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Abstract

This paper attempts to identify competition neutrality of state-owned enterprises (SOEs) in three consumer electronics industries in China. First, I draw a benefit-price indifference curve at the mode of consumer surplus for each year, and a benefit-price supply curve by manufacturers and ownership types based on the demand estimates for the color TV (CTV), mobile phone, and air conditioning industries in the 2000s. These exercises indicate heterogeneous situations of market neutrality of SOEs in the Chinese consumer electronics industries. The air conditioning market shows a clear positive relationship between benefit and price for all ownership types. At the same time, no clear correlation between ownership and strategies focusing on price or benefit is observed. On the other hand, SOEs and privately-owned enterprises (POEs) in CTV and mobile phone markets concentrate their products based on lower prices and lower benefit area, namely, cost advantage strategies. Ownership type and strategies appear to have a correlation. Furthermore, prices become independent to the level of benefit for local firms. These tendencies are clearly observed in the price-benefit supply curve of the two markets. A simple model of differentiated competition with one agent committing predatory pricing in expropriating soft financial constraint shows that the price set by the rivals of a soft constrained firm is independent to the benefit.

Keywords: Demand estimates, Competitive advantage, Cost advantage, Benefit advantage, SOEs, POEs, FOEs
JEL classification: L11 M21 L63 P52

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1 Introduction

This paper attempts to identify the competition neutrality of SOEs in Chinese markets. Attempts to identify behaviors abusing the competition neutrality has been regarded as controversial in the field of international law. This paper will undertake this task by building a small empirical model and empirically tested. The empirical test was exercised based on the data utilizing empirical industrial organization's technique and the concept of Porter's competitive advantage strategies (Watanbe, 2015). The competition neutrality of SOEs became a focus of research following the improvement of corporate governance principles in the OECD and international institution buildings is developed within the international trade rules develops. Mixed markets, where SOEs, private firms and foreign owned invested firms are competing each other, though under somehow different institutional settings, are very prevalent in China. Some industries maintain sound competition or neutrality in the presence of SOEs, whereas other industries do not. Therefore, whether the presence of SOEs in the market is capable of being neutral to market competition and social welfare is a quite a complex empirical question. This paper tries to answer the question.

This paper proceeds as follows: Section 2 reviews the literature on market competition and SOEs. Section 3 presents the strategy of analysis of this paper. Secion5 provides exercise tests on pricing behavior with soft financial constraint. Section 6 discusses the results and implication for understanding the characteristics of the Chinese markets, then concludes. Methodology of estimating benefit of individual benefitis elaborated in Appendix sections: Section A presents economic models as an analytical framework, and Section B reports the estimated results.

2 SOEs and Competition

THe motivation behind this paper is understanding whether the presence of SOEs may substantially affect outcomes of market competition, including not only price but also quality.

The mixed market literature originally studied this issues, but it needs to be modified to apply to China's case. On the other hand , the other literature from legal studies and the practical world began to argue a concept of "competitive neutrality." Essentially, the OECD began to propose the SOEs' competitive neutrality framework. I surveyed the argements from these two stream of literature.

2.1 Mixed Markets Literature

Public economics began to analyze outcomes of competition in the mixed market in the 1990s, along with development in the privatization of SOEs in the public utility industries. Heterogeneity of purpose or constraints between public enterprises and privte enterprises may generate unexpected outcomes.

The main characteristics that these theoretical papers share is an assumption that SOEs are constrained to maximizing social welfare, not profit, only the private firms are allowed to maximize profit. Under this assumption, the following papers developed the economic models of mixed oligopoly competition. Some of the relatively recent models of differentiated market presented the following outcomes: Matsuura and Matsushima (2004) showed that the private firm's cost is lower than the public firm's because the private firm engages in excessive strategic cost-reducing activities. Privatization of the public firms would improve welfare because it would mitigate losses arising from excessive cost-reducing investments. Luts and Pezzioni (2009) provided a review of a mixed oligopoly with a differentiated market where there is possibility that not all of the market is not covered. They argued that mixed competition is more socially plausible than private duopoly and seems to produce more efficient regulatory instruments than merely adop the minimum quality. Ghosh, Mitra and Saha (2015) argued that the SOEs will set prices under their marginal cost when they are duopolies competing with foreign profit maximizing firms. A partial privatization of domestic public firms will improve the welfare by decreasing the deficits of public firms competing against the foreign firms.

These theoretical papers presented diversified results under heterogeneous assumptions: some argues that partial privatization and mixed oligopoly are plausible options for maintaining a certain quality level in the market. Others argue that full privatization is better due to the smaller amoung of loss incurred. I must note that all these theoretical analyses assume that the SOEs or public firms are constrained to pursue welfare maximization, whereas the private firms pursue profit maximization. The reality is that the SOEs have never been constrained to maximizing social welfare, but have been allowed to simply pursue private profit [1].

2.2 SOEs Governance and Competitive Neutrality by OECD

Entering the 2000s, the OECD and other international trade regulation entities began to discuss the impact of SOEs' presence on market competition neutrality. Here, the State owned enterprises are regarded a special entity in terms of the following points: First, the enterprise is burdened to fulfill public welfare not only pursing their own private profit. This is facilitated through the public ownership by exercising decision power that allocated to the owners. As long as SOEs are producing public benefits, subsidies to the SOEs from the government are legitimate. This perspective can bell called the" burdened SOEs view." The problem expected to be solved under this view is how to alleviate the inefficiency of SOEs due to the public welfare burden. Secondly, however, the definition of public welfare is not clear and is difficult to distinguish whether the action of the SOEs really serves to the public welfare. Under this setting, the enterprises can ask for the government to exercise its power to favor them against their rivals in the market even if their actions do not serve public welfare at all. This phenomenon can be called as "not legally constrained SOEs views." The problem most concerned with this type of phenomenon is to how to control the SOEs unconstrained behaviors. Chaprbianco and Christiansen (2011) introduced the historical development of SOEs governance code to competitive neutrality principles, and discusses

[1] Concerning the details of the institution, see Unirele (2012) and Watanabe (2014)

the Competitive Neutrality Frameworks (CNFs). Then, they cataloged the various "anti-competitive practices" that SOEs might take, and then argued for remedies that competitive agencies can take. The OECD (2012) is a proposal following the argument of Chapribianco and Christiansen (2011). Kawashima (2015) introduced the Australian' "Market Neutrality Principle" and discussed its applicability to international trade regulation.

2.3 Anti-Competitive Practices and Remedy for Competitive Neutrality

Chapribianco and Christiansen (2011) discussed the four "anti competitive actions" and remedies for them as follows: The anti-competitive practices are (1) predatory pricing, (2) raising rivals costs, (3) cross subsidization and (4) strategic adopting of inefficient technology. Remedies that the anti competitive agency can take are (1) ex post enforcement of competition rules on unilateral conduct (2) using merger control rules to level the playing field and (3) exemptions from antitrust liability for SOEs.

3 Research Strategy and Background

3.1 Research Strategy

This paper attempts to identify the competitive strategy of Chinese brands, or by ownership type. I refer to an idea of Porter's generic competitive advantage strategies, that is, the cost advantage strategy and benefit advantage strategy. In implementing the exercise here, I used the predicted values that estimate in Watanabe (2015).

Researh of this papher goes as follows: First, I observe outcome of market competition in the three consumer electornics industies in China. Then, summarized the observation and indentified tendency and characteristics that might be related to "competition neutrality." Second, set up a model to explain the findings in the fist step, then, empirically test the prediction from the model. Detailed procedure of individual step will be elaborate in each section.

3.2 Description of Industries

In this paper, three electronics industries in China were the target of analysis: color TV, air conditioner and mobile phone. These industries all share competitive and mixed market characteristics. This is why I chose the three industry for the excersice of this paper to identify the competitive neutrality of SOEs.

Among these, the CTV industry was the earliest to have emerged, dating back to the late 1980s. There was a technological transfer from the Japanese manufacturer, Panasonic, to several SOEs including Changhong. The air conditioner industry began to grow in the 1990s, nearly ten years later. Initially, the technology was also transferred from Japanese manufacturers, such as Sanyo and Mitsubishi and German companies to the SOEs. The mobile phone industry is the newest of the three industries and emerged in the 2000s. In the very initial stage, Nokia and Motorola dominated the industry. Since the late 1990s, the government has encouraged foreign investment firm to transfer the technology by forming joint ventures. However, because the government lifted the regulation in 2006, massive entry of private brands was repeated[2].

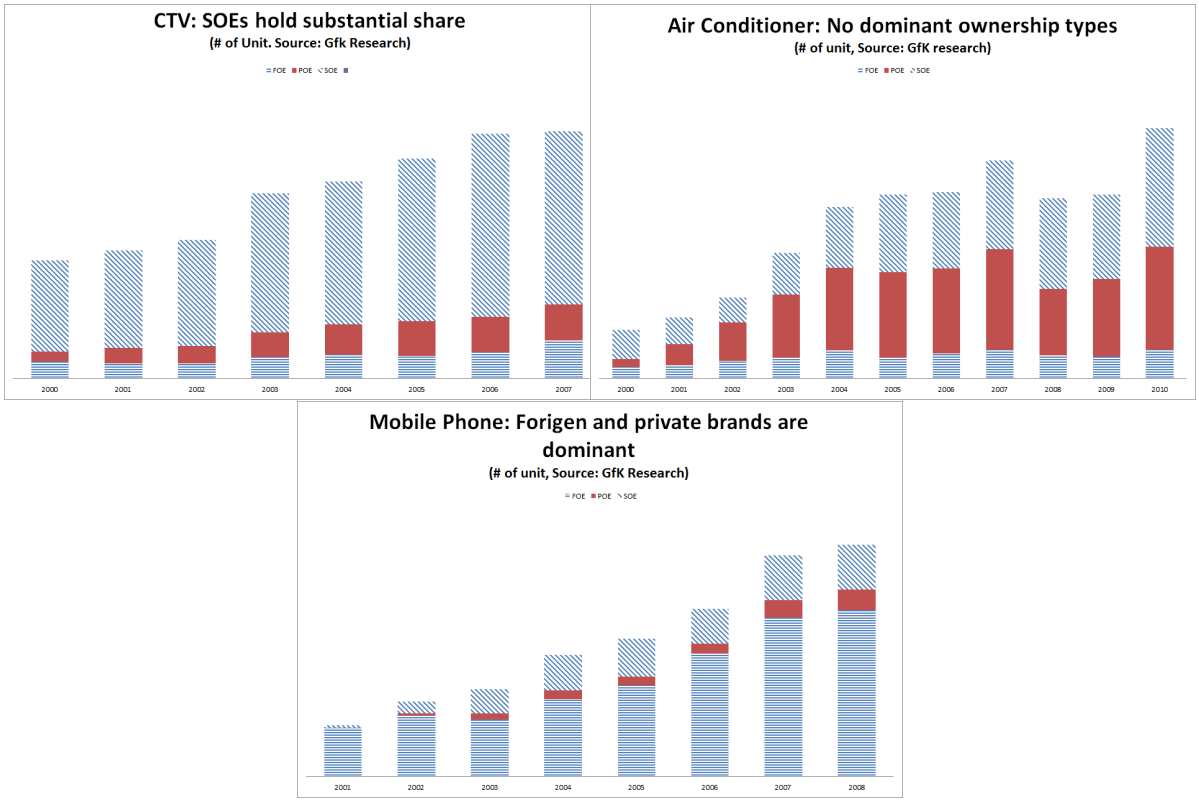
Figures 1 indicates how many products were supplied by privately owned, SOE or foreign investment enterprises. This figre shows extremely contrasting profiles among the three industries. In the color TV industry, SOEs dominate more than 80 per cent of units were produced by SOEs. Conversely, the mobile phone industry is dominated by foreign invested and privately owned ifirms.

