Essays on Empirical Development and Political Economics

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Abstract

The thesis consists of three essays in development and political economics.

Political Connection, Government Patronage and Firm Performance: Evidence from Chinese Manufacturing Firms

The paper tests whether politically connected firms receive preferential favor from the government, as measured by state capital investment from the central government and subsidies. By a panel data set of Chinese manufacturing firms and their connections with top leaders from the State Council (the central government) and the Central Committee of the Communist Party of China from 1998 to 2007, I exploit the variation in political connections for the same firm across years to get a clear identification of the preferential treatment. My results suggest that firms connected with one more top leader from the State Council receive 9.4 percent more subsidies, firms connected with one more leader who holds positions on both the State Council and the Central Committee obtain 23 percent more state capital and then have a two percentage point higher product markup. When there is extra state capital due to political connections, other domestic capital is crowded out. The heterogeneous effects find that firms with more employees, but lower sales and less profit tend to receive more state capital if equally connected, while firms with higher sales tend to obtain more subsidies. This additional state capital and these subsidies do not seem to improve the firm's performance.

The Determinants of Media Bias in China

We measure and investigate the determinants of political control of newspapers in China. To this end, we collect information, including the name and ownership, of all newspapers in China that existed between 1981 and 2011. We also analyze the content of 110 general interest newspapers between 1998 and 2011. We find that more strictly politically controlled newspapers cover

disasters and corruption more than their commercial competitors, most likely in order to monitor lower level officials. We also find that they cover leaders and the official news agency Xinhua to a larger extent. Moreover, we construct an index of political control of each of the 110 newspapers. We find that in the cross section, this correlates negatively with GDP per capita and population size. We find no time trend in the political control of Chinese newspapers in the 2000s. Finally, we analyze the effect of a reform to close down all county papers in 2003. The reduced competition significantly affected the degree of political control of the remaining papers.

Chinese Microblogs and Drug Quality

This paper examines the impact of the introduction of Sina Weibo, the most popular microblog in China, on the quality of drugs on the market. Using a unique data set on drug quality and Sina Weibo use, I explore the staggered diffusion of Sina Weibo across prefectures. I find that the number of bad drugs is decreasing in Sina Weibo use: if the Sina Weibo use is doubled, the number of bad drugs found will be reduced by 21 percent. Consistent with the prediction of a simple moral-hazard model, I show that the reduction of bad drugs is driven by two mechanisms: Sina Weibo induces more effort from the Drug Administration and it deters the production of bad drugs. Finally, I show that the diffusion of Sina Weibo has a higher marginal effect for disadvantaged groups, consistent with microblogging being a cheap, accessible media. The results suggest that microblogs can play an important role in monitoring both the public and the private sectors, especially in a context with media censorship.

给我的爸爸妈妈
秦禧年 和 邓佩华

Acknowledgments

"Try again, fail again, fail better."

Samuel Beckett

At the end of my first year in the PhD program, I started a paper about corruption and then I knocked on a door on the 8th floor:

"Can you be my advisor?"

"Yes."

The brief answer then opened the door to a fascinating academic life. Thank you, my advisor, Prof. Jakob Svensson. The typical conversation between Prof. Svensson and me is short, but super, super efficient and helpful. I have considered the commenting style of Prof. Svensson as magic for years - how come every word turns out as a bulletin and straight to the point? I really appreciate our countless such conversations, which has made it possible for me to try many projects and receive feedback quickly, and then succeed, or at least, fail better. Prof. Svensson has taught me a lifelong valuable lesson: what is good research that deserves our effort, and to what point I should decide to go ahead or give up.

I became a fan of Prof. David Strömberg after taking his lectures on political economy. Later on, I was fortunate to have Prof. Strömberg as my co-advisor and my co-author. When he told me, "You can just call me David, instead of Prof. Strömberg ." my life in academia suddenly became so much easier. For a Chinese student like me, something like that does break the ice and bring down my nervousness when talking to most professors. It is important because my ideas can then flow effortlessly. David is very encouraging, patient and easygoing so that I feel totally free and happy to discuss research with him, even some of my less clever ideas. David is also willing to share his trumps. I learned a lot from many mini courses starting with the David style words, "You know, here is some tip to do.....". The thesis would have been an impossible mission had it not been for his supervision. I am very grateful to David for leading me to the center of media research and for training me with his amazing research skills.

If there is a professor in Stockholm that I have never felt nervous with or hesitated to talk to, it is Masayuki Kudamatsu. Masa is always offering time and patience to discuss my ideas, my problems in developing the analysis, and my perplexity of the academic life. I have benefitted a great deal from his help and obtained sufficient confidence in what I am doing. I clearly remember the conversation we had in the IIES seminar room, the day before Easter 2012, when my advisors suggested that I come up with a new paper as my job market paper. To be honest, I did not believe I would be able to do that and was very depressed at that time. Masa told me, "Trust your supervisors, and trust yourself. I believe you can make it". I was convinced, and then, I made it.

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I want to express my gratitude to Mema, Maria Perrotta and Sebastian Koehne. Mema was the first to offer to read my clumsily written papers. I benefited a great deal from the lunches with Mema talking about framing research ideas, structuring papers and professional writing. I will keep those precious, full of red lines and side comments iAnnotate PDF from you, through which I learnt the way to write an academic paper. Sebastian was the first who offered to help me with my presentation. It was a surprise gift when I received the email from a professor specialized in macroeconomics (the field I never gonna understand), "I have a few comments on your presentation —-Sebastian". I began to realize that there are skills for the presentation, and from then on, I have not been terrified of giving presentations.

