful conditions (1), (2), and (3) in the WTO rules. In addition, it is clear that a subsidy provides profits to recipient firms because they receive the asset or cash free of charge. Thus, the remaining conditions to be discussed are (a) specificity and (b) bad effects. If a subsidy is explicitly or implicitly provided to specific firms or firm types without objective conditions or standards, it is regarded as a harmful subsidy under the SCM Agreement.

3.3 Ownership Discrimination and Subsidies

The laws and institutions of the People's Republic of China treat SOEs explicitly more favorably than they treat private and foreign enterprises. In China's market economy, public enterprises, SOEs, and enterprises owned by other types of public entities have priority over other proprietary enterprises. Formal systems in China determine this distinction by ownership. The Party Charter with this statement is described in Table 2.

The party charter and the constitution stipulate that the existence of public enterprises is the backbone of the economy and that the state must preserve their status. Thus, public enterprises and other companies face different competitive conditions, and private and foreign affiliated companies operate in an environment that tends to be disadvantaged. For example, public enterprises may be given priority for relief when management problems occur. In addition, private and foreign affiliated companies are prohibited from entering some markets based on ownership status (Unirule Institute of Economics, 2012).

3.4 Development of Industry and Policy

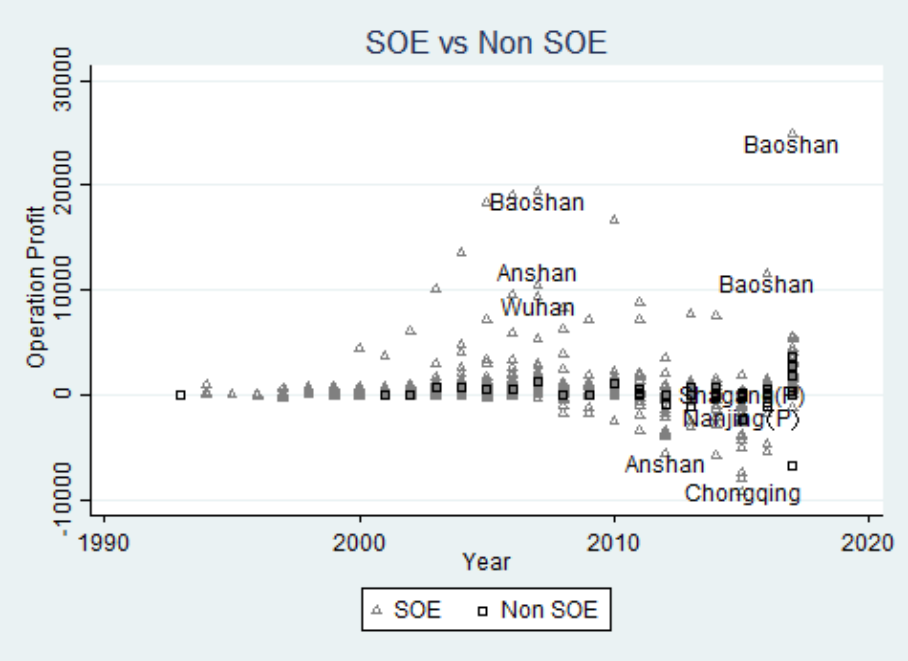
In 2008 to 2015, China's steel industry experienced a serious recession. Figure 1 shows that all listed firms in the steel industry earned profits until 2008. After 2008, the situation diversified, as some firms ran deficits and some maintained profits. In 2015, all firms except for Baoshan ran deficits. Chongqing Steel recorded the largest deficit among listed steel firms in 2015. Since 2016, the trend in the industry has shifted toward profits.

During the recession between 2008 to 2015, some local municipal governments provided subsidies to the local steel firms in order to maintain employment. For example, Chongqing Steel received a large enough subsidy to compensate for the operating deficit in 2012 (see Figure 2).

From the database I constructed, I find that subsidy provision is concentrated on SOEs, particularly, medium-sized listed SOEs within the steel industry that have deficits(Chongqing is the medium-sized and Wuhan is the large sized listed steel firms in Figure 2). The subsidies are large enough to make up for these firms' deficits in their steel products, but private firms do not receive large enough subsidies to be rescued when they run deficits. A subsidy to medium-sized listed SOEs is specific because private firms or foreign investors rarely receive these subsidies and, thus, specificity is satisfied. Table 3 listed the names of "rescued" firm, its ownership and name of ultimate owner, rescued year, size of deficit and subsidy given. Definition of "rescue" will be developed in section 5.2. Here, I can confirm that subsidy that is large enough to compensate operation deficit is mainly provided to small and medium sized SOEs.

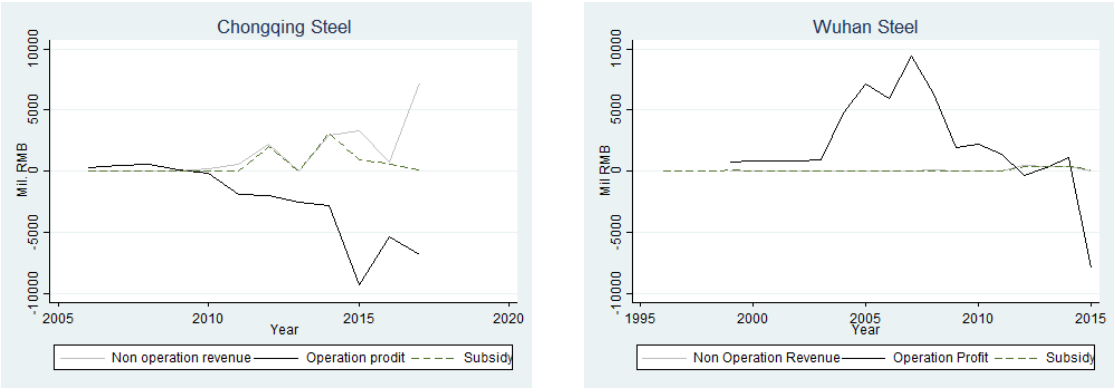
The remaining condition to check is bad effects, that is, whether the subsidy causes damages within the market or a third market. I find that the subsidies cause recipient firms to maintain their deficits, bringing the market price lower than in the case without a subsidy. This is the main agenda of this study.

Figure 1: Steel Industry Development: Operating Profits of Listed Enterprises



Source Sinofin Database.

Figure 2: Deficits and Subsidies in Chongqing Steel and Wuhan Steel



Source Sinofin Database .