3.3 Institutional setting: Law and Politics with SOEs

In China, the three types of ownership, foreign investment, SOEs and privately owned firms are faced with different institutional settings. Although they sometimes compete with each other in a market, the institutional constraints they face with are often substantially different. In terms of this nature, I regard the three ownership types as heterogeneous

[2]Detailed case studies of these industries were extended in Watanabe ed.,(2014).

Figure 1: Shares of production by ownership types of
Color TVs, Air Conditioners and Mobile Phones



Source GfK Market Auditing Survey.

agents in a market, and the market should be called a "mixed market."

Legal institution since the 1980s clearly discriminated private enterprises and SOEs until the middle of 2000s: Company Law, Security Law, Bankruptcy Law provided respective clauses for SOEs and private enterprises. Foreign investment enterprises are regulated by independent special laws and regulations. There was a substantial reform of these legal institution around 2006. Although major institutional discrimination among ownerships disappeared in the laws, but the enforcement remains widely a preferential toward SOEs[3].

[3]Referring legal institutions related to SOEs, Watanabe (2014) reviewed in detail. In October 2015, Communist Party of China revealed their plan of the SOE reform. It announced that SOEs will be classifiend into "commercial SOEs" and "Public welfare pursing SOEs." A part of SOEs in People's Republiuc of China are constrained to pursuing public welfare for the first time.

4 Competitive Strategy and Ownership Types: Observation

4.1 Comparing Consumer Surpluses and Benefits by Ownership types

The estimated demand parameters in Watanabe (2015) allow us to compute the consumer surplus and the benefit of individual products[4]. By summing up these consumer surplus and benefits, I can quantify the (relative) size of consumer surplus and benefit for each brand or ownership types. Here, I compare whether there is a systematic difference in consumer surplus or benefit across ownership types (Figures 2, 3 and 4 summarize the results.).

Across the three industries, foreign-investment firms offer the greatest benefit to the Chinese market, alsthough ther price are also the highest. Privately owned firms offer the lowest or not higher prices in all the three industries and offer the not smaller or higher consumer surplus to SOEs acrossthe industries. State owned enterprises does not show consistent advantages in price, benefit and consumer surplus across the three industries.

In the air conditioner market, in which no single type of ownership had a dominant share, foreign-investement firm supplies products with the greatest benefit, but their prices are high as well. As a result, the consumer surplus offered by foreign-investment firm is not higher than SOEs. Privately owned firms offered the larget consumer surplus by following the cost advantage strategy.

In the CTV market, in which a substantial share of the products are supplied by the state-owned enterprises, foreign-investment firms offers the largest consumer surplus, and those of privately owned and state-owned enterprises remain equal.

In the mobile phone market, in which foreign-investment firms shared the largest percentage of the market, but private firms vigorously entered, private firms provided the largest consumer surplus by following the cost advantage strategy, whereas foreign investment firms supply products with the highest benefit. Their benefit advantage strategies does not succeeded in offering the largest consumer surplus.

[4]Appendix of this paper also provide details of procedure to estimate the benefit and consumer surplus.

Figure 2: Difference in mean among ownerships - Air Conditioner

unit: RMB	Consumer Surplus	Benefit	Price
F-P	-128	1431***	1559***
F-S	259	1264***	1005***
P-S	387***	-166	-553***

Standard errors were not displayed

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 3: Difference in mean among ownerships - CTV

unit: RMB	Consumer Surplus	Benefit	Price
F-P	4352***	8532***	4180***
F-S	4190***	8138***	3948***
P-S	-162	-393	-232

Standard errors were not displayed.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 4: Difference in mean among ownerships - Mobile Phone

unit: RMB	Consumer Surplus	Benefit	Price
F-P	-735***	243***	980***
F-S	-237***	348***	587***
P-S	498***	104	-393***

Standard errors were not displayed.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In summary, foreign-investment firms supply products that provide greater benefit. In other words, they follow the benefit advantage strategy. At the same time, privately owned firms offers the cheapest class of products: They look to follow the cost advantage products. State-owned enterprises fell into the trap of the middle, and the size of the consumer surplus that offered by SOEs to the Chinese markets is lower than that of either the privately owned firms or foreign-investment firms[5].

[5]Besanko argues that a strategy of positioning in the middle of cost advantage and benefit advantage is effective as long as they are suceeding in providing largest "benefit of trade," that is B - C in the notation in this paper. Their argument makes sense. Now we can observe B the benefit offered by the SOEs is lowest, but not sure how much C the cost is.

4.2 Drawing Price-Benefit Curves

As we have the data on the price and benefit of the products, and we can draw a price-benefit indifference curve and a price-benefit supply curve for the three industries[6]. The procedures are as follows: First, utilizing the demand function estimates obtained in Watanabe (2015), I obtain the predicted value of the benefit of individual products in equation (19). Second, I draw a spline within the group, such as ownership or brand. I employ splines with equally spaced knots based on the prices and benefits of all units sold in each year.

4.2.1 Price-Benefit Indifference Curve

First, I depict price-benefit indifference curve. The curve depicts the relationship between price and benefit fixed at a certain level. Here, I took the price-benefit relationship at the mode value of consumer surplus for each year. The mode is a value that has the maximum observation on the distribution[7]. That is, I can see the price benefit relationship at the volume zone of the year. Under this setting, if a brand list products with larger benefit and higher price on the curve, we can see the brand is taking "benefit advantage" strategy. If the brand list products with lower benefit and lower price on the indifference curve, it implies the brand took "cost (price) advantage strategy."

Figures 5, 6 and 7 graphs actual distributions of strategies at the volume zone for each years for the three consumer electronics market.

In air conditioner market, Figure 5, the strategies that represented by positioning at price- benefit axis is relatively concentrated into a narrow area from 2001 to 2008. Difference of positioning among ownership types are not clear, except in 2006 and 2007. In 2006 and 2007, the FIEs took position at the higher price but relatively similar benefits compared to

[6]We depicted the cost-benefit supply curve by connecting the predicted value of benefit and consumer surplus by brands or ownerships. This is the line chosen by the suppliers. When you connected the predicted values of benefits and consumer surplus according to the equivalence of consumer surplus or benefit levels, it becomes the cost-benefit indifference cutve that Figure A.1 showed.

[7]I took a certain range between the mode value when I made these graphs so as to maintain a certain number of observations. Because of this, we can see a difference of consumer surplus in the actual figures

the local rivals. This implies FIE is inferior to SOEs and POEs in terms of this period. In 2008, difference of positioning of the strategies by ownership types disappeared in 2009. In 2010, relatively speaking, FIEs and SOEs exhibit "benefit advantage strategies," whereas POEs shows "cost advantage strategies".

In CTV market, Figure 6, FIEs took a wider positioning at price-benefit axis, that is, low price-low benefit to high price- high benefit between 2001 to 2006 and 2007. On the contrary, SOEs and POEs shows distribution of positioning concentrating into the low price and low benefit area at the same period. Ownership type and distribution of the strategies appears to be correlated.

What I need to note here is that, the price benefit curve get horizontal along with the progress of years.

In mobile phone market, Figure 7, difference of the positioning at at the price-benefit axis get more clear. FIEs took the higher price - higher benefit positioning, that is "the benefit advantage strategies," whereas SOEs and POEs adopt the low price and low benefit positioning, that is the "cost advantage strategies." In this market, the curve got horizontal in an area where SOEs and POEs are competing with each other.

In summary, the correlation between the ownership type and the strategies appeared in the CTV and mobile phone markets, whereas the correlation is not so clear as the other two markets. In the previous group, the curve get horizontal.

4.2.2 Price-Benefit Supply Curve

Figures 8, 9 and 10 graph the price and benefit supply curve for selected brands. I chose the brands that have data for the entire period of the study and for which the number of sales units is relatively large.

The graphs visualize the competitive positions of the ownership types or the brands. If a brand or one type of ownership listed the products with higher benefit and keeps price at approximately the same level as a competitor's, the brand or ownership type have a "benefit

advantage". On the other hand, a brand or a type of ownership that provides a product with a lower price and keeps the benefit more or less the same as that of a competitor has a "cost advantage" (Besanko, et. al 2010: Chapter 9).

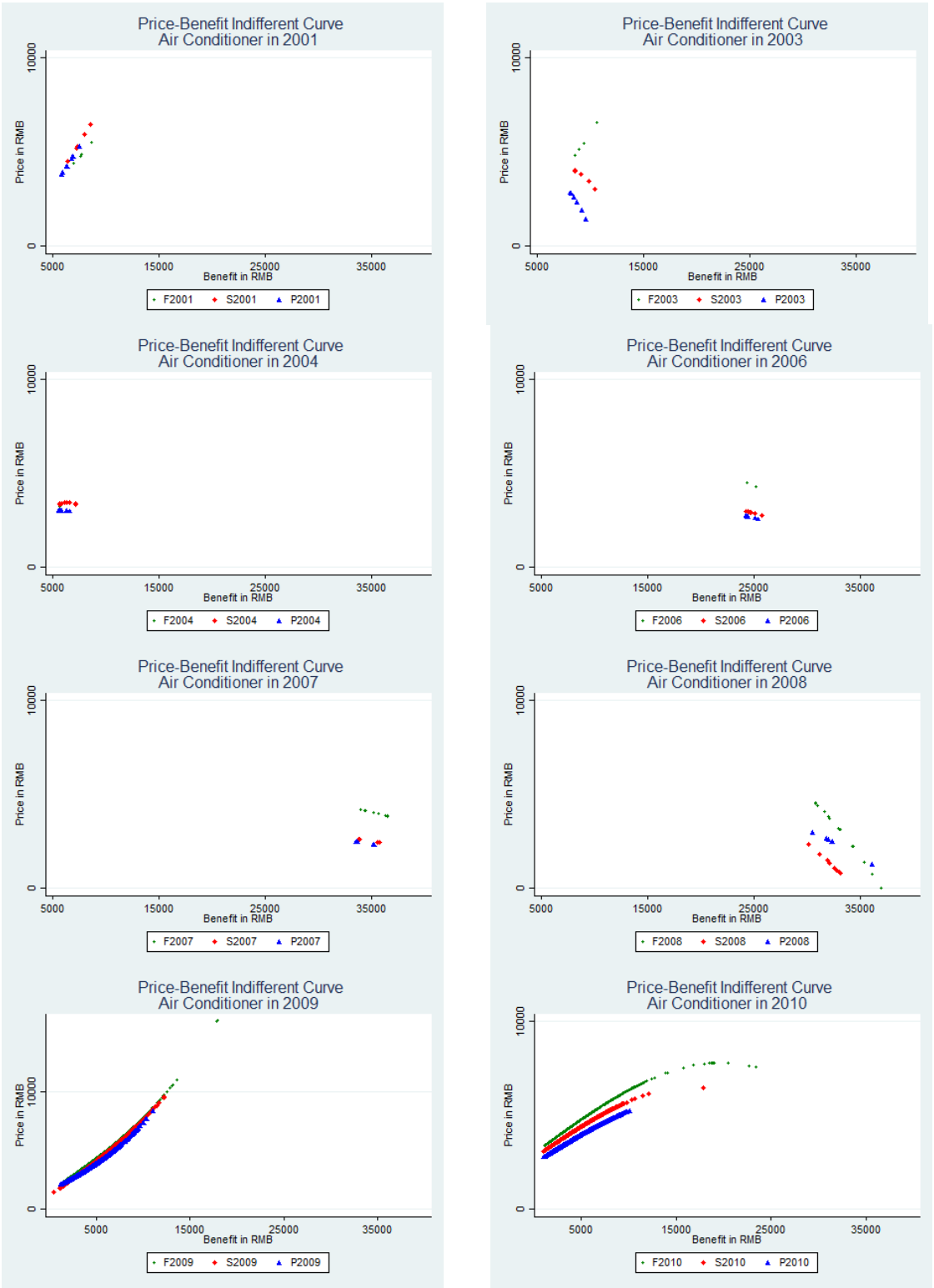
Figure 10 clearly indicates this positioning pattern in the mobile phone market. This indicate that foreign brands, such as Nokia, Samsung and Motorola listed the products with nearly all the support of the benefit distribution. Foreign brands monopolizes the higher benefit ranges, for example, 12,000 RMB and above range for 2001, 25,000 RMB and higher for 2005 and 40,000 RMB and above for 2008. Foreign brands succeeded in taking the"benefit advantage" position. On the contrary,the private and SOE price-benefit supply curves move nearly horizontally over the benefit. They are positioning at a lower cost and offer the same benefit to foreign brands. This relationship basically holds in the color TV market (Figure 9). For air conditioner market (Figure 8), the support of benefits for SOEs, POEs and FIEs does not show a substantial difference, although FIEs supply with systematically higher prices than their counterparts.