My comrades, Pamela Campa and Abdulaziz Shifa are friends of the tropical style, having kept me as sunny as possible in the long journey as a PhD student. I appreciate Pamela for always being helpful when there is a need: "Bei, do you want to practice the mock presentation?" ,"Mock interviews?", "I have some literature for you!". I will not be scared to receive a phone call at 2 o'clock in the morning, it must be Abdul: "Hey, I just got

an idea how you can structure your two minute version of the interviews!". And I will not hesitate to rush into Abdul's office when I am desperate to motivate my papers. Thanks to Abdul for frequently pulling me out of the swamp surrounded by questions about why I am doing this research.

I also acknowledge many inspirational conversations during my PhD period with Prof. Frederico Finan, Prof. Jin Feng, Prof. Ming Lu, Prof. Ethan Kaplan, Nathaniel Lane, Jinfeng Ge (also for the help on the homeworks), Linnea Wickström Östervall, Shuang Zhang, Tao Zhang, Yanhui Wu, Tomas Larsson, Prof. Konrad Burchard and Prof. Philippe Aghion. In addition, I owe much gratitude to Prof. Per Krusell, Prof. John Hassler, Prof. Robert Östling, Prof. Tobias Broer and Prof. Peter Nilsson for their excellent help on preparing me for the job market. Shengxing Zhang, from whom I learnt how to build theoretical models, deserves the special thanks. And thanks to all participants in the development study group at Stockholm University and the Stockholm School of Economics for helpful discussions on ideas and papers.

It is difficult to imagine how the Institute for International Economic Studies could function smoothly without Christina Lönnblad. I cannot. This is the name first bumping into my head every time when I get questions on any issue within the institute since the day I first sat in the office at the Institute. I also owe a big thanks to Christina for her incomparable editorial work on my papers. Since her first revision of a paper of mine, I would not want to make my economic writings public before they have been edited by Christina.

I sincerely thank Karl Eriksson for making the various programs working so properly in my computers during all these years of study in the department and at the institute. Karl has rescued my codes and files so many times in computer accidents, and I also learnt some techniques from Karl in programming. Thanks also to Hanna Christiansson, Annika Andreasson, Åsa Storm and Ingela Arvidsson for their great administrative support, especially during the job market period.

For all these Stockholm stories to happen, I must acknowledge Zheng Michael Song. Six years ago, it was Zheng who highly recommended the PhD

program and the Institute for International Economic Studies at Stockholm University to me. And I am also thankful to have had Zheng to discuss my research ideas with all these years. "Why are you doing this? What is the contribution? Is that an important question?" Such sharp comments from Zheng have quite often pushed me far into the corner. But if by then, the project can survive his questions, it will thrive.

There are many friends who may not help with research or academic work, but who have definitely lightened up my days all these years of my PhD life. Thanks to the members of our "Girls 4" group, Qin Li, Jiaying Zhang and Ying Zhu. Without your company in shopping, traveling, movies and dinners, life in Stockholm would be boring and harsh. Special thanks to Qin, a cancer specialist who even helped me categorize over 500 drugs for my job market paper. In particular, I want to thank a group of fun friends from the Institute for International Economic Studies, the Department of Economics and the Stockholm School of Economics, whom I hang out with and do sports with: Ettore Panetti, who also kindly helped me build up my "own" website, Pamela Campa and Elena Marttana (Grazie, my yoga buddies), Amanda Jakobsson, Claudia Wolff, Susanne Forstner, Leda Evangelia Pateli, Alexander Schmitt, Abel Schumann, Nathaniel Lane, Abdulaziz Shifa, Simon Wehrmüller, Timo Boppart, Christian Odendahl, Nicholas Sheard and Theodoros Rapanos. Specially for Abel, Alex, Simon and Timo: Obviously, I am the sour lemon in our badminton double matches, but thanks for not hesitating to play with me (for teaming with me, Abel). I would feel too quiet sitting in the office on a Sunday afternoon if Nathan were not around and asking "How are you doing?" with his New York accent. I also want to thank the nice faces in my office who make the office a pleasant and joyful place to work in: David Seim, Pamela Campa, Jinfeng Ge and Johan Gars. Without my musical office-mate, David Seim, who is singing and showing-off his arm muscles and our gossips about everything, I would be really lonely. I am very grateful to Wei Xiao and Yangzhou Yuan for spending so many Chinese festivals together with me in Stockholm and for having dinner parties here and there. I am grateful to Yangzhou for his amazing talents on furniture assembling, which saves me from freaking out on top of the boxes.

I will miss the mid-night baking in Forskarbacken 11 with Haleh Mardanian, Giulia Zambon, Liche. I thank Mounir Karadja for his patience in answering so many of my questions that are caused by Swedish. I also wish to remember all other fellow students at the Department of Economics, IIES and HHS.

There are some friends who are not in Stockholm, but have been with me all these years. I received so many encouraging words and help from Yang Lu, Min Chen, Zheyu Yang, Wenyi Jing, Shuang Zhang, Hua Lin, Yang Xu, Yuemei Ji, Yinan Xu, Cong Zhang, Yu Miao, Lulu Zhao, Haiyan Zhu, Ling Lin, Xiaoyan Ying, Guiying Laura Wu and her husband Qu Feng, in both my academic and my personal life.

