

**IMPACTS OF VERTICAL RESTRAINTS ON OUTPUT:
EVIDENCE FROM CHINA'S TOBACCO MARKET**

A Thesis

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by

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ABSTRACT

Tobacco industry has been playing a crucial role in China's national development in terms of both market performance and fiscal contribution. In this state-owned industry, state regulations affect the relationship between tobacco leaf farmers, cigarette manufacturers, wholesalers and retailers. In China, every stage of cigarette production is tightly regulated by the central government and its bureaus at different regional levels. State regulations governing the tobacco industry mandate that tobacco leaf production is restricted by national quota, wholesale and retail of cigarettes are under direct control of tobacco corporations and tax revenue is shared with various levels of government. The welfare consequences of these vertical restraints in China's tobacco market have been the subject of substantial analyses within economic and public health sectors. Theoretical studies suggest that the vertical monopolized structure of China's tobacco industry contributes to the high efficiency of the industry in generating income for the government, while also reduces competition, distorts resource allocation and results in the low market concentration. Empirical evidence is limited. This study analyzes the impacts of vertical restraints on the sales of cigarette, exploiting the discrepancies in local brand premium over time and across provinces. The results indicate that vertical restraints contribute to a segmented national market with strong home bias, where being a product under local brand could predict a 7 times larger market share in one province than products from other regions.

Keywords: Vertical restraints, Monopoly, Taxation, Quota allocation, Tobacco, Cigarette

BIOGRAPHICAL SKETCH

Boya Wang was born in China in 1992 and grew up in Taian, Shandong. She received her bachelor degree from the Department of Economics at The Chinese University of Hong Kong in 2014. After that, she started her Master's Degree at the Charles H. Dyson School of Applied Economics and Management at Cornell University. Her research focus during the graduate study is econometrics and quantitative analysis.

I would love to dedicate this thesis to my supportive advisors and beloved family.

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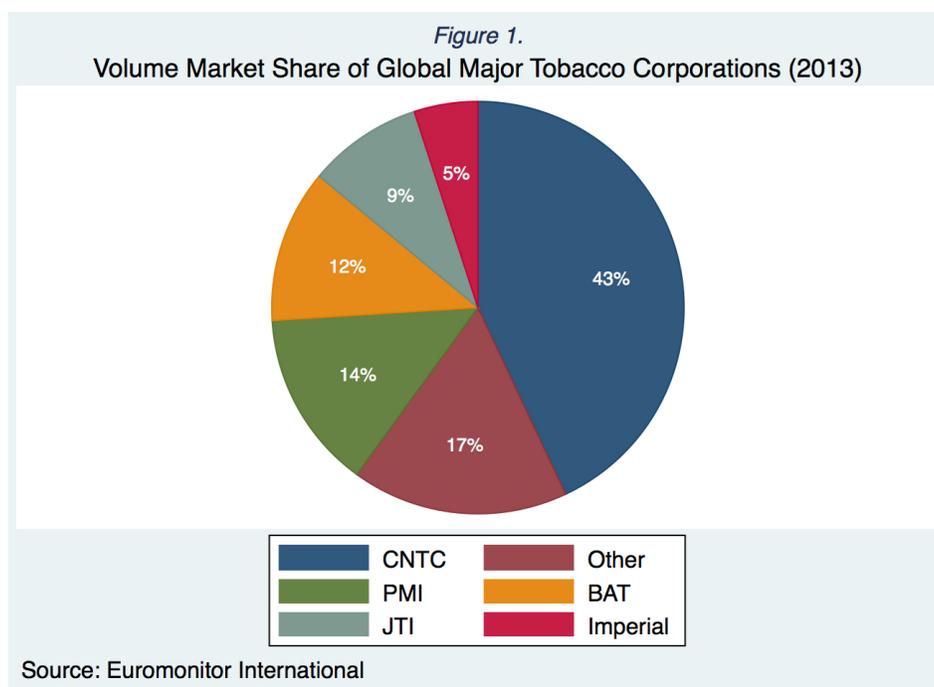
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CHPATER 1: INTRODUCTION

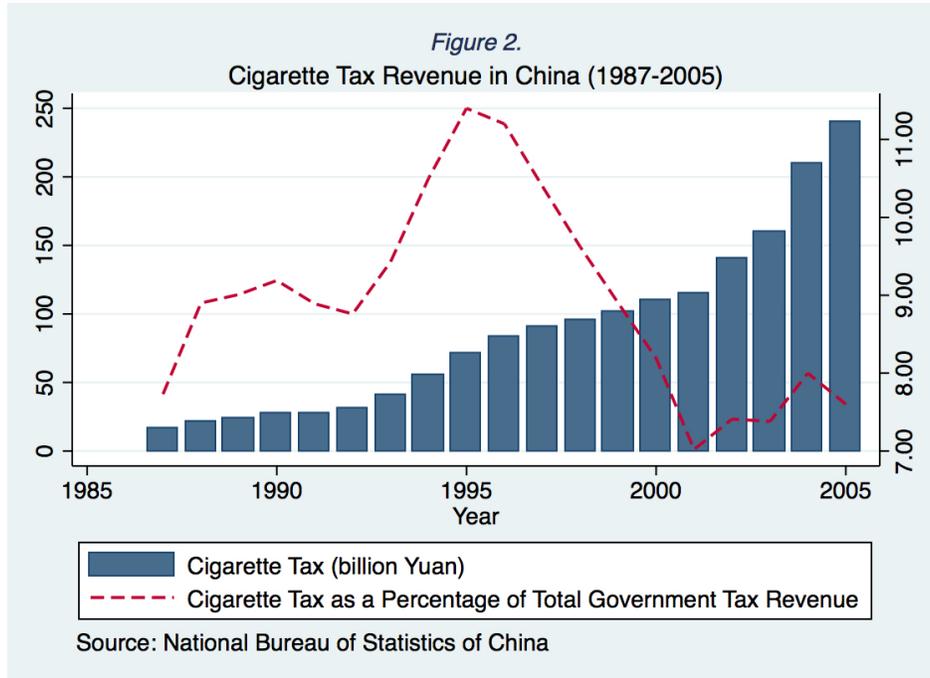
China has been occupying the first place in the world in terms of smoker population, level of tobacco leaf procurement, and level of cigarette production and sales since late 1990s. The huge domestic market has also impressed the world by its consistent growth. Between 2005 and 2010, it is reported that the total retail sales volume of cigarettes in China grew by 23%; the national retail sales value shot up by 76%, from RMB 522 billion (USD 77.1 billion) in 2005 to RMB 922.1 billion (USD 136.2 billion) in 2010 (“The Chinese Tobacco Market and Industry Profile”, 2012). The China National Tobacco Corporation (CNTC) serves the world largest tobacco market, producing more than 43% of cigarettes in the world by volume as of 2013 (*Figure 1*) (“The Global Cigarette Industry”, 2014). However, China’s cigarette products have been playing a weak role in the international market and the openness of the tobacco market in China has been relatively low. With strict import and export regulations in the tobacco and cigarette market in China, nearly 98% of all the cigarette products sold in China are produced domestically, while only about 1% of the total cigarette production of CNTC are exported and available on the international market¹ (Euromonitor International, 2011).

¹ In 2010, CNTC exported about 19 billion cigarettes; among the 19 billion sticks, 6.4 billion sticks were exported by Shanghai Tobacco Group, representing more than 30% of all Chinese cigarettes exported.

² In China, cigarette manufactures are under the direct control of provincial tobacco corporations, and each cigarette manufacture produces a combination of different brands. Explicitly, the local brands for Anhui are those produced



The healthy growth of China’s tobacco industry is of great political significance. Since 1987, the proportion of annual fiscal income contributed by profit and tax of the tobacco industry has been greater than 7%, ranking the top among all the industries in China. The percentage even reached 11% in mid 1990s (*Figure 2*). More remarkably, even though the sales volume of cigarettes in China was stable from 1995 to 2000 (Zhang, 2005), the profit and tax generated by tobacco industry increased by about 55%, indicating a high fiscal efficiency of China’s tobacco industry. Recent performance of the industry in generating tax and profit has become more impressive. From a report published on China Daily, in 2011, CNTC generated over RMB 752.96 billion (USD 119 billion) in taxes, up 22.5% year-on-year from 2010; the profit retained by the industry reached RMB 600.12 billion, or USD 94.3 billion, representing a 22.8% increase from 2010 (“China tobacco industry pays 735b yuan in taxes in ‘11”, 2012).