A comparison of the positioning among ownership types indicates that SOEs fail to take an advantageous positions and are "stuck in the middle" as argued by Porter (Besanko et.al, 2010, Chapter 9. Porter 1980: Chapter 2). This is because of the following point: In terms of benefit, SOEs are inferior to foreign investment brands: however, in terms of costs, I presume they could be inferior to the private brands because as the price advantage is taken by the privately owned firms, it implies SOEs do not have cost advantage. This observation is consistent with anecdotal evidences that appeared in the accumulated previous researches, news or reports.

Moreover, it is important to note the direction of correlation between benefits and price (the cost of the consumer). When the benefit is large, the consumer values the products to a larger degree, and there is more room for raising price. Usually, this is necessary for suppliers, as suppliers bear the additional cost of producing products with greater benefits. Relatively speaking, foreign brands can enjoy positive correlation between price and benefit.

However, private firms and SOEs are faced with a horizontal cost benefit indifference curve. That is, price is independent of benefits. For suppliers, this is a harsh market condition, and they may lose incentives to invest in upgrading the quality or benefit of products. Next sections will focus on this point and try to address why this phenomenon appears.

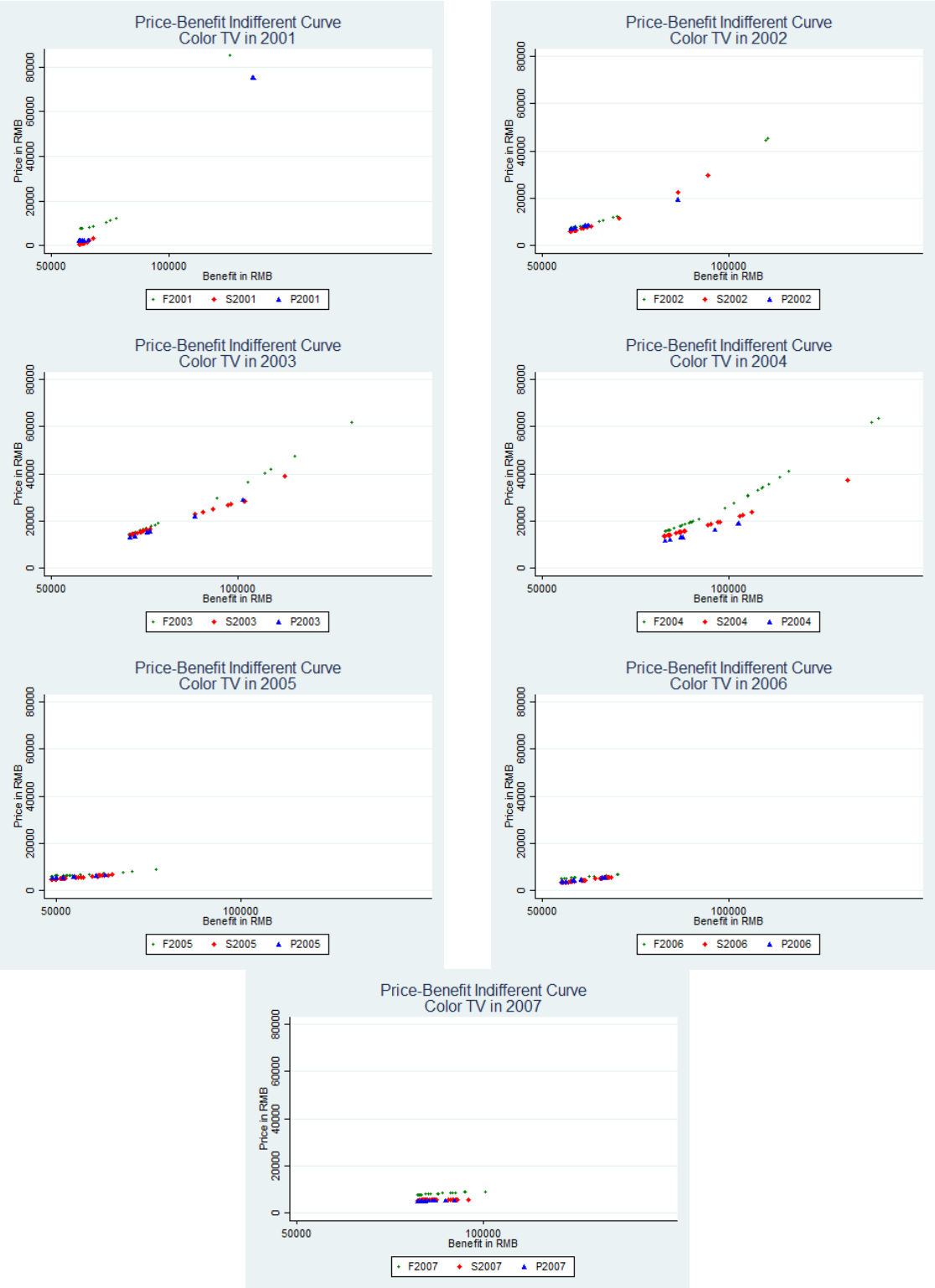
Figure 5: Price and Benefit Indifference Curve by Ownership Type - Air Conditioner



Note: Red/Orange dots represent SOEs. Blue dots represent Private owned firms. Green dots represent Foreign Owned firms.

Source Author's estimation.

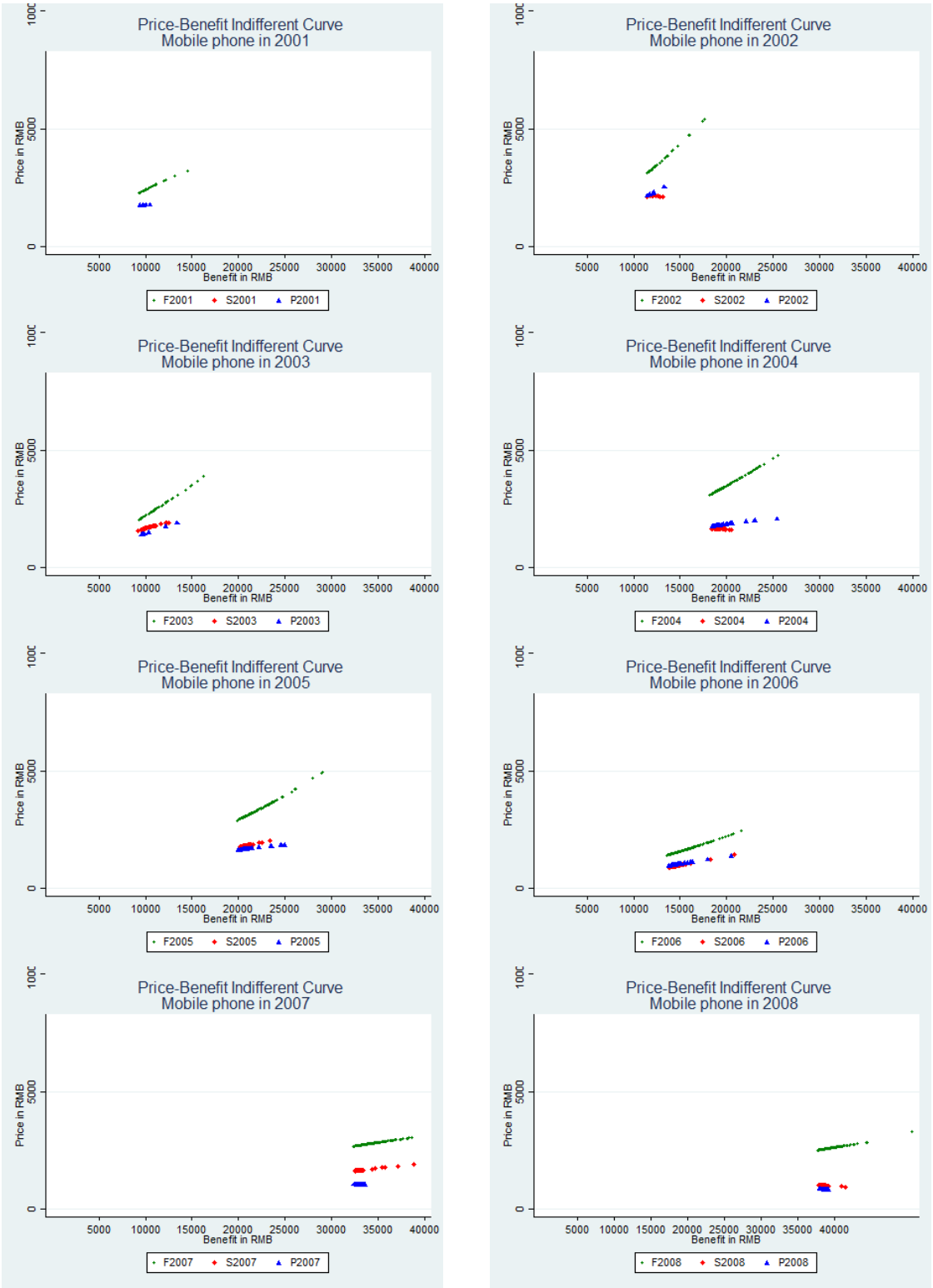
Figure 6: Price Benefit Indifference Curve by Ownership Types - Color TV



Note: Red/Orage dots represent SOEs. Blue dots represent Private owned firms. Green dots represent Foreign Owned firms.