Finally, I want to thank my family, my parents Xinian Qin and Peihua Deng and my sibling Lei Qin. Your love and inspiration are always there for me, to comfort me when I am frustrated and to cheer me up when I am down. I am brave enough to go abroad and fight for the life that I want, because I know there is always a home for me even till the end of the world.

A sunny afternoon in Lappis, Stockholm, April, 2013
Bei Qin

Contents

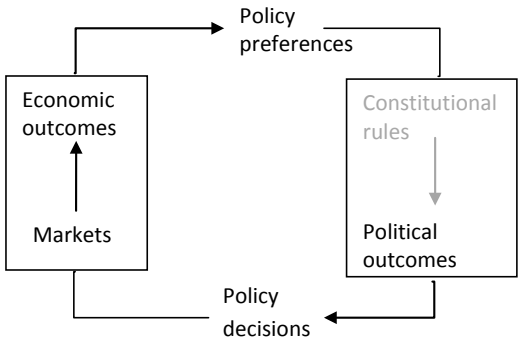
Chapter 1

Introduction

This thesis is about hope, a hope for development in a retardant political system.

For many developing countries with autocracies or poor democracies, the government can actually impede economic growth and the improvement of social welfare. The key problem for these nations is the absence of appropriate constitutional rule. The formal rules of a country's constitution influence political decisions over the economic policy, given some distribution of preferences over economic outcomes in the population (Persson and Tabellini, 2003). I show the policymaking process in figure 1, which is adapted from what Persson and Tabellini (2003) use to describe the process in democracies. When there are flaws in the constitutional rules, the domino effect of any improper political outcome will spoil the economic outcomes. This thesis aims at analyzing the area between political outcomes and economic outcomes, seeking possible solutions to enhance the efficiency of the process under the setting of a lack of proper constitutional rules.

Figure 1: The Policymaking Process



Source: Revised from figure 1.1 in Persson and Tabellini (2003)

To be specific, I ask two questions: in a nation without effective discipline, what is the impact on the economy if politicians have preferential slants towards firms that are connected with them? What are possible ways of solving the government discipline problem and promote the economic outcomes in an obstructed political system? The answers lie in the three studies on the case of China, a developing country under autocracy.

Chapter 2 examines the preferential treatment that Chinese manufacturing firms obtain when their connected leaders come into power. The treatment is measured by the resources from governments to firms - state capital investment and subsidies. The leaders are officers who were in power at some point in time during 1998 and rank on the same level or above the (vice) minister level in the economic policy related departments on the State Council (the Chinese central government) and the Central Committee of the Communist Party of China. The results suggest that firms connected with one more top leader from the State Council receive 9.4 percent more subsidies and firms connected with one more leader who holds positions on both the State Council and the Central Committee obtain 23 percent more state capital.

Is the preferential treatment necessarily defective? The answer is mixed. Chapter 2 shows that firms with more employees, but lower sales and less profit tend to receive more state capital if equally connected and the additional state capital and these subsidies do not seem to improve the firm's

performance. This has two meanings: on the one hand, as an investor, the government does not make a profit on the investment; on the other hand, the resource aims at supporting employment. The public, in the short run, may applaud employment, and this public opinion can be the reason for the preferential treatment due to the leader's reputation building concern. However, such preferential treatment of top leaders can be malicious for long- run economic growth. Furthermore, the heterogeneous effect is discussed within firms that are connected, but what about firms without any connections? The resource is not accessible to them no matter how good their performance is.

All in all, the study of political connections suggests at least two points: first, it is possible to steer officers by designs through career concerns; second, if we want to prevent a preferential treatment of leaders, we may need something more.

The existing literature has shown that free media play an essential role for accountability in democracies. Can media function more or less the same in autocracies? It is easy to derive from figure 1 that, with the appropriate constitutional rule missing, market failure and governance failure will occur and will then impede the economic development. In this situation, the media can play an important role by delivering information to consumers to promote product market quality, and by imposing pressure on regulators to foster the provision of public service. Chapters 3 and 4 discuss this issue in depth.

In China, no media is free from political control. The first step is then to understand how the media works in China. In chapter 3, my coauthors - David Strömberg , Yanhui Wu - and I investigate two specific questions for the particular example of newspapers in China: what do autocratic leaders use the media for? What accounts for the variation in the political control of media in autocracies? For the first question, we characterize three roles of the use of newspapers in China by the government: 1. Propaganda. More politically controlled newspapers cover leaders and the official news agency Xinhua to a larger extent. 2. Monitoring of bureaucrats and providing information to political leaders. More strictly politically controlled newspaper cover disasters and corruption more than their commercial competitors. 3. Commercial use. For the determinants of political control, we find that political control

is significantly lower in newspapers run by lower levels of government. We do not find the effect of GDP on political control in general, but we do find there is some effect for newspapers run by lower-level governments. Consequently, an increase in GDP is related to an increased gap in political control between the newspaper run by central and lower-level governments. Finally, we investigate the effect of competition on political control. Exploiting a policy reform that forced the closing down of most county-level party dailies, we find that the average effect was less political control. The effect is driven by the more commercial *Evenings* and *Subsidiary* papers, while the *Dailies* became more politically controlled.

Chapter 4 takes one step further to analyze the effect of media on market outcomes and government regulation. In this chapter, I choose Sina Weibo, the most popular Chinese microblog, the Chinese version of Twitter and the drug market to address this question. I find that Sina Weibo has a significant effect on reducing bad drugs: if the Sina Weibo use is doubled, the number of bad drugs found will be reduced by 21 percent, and the marginal effect is even higher for some disadvantaged groups.