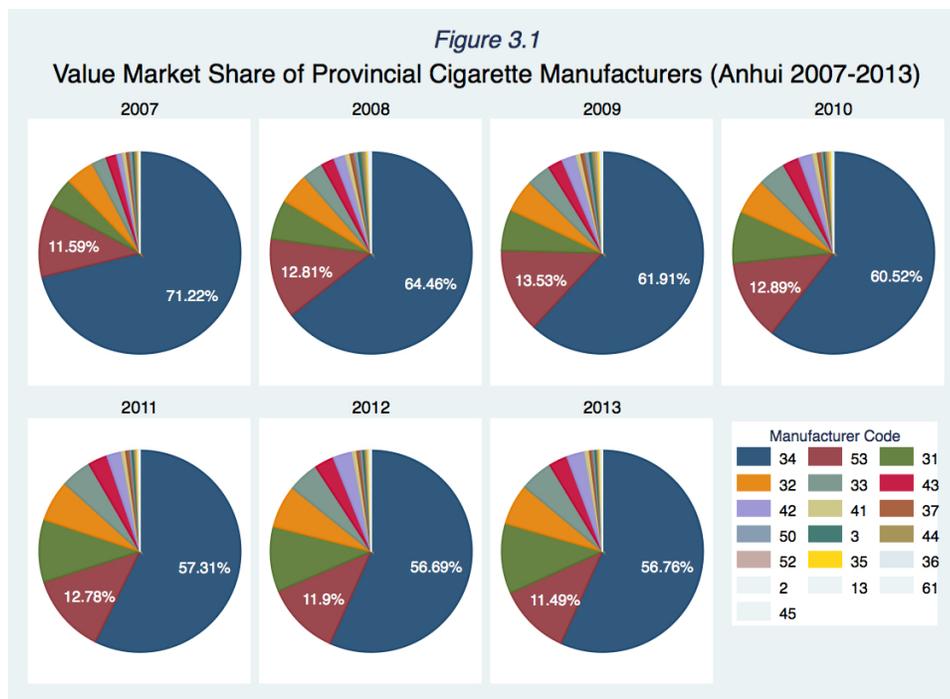
There has been substantial literature studying into the competitive implications of the high efficiency of China’s tobacco industry in generating fiscal income. Argument goes that the fiscal efficiency is achieved at the expense of market efficiency, as a result of the vertically restrained monopoly structure of China’s tobacco industry (Zhang, 2005; Hu, Mao, Shi, & Chen, 2008; Wang, 2009; Su, Xie, & Yang, 2013). In reality, the prosperous industry has been threatened by a number of challenges, especially after China joining WTO in 2001 and getting more involved into the global market. First of all, tobacco market in China is still underdeveloped, which is revealed by the low market concentration in the industry and low scale competitiveness of cigarette manufacturers (Zhang, Ji, Su, & Gao, 2013). In China, the national corporation CNTC runs more than 160 cigarette brands, manufactured in about 100 factories across the country. Within the tobacco industry, there are around 200 industrial enterprises (including regional

tobacco corporations and local tobacco groups) and more than 2,000 commercial entities at different levels. The four-firm concentration ratio (CR4) of China's tobacco industry has been below 0.35, while in mature oligarch monopoly market such as the United States, Great Britain and Japan, the number has been around 0.95. The low market concentration and dispersed operations have been the major obstacle of the achievement of scale economy in China's tobacco industry, making Chinese tobacco enterprises less competitive in the global market.

Secondly, as there have been strict restrictions on the import and export of tobacco leaf and cigarette products in China, the world's largest consumer and producer of cigarette have been playing a weak role in the global market. The total import and export of tobacco leaf in China has been smaller than 5% of tobacco leaf cultivated and procured domestically, and the import and export of cigarette products has been around only 1% of the total domestic production. The low presence of China in the global tobacco market is incommensurate to the huge domestic market; the development of the tobacco industry in China is driven mainly by the domestic consumption and there is still a large gap for China to get merged into the global market.

Last but not the least, China's tobacco industry has a unique characteristic that commercial activities are carried out at province-level and there are strong regional blockades in the tobacco and cigarette market. The regional blockade in China's tobacco market is formed by the efforts from provincial tobacco corporations in promoting local cigarette products and setting trade barriers against rival brands from other regions, which together have contributed to the strong and persistent dominance of local brands in cigarette-manufacturing provinces. *Figure 3* shows

the evolution of market share in three cigarette-manufacturing provinces/city in China from 2007 to 2013, where Anhui (province code 34) is an average province in China, Yunnan (province code 53) is one of the major tobacco leaf producers and cigarette manufacturers, and Shanghai (city code 31) is the largest metropolitan city with relatively high market openness. In all of the three regions, local brands² have been dominating the market while cigarette products produced by other regions have much weaker performance and smaller market share.



² In China, cigarette manufactures are under the direct control of provincial tobacco corporations, and each cigarette manufacture produces a combination of different brands. Explicitly, the local brands for Anhui are those produced by China Tobacco Anhui Industrial Co., Ltd. and the local brands for Shanghai are those produced by Shanghai Tobacco Group. Chapter 2 provides a more specific description about the organizational structure of China's tobacco industry.

Figure 3.2
Value Market Share of Provincial Cigarette Manufacturers (Yunnan 2007-2013)

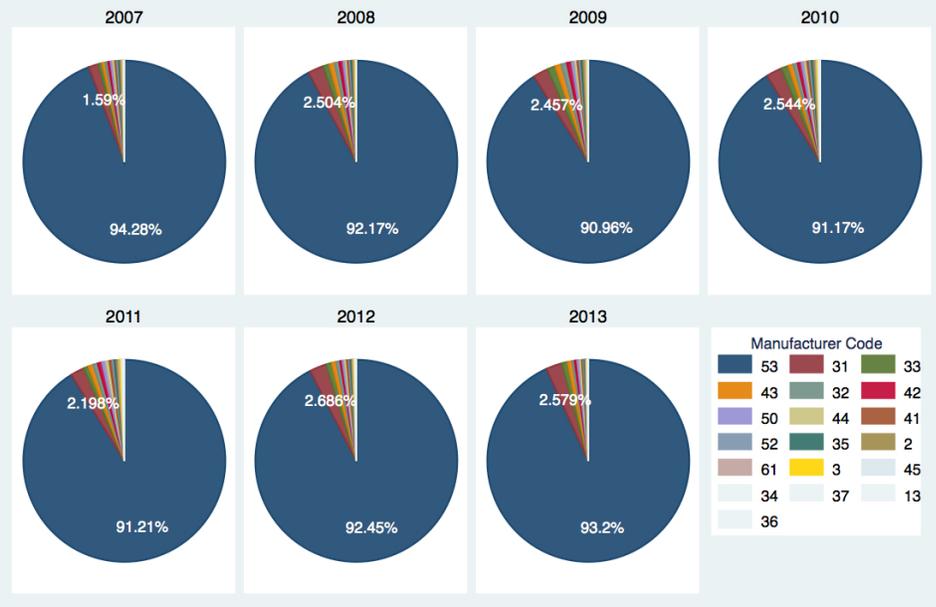
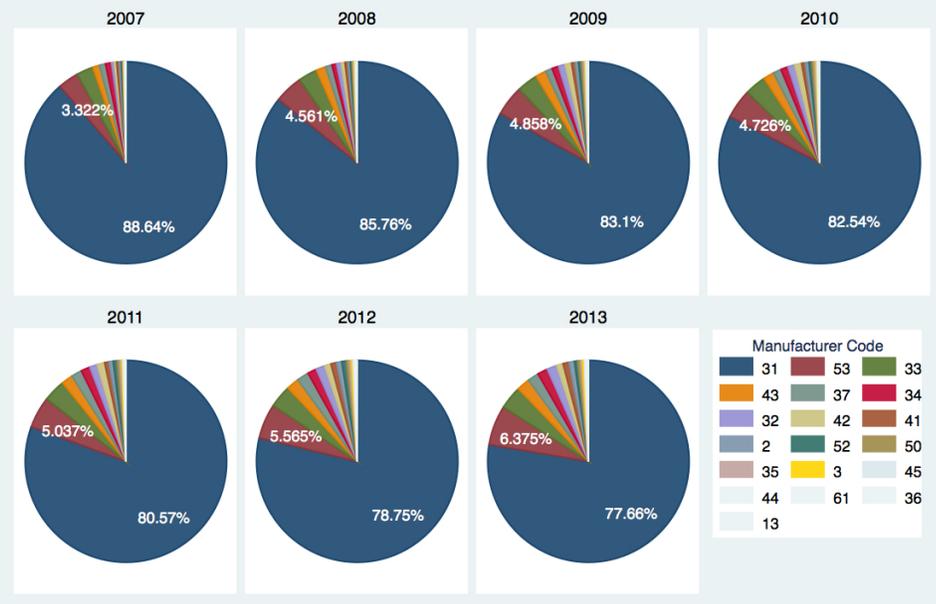


Figure 3.3
Value Market Share of Provincial Cigarette Manufacturers (Shanghai 2007-2013)



All of the above problems faced by China's tobacco industry could be attributed to the special vertically restrained structure in China's tobacco and cigarette market. There is little evidence of the competitive impacts of the vertical restraints in China's tobacco market. However, there is ample literature involving allegations that the taxation system and monopolized administrative structure of China's tobacco industry are key contributors to the market inefficiency. Econometrically identifying the effects of vertical restraints is difficult, as we could not observe the world without the restraints. In this study, I exploit variations in the market share of different products across provinces and estimate the effects of being a local brand on market share. More specifically, I observe annual market share of around 900 products across 31 retail localities from 2007 to 2013, and focus on the discrepancies in the market share of different products.

In Chapter 2, I summarize the economic literature on how vertical restraints work in China's tobacco market, emphasizing on the interplay of taxation system and administrative structure of the industry, and provide a discussion on the policy changes in China's tobacco industry. Chapter 3 presents my data, methodology and results. Chapter 4 discusses the results and addresses some drawbacks. Chapter 5 concludes, discusses future works and potential policy implications of my findings.