Source Author's estimation.

Figure 7: Price and Benefit Indifference Curve of Selected Brand - Mobile Phone



Note: Red/Orange dots represent SOEs. Blue dots represent Private owned firms. Green dots represent foreign-owned firms.

Source Author's estimation.

4.3 Summary: Heterogeneous Market Outcomes and Horizontal Price Benefit Curve

The main findings so far are summarized as follows. Concerning the relationship between ownership type and the chosen competitive strategy, we present the following findings; (1) Foreign brands exhibit a strategy to list products all in support of benefit of price-benefit indifference curve. This applies to all three markets. FIEs adopts the "benefit advantage strategy," at least, relative to SOEs or POEs. (2) In CTV and mobile markets, Private brands and SOEs concentrate on listing lower benefits products. This phenomenon is clearly captured in the price benefit supply curves for the two markets. In terms of this relative positioning, SOEs and POEs exhibit "cost advantage strategies" In these two markets, there seems to exist correlation between ownership type and chosen strategy. (3) In the air conditioner market, all three ownership types lists their products all over the price benefit indifference curve. It appears that there is no systematic relationship between ownership type and chosen strategy. Correlation between ownership type and strategy take are observed in some industry, and not observed in other industries.

One more aspect that needs to be noted is the relationship between price and benefit. (1) In the air conditioner market, price and benefit are positively correlated, except during a period between 2005 to 2007[8].(2) On the other hand, the price benefit curves for CTV and mobile phones tend to become horizontal as time progresses. This is very explicit for SOEs and POEs. The price benefit supply curve for CTV markets clearly exhibits that the price is maintained at the same level although benefits increase[9]. Interestingly, FIEs began to raise prices once SOEs and POEs give up listing at the higher benefit area. These

[8]The positive correlation between benefit and price reappeared in 2008, 2009 and 2010. In 2008, the Chinese government implemented a energy efficiency standard and labeling system to mitigate information asymmetry between consumers and suppliers in terms of the energy efficiency of products. Further study to investigate how the system intervene the market outcome.

[9]There are several anecdote that might be related to this market outcome feature in the CTV industry. From 2006 to 07, there took place an intense price competition among LCD, CRT and PDPs occured. At the same time, PDP was an advanced and expensive technology then, but Changhong began listing the PDP with a support of local government and technology transfer from Philips. The detailed story is developed in Watanabe ed. (2015). Until 2015, the project completely failed.

results imply that there exists a mechanism that causes price to beome independent from the benefits. In the next section, I will explore a mechanism that explain this phenomenon.

5 A Test on Competition Neutrality

The exercise above shows that there is a peculiarity in that (1) the price-benefit indifference curve tends to shrink and the price tends to become independent of the benefit, and (2) the price-benefit supply curve of Color TV industry shows that the curve of the FIEs resume goes correlated from the point that their rivals, the SOEs and POEs resume listing. This implies that the disappearance of competition to local brands allow them to price their products according to the cost to generate the benefit.

Several studies on Chinese SOEs system have referred to several points as a source of problem Among them, I will test a hypothesis that the "excess competition" phenomenon is caused by favorable financial constraints on the SOEs. In this section, I describe this phenomenon by using a simple model, and test whether the hypothesis is supported by the data.

5.1 Model: Pricing when one agent is facing soft financial constraint

Here, I consider a duopoly model of pricing behavior when one agent is faced with softened financial constraint based on the well known Hotelling model.

5.1.1 Basic model

Consumers will buy a product either from Firm A or Firm B. Assume the consumers are located at $x(0 \leq x \leq 1)$ according to the relative preference between A and B at x. A fan of firm A's products requires compensation when they will buy product B. The compensation cost is described as $t_A x$. t_A, t_B are the index of the consumer's royalties for the particular brands, that is, ones's costs to give up the favorite products.

The payoff of the consumer who choose product A is as follows:

$$B_A - p_A - t_B \times x$$

The payoff of the consumer who choose product B is as follows:

$$B_B - p_B - t_A \times (1 - x)$$

The payoff of a consumer who is indifferent between product A and B is equivalent. That is,

$$B_A - p_A - t_B \times x = B_B - p_B - t_A \times (1 - x) \tag{1}$$

where the x that satisfies equation (1) is,

$$x = \frac{t_A + (B_A - B_B) - (p_A - p_B)}{t_A + t_B} \tag{2}$$

Faced with this differentiated demand, firm A will maximize its profit with regard to price p_A.

$$(p_A - c_A) \times x = (p_A - c_A)\frac{(t_A + B_A - B_B - (p_A - p_B))}{t_A + t_B}$$

Firm B will maximize its profit with regard to price p_B.

$$(p_B - c_B) \times (1 - x) = (p_B - c_B)(1 - \frac{(t_A + B_A - B_B - (p_A - p_B))}{t_A + t_B})$$

The best response strategies for firms A and B satisfy the following conditions:

$$2p_A = p_B + c_A + t_A + B_A - B_B \tag{3}$$

$$2p_B = p_A + c_B + t_B + B_B - B_A \tag{4}$$

Prices A and B follow the relationships below:

$$p_A^* = \frac{2c_A + c_B + t_B + 2t_A + B_A - B_B}{3}$$
$$p_B^* = \frac{2c_B + c_A + t_A + 2t_B + B_B - B_A}{3}$$

The market share of A, x, becomes as follows:

$$x^* = \frac{2t_A + t_B + (B_A - B_B) - (c_A - c_B)}{t_A + t_B}$$

5.1.2 Model with soft financial constraint

Assume that firm A is facing a soft budget constraint; that is, if they incure a deficit, they can make it up by relying on borrowing from banks or trade credit. Under this environment, Firm A can set their price level below the cost and above the amount of debt D[10]. Deficit is feasible as long as it is smaller than debt. This is the assumption of predatory pricing by A:

$$p_A - c_A \leq D$$
$$p_A - D \leq c_A \tag{5}$$

I assume that firm A is faced with soft financial constraint: it can set its price p_A lower than cost c_A as long as the deficit $p_A - c_A$ is not bigger than its debt D. Firm B has no favorable condition: thus it cannot set the price p_B lower than their marginal cost c_B.

[10]This items can be regarded as subsidy.

Because of the strategic relationship described by equations (3) and (4), firm A has an incentive to shift the best response function by utilizing its soft constraint. If so, the best response strategy for firm A changed from equation (3). According to the condition of equation (5), c_A is replaced with $p_A - D$.

$$\begin{aligned} 2p_A &= p_B + p_A - D + t_A + B_A - B_B \\ p_A &= p_B - D + t_A + B_A - B_B \end{aligned}$$

These equations indicate that firm A, when faced with soft constraint, will set its price lower, and that the rival firm B should lower its price. If firm A set their price p_A lower than its rivals cost c_B, they can force firm B to exit from the market and thus obtain the whole demand.

In this case, the prices at equilibrium changed as follows:

$$p_A^* = c_B - 2D + t_B + 2t_A + B_A - B_B \tag{6}$$

$$p_B^* = c_B - D + t_A + t_B \tag{7}$$

The price at equilibrium shows that firm B, which received pressure to cut price fell into a situation in which it cannot raise its price according to its benefit advantage. The pricing of firm B become independent of the benefit they provide, although consumers still values them. This implies that the rivals of firms with soft budget constraints fell into a situation in which they will not be rewarded for their investment in the benefits for the consumer.

Thus, the market share of A, x_A, becomes as follows:

$$x_A^* = \frac{D}{t_A + t_B} \tag{8}$$

Propositions that derived from the model analysis above are as follows: under differentiated market competition, when there exists a player with soft financial constraints, the

soft constraint firm tends to set its price as low as possible.

Proposition 1 Amount of debt determines level of equilibrium price and market shares.

Proposition 2. Equilibrium price of the rival of a soft constraint firm becomes independent of the benefit they supplied to the society. That is, the price benefit function of rivals to soft budget constraint firms becomes horizontal when the soft budget constraint entity commits predatory pricing.

5.2 Estimation of Price Benefit Supply Curve

To test the relationship between the price benefit curve and financial constraint, I combined the estimated demand data with the financial statement data of companies listed in stock markets within China. About half of the market data for the three markets were matched. Although there exist substantial data omission, most of SOE listed firms were covered[11].

Therefore, I do assume that listed SOEs as "the soft budget constraint firm." According to this classification, I did estimate price benefit supply curve focusing on SOE's behavior on respective market[12].

Test functions are derived from equations (6 and 7) and described as follows:

$$\begin{aligned} ln(p^*_{soft}) &= \beta_1 ln(c_{hard}) + \beta_2 ln(c_{soft}) + \beta_3 ln(D_{soft}) + \beta_4 ln(t_{hard}) \\ &\quad + \beta_5 ln(t_{soft}) + \beta_6 ln(B_{self}) + \beta_7 ln(B_{others}) \qquad (9) \\ ln(p^*_{hard}) &= \beta_1 ln(c_{hard}) + \beta_2 ln(c_{soft}) + \beta_3 ln(D_{soft}) \\ &\quad + \beta_4 ln(t_{soft}) + \beta_5 ln(t_{hard}) + \beta_6 ln(B_{self}) + \beta_7 ln(B_{others}) \qquad (10) \end{aligned}$$

Figure 11 shows a consistent result with model prediction in equations (6 and 7): the benefit of own products is positively and the benefits of rivals is negatively correlated with

[11] Matched observation for respective market is as follows. the matched data in CTV market covers 59% in total, 97% for SOE. Air conditioner 59% for total, 99% for SOE. 16% for total and 67% for SOE.

[12] Here, I do not have sufficient information about financial constraint (e.g. amount of debt) and cost for FIEs.

price. Marginal costs are positively correlated. What interests us most is that the amount of own debt is negatively correlated with pricing. That implies that a brand with the larger borrowing sets lower prices. This is consistent with a prediction of the financial soft budget morel above, and contradict with an intuition that the more leveraged firm is faced with a higher financial cost and thus, tends to set higher prices.

I do also estimate following reduced form of price function of product j of firm h for the all three consumer electronics .

$$price_{hj} = \beta_0 benefit_{hj} \times Ownership + \beta_1 benefit_{hj}^2 \times Ownership + \beta_2 cost_h + \beta_3 Debt_h + \epsilon_{hij} \quad (11)$$

As for Debt, I use sum of following items: (1) amount of short term debt, (2) amount of account receivable, and (3) amount of account payable of the brand for respective year. Cost variables are (1) financial cost, (2) operating tax, (3) marketing cost, (4) management cost from the financial statement and (4) estimated costs from demand functions. OLS and IV estimation were conducted.