In today's China, Sina Weibo is very popular and influential: it substantially increases the information for millions of its users, and it potentially imposes pressure on governments by calling on public opinion in a very short time. Sina Weibo is certainly subjected to the notorious censorship, but it has so many users, each serving as a news outlet, and it circulates information really quickly and widely, so the government cannot silence it without shutting down the whole microblog. Therefore, even with political control, Sina Weibo is still regarded as the most free media and does work in China. As information and government regulation is very important for the market, Sina Weibo may have affected many products and services.

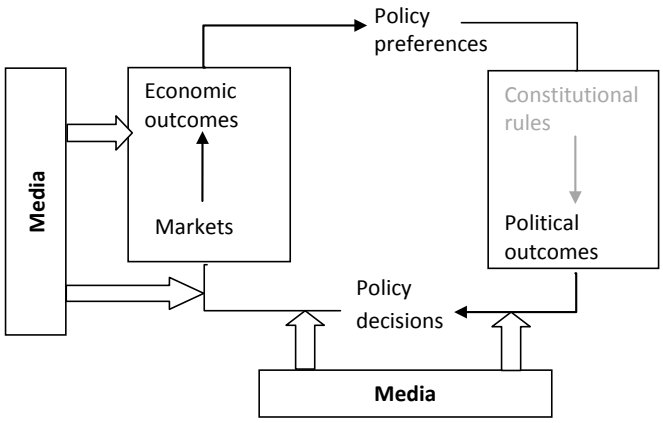
The study chooses to focus on the drug market for two reasons: First, the drug market is often riddled with imperfect information for consumers about product quality and is highly regulated by the government. It provides an interesting case to examine how information availability through microblogs affects market outcome in terms of drug quality and regulator's reaction. Second, the bad drug issue is serious but stubborn in many developing countries

just like in China.

I further explore the mechanisms behind my results. I find evidence that the Sina Weibo use increased the monitoring efforts of the SFDA officers, inducing them to check more drugs. The effect is also driven by deterring the production of bad drugs (not just distribution and sales).

The finding of the effect of media under the autocracy is extremely exciting, because it gives hope. Hereby, I summarize the aim of the whole thesis in figure 2: media will make a breakthrough for the discouraging political system.

Figure 2: Solutions? Media.



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Chapter 2

Political Connection, Government Patronage and Firm Performance: Evidence from Chinese Manufacturing Firms[1]

"From 1989 to 2002, China was led by a group of individuals imbued with heavy urban biases in their views of economic development and with a strong industrial policy conviction..... They followed a typical career path in a communist system-first serving as chief technicians and engineers at large SOEs and then ascending through the bureaucracy."

—– *Yasheng Huang, 2008*

[1]I thank Jakob Svensson, David Strömberg, Philippe Aghion, Konrad Burchardi, Pamela Campa, Frederico Finan, Jinfeng Ge, Masayuki Kudamatsu, Nathaniel Lane, Maria Perrotta, Nancy Qian, Abdulaziz Shifa, Zheng Michael Song, Tao Zhang, Shuang Zhang, Shengxing Zhang, for great comments and suggestions. Participants in seminars at the IIES, the Development Study Group at Stockholm University and Stockholm Institute of Transition Economics and Northeast Universities Development Consortium (NEUDC) 2011 are greatly acknowledged. All errors are my own.

2.1 Introduction

When there is an aggressive government that keeps a pervasive control on the economy, any preferential treatment of leaders can have a substantial implication on the economy. China is such an economy: First, its development is state-led and controlled from above; second, it is of network or guanxi capitalism from below (Bardhan, 2010). Around 40% of GDP are produced by firms directly controlled by the Chinese government, and around half of the Chinese employees work in these firms (Szamosszegi and Kyle, 2011). Along with the miracle growth of its economy, China is increasingly regarded as the crony capitalism. The literature has shown that Chinese firms whose owners or board members are Communist Party members or local government directors tend to benefit more in terms of obtaining financial credits and being less prosecuted (Li et. al., 2008; Cheung et. al., 2010), and it has also shown that local government officials take advantage of their controls on firms to grab rents when selling the state assets (Fisman and Wang, 2011). In this scenario, what are the economic consequences of political connections with top leaders who are maneuvering the resources and carrying out the economic policies in the presence of such a vast state control of the economy?.

In this paper, I empirically examine whether firms that are connected with top leaders in the central government receive more resources and acquire more market power. I define the political connections as the number of top leaders who are connected with firms and come into power in a specific year. In this paper, the top leaders refer to those who hold positions on or above the minister level in the Chinese central government - State Council and the Central Committee of Communist Party of China. The resources are measured by state capital, the part of the capital structure that is invested by the central government. Subsidies that are granted by the governments is another measure of the resources in the analysis. The market power is measured by the product markup. I find that if the firm is connected with one more leader from the State Council, the amount of subsidies it receives increases by 9.4 percent; if the firm is connected with one more leader who holds positions on both the State Council and the Central Committee, it

will receive 23 percent more state capital, and the markup is increased by 2 percentage points.