CHAPTER 2: THE ECONOMICS OF VERTICAL RESTRAINTS IN CHINA'S

TOBACCO INDUSTRY

Overall, the tobacco industry in China is tightly regulated by the government through two organizational bodies within the state structure. The administrative bureau of the tobacco industry, State Tobacco Monopoly Administration (STMA), is responsible for framing tobacco-related standards and targets, monitoring the implementation of regulations and controlling the importation of cigarette products to protect domestic manufacturers. The state-owned monopoly, China National Tobacco Corporation (CNTC), implements policies enacted by STMA and controls commercial activities such as farming and procurement of tobacco leaf, and production, distribution, sales and marketing of cigarette products in various level of localities. Even though CNTC and STMA were intended to be two separate entities, they function as one organization in practice and perform as both the owner and the regulator of the tobacco industry (“The Chinese Tobacco Market and Industry Profile”, 2012; Liu, Rizzo, Sun, & Wu, 2014).

The state-owned monopoly regulates the tobacco market in a variety of ways. The major two arms that CNTC employs in regulating the national market are the tax-revenue-sharing mechanism and quota allocation system. The impacts of industrial regulations on cigarette sales depend crucially on the role that these regulations play in resolving the principal-agent problem between CNTC and provincial tobacco corporations. In China, the governance of CNTC has been divided into specific levels such as city, district and even county; thus, within the state

monopoly, there are numerous corporation branches competing with each other in terms of profit and tax revenue. The cost to align the interests of regional corporations with that of the state corporation has been the major cost of the state monopoly. To overcome the principal-agent problem, an incentive-compatible mechanism has been introduced in China's tobacco market.

Specifically, the mechanism combines taxation and quota allocation, where the central government utilizes the tax-revenue-sharing setting to align the interests of local tobacco corporations and central government in terms of tobacco leaf production and cigarette manufacturing, while uses the quota allocation system to introduce competition among provincial tobacco corporations and underpin the stability of tax revenue contributions from local governments. This mechanism guarantees the high efficiency of China's tobacco industry in generating fiscal income, while also contributes to regional blockade across provinces.

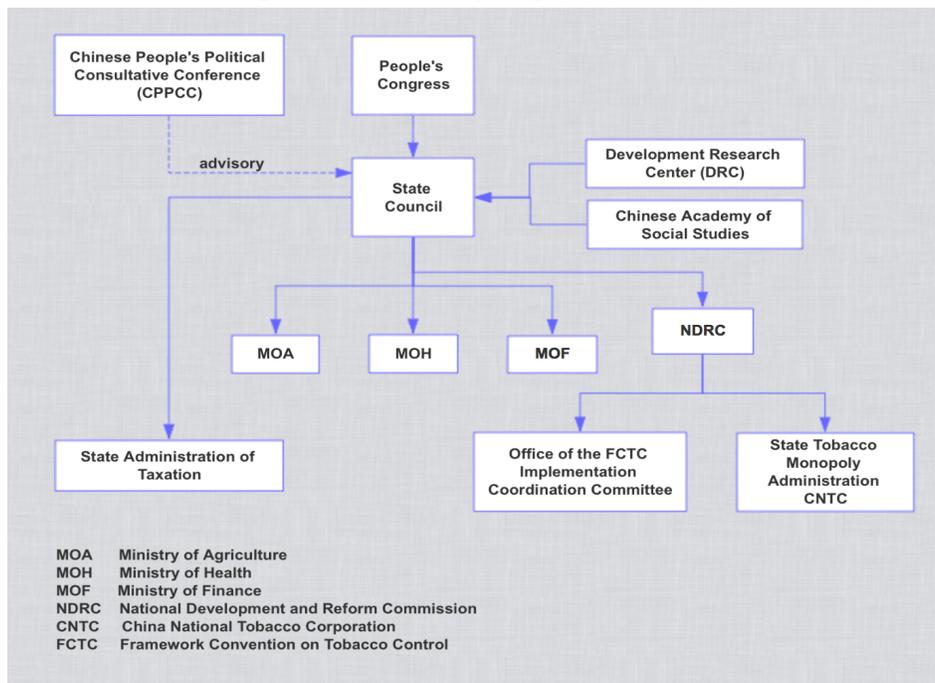
2.1 TAXATION SYSTEM

Tax-revenue sharing is the mechanism that central government employs to induce the efforts from local agents to promote local tobacco leaf cultivation and cigarette production, as the system allows local governments to internalize a fraction of the fruits of their efforts.

In China, a central government tax and a local government tax comprises the two-layer tax system. Under the State Council, there are two major government agencies in charge of tax administration, the Ministry of Finance (MOF) and the State Administration of Taxation (SAT). More specifically, the MOF is responsible for setting tax policy, distributing tax revenue to

government agencies and designing central and local government revenue-sharing, while the SAT is responsible for tax collection and regulations. *Figure 4* shows the tax policy legislation process in China, where the arrows indicate the command for policies and chain of decision-making. Within this system, MOP and SAT, which are responsible for tobacco tax formulation and collection, are completely independent from the tobacco industry regulators, CNTC and STMA.

Figure 4. Tax Policy Legislation Chart



Under the taxation system, majority of the taxes goes to the central government while revenue from some tax categories is shared with the local government. This revenue-sharing setting guarantees that the financial incentive of local government is aligned with that of the central government. Specifically in the tobacco industry, there are two levels of taxes collected

corresponding to the two stages of cigarette production, a tobacco leaf tax and a cigarette tax. Despite that tobacco leaf belongs to the category of agricultural commodity, the Ministry of Agricultural in China has no jurisdiction over the tobacco industry; instead, STMA and CNTC have full control over tobacco leaf production and cigarette manufacturing (Hu et al., 2008).

A discussion of the impacts of the taxation system on China's tobacco industry must begin with an understanding of the role that the points of tax collection plays in tax revenue-sharing. In China, the tobacco leaf tax is withheld by CNTC at the point of tobacco leaf procurement and the retained tax revenue is turned over to the local government. Under this setting, local government would be able to collect more tax revenue if it increases tobacco leaf production within the province. Thus, incentive is introduced for provincial government to cultivate more tobacco leaf at the local level.

The cigarette tax in China is a producer tax, which is valued at the producer level and levied on cigarette manufacturers (Hu & Mao, 2002). The state enterprise is directly responsible for the collection of tax revenue when the cigarette product is shipped to the market. Since 1994, a value-added tax has been collected at the cigarette manufacturing level and an additional cigarette tax, which is known as the consumption tax, has been levied at the wholesale level. In 2001, the MOF and SAT revised the cigarette consumption tax rate into two components: a specific excise tax and a producer price-based *ad valorem* tax³. In May 2009, the Chinese government announced another adjustment to the cigarette tax rate schedule and a new 5%

³ Producer price refers to the internal price that the distribution sector of CNTC pays to cigarette manufacturers.

excise tax was added for all cigarettes at the wholesale level (Liu et al., 2014). Since then, the cigarette tax system has become the combination of a producer value-added tax, a specific excise tax, an *ad valorem* tax and a wholesale tax. *Table 1* gives a summary of the tax structure and revenue beneficiaries in China's tobacco industry.

Table 1.
Tobacco Tax Structure in China

Type of Tax/Tax Base	Tax Rate	Revenue Beneficiary
1. Tobacco leaf tax (since 2006)	20%	100% local government
2. Value-added tax at cigarette manufacturers (since 1994)	17%	75% central government 25% local government
3. Consumption tax at wholesale level		
i) Specific excise tax (since 2001)	0.06 RMB/pack	100% central government
ii) <i>Ad valorem</i> tax (since 2009)		
- producer price per pack \geq 7 RMB	56%	100% central government
- producer price per pack $<$ 7 RMB	36%	
iii) Wholesale price tax (since 2009)	5%	100% central government

Economists studying the welfare implications of the taxation structure of China have consistently argued that the tax revenue-sharing system not only aligns the incentives of central and local governments in generating tax income, but also reduces market welfare and leads to market inefficiency. From *Table 1*, 100% of the tobacco leaf tax and 25% of the cigarette manufacturing tax are turned over to the local government, which means that local governments could gain more tax revenue by promoting tobacco leaf cultivation and cigarette production at local level (Hu, Mao, Ong, et al., 2006; Hu, Mao, Jiang, et al., 2007; Wang, 2009).