Tables (C.1), (C.2) and (C.3) indicates results of regression. Results shows again heterogeneous situation: (1) CTV markets data shows negative relationship between price and debt and positive relationship between financial cost for IV estimation. OLS estimation of the third column shows that insignificant parameters for debt variable. This implies the possibility of predatory pricing behavior thanks to loose financial constraint of SOEs in CTV market. (2) Air conditioner market shows that insignificant results for debt variable for both OLS and IV estimation. Financial cost and marketing cost is positively correlated with price for OLS estimator. Evidence for predatory behavior is not clear. (3) Mobile phone market, both debt amount and financial cost are not correlated with price for OLS estimates and financial cost is negatively correlated with price for GMM. The latter is against the hypothesis above.

As a whole, CTV market data could not reject the possibility that competitive neutrality

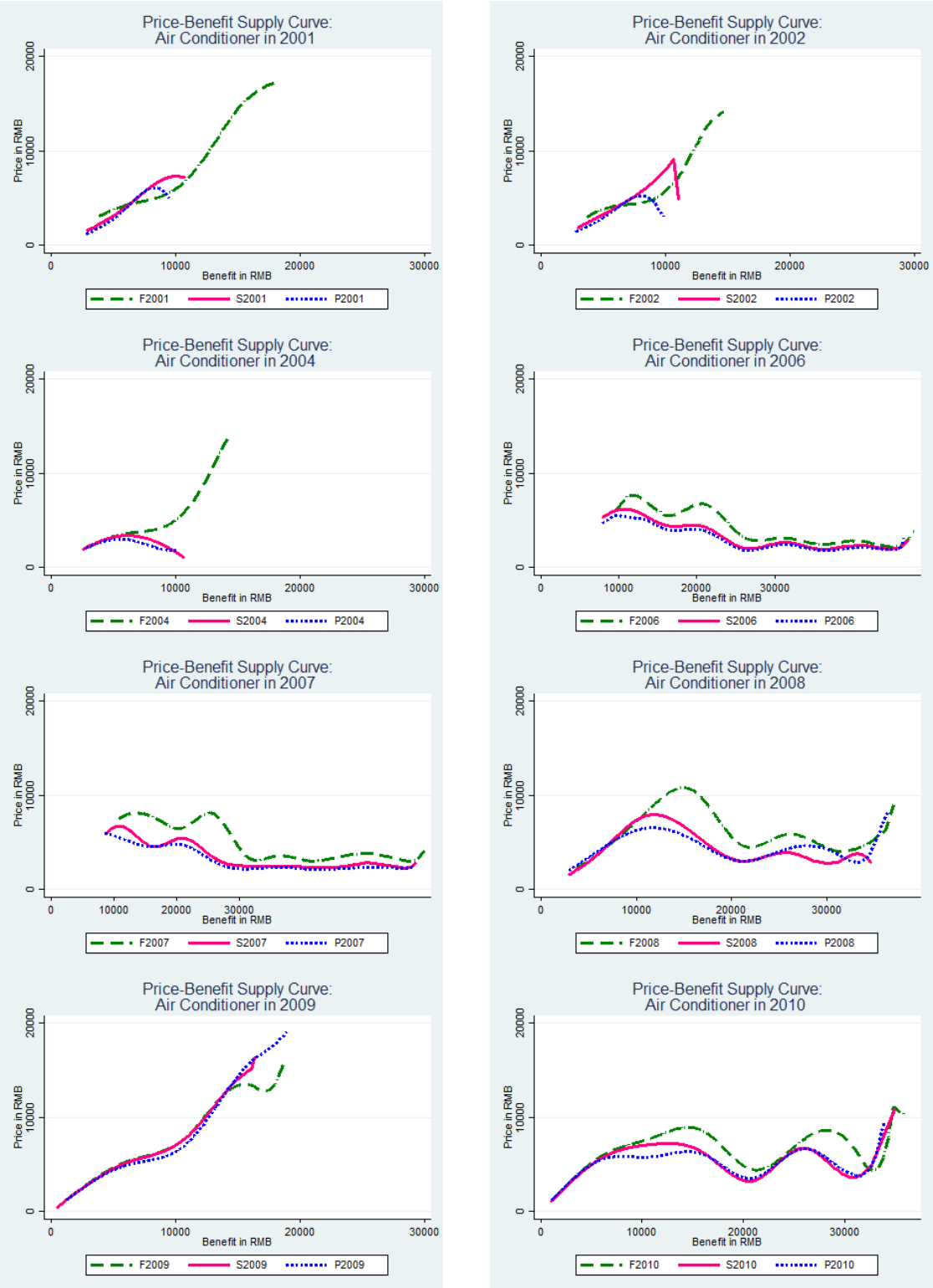
are violated due to soft financial constraint.

6 Conclusion

This paper attempted to identify competition neutrality of SOEs for three electronics industries in China . First, I draw price benefit demand and supply curves in order to identify positioning and the "competitive advantage" of brands in Chinese markets. The results reveal that there is a tendency across three industries for foreign brands to hold a "benefit advantage" and for private brands to maintain a "cost advantage". The SOEs are trapped in the middle, failing to hold competitive advantages.

One more important feature is the SOEs and private firms looks to have been trapped in the "excess" price competition equilibrium where price is independent to the benefit that firms offers to the society. Price Benefit curves goes horizontally, that is, price is independent to benefit of product. Theoretical analysis based on differentiated products competition with one soft financial constraint shows that due to predatory pricing strategy by the soft constraint firm, their rivals pricing got independent to benefit level of products. Profit from differentiation disappeared for their rivals. Regression of specification following model analysis on the CTV data shows that amount of debt of the soft constraint firm shows negative coefficient in the price function. Larger the debt amount of the soft budget firm, the lower price are set. Reduced form regression on price benefit function incorporating financial data shows contradicting results: SOEs in the color tv markets price their products lower when their debt is large and financial cost is lower. Estimating structural functions and identifying the mechanism that is generating the market equilibrium is attempting in line with the results of this paper.

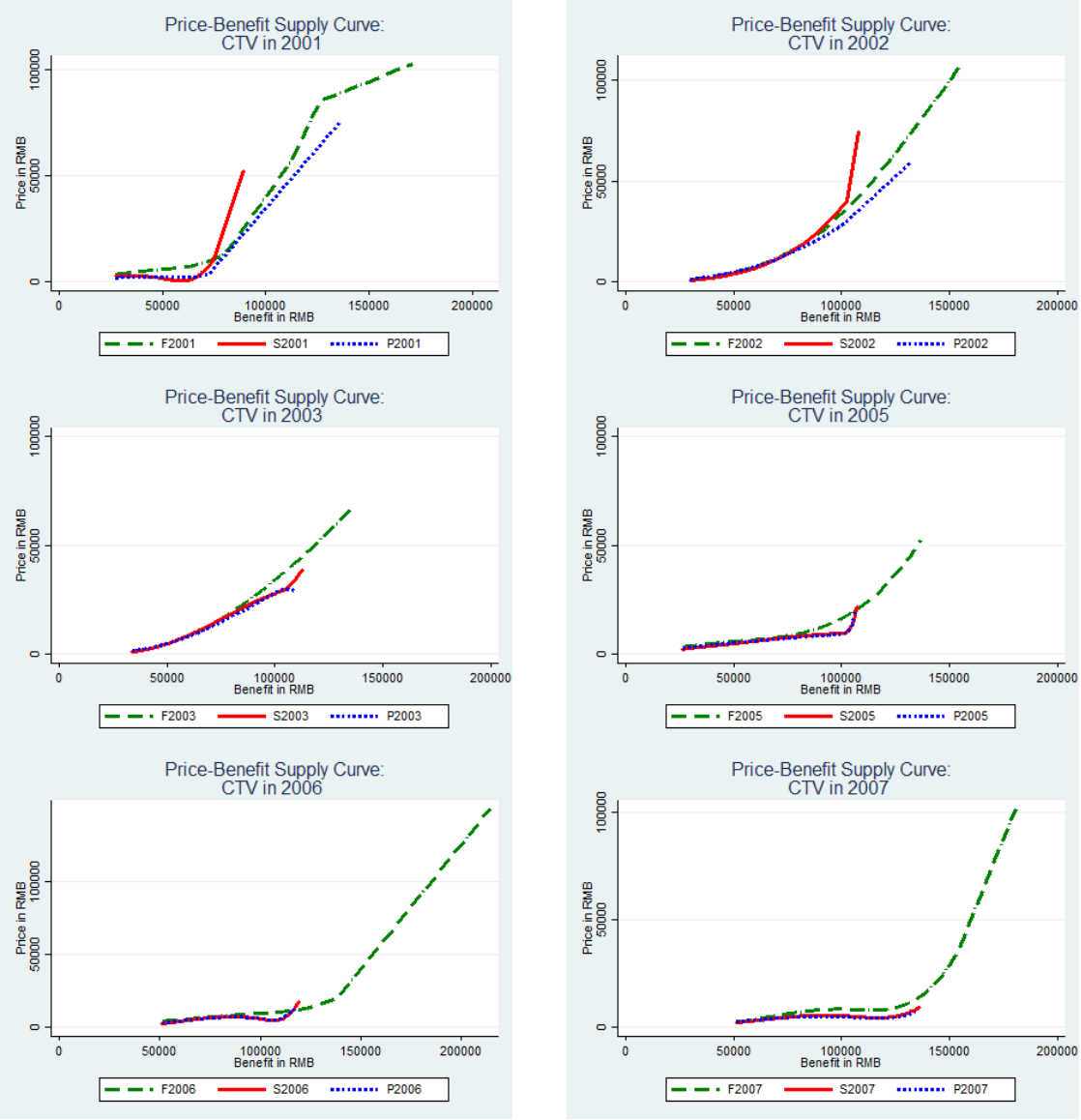
Figure 8: Price and Benefit Supply Curve by Ownership Type - Air Conditioner



Note: Red/Orange lines represent SOEs. Blue lines represent Private owned firms. Green lines represent Foreign Owned firms.

Source Author's estimation.