I track the firms and their political connections using the historical phenomenon that many government officials were selected from industrial firms in China. When China initiated the economy reform (1978-), the industrial sector was regarded as the central part of the reform and many individuals with working experience in the industries have been selected into governments since the late 1970s. At that time, interchanging jobs between government offices and firms were common since firms were all publicly owned before the reform of the economy. Actually it was not until the adoption of the Company Law in 1994 that there was a clear distinction between firms and government units. This is how the situation described above emerged, and the trend even continued after 2003. In my dataset, 153 out of the 295 top leaders in 1998-2002, and 119 out of the 280 top leaders in 2003-2007 on the central government and the party organ had some working experience in firms at some point in time. When the leaders start their influential positions, not only firms but also the industries in the cities from which they originate will gain more attention from the public. Political leaders may also favor the firms in the industry and the city where they have worked at some point in time.[1] In this paper, the firm is thus regarded as being connected to a top leader if it is in the industry and city where the leader worked at some point in time and the leader is in power in that year.

To construct the political connection with firms, I first collect a set of data on politicians covering the CV of 350 top leaders who were in power at some point in time during 1998-2007 either on the Central Committee of the Communist Party of China (the highest Party organ) or in economy-related offices on the State Council (the central government). Then, I match it with the panel data of manufacturing firms by the industry and the city where these top leaders worked at some point in time to obtain the panel data.

Assuming that the political connections are exogeneously shaped, I ex-

[1]In the firm data used in the paper, firms that top leaders actually worked for only account for 0.1% which is a very small group so I focus the discussion on a broader group with more general characteristics, firms in the industry and city top leader worked for at some point in time.

plore the variation within the same firm and across years to get a clean identification. Besides the historical fact, the political connection is arguably exogeneous also because of the top-side-down appointment pattern in Chinese bureaucracies. Once the individuals enter the government, they follow the stereotype promotion pattern: Initially, they work in local/city governments for years, then they can be promoted to provincial governments if they perform well, and several years later, they might be further promoted into central government. Then, they finally have the chance of being promoted to (vice) ministers or higher positions. The promotion process from local to central government usually takes a very long time (more than 10 years) and the top-side-down decision means that it cannot be affected by lower-level governments, institutes or citizens. It suggests that individual top leaders in-and-out of power is exogenous to one specific firm. Therefore, it provides the main identification for the paper.

Using the empirical results, I distinguish two possible mechanisms for why leaders favor the connected firms: the information view and the reputation building view. According to the information view, if the leader aims at maximizing the return to government investment, connected firms with a higher quality tend to receive more resources when the politician comes into power because the politician knows them well. According to the reputation building view, the leader will divert more resources to places where there is public attention and thus gain a good reputation from the public opinion. In China, when a leader is in power, places he worked for at some point in time immediately attract more attention from the general public. It is then easier to be aware of the good performance of those places. In China, people usually owe some credit to the leader if the places where the leader came from develop well. Therefore, to build a good reputation, the leader then diverts more resources to those places to promote their development. If the information view holds, we should observe that good firms (firms with higher sales and profit, for example) tend to receive more government resources; if the reputation building mechanism works, we should observe resources going where the public expects them to go, for example to large firms with more employees. Naturally, other mechanisms may also explain my results, for

example, the social networking view or the bribery view. However, due to the absence of the appropriate measurement, the paper is not able to test them.

After finding out the preferential treatment of the connected firms, I further examine two interesting questions: What types of firms are more likely to be granted more resources if equally connected? And, what happened to firms' performance after they received the extra resources due to their political connections? The results show that firms with more employees but lower yearly sales and a lower profit tend to obtain more state capital. However, after the firms have received the extra state capital, none of the firm characteristics mentioned above are found to have changed statistically significantly. When a similar analysis is applied to subsidies, I find that firms with higher sales predict more subsidies given that they are connected with a top leader from the State Council, and the profit only increases in the first year that the connection appears and then decreases. The extra resources due to political connections do not seem to have any long-term effects on any firm characteristic. The findings lend more support to the reputation building view than to the information view. It also presents a question for future research: What were these resources used for?

Another performance of firms that is worth studying is capital structure: when the central government invests more in a connected firm, how will other investors react? Limiting the sample to firms that actually obtain (lose) more resources in the first year or one year after they gain (lose) political connection, I check the years before and after they switch into (out of) the connection to track down the capital structure. I find that when extra state capital due to the political connections kicks in, collective capital (the capital owned by local governments), domestic private capital, legal person capital, and Hongkong & Macao capital are crowded out, while foreign capital remains. However, two years after the emergence of the connection, state capital starts to decrease while domestic private capital starts to increase. Furthermore, the total amount of capital does not increase but actually decreases with the arrival of the extra state capital. The state capital might substituteother kinds of capital and thus, getting extra state capital does not

make the firm more attractive for other investors.

This paper first relates to the literature in political economy that studies how political leaders use their power to grant economic favors to connected firms (Fisman, 2001; Johnson and Mitton, 2003; Faccio, 2006). However, most of the literature studies the political connection as the personal connection between politicians and specific firms, either via cronyism or shareholding or managers, see, for example, Khwaja and Mian (2005). This paper extends the definition of political connections to a group of firms sharing similar characteristics with politicians. The phenomenon cannot be explained as being the same as the concept of constituency, because there is no election for leaders in China. Therefore, the evidence provides a clue to consider for economic theorists : What is the motivation for this political favor without election disciplines?

Existing studies of political connections usually deal with democratic countries, and the trade off occurs between politician accountability and private (pecuniary) benefit. Under the autocracy, without the election system, accountability is considered to be difficult to hold, which then fades the development How much will the political connection affect the economic activity under an autocracy? This paper provides such evidence using the case of China.