The efforts from provincial governments in promoting local production sometimes lead to market inefficiency, examples include subsidies from local government given to economically

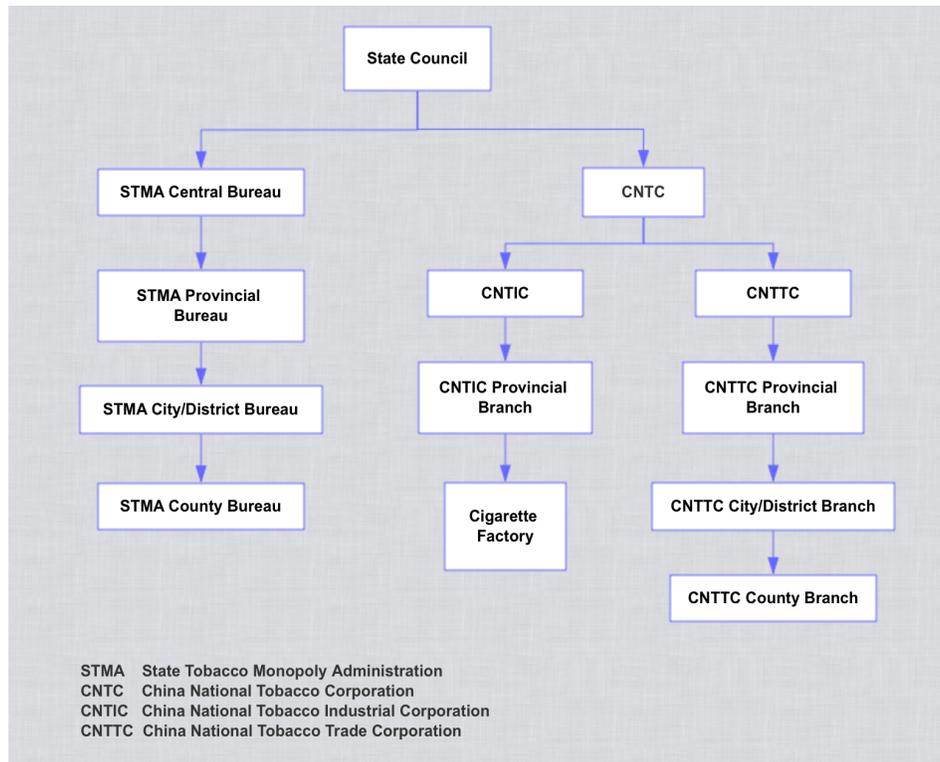
inefficient cigarette factories in overproduction of cigarette products for the sake of tax revenue, and trade barriers set by provincial tobacco corporations against cigarette products manufactured by other provinces (Hu, Mao, Shi, & Chen, 2008).

2.2 ORGANIZATIONAL STRUCTURE

As discussed before, the principal-agent problem between CNTC and provincial tobacco corporations has been pervasive in China's tobacco industry. In China, with the taxation system inducing efforts from regional corporations in promoting local productions, the institutional setting assures the achievement of central government tax, while at the same time contributes to regional blockade in the market.

Even though owned by the state, the tobacco industry in China runs its operations through various levels of government agencies. There are vertical bureaus formed under the STMA system that govern the tobacco market as a whole, and horizontal bureaus formed by provincial agencies of STMA and local government that manage tobacco operations in specific localities. The organizational structure of the China's tobacco industry is shown in *Figure 5*. Under the central monopoly, each provincial branch of CNTC is self-sufficient in terms of raw material of cigarette production, tobacco leaf in this case, and is allowed to retain its profit and pursue economic interests by competing with each other in the market. This results in a nationwide tobacco market segmented by horizontal bureaus at province level; the central state monopoly over China's tobacco industry has been transformed into local monopolies.

Figure 5. China's Tobacco Industrial System after 2003



A typical principal-agent problem exists in China's tobacco industry that the agent entities, provincial branches of CNTC, are motivated to act in its own best interests rather than the interest of the principal, the state corporation. From the taxation system (Table 1), only tax revenues from the tobacco leaf procurement and cigarette production level are shared with the local governments, meaning that incentives should be introduced to guarantee the efforts from provincial agents in promoting the sales of cigarette products.

The quota allocation and pricing system in China's tobacco industry serves to solve the problem. The national corporation CNTC is responsible for setting a national quota of tobacco leaf production and allocating it among provinces (Hu et al., 2008); then, the manufacturers

under each provincial tobacco corporation are responsible for producing cigarettes using the tobacco leaf produced within the province. The distribution and sales of cigarettes are under the control of the distribution sector of CNTC and prices of cigarette at both wholesale and retail level are set by STMA through a licensing system (Liu et al., 2014).

The system works as follows. Each year, CNTC would sign contract with tobacco farmers, specifying the amount of acreage of tobacco leaf cultivation and the price that CNTC will pay for different grades of tobacco leaf; then CNTC, as the only legal buyer of tobacco leaf in China, is obligated to purchase all the tobacco leaf at predetermined price, which is set by STMA. This quota allocation and central procurement system have been effective in ensuring the achievement of production quota and guaranteeing that CNTC is in full control of tobacco leaf. However, this system also introduces incentive for regional CNTC to promote local cigarette products while block the sales of cigarettes produced by other provinces.

The key factor that makes the quota allocation system attributable for the regional blockade is that CNTC uses tax and revenue generated by local tobacco corporations as index to evaluate the “efforts” of its branches, and allocate larger quota to the provincial tobacco corporations with “greater efforts”. The implication is that the larger sales value one province generates this year, which means higher tax and revenue generated for the central government, the larger tobacco leaf production quota it can apply next year. Under the taxation and quota allocation system, the profitability of each regional tobacco corporation would increase with the sales of locally produced cigarettes, while decrease with the sales of products from other provinces in the local

market. In a game theory setting, the dominant strategy of each provincial CNTC would be promoting the sales of its cigarette products in other provinces while restricting the local sales of cigarettes produced by other regions. The equilibrium would turn out to be provincial markets with regional blockade.

2.3 POLICY CHANGES AND THE IMPLICATIONS

As the operations of the tobacco industry in China are highly correlated with political concerns, one could not analyze the industry dynamically without studying into policy changes and their implications. This part of the paper discusses reforms in China's tobacco industry regarding taxation system and tar content restrictions.

The taxation system in China's tobacco industry has been relatively stable overtime; Chinese government has been fairly cautious on major cigarette taxation overhaul due to the potential negative impacts of tax-driven cigarette price elevation on employment and government tax revenue. Within the time period of my study (2007 to 2013), there has been only one taxation reform in China's tobacco industry. In 2009, in order to increase tax revenue, the Chinese government reformed the tobacco taxation by increasing the *ad valorem* tax levied at cigarette wholesalers and adding a wholesale price tax of 5% to the taxation system. *Table 2* presents changes in the taxation system with respect to the reform that took place in May 2009.

Table 2.

Comparison of Chinese Tobacco Tax Structure Before and After 2009

Type of Tax/Tax Base	Before May 2009	After May 2009
Consumption tax at wholesale level		
i) Specific excise tax	RMB 0.06/pack	RMB 0.06/pack
ii) Ad valorem tax		
- producer price (per pack)	≥ 5RMB 45%	≥ 7RMB 56%
- producer price (per pack)	< 5RMB 30%	< 7RMB 36%
iii) Wholesale price tax (since 2009)	0%	5%

Under this reform, however, the tax changes were required to be absorbed at the wholesale level and the higher taxes were not passed onto the retail price of cigarettes. Subsequently, the 2009 tax increase had no impact on tobacco use and cigarette consumption.

Different from the stable taxation system in the tobacco industry in China, regulations on cigarette tar content have gone through various modifications. Tar content per cigarette is one of the most important indexes to assess cigarette safety, and cigarettes with tar content less than 15 milligram (mg) per cigarette are internationally recognized as “safe cigarette”. In China, The average tar content per cigarette reached 28.2mg in 1980; in late 1980s, the Chinese government first intervened into the classification of cigarette with respect to its tar content, where cigarette with tar content above 25mg was classified as high-tar cigarette, per cigarette tar content below 15mg belonged to low-tar cigarette and per cigarette tar content between 15mg and 25mg was classified as mid-tar cigarette. In 2001, China revised the restriction and set a standard for tar content of 17mg per cigarette. In 2003, China joined the Framework Convention on Tobacco Control (FCTC) proposed by World Health Organization (WHO) and promised to restrict the

average per cigarette tar content to 12mg by 2005. Since then, CNTC has been working on promoting a low-tar environment in China's cigarette market. In 2012, the per cigarette tar content restriction was modified to 11mg, with the claim that cigarette produced after January 1, 2013 with per cigarette tar content higher than 11mg will be classified as nonconforming product. Regulation in prohibiting the import of cigarettes with tar content higher than 11mg was also enacted in the beginning of 2013.

Existing empirical evidence of the impacts of vertical restraints on output in China's tobacco market is relatively scarce. Zhou (2000) examines the fiscal decentralization in China's tobacco industry and demonstrates the impact of governmental competition on enterprise behavior and market performance. He suggests that the fiscal decentralization in China since 1980 has provided incentive and opportunities for local governments to develop local economies; however, power of local governments in China harm market competition, as is witnessed by the inter-provincial protectionist measures from local governments motivated by increasing local tax bases. Zhang (2005) offers a structural analysis of the monopoly system in China's tobacco industry and explores the dilemma faced by it. He studies into the industry structure, tax and financial system and the principal-agent relationship between central and local governments in terms of tax revenue sharing, and suggests that the fiscal efficiency of China's tobacco industry is achieved at the expense of market efficiency under the fiscal-oriented state monopoly system.

Hu and Mao (2002) address the policy dilemma in the China's tobacco industry by examining the potential impacts of an additional cigarette tax on the entire economy. They

predict that an increase in excise tax at the retail level would be a desirable public policy for the Chinese government, as it would reduce cigarette consumption and save lives, while at the same time, the increase in tax revenue generated for central government would be twice the total losses in tobacco farmers' income, industrial revenue and local government tax revenue. Hu et al. (2009) adopt a more systematic approach and further suggest that an increase of RMB 1 in the specific excise tax per pack of cigarettes in China would lead to an increase of RMB 64.9 billion (US\$ 7.9 billion) in government revenue and a reduction of RMB 2.68 billion (US\$ 325 million) in national medical costs, and save 3.4 million lives. The productivity gain for the Chinese economy resulting from less tobacco usage and better public health is estimated to be around RMB 9.92 billion (US\$ 1.2 billion).