Table 3: Rescued Firms, Operating Deficit and Subsidy

Security ID	Company Name	Year	Ownership	Ultimate Owner	Operating Deficit Million Yuan	Subsidy Million Yuan
515	Panzhihua Steel Group Co., Ltd.	2000	State	State SASAC	-1	5
717	ST SGIS Songshan Co., Ltd.	2016	State	Guangdong SASAC	-218	231
778	Xinxing Ductile Iron Pipes Co., Ltd.	2014	State	State SASAC	-439	1,611
932	Hunan Valin Steel	2011	State	Hunan SASAC	-1,008	1,165
932	Hunan Valin Steel	2013	State	Hunan SASAC	-105	500
932	Hunan Valin Steel	2014	State	Hunan SASAC	-3	285
2075	Shagang Group	2012	Private	Shen Wenrong	-24	50
2423	Zhongyuan Special Steel Co., Ltd.	2016	State	State SASAC	-76	126
600117	Xining Special Steel Co., Ltd.	2016	State	Qinghai SASAC	-42	104
600126	Hangzhou Steel	2014	State	Zhejiang SASAC	-43	81
600165	Ningxia Hengli	2004	State	Ningxia SASAC	-1	6
600165	Ningxia Hengli	2007	State	Ningxia SASAC	-6	9
600165	Ningxia Hengli	2008	State	Ningxia SASAC	-5	9
600165	Xinri Hengli	2011	Private	Xiao Jiashou	-4	11
600165	Xinri Hengli	2013	Private	Xiao Jiashou	-19	67
600231	Lingyuan Iron Steel Co., Ltd.	2012	State	Chaoyang SASAC	-461	508
600231	Lingyuan Iron Steel Co., Ltd.	2013	State	Chaoyang SASAC	-413	1,257
600231	Lingyuan Iron Steel Co., Ltd.	2015	State	Chaoyang SASAC	-744	809
600307	Gansu Jiu Steel Group Hongxing Iron Steel Co., Ltd.	2014	State	Gansu SASAC	-7	139
600782	Xinyu Iron Steel Co., Ltd.	2015	State	Jiangxi SASAC	-68	191
600808	Maanshan Iron and Steel	1999	State	Anhui SASAC	-74	110
601005	Chongqing Iron Steel Co., Ltd.	2014	State	Chongqing SASAC	-2,843	3,098
601968	Shanghai Baosteel Packaging Co., Ltd.	2016	State	China Baowu Steel	-2	25

4 Model of Prices and Subsidies

Here, I consider a duopoly model of pricing behavior when one agent faces a softened financial constraint based on the well-known Hotelling model[11].The model described in this section uses the same structure as the model developed by Watanabe (2017). .

4.1 Basic Model

Consumers buy a product either from firm S or firm H. I assume that consumers are located at $x(0 \leq x \leq 1)$ according to their relative preference between S and H. A fan of firm S's products requires compensation to buy product H. The cost of this compensation is given by $t_S x$. t_S, t_H are the indexes of consumers' royalties for the particular brands, that is, the compensation costs for consumers to give up their favorite products.

The payoff of a consumer who chooses product S is as follows:

$$B_S - p_S - t_H \times x$$

The payoff of a consumer who chooses product H is as follows:

$$B_H - p_H - t_S \times (1 - x)$$

The payoff of a consumer who is indifferent between products S and H is equivalent when either product is chosen. That is,

$$B_S - p_S - t_H \times x = B_H - p_H - t_S \times (1 - x) \tag{1}$$

where the value of x that satisfies equation (1) is

$$x = \frac{t_S + (B_S - B_H) - (p_S - p_H)}{t_S + t_H} \tag{2}$$

Faced with this differentiated demand, firm S maximizes its profit with regard to price p_S.

$$(p_S - c_S) \times x = (p_S - c_S)\frac{(t_S + B_S - B_H - (p_S - p_H))}{t_S + t_H}$$

Firm H maximizes its profit with regard to price p_H.

$$(p_H - c_H) \times (1 - x) = (p_H - c_H)(1 - \frac{(t_S + B_S - B_H - (p_S - p_H))}{t_S + t_H})$$

The best responses of firms S and H satisfy the following conditions:

$$2p_S = p_H + c_S + t_S + B_S - B_H \quad (3)$$

$$2p_H = p_S + c_H + t_H + B_H - B_S \quad (4)$$

The pricing of firms S and H satisfies the following relationships:

$$p_S^* = \frac{2c_S + c_H + t_H + 2t_S + B_S - B_H}{3}$$

$$p_H^* = \frac{2c_H + c_S + t_S + 2t_H + B_H - B_S}{3}$$

The market share of firm S, x, is as follows:

$$x_S^* = \frac{2t_S + t_H + (B_S - B_H) - (c_S - c_H)}{3(t_S + t_H)}$$

4.2 Model with a Soft Budget Constraint

Assume that firm S faces a soft budget constraint owing to some particular institutional setting favorable to this firm, whereas firm H does not. Further, I assume that firms S and H have identical technology to produce their product at a generic marginal costs c_{Hg} and c_{Sg}. Due to favorable institutions, firm S is guaranteed to obtain a subsidy D regardless of whether it earns a profit or deficit. Thus, firm S can set its price as low as c_{Sg} minus D. That is, the realized marginal cost of firm S is c_S in equation (5). Conversely, firm H faces the condition that the margin must be zero or greater; once firm H runs a deficit, it should exit the market. Here, the realized marginal cost of firm H is equivalent to the generic marginal cost c_{Hg}.

$$p_S \geq c_{Sg} - D = c_S \quad (5)$$

$$p_H \geq c_{Hg} = c_H$$

Firms can maximize their profits by setting their prices as low as possible. At the same time, under the assumptions in this setting, firm S can set its price p_S lower than the generic marginal cost c. However, firm H has no favorable condition and, thus, cannot set its price p_H lower than its marginal cost c_H.

Thus, c_S is replaced by $c_{Sg} - D$ and c_H is replaced by c_{Hg} in the firms' best response functions (equations (4) and (6)). .

$$\begin{aligned} 2p_S &= p_H + c_{Sg} - D + t_S + B_S - B_H \\ 2p_H &= p_S + c_{Hg} + t_S + B_H - B_S \end{aligned}$$

These equations indicate that firm S, when faced with a soft constraint, sets its price lower and that firm H, its rival, should lower its price. If firm S sets its price p_S lower than its rival's cost c_H, it can force firm H to exit the market and, thus, can capture the entire market.

In this case, the prices in equilibrium change as follows:

$$p_S^* = \frac{c_{Hg} + 2c_{Sg} - 2D + t_H + 2t_S + B_S - B_H}{3} \tag{6}$$

$$p_H^* = \frac{c_{Sg} - D + 2c_{Hg} + t_S + 2t_H + B_H - B_S}{3} \tag{7}$$

Thus, the market share of firm S, x_S, is as follows:

$$x_S^* = \begin{cases} \frac{2t_S + t_H + B_S - B_H + D - (c_{Sg} - c_{Hg})}{3(t_S + t_H)} & (D \leq t_S + 2t_H + B_H - B_S + c_{Sg} - c_{Hg}) \\ 1 & (D \geq t_S + 2t_H + B_H - B_S + c_{Sg} - c_{Hg}) \end{cases} \tag{8}$$

The propositions derived from this model analysis are as follows: under differentiated market competition, when a player faces soft financial constraints, the firm with the soft constraint tends to set its price as low as possible.