The study also contributes to the political connection literature in two ways. First, the paper measures the intensity of the connections by the number of connected leaders instead of a simple indication of their presence. Second, the study reduces the omitted variable concern that often plagues the literature on political connections by using a panel data framework with firm fixed effect controls.

The rest of the paper is organized as follows. Section 2 presents the background information on government resources, enterprises and politicians. Section 3 describes the building of the data set and the main econometric methodology used in the paper. Section 4 presents the basic results of the political connection on state capital, subsidies and markup, while section 5 explores how other firm characteristics change with the connection. Section 6 checks the heterogeneous effect of the political connection and firm per-

formance after the firms get more resources from the government via the connection. Section 7 concludes the paper.

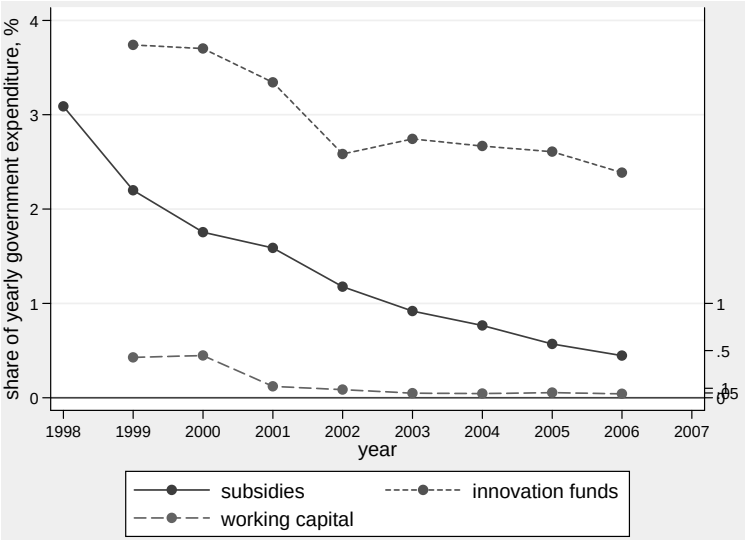
2.2 Background of politicians and firms in China

2.2.1 Firms and government gesources

Besides ownership, the Chinese government is always inclined to use active fiscal policy to intervene in economic activities. For example, to fight the global recession in 2008-2009, the Chinese government implemented a government spending package valued at RMB 4 trillion (US$ 86 billion) in November 2008 (Deng et al., 2011). And Chinese governments have been allocating plenty of resources to support firms, including direct investment, subsidies, special funds, tax breaks etc. To have a rough idea of how large that part of the money is, figure 1 plots the total subsidy and additional working capital that the central government gave to enterprises as ratios of yearly government expenditure. Although decreasing across years, the yearly subsidy to enterprises is still large, accounting for 0.5-3 percentage points of yearly government expenditure; similarly, the working capital of enterprises also decreases over the years, accounting for 0.05-0.5 percentage points of yearly government expenditure; however, the innovation funds to enterprises still remain 2.4-3.7 percentage points of the yearly expenditure. Government investment and subsidies to firms (including the innovation funds)[2] constitute the main focus of the paper. This paper studies the political connection with the national top leaders, so the analysis only focuses on capital flows from the central government. Since there is no detailed information on the subsidy sources, I use the total amount of all government subsidies as the measure.

[2]For individual firms, granted innovation funds are grouped into government subsidy.

Figure 1: Yearly Subsidies, Innovation Funds, Working Capital from the Central Government to Enterprises



Source: Calculated from the government finance part, Premium China Database, CEIC data

The capital from the central government is called state capital, and falls into two types: capital to the central enterprises and capital to other regional enterprises.[3] The investment in the central enterprises are directly managed by the State-owned Assets Supervision and Administration Commission (SASAC) on the State Council, whose core mission is to act as an investor and owner of state assets for the central government. Another type of regular investment planned by the State Council is called the central government within budgetary investment, at least amounting to 2-3 hundred million RMB (i.e. 30-45 million US dollars) per year, and this part of the investment

[3]The Chinese economic system classifies enterprises according to their level of administrative supervision. The central enterprise is the one where the control rights-managerial appointments, asset disposals, strategic directions-of the firms and some or all of the income rights reside with the central government. For regional enterprise, the same control and income rights belong to a regional government (Huang, 2004). For enterprises with more than one public share holder (central or local governments), the administrative supervision is carried out by the largest investor. If the enterprises are completely private or foreign invested, the relationship of administrative supervision is decided by the level of government they are registered with.

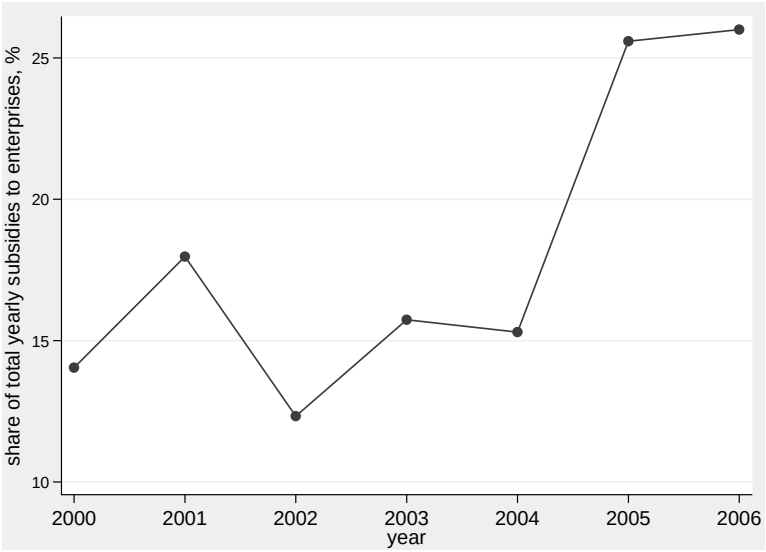
can be increased contingently. It is managed and decided by the National Development and Reform Commission (formerly the State Planning Commission and the State Development Planning Commission before 2003), while the Ministry of Finance issues the funds. In principle, the budget investment functions work like industrial and fiscal policies for the macro-economy adjustment; in practice, they work like the project investment funds, and there is no clear rules to guide in which firms they should invest. There can also be other irregular investments issued out from the offices listed above.