Liu et al. (2013) examine Chinese smokers' response to cigarette price elevation driven by tax increase by estimating the demand for differentiated products with a discrete choice model. They allow for inter-brand substitution among smokers and incorporate the rational addiction theory into estimation. They contribute to the literature by quantifying the own-price elasticity for cigarette product in China at brand level and conclude that the own-price elasticity is greater for high-end brands than for low-price brands. They also predict that consumers would substitute towards low-price and high-tar cigarettes with respect an increase in price and that tax hikes would encourage more within-class substitutions than across-class substitutions.

Studies regarding the effects of public monopoly and vertical restraints in a variety of industries have been carried out around the world. In Klick and Wright (2008), variance in state

regulations in the beer industry over time is exploited to demonstrate the impacts of vertical restraints on market outcome. According to the literature, state regulations formed by exclusive wholesale territories, prohibition of exclusive dealing contracts and restriction on dealing termination between brewers and wholesales have been playing a significant role in aligning the incentive conflicts between alcohol manufacturers and retailers, and enhancing the promotional efforts from distributors. However, the vertical restraints also harm competition as rival wholesalers and retailers have been excluded from the distribution system. Klick and Wright exploit the changes in the “Beer Franchise Acts” over the time period 1980 to 2000 and across states. They conclude that there would be a 7% to 10% increase in the sales of beer if exclusive dealing were prohibited in the beer industry; they also find that the exclusive territories have positive impact on beer sales while restriction on restrictions on franchise termination affect beer sales negatively.

Seim and Waldfogel (2012) study into the influence of political regulations on entry patterns in the Pennsylvania liquor market. They estimate the liquor demand with a spatial model and conclude that if the Pennsylvania Liquor Control Board were absent, the state would have 2.5 times more liquor stores, each of which has lower employee payments, and enjoy higher consumer surplus as a whole. They also conclude that by introducing a profit-sharing mechanism, the governmental system would be better rationalized in terms of economic efficiency and profit maximization.

My study focuses on the impacts of vertical restraints on the market output in China’s

tobacco industry. More specifically, I study into the unbalanced market share across provincial market and the home bias in product set, and explore the causality between being a local brand and dominating a specific market. We now turn to analysis of the effect of vertical restraints on cigarette sales.

CHAPTER 3: THE IMPACTS OF VERTICAL RESTRIANTS ON CIGARETTE SALES

To examine the effects of vertical restraints on market outcome, I use data on annual cigarette sales in China over the period 2007 to 2013, covering 27 provinces and 4 direct-controlled municipalities (Beijing, Shanghai, Tianjin and Chongqing). Among the 31 provincial regions, 18 of them are cigarette manufacturers with local factories while the other 13 do not produce cigarettes⁴. The cigarette products in the dataset are produced by 20 manufacturers, including 18 provincial tobacco corporations in China, the China Tobacco Industry Development Center⁵ and the foreign manufacturer aggregated for all import cigarette products.

Within the data time period, cigarette product variety at national level has changed quite a lot with respect to number of brands in the market and number of specifications within a brand. From *Table 3*, the number of brands has been decreasing while product variety within a brand has been increasing, indicating a more concentrated domestic cigarette market with increasing product heterogeneity. When comparing the product variety across provinces, the mean number of products in cigarette-manufacturing provinces is greater than that in provinces that do not produce cigarettes (*Table 4*). This means that smokers in cigarette-manufacturing provinces would have a richer set of cigarette products to choose from than consumers in provinces that do not produce cigarettes.

⁴ See Appendix 1 for the full list of domestic cigarette manufactures.

⁵ China Tobacco Industry Development Center was established in 1999 and is an economic entity under the direct control of STMA and CNTC.

Table 3.

Cigarette Product Variety in China, 2007-2013

Year	Number of Brands	Number of Specifications	Number of Specifications within a Brand		
			Mean	Min	Max
2007	168	843	5.018	1	28
2008	153	821	5.366	1	28
2009	152	852	5.605	1	26
2010	146	885	6.062	1	26
2011	132	948	7.182	1	39
2012	123	932	7.577	1	43
2013	123	939	7.634	1	47

Table 4.

Product Variety in Manufacturing and Non-Manufacturing Provinces, 2007-2013

Cigarette-Manufacturing Province	Province-level Cigarette Product Variety		
	Mean	S.D.	Freq.
0	204.604	71.5024	91
1	251.683	61.3942	126
Total	231.940	69.6685	217

* Freq.: 91 = 13 Non-Manufacturing Province×7 Years

126 = 18 Manufacturing×7 Years

In China, cigarette products are classified by both producer price and wholesale price. The producer price determines the Classification of a cigarette, where cigarettes with producer price greater than or equal to 5RMB per pack are of Class A and products with producer price less than 5RMB per pack belong to Class B. Grade of cigarette is determined by the wholesale price, where the cigarettes with highest wholesale price go to Grade I while products with lowest

wholesale price belongs to Grade V⁶. The number of cigarette products in each category is summarized in *Table 5*. Notice that among the 1,841 Grade I cigarette products, 5 of them are of Classification B, which means that they had producer price less than 5RMB per pack but were priced more than 155RMB per pack at the wholesale level. The huge markup at the wholesale level may have implications on the licensing system adopted by STMA in setting cigarette prices. I failed to study deeper into the discrepancies in markup due to the unavailability of literature on relevant regulations.

Table 5.
Grade and Classification of Cigarettes in China's Market, 2007-2013

Classification (by producer price)	Grade (by wholesale price)					Total
	I	II	III	IV	V	
A	1,836	759	1,078	11	13	3,697
B	5	1	609	717	1,214	2,546
Total	1,841	760	1,687	728	1,227	6,243

Another product characteristic variable in the dataset is the tar content per cigarette, which is one of the three major compositions of a cigarette⁷. The tar content of cigarettes by Grade is summarized in *Table 6*. On average, cigarettes of higher Grade (lower price) have higher tar content, which implies that cheaper cigarettes may have more negative impacts on smokers' health.

⁶ The Grade of cigarettes in China is set as follows:
 Wholesale price per carton \geq 155RMB, Grade I
 155RMB \geq Wholesale price per carton \geq 108RMB, Grade II
 108RMB \geq Wholesale price per carton \geq 47RMB, Grade III
 47RMB \geq Wholesale price per carton \geq 36RMB, Grade IIII
 36RMB $>$ Wholesale price per carton, Grade IV

⁷ The three major compositions that distinguish a cigarette product are tar amount, nicotine content of flue gas and carbon monoxide in the cigarette smoke.

Table 6.
Tar Content of Cigarette by Grade in China, 2007-2013

Grade	Tar (mg/cigarette)		Freq.
	Mean	S.D.	
I	10.353719	2.4561282	56265
II	10.243421	2.5272653	23560
III	10.994646	2.3173459	52111
IV	11.441989	1.8799162	22444
V	11.554237	1.7078143	36580
Total	10.87289	2.2943905	190960

Table 7 shows the retail price variations in the dataset. From the table, only four products from three brands have experienced retail price changes within the 7-year time period. Noticeably, the price changes are quite structural. For example, cigarette product under the specification *HaoMao (Blue)* has been set at two different prices in one year, 180RMB per carton and 200RMB per carton, and the price pattern has repeated from 2009 to 2012; while differences in number of retail cities may imply that products under the same specification⁸ but with different prices have been sold in different localities. The structural price variations and differences in retail city designations may have some implications on the product differentiation strategies and promotional efforts from manufacturers and franchisers under the supervision of STMA.

⁸ These cigarettes are the same in terms of tar amount and product specifications, which are the descriptive words used by manufacturers to label the cigarette, such as *soft, hard, mild*, etc.; however, they might come in different packages targeting at different consumer groups, and the availability may differ with respect to retail locations. Unfortunately, we do not have data on these information.

Table 7.

Products with Price Variations in China's Cigarette Market, 2007 - 2013

Brand	Specification	Year	Tar (mg/cigarette)	Retail Price (per carton)	Number of Retail Cities	S.D. (Retail Price)
HaoMao	HaoMao (Blue)	2008	12	200	67	10.541
	HaoMao (Blue)	2009	12	180	28	10.541
	HaoMao (Blue)	2009	12	200	65	10.541
	HaoMao (Blue)	2010	12	180	32	10.541
	HaoMao (Blue)	2010	12	200	16	10.541
	HaoMao (Blue)	2011	12	180	38	10.541
	HaoMao (Blue)	2011	12	200	7	10.541
	HaoMao (Blue)	2012	12	180	48	10.541
	HaoMao (Blue)	2012	12	200	2	10.541
	HaoMao (Blue)	2013	12	180	48	10.541
HaoMao	HaoMao (Golden)	2011	12	130	9	10.954
	HaoMao (Golden)	2012	12	110	32	10.954
	HaoMao (Golden)	2012	12	130	9	10.954
	HaoMao (Golden)	2013	12	110	55	10.954
	HaoMao (Golden)	2013	12	130	7	10.954
GuoYan	GuoYan (soft)	2007	13	450	2	50.000
	GuoYan (soft)	2007	13	550	45	50.000
	GuoYan (soft)	2008	13	550	25	50.000
	GuoYan (soft)	2009	13	550	4	50.000
JiaoZi	JiaoZi (Yellow hard)	2011	8	700	2	54.772
	JiaoZi (Yellow hard)	2011	8	800	43	54.772
	JiaoZi (Yellow hard)	2012	8	700	23	54.772
	JiaoZi (Yellow hard)	2012	8	800	43	54.772
	JiaoZi (Yellow hard)	2013	8	700	23	54.772
	JiaoZi (Yellow hard)	2013	8	800	28	54.772

*	HaoMao (Blue)	好猫(蓝)
	HaoMao (Golden)	好猫(金延安)
	GuoYan (soft)	国烟(软)
	JiaoZi (Yellow hard)	娇子(硬正黄天子)

Summary statistics at cigarette product level and province level are presented in *Table 8* and *Table 9* respectively. From the product-level statistics, product heterogeneity has been remarkably strong in China's cigarette market, as is shown by the large range of tar content and real prices. Notably, the minimum of both the annual number of retail cities for a cigarette product and the annual per brand sales value is zero; one potential explanation would be that tobacco corporations and cigarette manufacturers in China would come up with different combinations of brands and cigarette products each year to introduce into the market, resulting in the fact that some brands or specific cigarette products have zero sales value in a certain year. The province-level statistics is shown in *Table 9*. From the table, the range of province-level total sales value and volume is large; this may imply the heterogeneity in tobacco control policies, affordability of cigarettes, consumer preferences and economy development level in different provinces. There are also zero entries in the minimum value of per product sales in each province and market share of a cigarette product, indicating the existence of trade barrier against certain product.