Proposition 1 The amount of the subsidy affects the equilibrium price and the market shares.

Proposition 2. The equilibrium price of the rival of a firm with a soft budget constraint is higher than that of the firm with a soft budget constraint.

That is, the price benefit function of firms competing against those with soft budget constraints becomes horizontal when the market includes a firm with a soft budget constraint.

5 Estimation

In this study, I conduct causal inference using difference-in-differences estimation on (1) the existence of a soft budget constraint and (2) price distorting behavior by SOEs in China's

steel industry. I analyze the impact of subsidy provision to SOEs on profits and prices in the steel industry in the next period and in a setting of comparison.

5.1 Data

I construct the data from the following sources. First, I define the following firms as belonging to the listed steel industry: firms (1) who belong to GICS classification 151040 and (2) those whose names have characteristics related to steel and/or iron. The database has 44 firms in total (AppendixB.10). Then, I obtain operating profits and deficits, sales, and subsidy data from the financial statements in the annual reports of listed firms. The prices of the 21 types of steel products for individual firms are collected from the Yearbook of Special Steel. I redefine the markets as 37 markets through clustering by price. The price-cost data and listed financial report data are matched for 13 listed companies.

Tables 4 and 5 present the main variables for the analysis comparing SOEs and non-SOEs, that is, the treatment and reference groups. The operating profits, subsidies, and rescue dummies are so disperse that mean values of all of these variables are smaller than the standard deviations. The prices, costs, and outputs of the products are also disperse.

5.2 Comparative Framework and its Treatment

To identify the causal relationship between a subsidy and the market equilibrium price, I incorporate a comparative framework in the estimation model. Here, I define (1) the scope of the framework of comparison, (2) the conduct of the treatment, and (3) the treatment and control groups.

First, I regard a government rescue by subsidy provision during this period as the comparative framework in this analysis. I define a "rescue" by the government as follows: in a particular year, (a) a firm in the steel industry recorded a deficit, that is, a negative operating profit in accounting terms, (b) a firm received a subsidy from the government, and (c) the amount of the subsidy is large enough to cover the deficit in (a).

The treatment in this setting for comparison is a rescue by the government, as defined above, favoring SOEs in this industry. Figure 3 shows changes in the probability of being rescued for SOEs and non-SOEs. Interestingly, the probability of being rescued does not differ among SOEs and non-SOEs[2] in spite of explicit discrimination to PE over SOEs exists.

[2]The difference in the means is not statistically significant. The t-value of the difference of means test is

Table 4: **Basic Profile: Firm Level**

	N	mean	sd	min	max
Total					
Year	256	2,011	2.35	2008	2015
Operating Profit	254	66.36	2,296	-9,284	16,665
Subsidy	256	116.32	317.59	0.00	3,098
Non-operating Revenue	254	192.09	754.21	0.32	10,502
Rescue Dummy	256	0.10	0.30	0	1
Deficit Dummy	256	0.32	0.47	0	1
Non-SOEs					
Year	24	2,012	2.01	2,008	2,015
Operating Profit	22	2.01	691.45	-2,262	1,057
Subsidy	24	58.27	65.29	0.00	213
Non-operating Revenue	22	59.23	48.19	10.46	188
Rescue Dummy	24	0.17	0.38	0.00	1.00
Deficit Dummy	24	0.33	0.48	0.00	1.00
SOEs					
Year	232	2,011	2.35	2,008	2,015
Operating Profit	232	72.47	2,393	-9,284	16,665
Subsidy	232	122.3	332.5	0.00	3,098
Non-operating Revenue	232	204.7	788	0.32	10,502
Rescue Dummy	232	0.09	0.29	0	1
Deficit Dummy	232	0.31	0.47	0	1

Source: Author.

This implies whether the rescue by governments actually softens the budget constraints of SOEs and nonSOE is the empirical questions to be investigated.

Table 7 compares the main variables between rescued and non-rescued firms. The operating profit of the rescued group is negative on average, and the subsidy for this group is larger than that for the non-rescued group. The subsidies and ratios of SOEs are larger and the price and cost are larger for the rescued groups on average. However, the difference is statistically significant only for the ratio of SOEs.

-1.2393.

Table 5: **Basic Profile: Product Level**

Ownership	**N**	**mean**	**sd**	**min**	**max**
Total					
Output(mil. ton)	401	1.73	49	00	33.89
Price (0000 RMB per ton)	375	0.59	0.59	0.16	3.71
Cost (0000 RMB per ton)	352	0.56	0.56	-00	4.73
Non-SOE					
Output (mil. ton)	129	3.43	6.47	00	33.89
Price (0000 RMB per ton)	122	0.41	0.28	0.18	23
Cost (0000 RMB per ton)	115	0.39	0.27	0.17	1.97
SOEs					
Output (mil. ton)	272	0.92	1.69	00	104
Price (0000 RMB, per ton)	253	0.68	0.67	0.16	3.71
Cost (0000 RMB, per ton)	237	0.64	0.65	-00	4.73

Source: Special Steel Almanac

Table 6: **Rescue vs Price and Profits**

		Price		Profit	
		Non-SOE	**SOE**	**Non-SOE**	**SOE**
Non-rescued	mean	0.3984	0.7558	-448	47.26
	s.d.	0.2776	0.6992	822	1,157.4727
	N	294	798	294	798
Rescued	mean	0.4425	0.2558***	45.95	-245.13
	s.d.	0.3435	0.0570	0	646.7
	N	21	105	21	105

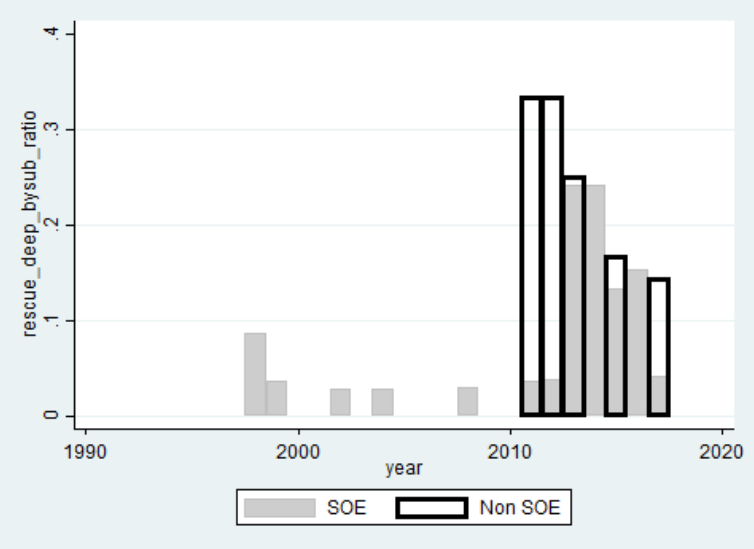
Source: Author.