Every year, many kinds of subsidies are announced by various offices in the State Council, and for each of them, there is a specific title. According to Qin (2004), there are three types of subsidies toward SOEs: a) subsidies to help sustain and revive loss-making SOEs; b) subsidies to help privatize or restructure SOEs; and c) subsidies to foster key SOEs. In more detail, if an SOE wants to lay off redundant employees (caused by the old command economy system), wants to reconstruct the production and business, plans to diversify the ownership, or wants to purchase advance technology or replace the old machines, it can apply for such corresponding subsidies to realize its plan. For subsidies that are used to lay off redundant employees, the firm should interact with the Ministry of Human Resources and Social Security (formerly the Ministry of Labour and Social Security before 2003); subsidies for upgrading technology and production machines, and for projects with innovative science and technology are managed by the Ministry of Science and Technology. Other offices that may issue subsidies include the National Development and Reform Commission, the State-Owned Assets Supervision and Administration Commission, the State Planning Commission, the State Development Planning Commission, the State Commission for Economic Restructuring, the Ministry of Finance as well as the Ministry of Commerce. Actually, not only SOEs but also firms with other kinds of ownership, for example collective firms or even firms financed by foreign investments are qualified to apply for such subsidies.

Figure 2 shows the share of subsidies that was directed to foreign enterprises from 2000 to 2006: it increased across years and amounted to 26% of the total subsidies from the central government. In the data used in the

paper, firms with all types of ownership report non-zero subsidies. Usually, firms that are subjected to the administration and supervision of higher level governments (those closer to the central government) respond more to the subsidy announced by the State Council. At the same time, there are subsidies with various titles announced by local governments that firms can apply for. Given the vertical style of bureaucracy in China, we cannot deny that the top leaders from the State Council or the Central Committee may also affect the decision of the local resource allocation.

Figure 2: Yearly Subsidies from the Central Government to Foreign Enterprises



Source: Calculated from the government finance part, Premium China Database, CEIC data

Allocating the state capital investment and subsidies is the duty of the related State Council offices. However, China is lead by the unique party, the Communist Party of China (CPC), and the Central Committee is the top authority within the CPC and in charge of all work of the Party. Although there is no explicit way for the party of directly intervening in the economy , it is reasonable to believe that the Central Committee has the power of influencing the decision of the State Council: all the most essential social

and economic policies need to be approved by CPC and, more importantly, CPC holds the nomenclature role for appointments on the State Council. According to the legal right of Central Committee members, we should not observe the impact of the political connection with a Central Committee member on resources from the central government to firms, but given the possible Party influence, I leave this question open.

2.2.2 Top leaders arising from firms

The study defines that a firm is regarded as connected with a political leader in power if the firm is located in a city/county and industry where the politician has worked at some point in time. The leaders on which the paper focuses include the heads of offices on the State Council that are mentioned in section 2.1, and the members of the Central Committee who were in power at some point in time between 1998 and 2007. In sum:

1. Members of the Central Committee of the Communist Party of China except those who were promoted from the army, since the administration system of the army is separated from other government bureaucracies and thus, the promotion pattern is also different.

2. Heads or vice heads of the departments in the State Council which are involved in the decision of or carrying out the allocation of resources to firms. Premiers, ministers, directors, the secretary general or the vice secretary general from the National Development and Reform Commission; the State-Owned Assets Supervision and Administration Commission; the State Planning Commission; the State Development Planning Commission; the State Commission for Economic Restructuring; the Ministry of Finance; the Ministry of Commerce; the Ministry of Labour and Social Security; the Ministry of Human Resources and Social Security; the Ministry of Science and Technology.

The political leaders of the two categories might overlap. That is, a leader can be a head of office in the State Council and, at the same time, be a member of the Central Committee of CPC, and the leaders who hold positions in

both are usually more powerful. Many of the top leaders have been working in SOEs. It is worth noting that many of the SOEs that they worked for at some point in time have been re-constructed as concernsboth ownership and corporate governance aspects today (Clarke, 2003). Therefore, the type of ownership might not be of any great importance in terms of receiving preferential treatment due to political connections.

A typical career pattern for leaders would be: First, they are re-assigned to the local government from firms. Subsequently, as a common case, they would serve in the local governments, possibly at the county to provincial level for years. Then, if their performance is highly valued, they will be promoted to the State Council and finally get the chance of being selected into top positions, or being elected to the Central Committee.

The process for a politician of getting to the top position is very complicated and long, so I argue that whether and when the politicians come into power is independent of the individual firms they ever worked for. To become a member of the Central Committee, the politician needs to win in the voting of the Party National Congresses, which is composed by thousands of Party members across the country. The heads of departments on the State Council are nominated by the Premier each term, and appointed by the Party, while the vice heads are selected in a more flexible fashion and not restricted by the time period of the term. It is impossible for one individual firm to lobby the various persons who are involved in the appointment. Furthermore, for firms with more than one connected politician, it is even harder to predict the total number of politicians to whom they are connected in a certain year.