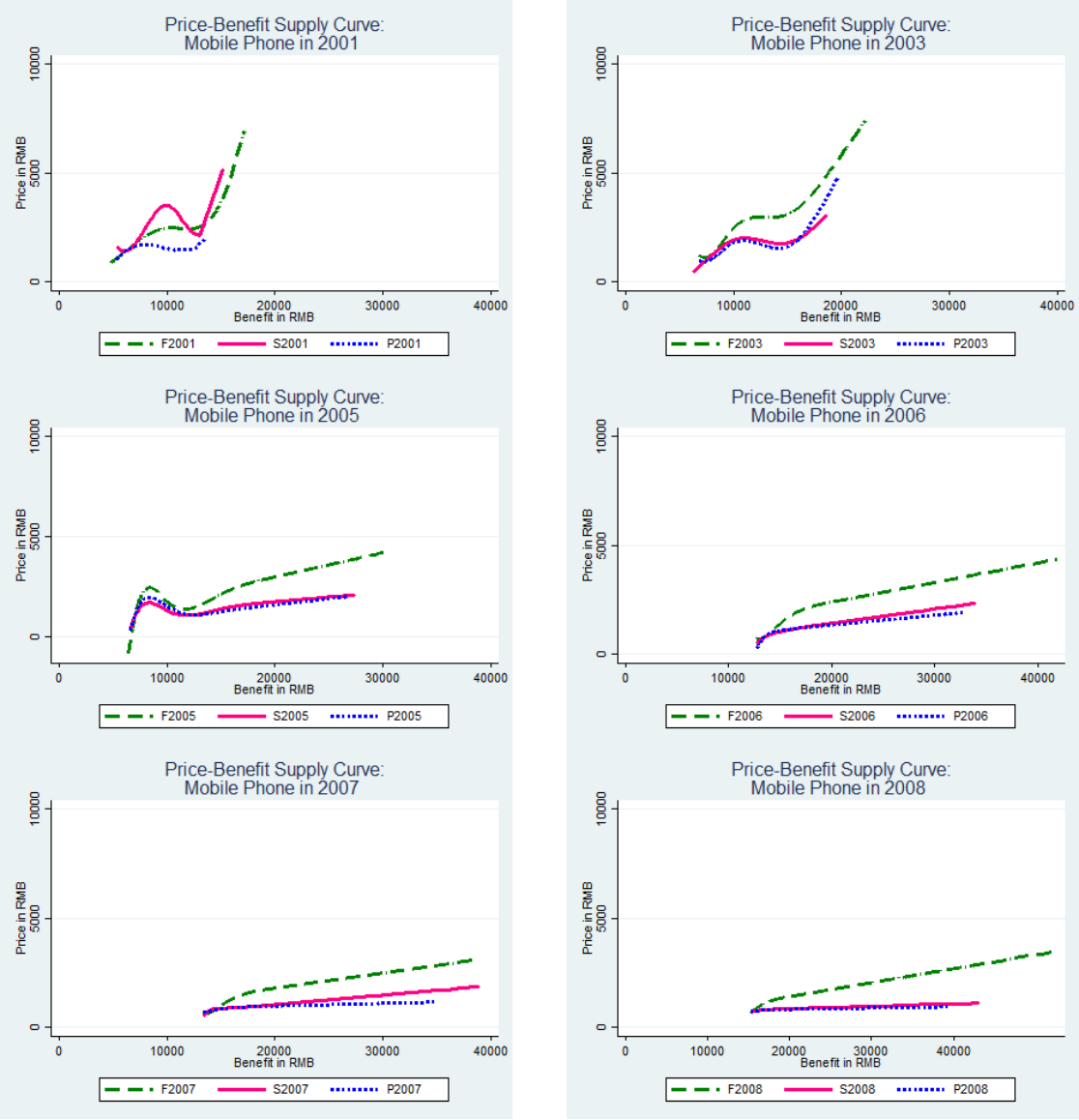
Figure 9: Price and Benefit Supply Curve by Ownership Types - Color TV



Note: Red/Orage lines represent SOEs. Blue lines represent Private owned firms. Green lines represent Foreign Owned firms.

Source Author's estimation.

Figure 10: Price and Benefit Supply Curve by ownership - Mobile Phone



Note: Red/Orange lines represent SOEs. Blue lines represent Private owned firms. Green lines represent foreign-owned firms.

Source Author's estimation.

Figure 11: Price Benefit Supply Curve (Structural form) - CTV market

	(1) Hard Constraint OLS ln $price_{constraint}$	(2) Soft budget constraint OLS ln $price_{softbudget}$
ln $benefit_{own}$	4.527***	6.354***
	(0.000)	(0.000)
ln $benefit_{others}$	-3.995***	-6.127***
	(0.000)	(0.000)
ln $mc_{softbudget}$	0.097	0.277***
	(0.163)	(0.000)
ln $mc_{constraint}$	0.308***	0.016
	(0.000)	(0.609)
ln $debt_{own}$		-0.047***
		(0.000)
ln $debt_{rivals}$	0.076	
	(0.496)	
constant	-3.466	4.589***
	(0.264)	(0.000)
City Dummies	+	+
Year Dummies	+	+
Brand Dummies	+	+
N	5734	6377
R^2	0.709	0.709

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(Note) Marginal costs (mc) are computed from the equation: $p_{jt} - mc_{jt} = -q_{jt}\frac{\partial p_{jt}}{\partial q_{jt}}$ $\frac{\partial p_{jt}}{\partial q_{jt}}$ is estimated from demand estimates in previous setion.

References

[1] Ackerberg, Daniel A. and Gregory S. Crawford (2009), "Estimating Price Elasticities in Differentiated Product Demand Models with Endogenous Characteristics," mimeo, 2009.

[2] Besanko, David et.al (2010), *Economics of Strategy*, 6th edition, Wiley. (Japanese version, Besanko et.al 2002 is translated from the 2nd edition.)

[3] Berry, Steven (1994) "Estimating Discrete-Choice Models of Product Differentiation" *Rand Journal of Economics*, 25 (2) 242-262

[4] Berry, Steven, James Levinson Ariel Pakes (1995) "Automobile Prices in Market Equilibrium" *Econometrica*, 63 (4): 841-890.

[5] Cheng, Thomas (2015) "Competitive Neutrality from Asian Perspective" ROUNDTABLE ON COMPETITION NEUTRALITY at OECD, 16-18 June 2015

[6] Capobianco, A. and H. Christiansen (2011), "Competitive Neutrality and State-Owned Enterprises: Challenges and Policy Options", OECD Corporate Governance Working Papers, No. 1, OECD Publishing. http://dx.doi.org/10.1787/5kg9xfgjdhg6-en

[7] De Fraja, Giovanni and Flavio Delbono(1990), "Game Theoretic Models of Mixed Oligoply", Journal of Economics Survey, Wiley, Volume 4, Issue 1, pp 1–17, March 1990

[8] De Fraja, Giovanni (2009) "Mixed Oligopoly: Old and New," Working Paper No.09/20, University of Leicester, Department of Economics

[9] Fjell, Kenneth and Debasis Pal (1996) "A Mixed Oligopoly in the Presence of Foreign

Private Firms" The Canadian Journal of Economics / Revue canadienne d'Economique Vol. 29, No. 3 (Aug., 1996), pp. 737-743

[10] Ghosh, A., et al. (2015). "Privatization, Underpricing, and Welfare in the Presence of Foreign Competition." Journal of Public Economic Theory 17(3): 433-460.

[11] Grigolon, Laura and Franc Verboven (2011) " Nested logit or random coefficient logit? A comparison of alternative discrete choice models of product differentiation" Center for Economic Studies, Discussion Paper Series 11-24.

[12] Hausman, J. (1996) " Valuation of New Goods under Perfect and Imperfect Competition, " in *The Economics of New Goods*, ed. by T. Bresnahan, and R. Gordon. University of Chicago Press.

[13] Hotelling

[14] Ivaldi and Frank Vanboven (2005), "Quantifying the effects from horizontal mergers in European competition policy" *International Journal of Industrial Organization* 23 (2005) 669-691.

[15] Kawashima, Fujio (2015) "On Market Competition Neutrality" RIETI Discussion Paper.

[16] Luts, Stefani and Mario Pezzino (2010) " Mixed Oligopoly, Vertical Product Differentiation and Fixed Quality Dependent Costs, " Working Paper Series, International Center for Economic Research.

[17] Matsumura, T. and N. Matsushima (2004). "Endogenous Cost Differentials between Public and Private Enterprises: A Mixed Duopoly Approach." Economica 71(284): 671-688.

[18] Organization of Economic Cooperation and Development (OECD), t (2012), *Compet-*

itive Neutrality: Maintaining a level playing field between public and private business, OECD Publishing.

[19] Porter, M. E.(1980) *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York: Free Press, 1980. (Republished with a new introduction, 1998.)

[20] Train, Kenneth (2009),*Discrete Choice Methods with Simulation*, 2nd edition, 2009. Cambridge University Press.

[21] Unirele Institute of Economic Research, SOE report, 2012.

[22] UNCTAD Research Partnershi p Platform Publication Series " Competitive neutrality and its application in selected developing countries" Project Coordinator, Deborah Healey, UNITED NATIONS Geneva, 2014 *http* : *//unctad.org/en/PublicationsLibrary/ditcclpmisc*2014*d*1$_e$*n.pdf*

[23] Nevo, A. (2001): " Measuring Market Power in the Ready-To-Eat Cereal Industry, " *Econometrica*, 69(2), 307–342.'

[24] Verboven, Frank (1996). "International Price Discrimination in the European Car Market." RAND Journal of Economics 27(2).

[25] Watanabe, Mariko ed.(2014), *Disintegration of Production* Palgrave-McMillan.

[26] Watanabe, Mariko (2014), "Institution related to Corporate System"Katsuji Nakagane ed.,*How China Eonomy has changed? Evaluating Policy and Institution of Reform and Open Policy Era of China* (In Japanese) Kokusai-Shoin (publisher)

[27] Watanabe, Mariko (2015), "Estimating Competitive Advantages of SOEs and their rivals: A preliminary result," Journal of Chinese Economy and Management, 2015 June, Japan Association for Chinese Economy and Management, Vol. xx, No. x.

[28] Zhou, Qiren (2006) "Excess capacity problem only appears in the market where the governments heavily intervene' *The Economic Observer*, 29, April, 2006 (*http* : *//finance.sina.com.cn/review/*20060429/09432541373.*shtml*). In Chinese.

A Demand Estimation

A.1 Estimating Benefits of the Products

A theory behind my exercise is as follows: Consumers prefer more benefits and lower priced/cost products. At the same time, there is a trade-off between benefit and cost at a certain level of total utility. Figure A.1 indicates this indifferent relationship. [13] Consumers evaluate the products equivalently as long as configuration of benefit and price of the product remains along with indifference curve or left down the curve and will buy either of the products with the same probability.

Faced with this consumer's preference, supplier can take either of following two strategies. One is the "cost advantage strategy" whereby a manufacturer lists a product with lower cost maintaining the same level of benefit with their rivals. The other is the "benefit advantage strategies" whereby the manufacturers lists a product with greater benefits products whereby maintaining their price as the same level with their rivals. This is the familiar concept of generic competitive advantage strategies in business management studies(Porter(1980), Besanko, et.al (2010)).

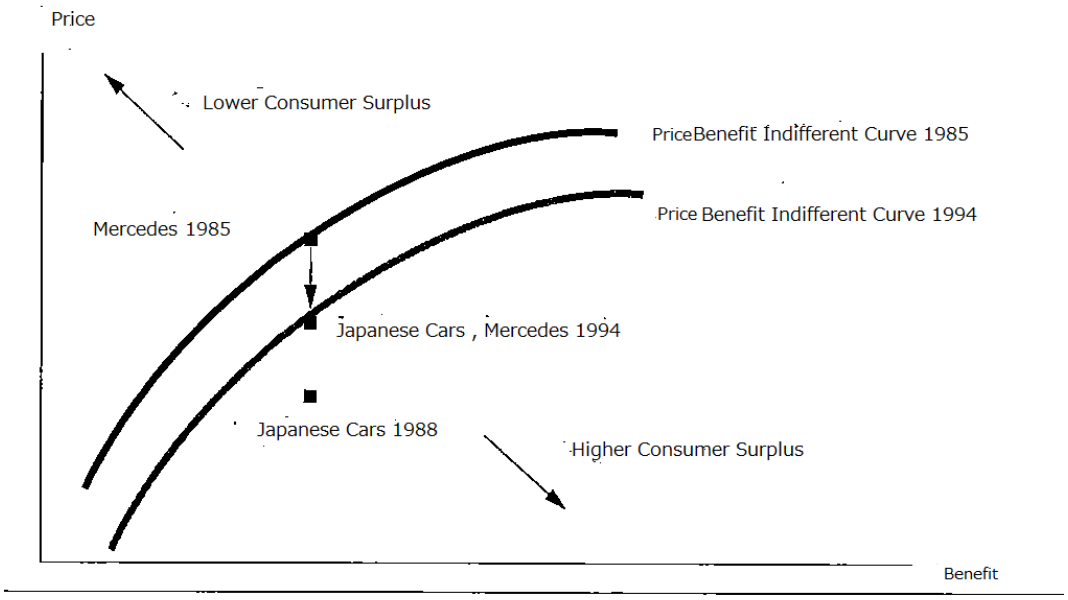
Once the price-benefit curve were depicted, we can identify where a brand's strategies locates. When the curve is going to be depicted, we need to get the data of benefit. I use estimated utility from the product as the benefit of transaction that explained below.