5.3 Estimation Equations

In this study, I test whether SOEs take advantage of their special relationship with government. Thus, here, I assume that SOEs are the treatment group and private firms are the reference group. The treatment is identified by a "rescue by subsidy" dummy.

I claim that this comparative framework is effective for the following reasons. First, in China, firms cannot choose or change their ownership at will. Thus, I can assume there is no self-selection bias in terms of ownership choice. If an SOE wishes to become a private firm, it will have to put great effort into negotiation with the government. Furthermore, a

Figure 3: Probability of being rescued: SOEs vs Non-SOEs



Note:
Source Computed from listed firms' annual reports by the author.

private firm cannot become an SOE by any means other than merging with an SOE. As a result, any biases in a certain ownership policy are uncontrollable for the firms themselves.

Second, the event I study here, rescues of SOEs by subsidies, has the following characteristics. (1) The treatment, a rescue, may take place multiple times for individual firms. (2) The treatment and reference groups may follow a common trend, but each firm also has an individual trend.

I address these problems using the remedy proposed by Angrist and Piske (2015: Chapter 5). To address the first problem, I create a variable that represents the treatment, which I call the rescue dummy. For problem (2), I add an individual trend dummy, which is a firm dummy multiplied by the trend variable.

To summarize these consideration, I define the regression difference-in-differences estimation function as follows:

$$\begin{aligned} Y_{it} &= \alpha + \beta SOE_{it} + \theta Rescue_{it} + \delta SOE_{it} \times Rescue_{it} \times subsidy_{it} + \\ &\quad \lambda_i d_i + \lambda_t d_t + \phi d_i \times T + \gamma_1 X_{it} + \varepsilon_{it} \end{aligned} \tag{9}$$

Here, Y_{it} is dependent variable, which is either operating profits or the price. d_i, d_t, T,

Table 7: **Basic Profile of Rescued and Non-Rescued Firms**

rescue	**SOE**	**Operating Profit** mil. RMB	**Price** per ton	**Cost** per ton	**Output** mil. ton	**Subsidy** mil. RMB
No rescue						
mean	0.73	1.88	0.62	0.58	1.66	86.74
s.d.	0.44	1,071.05	0.61	0.59	3.94	195.61
Rescued						
mean	0.83	-288.54	0.36	0.34	2.37	666.63
s.d.	0.37	266.99	0.24	0.23	5.27	609.37
Total						
mean	0.74	-26.23	0.59	0.56	1.73	142.86
s.d.	0.44	1,024.83	0.59	0.56	4.09	315.68

Source: Author

$Rescue_{it}$ and SOE_{it} are the firm's fixed effect, the year dummy, the trend variable, and the rescue and SOE/Non SOE dummies. X_{it} is time variant covariates other than the subsidy, such as sales, cost or output. ε_{it} is unobservable profit/price/cost factors. I assume that unobservable factor may correlate with ownership types and action Rescue.

$$E[\varepsilon_{it}|SOE, Rescue] = \xi_{SOE,Rescue}$$

$$V[\varepsilon_{it}|SOE, Rescue] = \sigma^2_{SOE,Rescue}$$

The interpretation of the coefficient is as follows. In the case of non rescued non SOE firms, the expected operating profit is

$$\begin{aligned} & E[Y_{it}|SOE = 0, rescue = 0] \\ = \; & \Sigma_{i=1}^{I}\lambda_i + \Sigma_{t=1}^{T}\lambda_t + \Sigma_{i=1}^{I}\phi_i T + \Sigma_{j=1}^{J}\gamma_1 X_{ijt}. \end{aligned} \tag{10}$$

The expected operating profit of rescued non SOEs is

$$\begin{aligned} & E[Y_{it}|SOE = 0, rescue = 1] \\ = \; & \theta + \Sigma_{i=1}^{I}\lambda_i + \Sigma_{t=1}^{T}\lambda_t + \Sigma_{i=1}^{I}\phi_i T + \Sigma_{j=1}^{J}\gamma_1 X_{ijt} + \xi_{Non\_SOE,Rescue}. \end{aligned} \tag{11}$$

For non-rescued and rescued SOEs, the expected operating profits are,

$$\begin{aligned} & E[Y_{it}|SOE = 1, rescued = 0] \\ = \; & \beta + \Sigma_{i=1}^{I}\lambda_i + \Sigma_{t=1}^{T}\lambda_t + \Sigma_{i=1}^{I}\phi_i T + \Sigma_{j=1}^{J}\gamma_1 X_{it} + \xi_{SOE,NotRescued} \end{aligned}$$

and

$$\begin{aligned} & E[Y_{it}|SOE=1, rescued=1] \\ = \quad & \beta+\theta+(\delta+\frac{\xi_{SOE,Rescue}}{\sigma^2_{SOE,Rescue}})subsidy_{it}+\Sigma_{i=1}^{I}\lambda_i+\Sigma_{t=1}^{T}\lambda_t \\ + \quad & \Sigma_{i=1}^{I}\phi_i T+\Sigma_{j=1}^{J}\gamma_1 X_{it}+\xi_{SOE,Rescue}. \end{aligned}$$

The impact of rescues on non-SOEs can be measured as the difference between equations (11) and (10). That is,

$$\begin{aligned} & E[Y_{it}|SOE=0, rescue=1]-E[Y_{it}|SOE=0, rescue=0] \\ = \quad & \theta+\gamma_1\Delta X_{NonSOE,i,t}+\Delta\xi_{SOE,Rescue;NonRescue}. \end{aligned} \tag{12}$$

The impact of rescues on SOEs is

$$\begin{aligned} & E[Y_{it}|SOE=1, rescue=1]-E[Y_{it}|SOE=1, rescue=0] \\ = \quad & \theta+(\delta+\frac{\xi}{\sigma^2})subsidy_{it}+\gamma_1\Delta X_{SOE,i,t}+\Delta\xi_{SOE,Rescue:NonRescue,}. \end{aligned} \tag{13}$$

The overall impact of rescues on SOEs is captured as the difference between equations (13) and (12). That is,

$$\begin{aligned} & (E[Y_{it}|SOE=1, rescue=1]-E[Y_{it}|SOE=1, rescue=0]) \\ - \quad & (E[Y_{it}|SOE=0, rescue=1]-E[Y_{it}|SOE=0, rescue=0]) \\ = \quad & (\delta+\frac{\xi_{SOE,Rescue}}{\sigma^2_{SOE,Rescue}})subsidy_{SOE,Rescue,t}+\gamma_1\Delta X_{it_{SOE,NonSOE}}+\Delta\xi. \end{aligned} \tag{14}$$

As a whole, the coefficient δ captures the impact of a subsidy on an SOE and coefficient $\frac{\xi_{SOE,Rescue}}{\sigma^2_{SOE,rescue}}$ is the bias due to a correlation between unobservable factors and SOE and Rescues. If $\xi_{SOE,Rescue}$ is zero, I can directly observe the size and direction of the impact of a subsidy on profits and the price through δ. However, it is not clear whether $\xi_{SOE,Rescue}$ is zero, negative or positive. I will go through how I will address this problem in section 5.4.