Table 8.
Summary Statistics at Cigarette Product Level, 2007-2013

	Mean	S.D.	Min	Max
Tar (mg/cigarette)	10.873	2.294	1	17
Wholesale price (per carton)	133.180	152.445	9.208	1384.157
Retail price (per carton)	156.788	189.772	10.129	1703.578
Number of retail cities	45.102	65.867	0	351
Annual sales value per product (billion)	0.895	3.060	0	58.866

*Value amount are in RMB in 2007

Table 9.
Summary Statistics at Retail Province Level, 2007-2013

	Mean	S.D.	Min	Max
Per product sales value in each province (billion RMB)	0.029	0.234	0	12.474
Per product sales volume in each province (million)	0.374	2.992	0	200.253
Total sales value in each province (billion RMB)	25.922	18.650	1.465	86.243
Total sales volume in each province (million)	333.946	206.658	13.348	856.969
Per product value market share in each province	0.1123%	0.00737	0	25.373%
Per product volume market share in each province	0.1124%	0.00767	0	35.278%

*Value amount are in RMB in 2007

3.1 LEAST SQUARE DUMMY VARIABLE MODEL WITH FIXED EFFECTS

The dependent variable in my model is measured as the logarithm of the volume market share of a certain cigarette product in a province in a given year, which is calculated as the annual sales volume of a certain cigarette product in one province divided by the total annual sales volume in that province. The primary regressor of interest is the Local Brand Dummy, whose coefficient would capture the effect of being a local brand on the market share of a certain cigarette product, thus has strong implication on the existence of home bias and the impact of regional blockade. In addition to examining the local brand effect, I also include product attributes such as the logarithm of real retail price and tar content per cigarette, as they would affect cigarette sales in one province, and number of retail cities of a specific cigarette product, which has implications on the promotional efforts from CNTC regarding a specific product and the severity of regional blockade.

To quantify the effect of being a local brand on the market share of a certain cigarette product in one locality, let i index province, j index a cigarette product, such as *Marlboro White*

$Soft_t$, and t index year. I estimate the following general regression:

$$\ln(MS_{ijt}) = \beta_0 + \beta_1 LB_{ijt} + \beta_2 Tar_{jt} + \beta_3 Cities_{jt} + \beta_4 \ln(RP_{jt}) + \tau_t + \delta_j + \varphi_i + \varepsilon_{ijt}$$

where LB_{ijt} equals to one if in year t , cigarette j is produced by manufacturers in province i , i.e., cigarette j is a local product for province i (0 otherwise). The Tar_{jt} represents the tar content per cigarette of product j at year t (there is no province subscript in this variable as there is no difference in the tar content of a certain cigarette product across provinces in a given year). $Cities_{jt}$ is the number of retail cities of product j in year t and the RP_{jt} term represents the real retail price of product j in year t , using 2007 as the base year. The retail price is set by STMA annually at national level and is thus fixed across provinces in a given year. τ_t , δ_j and φ_i are Year Fixed Effects, Brand Fixed Effects and Province Fixed Effects I add successively into the model.

In *Table 10* Column 1, I present the baseline regression in which I do not include the time, brand or province controls. Consistent with theoretical analysis and existing evidence, the result shows that when a cigarette product is manufactured in one province, market share of the locally produced product would be larger than that of others, and the “local brand effect” is statistically significant at 1% level. The coefficient implies that other things being equal, being a local brand would predict a 7 times larger market share for the cigarette product in that province, comparing with the market share of cigarette product produced by other manufacturers.

To account for the effects that have been invariant across time, brand or province, I added

three groups of fixed effects successively. The Year Fixed Effects are used to control for time trends that are common to all cigarette brands in all provinces, such as national-level shift in consumer awareness of health problem caused by smoking, national anti-smoking legislations, and international restrictive convention⁹. The Brand Fixed Effects control for time-invariant product attributes, product quality and smoker loyalty associated a specific brand that affect consumer preferences. Lastly, the Province Fixed Effects are used to control for time-invariant province heterogeneity, such as divergence in economy development level, affordability and availability of cigarette products, as well as literacy and culture in specific localities¹⁰. The models with fixed effects are standard Least Square Dummy Variable (LSDV) design.

Column 2 to 4 in *Table 10* report the Ordinary Least Square (OLS) estimation results, where three groups of fixed effects are added successively. All the three LSDV models provide a positive and statistically significant coefficient on the Local Brand Dummy (ranging from 7.014 to 7.562). The coefficient increases as more fixed effects are added to the model, meaning that these fixed effects have been weakening the local brand effect. The result is intuitive; on the one hand, China has been working on the reform of the tobacco industry by “brand-stretching”, fostering influential manufacturers, increasing the openness of the industry and promoting a

⁹ WHO have been proposing the Framework Convention on Tobacco Control (FCTC) since 2003 and China has been a party of the treaty ever since its establishment. The National People’s Congress ratified the treaty in 2005 and China has been focusing on non-price tobacco control measures, such as banning smoking in public areas, mandating larger warning labels, banning cigarette-related advertising and proposing anti-smoking education among the youth. More and more countries have ratified the treaty and made significant strides in tobacco control. The FCTC has further required that signatory countries be committed to effective tobacco control measures utilizing pricing and taxation system.

¹⁰ In China, some regions or ethnic minorities, especially in Yunnan Province, have the tradition of smoking and a much greater proportion of female smokers.

more integrated national market, all of which would weaken the premium on local brand; on the other hand, brand loyalty of smokers has been relatively high in China, thus the local brand effect becomes smaller when the smoker loyalty related to one product is controlled. The coefficient estimates for cigarette retail price are negative and statistically significant, the values imply that other things being equal, a 1% increase in the retail price of a cigarette product would lead to a 0.29% to 0.39% decline in the market share of that product.

Table 10.
Fixed Effect Model

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Tar Amount (mg/cigarette)	-0.0784*** (0.00376)	-0.0978*** (0.00390)	-0.0727*** (0.00501)	-0.0727*** (0.00492)	-0.118*** (0.0176)	-0.145*** (0.0265)
Number of Retail Cities	0.0474*** (0.000130)	0.0474*** (0.000130)	0.0467*** (0.000145)	0.0467*** (0.000142)	0.0469*** (0.000292)	0.0469*** (0.000301)
Local Brand Dummy	7.009*** (0.0487)	7.014*** (0.0486)	7.071*** (0.0485)	7.562*** (0.0485)	7.563*** (0.0477)	7.564*** (0.0477)
ln (Retail Price)	-0.291*** (0.00848)	-0.279*** (0.00850)	-0.392*** (0.0133)	-0.392*** (0.0131)	0.458*** (0.163)	- -
Constant	-16.76*** (0.0619)	-16.34*** (0.0675)	-14.61*** (0.173)	-14.19*** (0.176)	-19.12*** (0.961)	-17.04*** (0.702)
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	No	No	Yes	Yes	Yes	Yes
Province Fixed Effects	No	No	No	Yes	Yes	Yes
Specification Fixed Effects	No	No	No	No	Yes	No
Product Fixed Effects	No	No	No	No	No	Yes
Observations	191,673	191,673	191,673	191,673	191,673	191,673
R-squared	0.451	0.452	0.459	0.478	0.497	0.498

Standard errors in parentheses

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

3.2 LEAST SQUARE DUMMY VARIABLE MODEL WITH INTERACTIONS

As there is reason to believe that the effect of one independent variable in the model is correlated with the value of another regressor, for example, the effect of being a local brand in one province may be correlated with the openness of the market, or there exists province-specific time-varying trends regarding tobacco use, I add interactions in the model to account for the interplay between factors. The modified model can be written as the following:

$$\ln(MS_{ijt}) = \beta_0 + \sum_i \beta_{1i} (LB_{ijt} * \varphi_i) + \beta_2 Tar_{jt} + \beta_3 Cities_{jt} + \beta_4 \ln(RP_{jt}) + (\tau_t * \varphi_i) + \tau_t + \delta_j + \varphi_i + \varepsilon_{ijt}$$

I first add the interaction of Local Brand Dummy and Province Fixed Effect, which is represented by the summation in the above regression, instead of a single Local Brand Dummy to account for the province-specific heterogeneity on local brand premium. The regression results are shown in *Table 11* Column 1. From the coefficient estimates, the local brand effects are positive and statistically significant at 1% level for all the 18 cigarette-manufacturing provinces. The differences in the estimated coefficients imply the heterogeneity in the local brand premium across cigarette-manufacturing provinces. Provinces with highest local brand premium are Shaanxi, Hebei, Jiangxi and Guangdong, while Yunnan and Hunan have the smallest premium.