When a products are traded, the product that are generating a benefit B that was valued by a consumer/buyer. The net value or social welfare[14] of an economic transaction is defined as a difference between a benefit B of product j for consumer i, and its production

[13] In 1985, Mercedes' products stayed on the cost benefit indifference curve 1985. In 1988, Japanese cars appeared on the point that named Japanese Cars 1988. The positioning of the Japanese cars product 1988 is far superior to Mercedes 1985 in terms of consumer welfare: Japanese cars in 1988 is much cheaper and better in quality than Mercedes then. In 1994, Mercedes recovered their positioning which is equivalent to Japanese cars in terms of consumer surplus. As is seen in this story of Mercedes positioning, utility of consumer remains the same on the bold line in Figure A.1 for Japanese cars and Mercedes, but configuration of price and benefit changes along the line.

[14] If the transaction generates positive or negative externality, we need to grasp its impact and we can explicitly describe them out in the model.

Figure A.1: Concept of Price and Benefit Indifference Curve



Source:Besanko, et.al (2002, Japanese edition), Figure 12.5

cost C. As long as $B - C$ is not smaller than zero, the business is viable. The larger the benefit of transaction, $B - C$, the larger is the contribution provided by the business to the society.

$$\begin{aligned} Value\ of\ transaction &= (B - P) + (P - C) \\ &= B - C \end{aligned}$$

Value of the transaction are divided between the consumer and producer: Consumers/buyer receives a fraction as much as $B - P$. This is called consumer surplus. The seller receives another fraction of value as much as $P - C$, which is profit. Once we obtained the data of consumer surplus, $B - P$, we can quantitatively compare the size of welfare produced by particular type of sellers or products. Then, question remains as to how to obtain the benefit or consumer welfare? I obtained them by estimating demand function for the mar-

kets. Demand function induced from product choice model based on individual utility will be detailed in Section A.2.

Based on this estimated parameters of demand function for products supplied by manufacturers, I can depict price-benefit curves for the consumers.

A.2 Estimation model of demand

Here, I develop a model for demand estimation. Consumer demand is modeled using a discrete-choice formulation. This model describes a process that consumer will choose a product according to the size of the utilities. On the supply side, I assume competition between several brands in different geographical markets at different timings.

A.2.1 Utility and Demand

First, I describe the utility of consumer i that consists of the benefit product j. Consumers chose a brand j in a given market (=city and year, here) to maximize their utility. I view a product as a particular brand sold in a city market $m = 1, 2, ...M$.(I delete m hereafter simply for the reader's convenience). The indirect utility U_{ijt} of consumer i from purchasing brand $j = 1, 2, ...J$ at time $t = 1, 2, ...T$ is,

$$u_{ijt} = -\alpha_i p_{jt} + \beta X_{jt} + \xi_{jt} + \epsilon_{ijt}. \tag{12}$$

p_{jt} denotes price of brand j at market m in time t. Other factors affect product choice, such as the features of product x_{jt}. ξ_{jt} is a product-market specific unobservable. ϵ_{ijt} is the random unobservable error. To predict consumer surplus as much as appropriately, we need capture difference of elasticity of price to the same product by attributes of consumers. We need some random coefficient of the price. The random coefficients of price in this paper are defined as $\alpha_i = \alpha/Y_i$, whereas Y_{it} is the observed income[15].

[15]I used average income of each city-year segments in this paper because we do not have data of individual income. That means $Y_i = Y_{mt} = \sum Y_i/I_{mt}$ and $\alpha_i = \alpha_{mt} = \alpha/Y_{mt}$. I_{mt} is population at market m and

Mean utility of product[16] j can be rewritten as,

$$\delta_{jt} = -\alpha_i p_{jt} + \beta X_{jt} + \xi_{jt}, \tag{13}$$

where ξ_{jt} represents unobservable and time specific characteristics. Each consumer i in market m will choose product j to maximize her utility. Therefore, the aggregate market share for product j in market m is the probability that product j yields the highest utility across all products including outside goods 0. Therefore, the predicted market share of product $j = 1, ...J$, s_j is a function of mean utility δ_{jt} and parameter vector $\theta = (\alpha, \beta, \rho$[17]). If the unobserved error, ϵ_{ijt} in the equation (12) follows i.i.d. extreme value, this relationship can be rewritten as a logit choice probability(see Train (2009)) as below.

$$\begin{aligned} P_{jt} &= s_{jt}(\delta_{jt}, \theta) \\ &= \frac{e^{u_{jt}}}{\sum_k e^{u_{kt}}} \\ &= \frac{e^{-\alpha_i p_{jt} + \beta X_{jt} + \xi_{jt} + \epsilon_{ijt}.}}{1 + \sum_k e^{-\alpha_i p_{kt} + \beta X_{kt} + \xi_{kt} + \epsilon_{ikt}}} \end{aligned} \tag{14}$$

Here, 1 in denominator in equation (14) represents value of outside option, because $exp(u_0) = exp(0) = 1$. Remaining variables in the denominator is sum of exponential utilities of all of the choices in every market.

Under this logit assumption, consumer surplus CS_i for consumer i, previously indicated by $B - P$, takes the following closed format.

$$E(CS_i) = \frac{1}{\alpha_i} E[Max(u_{jt})] \tag{15}$$

The expectation is over all possible values of error ϵ_{ijt}. Here, expected consumer surplus

time t in this paper.

[16]Because this is the mean of utility, unobserved independent error ξ_{jt} in equation (12) can be regarded as zero.

[17]ρ is the nesting parameter that explained later referring to equation (21)

for individual i or product j can be written as follows.

$$E(CS_i) = \frac{1}{\alpha_i} ln(\sum_{j=1}^{J} e^{u_{ijt}}) + C.^{18} \tag{16}$$

$$E(CS_j) = \sum_{i=1}^{I} \frac{1}{\alpha_i} ln(e^{u_{ijt}}) + C \tag{17}$$

Absolute value of consumer surplus is meaningless because of the unknown C. But the difference between several states of consumer surplus as a figure generated from the structure. This paper focused on difference between two different agents, for example, agent h or ownership type h comparing to agent k or ownership type k, difference of sum of consumer surplus of products supplied by firm k and firm h. This can be written as follows:

$$\Delta CS_{hk} = [\sum_{j=1}^{J|h} \frac{1}{\alpha_i} ln(e^{u_{ijt}}) - \sum_{j=1}^{J|h} \frac{1}{\alpha_i} ln(e^{u_{ijt}})] \tag{18}$$

Once you obtained CS_j for product j from above estimates, we can compute the value of benefit of product j, B_{jt}.

$$Benefit_j = CS_j + Price_j \tag{19}$$

Here, we can see the relative size of benefits of the product following the same way as we can do for consumer surplus.

A.2.2 Nested Logit Model and Identification

The logit-based utility model provides an estimating equation of utility in the following form (see Train(2009) for an explicit explanation.). Based on the model, I estimate the demand parameters following Berry (1994) and Nevo (2000) and other BLP literatures.

Our estimation equation is,

$$ln(s_{jt}) - ln(s_{ot}) = -\alpha_i p_{jt} + \beta X_{jt} + \rho ln(s_j t|g) + \xi_{jt}. \tag{20}$$

Here, I set the outside option as a difference between population and total number of air conditioner for individual market and year that represents number of potential buyer of the products. $s_{jt|g}$ is the share of product j withing group g.

The parameters of this demand can be identified as the previous empirical industrial organization literatures claimed (see Ackerberg and Crawford (2009)). Identification of price parameters, which is critical for our benefit computing, relies on the fact that the unobserved determinants of demand are uncorrelated with input prices. To account for this potential endogeneity of prices that may be caused by the presence of changes in unobserved attributes, we use the GMM estimator with either type of instruments variables discussed in Section A.4.

To account for the degree of preference correlation between products of the same group, I imposed a further assumption on the error term, ϵ_{ijt} of equation (12).

$$\epsilon_{ijt} = \rho\eta_{igt} + \bar{\epsilon_{ijt}} \tag{21}$$

ρ is a "nesting parameter" , $0 \leq \rho \leq 1$ that captures the correlation between preference and product characteristics. $\bar{\epsilon_{ijt}}$ is independently distributed error for consumer, product and timing.

When demand function parameters estimated based on the nested logit model, consumer surplus will be computed as follows (see Ivaldi and Verboven[2005:677]).

$$E(CS_i) = \frac{1}{\alpha_i} ln(1 + \sum_{j=1}^{J} D_g^{1-\rho}) + C. \tag{22}$$

$$D_g = \sum_{k=1}^{G_g} exp(\delta_{jt}/(1-\rho)) \tag{23}$$

A.3 Data

I use the market survey data of GfK market services for the three industries: air conditioner, color TV and mobile phone. Sales value and number of units for individual model categories are available for each top 10 brands and others for several features of the products for 30 cities in China. The features of the products are as follows: Air conditioners are divided by (1) horsepower (1 HP, 1 to 2 HP and 2 HP and above) (2) grades of the energy efficiency labels, and (3) types of installment, (4) whether inverter controlled or not. Color TV data are divided by (1) types of panels (CRT, LCD, PDP) , (2) screen size (21 inches and below, 21 to 32 inches, 32 inches and over). Mobile phones are divided by (1) types of networks (CDMA, GSM, TDS-CDMA), (2) types of operation system (no OS installed, Linux, Symbian, Windows Mobile and others) (3) Number of colors in the panel, and (4) Camera is installed or not.

Regarding the air conditioner data, the data on sales and information related to energy consumption begins with the year 2008 and is obtained from the GfK market auditing data. Data for power consumption are not available directly from this data base. Hence, I supplemented the power consumption information from the catalog data on e-commerce site, SOHU.