What I note here is that what equation (9) describe is consistent with the price function (6); a subsidy that rescues SOEs lowers not only firms' profits but also the price at market equilibrium. Thus, I use the equation (9) as an estimation function in this study.

5.4 Identification

Based on the model analysis in section 4, I expect that impacts of subsidies on (1) profit and (2) price, captured by coefficient δ will be negative.

In order to correctly estimate impact of subsidy provision on price, I need to address following identification problem: (1) a bias from correlation between unobservable and ownership type and action of rescue. (2) endogeneity problem in a price function that describes supply behavior.

5.4.1 Biases from SOE and Rescue dummies

First, in profit/deficit function,

$$\begin{aligned} profit_{it} &= \alpha + \beta SOE_{it} + \theta L.Rescue_{it} + \delta SOE_{it} \times L.Rescueit \times subsidy + \\ &\quad \lambda_i d_i + \lambda_t d_t + \phi d_i \times T + \gamma_1 X_{jt} + \varepsilon_{it} \end{aligned} \tag{15}$$

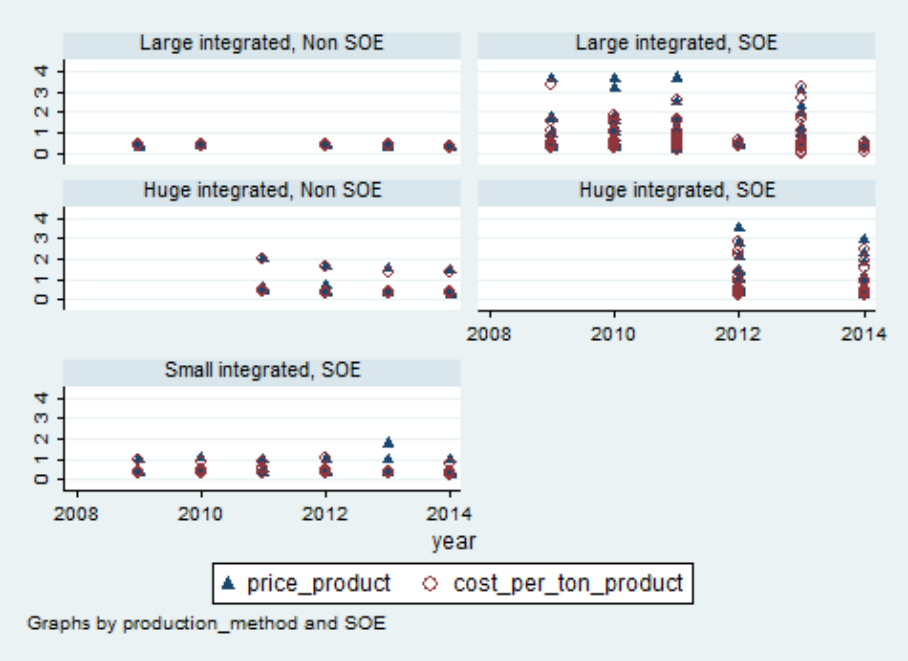
I go through possible correlations between unobservable factor related to profit and subsidies.

Ownership type of firm and subsidies received in previous period can be assumed to be uncorrelated with unobservable profit factor ε_{it} because of following reasons: First, as point out in the section of setting out a comparative framework, choice of ownership type, such as SOEs or private firms, is predetermined under the Chinese institution. Firms cannot choose or change their ownership at their own will. Ownership type is predetermined and not correlated with current unobservable profit factor. Second, rescue by subsidy in in previous period is predetermined and uncorrelated with current unobservable profit factor. To summarize, I claim that both SOE/non SOE dummies and Rescue by subsidy dummies is exogenous to unobservables and the biases $\xi_{SOE,Rescue}$ are zero. When I estimate the profit function in the section below, I do not add any time variant covariates X_{jt}.

Regarding price function, it is difficult to straightforwardly claim that unobservables is uncorrelated with ownership type and the rescue.

I regard price function as supply function: a firm set prices of their product based on the marginal cost of product j plus margin. As is well known, price is correlated with both demand factors and supply factors. In order to eliminate the demand factor, I employed

Figure 4: Cost Structure by Ownership and Production Method



Source Special Steel Yearbook.

instrumental variable (IV) estimation using IVs that is correlated with demand factor, but independent to supply factors. I will detail in section 5.4.2.

Then remained unobservables factor is related to cost factors. I need to address the problem comes from correlation between unobservable cost factors and ownership type choice and the rescue action. Regarding choice of ownership type, I claim again that it is predetermined and exogenous to unobservable cost factors. That is unobservable cost factors is determined by ownership type, but unobservable factor cannot change ownership types.

However, the rescue action may correlate with the unobservable cost factors. What model describes in section 4 is the case: Soft budget constraint firm may set their price lower than their generic production cost, although their reported cost is lower than price, due to the subsidies. However, exactly which firm behaves in this manner is unobservable. This type of manipulation is a possible characteristics of unobservable cost factor.

The unobservable cost factor relate with the manipulation is unobservable but what induce the rescue action. The higher their generic marginal cost c_{Sg} , the more possibly the

firm turned deficit, which is confirmed in the profit function estimation below, then rescued.

In this case, the unobservable cost factor is expected to be positively correlated with the rescue action. The bias $\xi_{SOE,Rescue}$ is positive and estimated δ in equation (15) is upper biased. Figure 4 and Table 5 implies average marginal cost of SOE is higher than Non-SOE counterparts within a group who employs the similar production method and size.

The theory expects that the coefficient of subsidies δ, which captures impact of subsidy on price, is negative. But expected estimated coefficients in the estimation equation (16) will be biased in the upper direction. That is, if the estimated coefficients of δ is negative, although which may be suffered from upper biased, I can claim that subsidies causes lower price, even in a conservative way.

5.4.2 Instrumental Variable for the Price Function

The comparative framework set out in section 5.2 is effective for identifying the relationship between the subsidy and the price. It describes the causal relationship in which the subsidy that rescued SOEs receive lowers the market equilibrium price.

The price function, specified in the description of equation (9), is as follows:

$$\begin{aligned} p_{ijt} &= \alpha + \beta SOE_{it} + \theta Rescue_{it} + \delta SOE_{it} \times SOE_{it} \times subsidy + \lambda_i d_i + \lambda_t d_t \\ &\quad + \phi d_i \times T + \gamma_1 ln\_cost_{ijt} \times production\_method_{imt} + \gamma_1 ln\_output_{ijt} + \varepsilon_{ijt} \quad (16) \end{aligned}$$

Appropriate instrumental variables are needed to address a problem of endogeneity, a correlation, between price, cost and the unobservable demand factors. For the supply function, these variables might be correlated with qualitative factors on the demand side but should not be correlated with the supply side. Thus, I use the product type dummies for 21 products as an instrumental variable.