Table 11.

Least Square Dummy Variable Model with Interactions

VARIABLES	(1) OLS	(2) OLS	(3) OLS
Tar Amount (mg/cigarette)	-0.0726*** (0.00490)	-0.0727*** (0.00492)	-0.0726*** (0.00490)
Number of Retail Cities	0.0467*** (0.000142)	0.0467*** (0.000142)	0.0467*** (0.000142)
Local Brand Dummy	- -	7.566*** (0.0485)	- -
ln (Retail Price)	-0.392*** (0.0130)	-0.392*** (0.0131)	-0.392*** (0.0130)
LB*Prov_13 (Hebei)	10.83*** (0.248)		10.84*** (0.248)
LB*Prov_31 (Shanghai)	6.324*** (0.198)		6.325*** (0.198)
LB*Prov_32 (Jiangsu)	9.388*** (0.196)		9.379*** (0.196)
LB*Prov_33 (Zhejiang)	7.039*** (0.217)		7.026*** (0.217)
LB*Prov_34 (Anhui)	8.271*** (0.205)		8.270*** (0.204)
LB*Prov_35 (Fujian)	8.710*** (0.233)		8.712*** (0.233)
LB*Prov_36 (Jiangxi)	10.78*** (0.236)		10.78*** (0.235)
LB*Prov_37 (Shandong)	8.412*** (0.219)		8.406*** (0.219)
LB*Prov_41 (Henan)	6.823*** (0.231)		6.825*** (0.231)
LB*Prov_42 (Hubei)	7.357*** (0.190)		7.411*** (0.190)
LB*Prov_43 (Hunan)	4.942*** (0.227)		4.940*** (0.227)
LB*Prov_44 (Guangdong)	10.07*** (0.221)		10.07*** (0.221)
LB*Prov_45 (Guangxi)	9.771*** (0.278)		9.803*** (0.277)
LB*Prov_50 (Chongqing)	6.436***		6.422***

	(0.175)		(0.175)
LB*Prov_51 (Sichuan)	7.340***		7.339***
	(0.175)		(0.175)
LB*Prov_52 (Guizhou)	8.850***		8.857***
	(0.246)		(0.246)
LB*Prov_53 (Yunnan)	3.843***		3.849***
	(0.135)		(0.135)
LB*Prov_61 (Shaanxi)	11.50***		11.49***
	(0.294)		(0.294)
Constant	-14.20***	-14.27***	-14.28***
	(0.175)	(0.209)	(0.208)
Year Fixed Effects	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes
Local Brand Dummy*Province Fixed Effects	Yes	No	Yes
Year Fixed Effect*Province Fixed Effects	No	Yes	Yes
Observations	191,673	191,673	191,673
R-squared	0.483	0.479	0.484

Standard errors in parentheses

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

Intuitively, the local brand premium in Yunnan Province should be large, as we saw a strong dominance of local brand in Yunnan's cigarette market (*Figure 3.2*). In the model, however, the dependent variable is the product-level provincial market share instead of brand-level. From *Table 12*, among the 1,735 cigarette products sold in Yunnan Province between 2007 and 2013, nearly 30% of them are produced by local manufacturers; as a comparison, the number of cigarette products under local brands in Shaanxi Province is much smaller, constituting only around 10% of the whole product set (*Table 13*). This means that within the large pie that dominating each provincial cigarette market, the competition among local cigarette products in Yunnan Province are much fiercer than the competition in Shaanxi. Even though products under

local brands have strong dominance in Yunnan’s cigarette market as a whole, the local brand premium on each cigarette product in Yunnan Province, which is captured by the coefficient estimate, becomes smaller due to the rich local product set.

Table 12.

Composition of Cigarette Product Set in Yunnan Province, 2007-2013

Year	Local Brand Dummy		Total
	0	1	
2007	138	83	221
2008	120	70	190
2009	146	66	212
2010	191	67	258
2011	202	75	277
2012	208	62	270
2013	232	75	307
Total	1,237	498	1,735

* Only products with non-zero sales value in Yunnan Province each year is counted in the product set

Table 13.

Composition of Cigarette Product Set in Shaanxi Province, 2007-2013

Year	Local Brand Dummy		Total
	0	1	
2007	139	19	158
2008	125	19	144
2009	152	21	173
2010	163	22	185
2011	228	26	254
2012	222	20	242
2013	192	17	209
Total	1,221	144	1,365

* Only products with non-zero sales value in Shaanxi Province each year is counted in the product set

The second group of interacting terms added is the interaction of Year Fixed Effects and Province Fixed Effects, which is used to control for the time-varying province-specific factors such as promotional efforts from local franchisers, provincial anti-smoking campaigns and legislations on tobacco control targeted at certain regions. In Column 2 of *Table 11*, I present the results where I control for three groups of fixed effects and the interaction of Year Fixed Effects with Province Fixed Effects. The results are largely the same as just adding three groups of fixed effects (as is shown in Column 4 *Table 10*). Column 3 of *Table 11* shows the results where both the three groups of fixed effects and the two interactions are included. Again, the results are largely the same as when only the interaction of Local Brand Dummy and Province Fixed Effect is included in the model. Results in column 2 and 3 of *Table 11* imply that time-varying province-specific factors have been affecting the local brand premium in a minor way. A potential explanation for the minor changes brought by the interaction term would be that the economy development level across provinces has been relatively stable over time, and the standards regulating commercial activities in China's tobacco industry are set at national level under the supervision of STMA, regional tobacco corporations have little power in local legislations.

CHAPTER 4: DISCUSSION

With the restrictive monopoly structure and taxation system in China's tobacco market, regional blockade has been contributing to the unbalanced market share of local and non-local cigarette products within one province. The Fixed Effect Model in previous chapter suggests that the local brand effects are both statistically and economically significant, implying a strong home bias in the product set in cigarette-manufacturing provinces.

While the estimation results are consistent with previous studies and our intuition, there are a number of drawbacks in the dataset and modeling that might affect the accuracy of the estimation. First of all, the only variable on product characteristics in the dataset is the tar content per cigarette. For a smoker, there are three major compositions distinguishing the flavor of a cigarette, namely tar, nicotine and carbon monoxide (CO) in cigarette smoke; the per cigarette tar amount, nicotine content of flue gas and CO content in cigarette smoke are required to be marked on each pack of the cigarette products sold in China. Of the three components, tar and CO would blend with blood and are the major factors that contribute to lung disease, tumors and cancers, while nicotine is what makes smoking addictive and may have strong implications on consumer preference. Ignoring these product characteristics may lead to bias in coefficient estimates.

Another drawback of the dataset is the lack of data on pack per carton, as the packages of cigarette products differ quite a lot in China's market. Normally there are 10 packs of cigarette per carton and 20 cigarettes per pack; however, some high-end cigarettes and cigars have special

packages. For example, *Wang Guan* sells their products in 10 packs per carton and 10 sticks per pack, while *Greatwall South Pole* are packed in 10 packs per carton and 5 sticks per pack. As differences in the packages may have implications on pricing and the marketing strategies adopted by manufacturers, thus affect the market share of a certain product, omission of it might lead to the problem of endogeneity.

To deal with the potential problems due to lack of data on product characteristics and packages, I add Specification Fixed Effect¹¹ to the Least Square Dummy Variable Model to account for the product heterogeneity. Column 5 in *Table 10* report the OLS estimation results with four groups of fixed effects. Consistent with previous trend, the coefficient of Local Brand Dummy increases as the Specification Fixed Effect is added to the model and remains significant at 1% level. There is a notable change in the coefficient of the logarithm of Retail Price. After Specification Fixed Effect is added to the model, the coefficient on price changes from negative to positive, which may indicate a positive relationship between retail price and market share. However, as has been discussed above, most of the products in the dataset have fixed retail prices throughout the study period; only 4 out of 6,243 kinds of cigarettes have experienced structural adjustment in prices from 2007 to 2013, as is shown in *Table 7*. The coefficient of the retail price when Specification Fixed Effect is added to the model tells that other things being equal, product with higher price would have larger market share than the product that is set at a

¹¹ The “Specification” is used by manufacturers to define a specific cigarette product under a certain brand. For example, *Marlboro White Soft*, *Marlboro Blue* and *Marlboro Red Hard* are three products with different specifications under the same brand *Marlboro*.

lower price. The 0.458% increase in market share with respect to 1% increase in cigarette retail price may be attributed to the better packages of the higher-priced products, which would be the purpose of the product differentiation strategy adopted by manufacturers to promote high-end cigarettes.

To take fully account of the differences in cigarette product characteristics, I add Product Fixed Effects¹² into the model. The result is reported in Column 6 in *Table 10*. We do not have the *Retail Price* term any more as it is fully controlled in the Product Fixed Effects. Again, the local brand effect remains economically and statistically significant.