A.4 Instruments

The estimation of the models I employed here is typically done using IV or GMM using instruments for p_{jt} and nested variables. Instruments z_{jt} that are correlated to p_{jt} but are independent to $\bar{\epsilon}_{ijt}$ or ϵ_{ijt} . In this case, candidates of instruments here mainly come from following four sources: (1) cost shifters; fees of electricity etc. (2) price of the same products of the same brand in other city. Here, we need to assume that difference of

prices of the same products across cities only reflects demand factors, and that the price of other city of the same products are correlated with price via only cost factors. (Berry, Levinson and Pakes, 1995 (BLP paper) , Hausman, 1996. Nevo, 2001). (3) Price of the same type of products by competitor brands in a same city (Berry, Levinson and Pakes, 1995) (4) characteristics of products; it is natural to assume that characteristics of products are designed and planned in advance, before the price is fixed. Exploiting this natural assumption, we use the characteristics of products as instruments that predetermined to the price. Either of four types of instruments were tried; (i) The first type of "quality" dummies are sum of index of characteristics within the own brand, such as capacity of air conditioners or size of visual panels of color television. (ii) The second type of this category's IV is sum of the characteristics of other products of rival firms, and (iii) the third one is sum of the characteristics of other products of own firms (see Grigolon and Verboven (2011) Verboven (1996)). (iv) The fourth is the average index of the characteristics of a competitor.

The Hausman instrument approach ((2)) relies on the assumption that prices in two different markets be correlated via common cost shocks and not via common demand side shocks such as nationwide demand shock. If a situation such as particular two markets' demand shrink a certain common shock occurring when shrinkage in demand tales place between two particular markets, the instruments are invalid[19]. However, in our estimation case, this IV works effectively[20].

[19]The Herfindahl-Hirschman Index, HHI, that is computed by the data of the three markets shows high competition mode. It clearly denied a monopolistic environment.

[20]GMM c-statistics of demand estimates results in Figures B.1(GMM c-statistics 1.185 and p=0.2763), Figures B.2 (GMM c-statistics is 3.05299 (p = 0.2173)) and B.3 (GMM c-statistics is 1.6e-07 (p = 1.0000)) show that the IV were confirmed as exogenous to our demand.

B Estimated Demand and Market Outcome

B.1 Estimated Parameters

Estimated demand parameters are presented in Figures B.1, B.2 and B.3. The CTV and mobile phone markets demands are estimated with nested logit model and air conditioner market demand is estimated with a logit model. For the all three markets, it is confirmed that the instrument variables used were exogenous to price variation. Nesting parameters in the color TV and mobile phone market indicates that color TV market is homogenized (ρ= 0.995), whereas mobile phone market is more differentiated (ρ=0.245). For the air conditioner markets, I could not find effective instruments variables for the nested logit model, but could find appropriate IVs for the logit specification.

Figure B.1: Demand Estimates:Air Conditioner

	(1) $ln(s_j) - ln(s_o)$
price/wage	-5.496***
	(0.431)
cooling capacity	0.0001***
	(0.000)
power consumption capacity	-0.0004***
	(0.000)
HP: 1 to 2	0.544***
(Reference=1HP below)	(0.124)
HP: 2 and over	0.476***
	(0.090)
Label Introduced	0
Introduced X Label 1	4.816***
	(0.125)
Introduced X Label 2	-1.844***
	(0.056)
Introduced X Label 3	-1.052***
	(0.047)
Introduced X Label 4	-0.522***
	(0.041)
Inverter Introduced	-0.983***
	(0.041)
Non Inverter Period	0.000
	(.)
Installment: Stand Alone	0.0046
(Reference=Others)	(0.058)
Installment: Split	-3.137***
	(0.125)
Brand dummies	+
City dummies	+
Year dummies	+
Constant	-5.243***
	(0.247)
N	17914
R^2	0.487
$GMMcstatistics$	1.185
	$p = 0.2763$
IV	average cooling capacity of competing products
	sum of horse power of products of the same brand
	average horse power of own brand
	average horse power of rival brand
	price of other city of the same brand products, wage
	per capita space of living

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure B.2: Demand Estimates: CTV market

	(1) $ln(s_j) - ln(s_o)$
price/wage	-1.110***
	(0.060)
$\rho_{ctvtypes}$	0.995***
	(0.060)
CTV Type: LCD	-2.096***
(Reference= CRT)	(0.037)
CTV Type PDP	-3.356***
	(0.088)
Screen size: 21 to 32 inches	0.316***
(Reference= 21 inches and below)	(0.034)
Screen size: 32 inches and over	0.658***
	(0.059)
Year dummies	+
City dummies	+
Brand dummies	+
Constant	-2.432***
	(0.243)
N	12432
R^2	0.850
IV	average price of other markets of the same products by the same brand sum of the screen size among the same type products the same brand wage, population of other city

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: Author's Estimates

Figure B.3: Demand Estimates: Mobile phone market

	(1) $ln(s_j) - ln(s_o)$
price/wage	-6.422***
	(0.797)
ρ_{OS}	0.245**
	(0.106)
Network:GSM	1.669***
(Reference=CDMA)	(0.240)
Network: TDS-CDMA	0.823***
	(0.158)
Panel: Color	0.131***
(Reference= B&White)	(0.042)
No Camera	-0.562***
	(0.077)
OS:Others	-2.489***
(Reference=Linux)	(0.390)
OS: Symbian	0.410***
	(0.075)
OS Windows mobile	-0.170
	(0.153)
OS: No OS	1.940***
	(0.279)
Brand dummies	+
Year dummies	+
City dummies	+
Constant	-8.418***
	(0.461)
N	46741
R^2	0.598
IV	price in other markets of the same products by the same brand
	square of price in other markets of the same products by the same brand

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C Results of Reduced Form Estimation of Price Benefit Supply Curve

Figure C.1: Listed SOE's Price Benefit Supply Curve (Reduced Form) CTV market

	(1) OLS	(2) OLS	(3) OLS	(4) GMM
Private	3215.01***	0	0	0
	(0.000)	(.)	(.)	(.)
SOE	6846.73***	0	0	0
	(0.000)	(.)	(.)	(.)
benefit	1.05539***	0.86043***	0.85984***	0.85859***
	(0.000)	(0.000)	(0.000)	(0.000)
$Private \times benefit$	-0.069248***	0	0	0
	(0.000)	(.)	(.)	(.)
$SOE \times benefit$	-0.078118***	0	0	0
	(0.000)	(.)	(.)	(.)
$benefit^2$	-1.6809e-06***	-1.4054e-06***	-1.4044e-06***	-1.4022e-06***
	(0.000)	(0.000)	(0.000)	(0.000)
$Private \times benefit^2$	6.5774e-08	0	0	0
	(0.118)	(.)	(.)	(.)
$SOE \times benefit^2$	8.4946e-08**	0	0	0
	(0.011)	(.)	(.)	(.)
debt_total		-2.2137e-08	-2.2586e-08	-3.9581e-08**
		(0.106)	(0.140)	(0.015)
financial_cost			2.1897e-06**	7.7206e-06***
			(0.047)	(0.004)
operating_tax			6.9172e-06	0.000017897***
			(0.123)	(0.005)
marketing_cost			-1.1747e-07	-3.2572e-07***
			(0.154)	(0.009)
management_cost			-1.2729e-07	-9.5519e-08
			(0.123)	(0.249)
constant	-51227.7***	-39673.7***	-39808.4***	-39893.1***
	(0.000)	(0.000)	(0.000)	(0.000)
City Dummies	+	+	+	+
Year Dummies	+	+	+	+
Brand Dummies	+	+	+	+
N	11406	6724	6724	6724
R^2	0.781	0.684	0.684	0.683

P-value in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure C.2: Listed SOE's Price Benefit Supply Curve Estimates: Air conditioner market

	(1) OLS	(2) OLS	(3) OLS	(4) GMM
Private	-138.648	0	0	0
	(0.594)	(.)	(.)	(.)
SOE	-1111.59***	0	0	0
	(0.000)	(.)	(.)	(.)
benefit	0.70127***	0.95465***	0.96415***	0.95272***
	(0.000)	(0.000)	(0.000)	(0.000)
Priate X benefit	0.018613	-0.41127***	-0.43382***	-0.42076***
	(0.721)	(0.000)	(0.000)	(0.000)
SOE X benefit	0.28458***	0	0	0
	(0.000)	(.)	(.)	(.)
$benefit^2$	8.1643e-06***	-0.000011399***	-0.000011949***	-0.000011258***
	(0.000)	(0.000)	(0.000)	(0.000)
Private X $benefit^2$	-7.0168e-06*	0.000028382***	0.000029532***	0.000029034***
	(0.056)	(0.000)	(0.000)	(0.000)
SOE X $benefit^2$	-0.000020670***	0	0	0
	(0.000)	(.)	(.)	(.)
debt_total		1.3473e-08***	-6.6514e-09	-5.2525e-09
		(0.000)	(0.283)	(0.820)
financial_cost			9.7814e-07***	8.4396e-07
			(0.000)	(0.673)
operating_tax			-3.1684e-07	-2.6654e-07
			(0.499)	(0.777)
marketing_cost			1.4798e-07***	1.4494e-07***
			(0.000)	(0.000)
management_cost			-2.0695e-08	-2.3661e-08
			(0.674)	(0.686)
constant	-6.97129	-906.748***	-1020.78***	-1005.66***
	(0.968)	(0.000)	(0.000)	(0.000)
City Dummies	+	+	+	+
Year Dummies	+	+	+	+
Brand Dummies	+	+	+	+
N	22308	13158	13158	13158
R^2	0.592	0.545	0.547	0.547

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure C.3: Listed SOE's Price Benefit Supply Curve Estimates: Mobile phone market

	(1) OLS	(2) OLS	(3) OLS	(4) GMM
Private	523.822***	0	0	0
	(0.001)	(.)	(.)	(.)
SOE	535.895***	0	0	0
	(0.001)	(.)	(.)	(.)
benefit	1.07683***	0.54672***	0.55009***	0.55439***
	(0.000)	(0.000)	(0.000)	(0.000)
Private X benefit	-0.026086	0.094058***	0.079277***	0.071988***
	(0.110)	(0.000)	(0.000)	(0.000)
SOE X benefit	-0.017103	0	0	0
	(0.208)	(.)	(.)	(.)
$benefit^2$	-0.000012319***	-7.4103e-06***	-7.5000e-06***	-7.5860e-06***
	(0.000)	(0.000)	(0.000)	(0.000)
Private X$benefit^2$	-7.0780e-07*	-3.2733e-06***	-2.8617e-06***	-2.6990e-06***
	(0.099)	(0.000)	(0.000)	(0.000)
SOE X $benefit^2$	5.7006e-08	0	0	0
	(0.883)	(.)	(.)	(.)
debt_total		-5.1677e-09**	1.6572e-09	2.8493e-09
		(0.014)	(0.478)	(0.230)
financial_cost			1.4784e-07	-7.1338e-07**
			(0.477)	(0.028)
operating_tax			-1.8722e-06***	-4.0129e-06***
			(0.010)	(0.000)
marketing_cost			4.9285e-08*	1.0762e-07***
			(0.072)	(0.001)
management_cost			-1.4395e-07***	-1.5814e-07***
			(0.001)	(0.000)
constant	-9464.13***	-3196.66***	-2812.70***	-2515.81***
	(0.000)	(0.000)	(0.000)	(0.000)
City Dummies	+	+	+	+
Year Dummies	+	+	+	+
Brand Dummies	+	+	+	+
N	22308	13158	13158	13158
R^2	0.592	0.545	0.547	0.547

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$