The justification for this assumption is as follows: from the perspective of a steel company, differences in the price and costs by product type are dominated by demand side factors rather than their own management capability. When a firm set a product configurations in response to the demand side, levels of cost and price will be subsequently determined.

A steel company i, whose capacity as a supplier is fixed, supplies more than two types of products, j and k. Because firm i expects that demand exists, it decides to list the

respective products and bear their costs. The cost of a firm's products is a function of the specific product type, j or k, and the choice is a response to demand; the capacity of firm i, a supply side-specific factor; and unobservables ε_{ijt}.

$$c_{ijt} = \alpha product\_type_{jt} + \beta capacity_{it} + \varepsilon_{ijt}$$

$$c_{ikt} = \alpha product_type_{kt} + \beta capacity_{it} + \varepsilon_{ijt}$$

$$c_{ijt} - c_{ikt} = \alpha(product\_type_j - product\_type_k) + \Delta\varepsilon_{ijt}$$

The difference in costs among a firm's product types is explained by the choice set of product types, not the supplier's capability. Thus, the configuration of the product dummies is an proxy for the demand factors but is independent to the firm's supply factors. Thus, I expect it to be an appropriate instrument for the supply function. My data also suggest that the cost and price differences across product types are large (see Figure 4) [3].

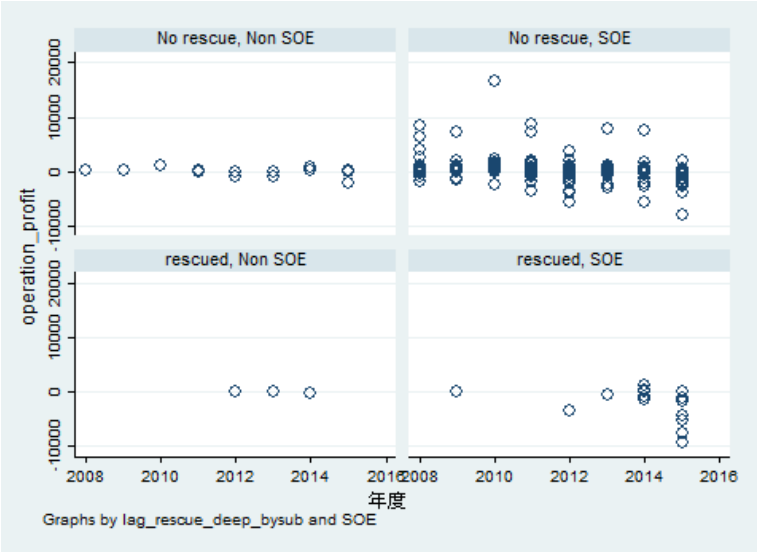
5.5 Graphical Analysis: Profit, Price, and Rescue via Subsidy

Prior to conducting the difference-in-differences regression, I plot the correlations between profits, prices, and rescues via subsidy. Figure 5 shows that private firms that are rescued in the previous year earn zero or positive profits. However, SOEs that are rescued in the previous year maintain a deficit in the next year. This graph indicates that rescues by subsidy affect SOEs and private firms differently. Rescues by subsidy lead SOEs to continue their deficit operations. This result implies that subsidies to SOEs soften their budget constraints.

In Figure 6, I partition the prices of steel products across the reference and treatment groups and before and after the treatment. Here, I observe that prices of rescued SOEs are concentrated at the lowest level among the four categories. This result implies that being rescued by the government may induce SOEs to set lower prices.

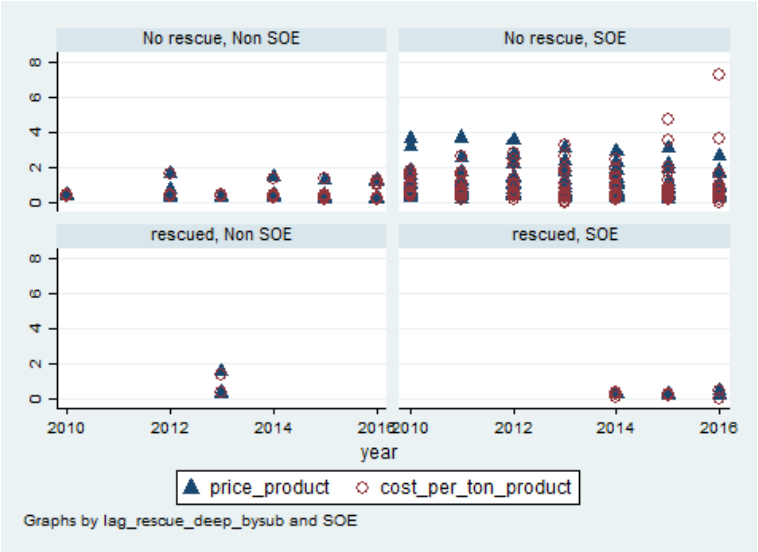
[3] The size of cost or price difference across products is also a potential instrument.

Figure 5: Profit before/after Rescue



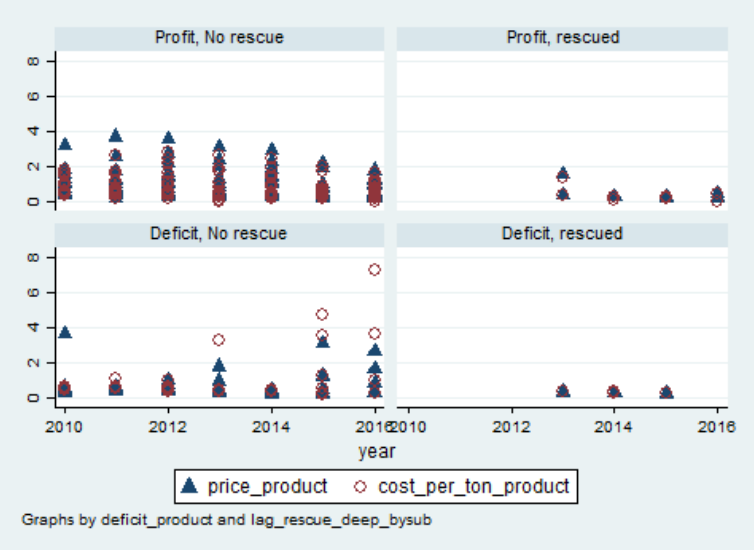
Note: If the subsidy received is larger than operating deficit, the firm is *rescued*. Otherwise, it is not *rescued*.
Source Author.

Figure 6: Price Levels after Rescued



Note: Prices at product level. If subsidy received is larger than operation benefit, the firm is *rescued*. Otherwise, not *rescued*.
Source Author.

Figure 7: Deficit at Product Level after Rescued



Note: If price is lower than cost per ton at product level, it is deficit. Otherwise, profit.
Source Author.