The second drawback in the study is the potential problem of endogeneity of the independent variables. It seems plausible to argue that *retail price*, *number of retail cities* and *tar content* in the model are endogenous due to reverse causality. The endogeneity of *retail price* is not addressed in the study due to the fact that in China's tobacco market, retail price of each specific cigarette product is set annually by STMA through a licensing system. Within the period of my study, cigarette retail prices have been fixed over seven years and across provinces (except for the four products experiencing structural price adjustments, as has been shown in *Table 7*). As local tobacco corporations and franchisers have none autonomy in setting prices for cigarette products, the *retail price* is taken as exogenous in the model.

The endogeneity problem regarding *tar content* and *number of retail cities* is more

¹² "Specification" is defined by the name and descriptive words used by cigarette manufacturers to label the product, regardless of the retail prices and packages. As is shown in *Table 7*, "Specification" does not uniquely define a product in the dataset. To take into account the differences in prices of the products with the same "Specification", I construct a new variable called "Product", which identify cigarette product uniquely.

ambiguous. As has been discussed in literatures and previous studies, the restrictions on tar content and designation of retail cities of cigarettes in China's tobacco market are under the control of CNTC. In this study, national level shift in tar content restrictions can be controlled by the Year Fixed Effects while brand-specific tar content changes and retail city designations could be controlled by the Brand Fixed Effects. However, it is doubtful regarding the autonomy of provincial cigarette manufacturers and wholesalers in determining tar content and cigarette retail cities. Further studies should be done to explore the mechanism behind the decision making process regarding tar content and retail cities in order to rule out the problem of endogeneity.

Another important drawback that needs to be addressed is that in constructing the model, I fail to distinguish the differences between non-local brands sold in a cigarette-manufacturing province and the brands sold in a province that does not produce cigarettes; both of these two cases are coded in the model as 0 entries in the Local Brand Dummy. However, one could argue that these two scenarios should be treated differently. For a province that does not produce cigarette, cigarette product under any brand in the market would go to the non-local brand category and there does not exist any financial incentive for the distribution sector of provincial tobacco corporation to promote a specific brand. However, with the regional blockade mechanism playing a significant role in cigarette-manufacturing provinces, we would expect that other things being equal, the non-local brand in those provinces would encounter unfair competition and be expelled from the provincial market, leading to a negative "non-local brand effect". Failing to take into account the differences in the non-local brand effect may lead to the

bias in the estimation of local brand premium. The problem may become non-negligible when trying to construct counterfactual analysis.

CHAPTER 5: CONCLUSION

State bureaus and provincial monopolies have been regulating China's tobacco industry and the relationship between tobacco leaf farmers, cigarette manufacturers, wholesalers and retailers. In particular, I study the impacts of vertical restraints formed by tax revenue-sharing and quota allocation system, requiring that central government share tax revenue with local governments and allocate tobacco-related production quota based on central government tax contribution. I find that vertical restraints lead to a "local brand premium", which is shown by the strong and persistent dominance of local brands in cigarette-manufacturing provinces. The results also show a negative relationship between retail price and market share of a certain cigarette product. Both the findings are consistent with previous studies discussed in the literature.

The most important result from the model is that the local brand premium contributed by the vertical restraints in China's tobacco market is economically and statistically significant, leading to a 7 times larger market share of cigarettes produced by local manufacturers comparing with products produced by other provinces, *ceteris paribus*. The local brand effect gets greater as more fixed effects are added to the model and remains significant at 1% level. This result gives prima facie evidence that vertical restraints in the tobacco industry in China have led to strong home bias in the product set in cigarette manufacturing-provinces, which could be attributed to the efforts from provincial monopolies in promoting local brands and excluding rival products from other provinces.

With the empirical evaluation of the impacts of vertical restraints on output in China's

tobacco market, further studies can be carried out to analyze how vertical restraints and regional blockade in China's tobacco market affect cigarette sales in both cigarette-manufacturing provinces and those provinces that do not produce cigarettes. One approach would be counterfactual analysis, shutting down the local brand parameters and comparing the changes in the market share of local brands and non-local brands at provincial level and the market share of different brands at national level.

As regulations in China's tobacco industry are set at national level and we do not observe provinces where the restrictive regulations are prohibited, it would be econometrically difficult to identify the competitive impacts of the vertical restraints. One potential approach would be to explore changes in the taxation system and institutional settings and construct pre- and post-reform analysis¹³. A deeper analysis into the home bias in the product set and the addictive nature of smoking could also be useful in addressing the consumer substitution behavior corresponding to an institutional changes. These would help with the simulation of the scenario where there is no monopoly power in the market.

Normally, monopoly power would harm market competition and social welfare, leading to increase in price and shrink in output. Specifically for the cigarette market in China, from the consumer side, smokers in cigarette-manufacturing provinces would have to face a product set

¹³ In Klick & Wright (2008), they exploit the variance in "Beer Franchise Acts" over time (from 1980 to 2000) and across states in the U.S. and analyze the effects of state regulation on beer consumption. Their result suggests that the exclusive dealing prohibition in the United States would predict a 7-10% increase in beer sales.

dominated by local brands; restrictions in the choice set thus force consumers to buy sub-optimal products. From the manufacturer side, production would be distorted as local tobacco corporations may give a mandate to overproduce for the sake of tax revenue, or there would be idle capacity and overproduction as a result of the trade barriers set by tobacco corporations in cigarette-manufacturing provinces against non-local brands. Moreover, in the long run, the vertical restraints in China's tobacco industry and the local protectionism would distort the entry and exit in the market, and lead to inefficiency in resource allocation.

With the potential welfare loss brought by vertical restraints in China's tobacco market, it may sound appealing to conduct counterfactual analysis and quantify the effect of vertical restraints termination on price, cigarette consumption and social welfare. Intuitively, terminating market regulations would lead to a more integrated market, greater variety in the product set and increase in social welfare. However, tobacco market is a special one in that its product brings negative externality to the society. It is reported that in 2013, about 45.3% of Chinese men are smokers and tobacco use has been responsible for about 19.5% of all deaths among men in China since 2010; this number has been rising significantly (The Tobacco Atlas, n.d.). Moreover, exposure to secondhand smoke has been a significant cause of mortality, especially for women and children. According to The Tobacco Atlas, about 600,000 people die from secondhand smoke exposure each year in China ("Hundreds of millions of Chinese men could die from tobacco related diseases", 2013). The welfare analysis of the tobacco market is thus complicated by a double market failure due to both monopoly power and negative externality.

The consumer welfare effect, which is at the heart of antitrust law, is infused with the negative externality of the tobacco industry; regulations of the tobacco industry thus involve numerous policy concerns. On the one hand, state regulations and vertical restraints foster monopoly power, leading to regional market with higher prices and smaller product set. On the other hand, however, international treaty requires that government intervene in the cigarette market and act proactively in tobacco control. Numerous studies regarding the impacts of taxation on cigarette consumption have shown that the most potent and cost-effective approach to control the spread of tobacco use is the elevation of prices using consumption taxes. According to the World Health Organization (WHO) ("Tobacco Taxation in China", 2014), a tax-driven cigarette price increase of 10% per pack would reduce cigarette demand by about 4% in countries with high per-capita income; the effect is even greater in low- and middle-income countries where consumers are more sensitive to price changes, and the decline in consumption is estimated to be more than 5%. Children and adolescents are estimated to be more sensitive to increase in cigarette prices; according to WHO (2014), decrease in cigarette consumption among the youth regarding a cigarette price increase would be 2-3 times larger than the decrease in adult consumption. Moreover, utilizing pricing and taxation system and increasing tobacco tax would lead to a win-win scenario, which not only protect the public health, but also increase the tax revenue for the governments. Currently, the WHO benchmark for the excise tax as a percent of cigarette price is 70%; in China however, the effective excise tax is only about 40% of retail price. Perhaps it is appealing to figure out an optimal taxation design and institutional setting for

China's tobacco industry, which not only guarantees the stability of government income, but also helps protect public health and social welfare.

APPENDIX

Appendix 1. List of domestic cigarette manufactures

	Province	Manufacturer	Province Index
1	Anhui	China Tobacco Anhui Industrial Co., Ltd.	34
2	Fujian	China Tobacco Fujian Industrial Co., Ltd.	35
3	Guangdong	China Tobacco Guangdong Industrial Co., Ltd.	44
4	Guangxi	China Tobacco Guangxi Industrial Co., Ltd.	45
5	Guizhou	China Tobacco Guizhou Industrial Co., Ltd.	52
6	Henan	China Tobacco Henan Industrial Co., Ltd.	41
7	Hebei	China Tobacco Hebei Industrial Co., Ltd.	13
8	Hubei	China Tobacco Hubei Industrial Co., Ltd.	42
9	Hunan	China Tobacco Hunan Industrial Co., Ltd.	43
10	Jiangsu	China Tobacco Jiangsu Industrial Co., Ltd.	32
11	Jiangxi	China Tobacco Jiangxi Industrial Co., Ltd.	36
12	Shandong	China Tobacco Shandong Industrial Co., Ltd.	37
13	Shaanxi	China Tobacco Shaanxi Industrial Co., Ltd.	61
14	Shanghai	Shanghai Tobacco Group	31
15	Sichuan	China Tobacco Chuanyu Industrial Co., Ltd.	51
16	Chongqing	China Tobacco Chuanyu Industrial Co., Ltd.	50
17	Yunnan	Hongta Tobacco Group Co., Ltd. Hongyun Honghe Group	53
18	Zhejiang	China Tobacco Zhejiang Industrial Co., Ltd.	33
19	National Bureau	China Tobacco Industry Development Center	3
20	Import	Import brand	2

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