6 Estimation Results

6.1 Profit vs Subsidy

The estimation results are presented in Table 8. Here, rescue via subsidy for SOEs reduces profits by 120 percent the next year in equation (2) for SOEs. In contrast, subsidies provided to "rescued" private firms do not lower profits in the next year. Private firms take actions to reduce their deficits, whereas SOEs maintain deficits in the next period. Thus, strategies and internal decision mechanisms differ between SOEs and private firms. I interpret this result as implying that SOEs have softer budget constraints than private enterprises have. Robustness checks are presented in Table B.11.

Table 8: Rescued SOEs and Operating Profits: Estimation Results

	(1) operation_profit		(2) operation_profit		(3) operation_profit		(4) operation_profit		(5) operation_profit	
	b	ci95	b	ci95	b	ci95	b	ci95	b	ci95
SOE	870.2	-3055.3, 4795.7	1279.3	-1745.3, 4303.8	296.9	-3644.6, 4238.5	606.3	-2408.4, 3621.0		
private									-571.3	-3664.2, 2521.6
rescue	871.4	-50.3, 1793.0	929.7	205.3, 1654.0						
SOE ×rescue×subsidy:δ	0.14	-0.90, 1.17	0.20	-0.59, 1.00						
L.rescue					-36.9	-1080.7, 1006.8	-310.7	-1128.1, 506.7	-865.4	-1661.0, -69.9
L.SOE ×rescue×subsidy:δ					**-1.14**	**-2.30, 0.021**	**-1.21**	**-2.09, -0.32**		
L.private×rescue×subsidy:δ									2.56	-32.0, 37.1
_cons	977567	-3276657, 5231792	1027788	-2070758, 4126336	-8247771	-17048526, 552983	-2280927	-8543455, 3981601	-2503213	-8918723, 3912295
N	254		229		246		222		222	
R^2	0.746		0.656		0.748		0.663		0.646	

6.2 Price and Subsidy

Rescuing an SOE is negatively correlated with the price level at equilibrium. Figure 6 presents price movements from 2010 to 2015 for the treatment group, SOEs, and the reference group, non-SOEs. The price and cost of treatment group for treatment period shift to the lowest level relative to non-treated SOEs and rescued non-SOEs.

The instrumental variables estimates of the supply function with a subsidy, equation (6), are presented in Table 6. Here, when an SOE is rescued by a subsidy, the market equilibrium price is negatively correlated with the amount of the subsidy provided to SOEs. The coefficient δ ranges from -0.12 to -0029 with a 95 percent certification range (Equation (1)). On the contrary, in the estimation equation for private firms rescued by subsidies, being rescued does not lower the market equilibrium price. This result is consistent with those in the graphs.

.

Table 9: Supply Function with a Subsidy: IV Estimates

	(1)		(2)		(3)	
	ln_price		ln_price		ln_price	
	b	ci95	b	ci95	b	ci95
ln_cost	0.58	0.32, 0.83	0.55	0.25, 0.85	0.46	0.12, 0.80
ln_output	0048	-0046, 014	-000034	-013, 013	-00061	-024, 023
ln_subsidy	024	-026, 074				
Large Integrated Factory	0.26	0046, 0.52	0.29	-013, 0.60	0.72	087, 1.35
Small Integrated Factory	32.1	-227.3, 291.4	295.3	-415, 1005.6	536	-492.9, 1565
Large ITG ×ln_cost	0.56	0.23, 0.89	0.61	0.20, 11	0.73	0.22, 1.24
Small ITG ×ln_cost	0.54	087, 0.98	0.43	-073, 0.94	0.51	-0.14, 1.16
SOE			-65	-230.4, 100.4		
private					244.6	-138.6, 627.7
L.rescue			-0018	-059, 055	**-0.22**	**-0.42, -.0075**
L.SOE×rescue×ln_subsidy: δ			**-.062**	**-0.12, -.0029**		
L.private×rescue×ln_subsidy: δ					-.0045	-0.12, 0.11
_cons	0	0, 0	0	0, 0	235.9	-86.1, 557.9
Firm dummy	YES		YES		YES	
Year dummy	YES		YES		YES	
Firm dummy × trend dummy	YES		YES		YES	
N	212		189		189	
R^2	0.849		0.825		0.758	

(Notes) : IV is product dummies for 21 products

7 Conclusion

The theory expects that the coefficient of subsidies δ, which captures impact of subsidy on price, is negative. But expected estimated coefficients in the estimation equation 16 will be biased in the upper direction. That is, if the estimated coefficients of δ is negative, although which may be suffered from upper biased, I can claim that subsidies causes lower price, even in a conservative way.

This study finds following main results. First, SOEs that are rescued by large enough subsidies to compensate for their deficits continue to run a deficit. At the same time, preferential rescues of specific SOEs induce lower price setting behavior by rescued firms, which harms competitiveness in the market. Subsidies to SOEs in China's steel industry may be subject to discipline by the SCM rules.

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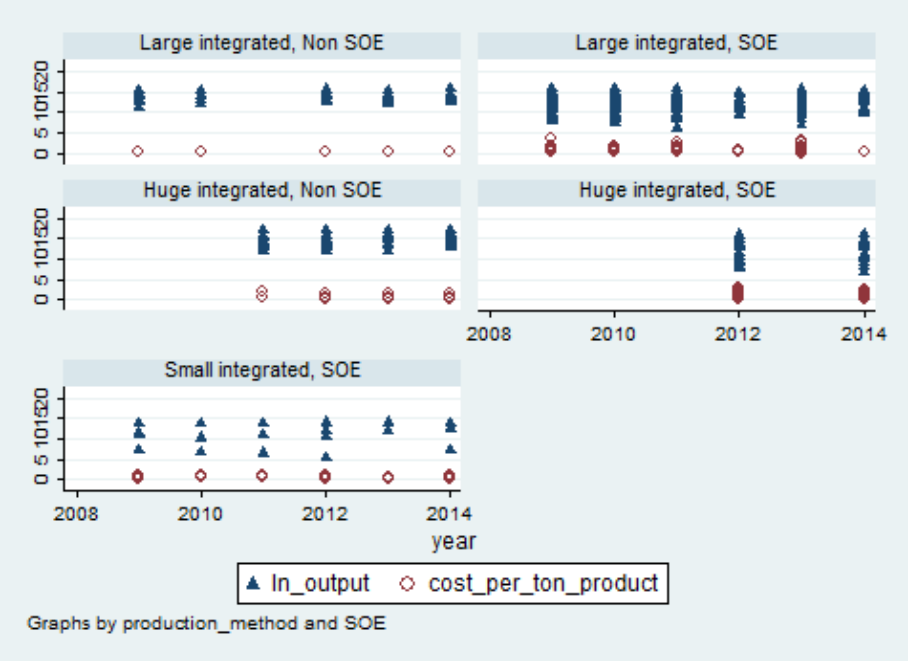
A Figures

Figure A.8: Cost and Output Size by Ownership and Production Method



Source Special Steel Yearbook.

B Tables

Table B.10: List of Listed Steel Companies

	Name	Stock ID	Year 2008	2009	2010	2011	2012	2013	2014	2015	Total
1	ANGANG STEEL COMPANY LIMITED	898	1	1	1	1	1	1	1	1	8
2	AnYang Iron& Steel Inc.	600569	1	1	1	1	1	1	1	1	8
3	Anhui Fuhuang Steel Structure Co., Ltd.	2743	0	0	0	0	0	0	1	1	2
4	BAOSHAN IRON & STEEL CO.,LTD.	600019	1	1	1	1	1	1	1	1	8
5	BEIJING SHOUGANG CO.,LTD	959	1	1	1	1	1	1	1	1	8
6	BENGANG STEEL PLATES CO.,LTD.	761	1	1	1	1	1	1	1	1	8
7	CHENGDE XINXIN VANADIUM AND TITANIUM COMPANY LIMITED	600357	1	0	0	0	0	0	0	0	1
8	CHONGQING IRON & STEEL COMPANY LIMITED	601005	1	1	1	1	1	1	1	1	8
9	DALIAN JINNIU CO.,LTD	961	1	0	0	0	0	0	0	0	1
10	DAYE SPECIAL STEEL CO.,LTD.	708	1	1	1	1	1	1	1	1	8
11	FANGDA SPECIAL STEEL TECHNOLOGY CO., LTD	600507	0	0	0	0	0	1	1	1	3
12	FUSHUN SPECIAL STEEL CO.,LTD	600399	1	1	1	1	1	1	1	1	8
13	GUANGZHOU IRON AND STEEL CO.,LTD.	600894	1	1	1	1	0	0	0	0	4
14	GUIZHOU WIRE ROPE CO., LTD	600992	1	1	1	1	1	1	1	1	8
15	Gan Su Jiu Steel Group Hong Xing Iron & Steel Co,Ltd.	600307	1	1	1	1	1	1	1	1	8
16	HANDAN IRON & STEEL CO.,LTD.	600001	1	0	0	0	0	0	0	0	1
17	HANG ZHOU IRON & STEEL CO.,LTD.	600126	1	1	1	1	1	1	1	1	8
18	HEBEI IRON AND STEEL CO., LTD	709	0	1	1	1	1	1	1	1	7
19	Hunan Valin Steel Co., Ltd.	932	1	1	1	1	1	1	1	1	8
20	INNER MONGOLIA BAOTOU STEEL RARE-EARTH HI-TECH CO.,LTD.	600111	1	1	1	1	1	1	1	0	1
	China Northern Rare Earth (Group) High-Tech Co.,Ltd	600111	0	0	0	0	0	0	0	1	1
21	JIANGSU SHAGANG CO.,LTD.	2075	0	0	0	1	1	1	1	1	5
22	JINAN IRON AND STEEL COMPANY Ltd.	600022	1	1	1	1	0	0	0	0	4
23	LAIWU STEEL CORPORATION	600102	1	1	1	0	0	0	0	0	3
24	LINGYUAN IRON & STEEL CO.,LTD.	600231	1	1	1	1	1	1	1	1	8
25	LIUZHOU IRON & STEEL CO., LTD	601003	1	1	1	1	1	1	1	1	8
26	LUYIN INVESTMENT GROUP CO.,LTD.	600282	0	0	0	0	0	1	1	1	3
27	MAANSHAN IRON & STEEL CO.,LTD.	600808	1	1	1	1	1	1	1	1	8
28	NANJING IRON & STEEL CO.,LTD.	600282	1	1	1	1	1	1	1	1	8
29	NING XIA HENG LI STEEL WIRE ROPE CL.,LTD	600165	1	1	1	1	1	1	1	1	8
30	Pan Gang Group Sichuan Changcheng Special Steel Company Limited.	569	1	0	0	0	0	0	0	0	1
31	Pangang Group Steel Vanadium & Titanium Co.,Ltd.	629	1	1	1	1	1	1	1	1	6
32	SGIS SONGSHAN CO.,LTD.	717	1	1	1	1	1	1	1	1	8
33	SHANDONG IRON AND STEEL COMPANY LTD	600022	0	0	0	0	1	1	1	1	4
34	SHANXI TAIGANG STAINLESS STEEL CO.,LTD.	825	1	1	1	1	1	1	1	1	8
35	SUFA TECHNOLONGY INDUSTRY CO.,LTD., CNNC	778	0	0	0	0	0	1	1	1	3
36	Sansteel MinGuang Co.,Ltd.,Fujian	2110	1	1	1	1	1	1	1	1	8
37	Shanghai Baosteel Packaging Co., Ltd.	601968	0	0	0	0	0	0	0	1	1
38	TANGSHAN IRON AND STEEL CO.,LTD.	709	1	0	0	0	0	0	0	0	1
39	Wuhan Iron and Steel Company Limited	600005	1	1	1	1	1	1	1	1	8
40	XINING SPECIAL STEEL CO.,LTD	600117	1	1	1	1	1	1	1	1	8
41	Xinjiang Ba Yi Iron & Steel Co.,Ltd.	600581	1	1	1	1	1	1	1	1	8
42	Xinyu Iron & Steel Co., Ltd	600782	1	1	1	1	1	1	1	1	8
43	Yongxing Special Stainless Steel Co.,Ltd.	2756	0	0	0	0	0	0	0	1	1
44	ZHONGYUAN SPECIAL STEEL CO.,LTD.	2423	0	0	0	0	0	1	1	1	3
	Total		34	30	30	30	29	33	34	36	256

Table B.11: Subsidy vs. Non-Operating Revenue: Robustness Check

Dependent Variable: Operating Profit	(1)	(2)	(3)	(4)	(5)
sales	007		007		
	(010)		(010)		
D.sales		011			
		(013)			
SOE				981.5	495.8
				(930.8)	(921.5)
L.rescue				-582.7*	
				(311.7)	
L.non_operation_revenue				1.471*	
				(0.777)	
L.SOE×rescue	-702.1**	-1361.9***	-702.1**		
	(312.6)	(431.5)	(312.6)		
L.SOE s×rescue×nonope_rev				-31043***	
				(11371)	
L.rescue_by_subsidy					-332.7
					(395.4)
L.subsidy					0.233
					(0.600)
L.SOE×rescue_by_subsidy×subsidy					-1.394**
					(0.637)
constant	-861921	532994	3143310***	3887458	-8204151**
	(3151166)	(4337886)	(609294)	(3583501)	(3256042)
Firm dummy	YES	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES	YES
Firm dummy × trend dummy	YES	YES	YES	YES	YES
N	254	254	254	254	254
R^2	0.650	0.353	0.536	0.667	0.668

Standard errors are in parentheses.

* $p < 0.1$, ** $p < 05$, *** $p < 01$

Equation (5) is the same as equation (2) in Table 8