Although whether and when an individual politician is in power is arguably exogenous, industries in cities that the politicians come from may be important for the (local or national) economy in a certain period of development of the economy. Therefore, the government will grant economic favor to them even if they do not have any connections at all. The study takes this issue into account by controlling for the interaction terms between industry and year dummies and between province and year dummies.

2.3 Data and methodology

2.3.1 Data sources

The firm data is from the Annual Surveys of Industrial Production, collected by the Chinese National Bureau of Statistics every year since 1998. It is a census of all manufacturing firms with a yearly sales revenue exceeding 5 million RMB, i.e. approximately 0.9 million US dollars, in mainland China, including firms with all types of ownership. The panel data started with over 160,000 firms in 1998, with new firms joining every year, and in 2007 a total of 330,000 firms is included. The surveys cover very detailed information about firms: names, addresses, age, ownership, registered capital and its sources, employees, wage, equity, tax, subsidies etc. The paper limits the leaders under study to the top leaders from the central government and Central Committees. Assuming that the influential power of top leaders decreases along the government cadre, in the study, only firms with an administrative supervision relationship to the central, provincial and prefecture governments, for least one year during the data period, are chosen. It includes 86,827 distinct firms with a ten-year panel from 1998 to 2007, and a total of 406,774 observations.

The data on politicians has been collected by the author: first, the name list of members of the CPC Central Committee, (vice) Ministers/ secretaries of the State Council departments that were mentioned in section 2.2 and were in power at some point in time during 1998-2007 are found, in total 350 politicians; next, politicians' individual CVs are collected from the Dictionary of Successive Communist Party of China Central Committee 1921-2003 (The Organization Department of the Communist Party of the China Central Committee and the Party History Research Center of the Communist Party of China Central Committee, 2004), www.baidu.com, www.renwu360.cn/, www.xinhuanet.com. Information on individual characteristics, including education, fields of majors, working experience, province/city/county worked in at some point in time are all collected.

Among the 350 politicians, 200 indicate having work experience in firms,

but only 173 politicians clearly state the firm names. Then, I use the 173 politician records to build the political connections with firms. Then, 277 distinct firm names are obtained from their CVs (not all of them are manufacturing firms).

I check the two-digit industry codes for these firms and the corresponding city/county they locate in. For firms existing in the survey data, I use the industry code given there (the matched firms can have more than one industry code across years, all are recorded); for firms that are not found in the survey data, I check their online profile to obtain the industry they claim to belong to; for firms that do not specify the industry on their web site, I search in the survey data of manufacturing firms for similar firms by product and then take the top three frequently stated industries as their industry Therefore, one firm can correspond to more than one industry.

Some members of the Central Committee serve in the provincial governments at the same time. This group of leaders is addressed in particular because there might be conflicts about the favors between the local region they are serving and the regions they have served at some point in time. Firms in the industries and cities/counties associated with these leaders are regarded as connected if the cities/counties are inside the same province where the leaders serve while they are members of the Central Committee. Otherwise, they are regarded as not connected. The political connection is thus coded by the pair of $city/county + industry$. It finally gives 194 $city/county + industry$ connection pairs. For each of these pairs in each year, there are three types of political connections: the number of connected leaders from the State Council, the number of connected leaders from the Central Committee, the number of connected leaders who holds positions on both the State Council and the Central Committee. Merging this with the manufacturing firm data, 170 $city/county + industry$ connection pairs associated with 131 politicians are matched. In total, 10,287 out of 86,827 distinct firms ever had any political connection during 1998-2007

2.3.2 Summary of statistics

Table 1 presents the summary of statistics for the variables of interest. State capital, the part in the capital structure that is invested by the central government, and subsidies that are granted from the governments are the measures for preferential treatment from governments. Both of them are in the logarithm of the yearly amount.[4] As shown by table 1, the state capital for one single firm can be as large as 2000 billion RMB and the yearly subsidy can be as large as 13.8 billion RMB. Markup is the measure for the market power of firms, and is calculated by dividing the total profit by the total cost of the products. The range of the markup is huge, from -199.1 to 16826.4. Other firm characteristics, including the total number of employees, yearly sales, profit, total number of actual received capital as well as the birth year are also described in table 1.

[4]The two measures are the logarithm of the number plus 1 so as to get rid of the negative infinite value.

Table 1: Statistics of Firms

VARIABLES	N	Mean	Sd	Min	Max
Panel A: Full Sample					
State Capital (log 10,000 RMB)	406,629	3.987	4.612	0	19.07
Subsidy (log 10,000 RMB)	406,109	1.094	2.506	-2.671	14.02
Markup	391,728	.0177757	26.90143	-199.1	16826.4
Employee (log)	406,773	5.159	1.645	0	12.18
Yearly Sales (log 10,000 RMB)	406,747	9.557	2.839	0	18.98
Total actual received capital (log 10,000 RMB)	389,365	9.069	1.941	-0.119	19.07
Yearly profit (10,000 RMB)	406,773	11,444	405,358	-5.194e+06	1.108e+08
# of CCSC connected	406,774	0.0364	0.213	0	2
# of CC connected	406,774	0.0967	0.520	0	9
# of SC connected	406,774	0.0392	0.227	0	3
Having connection with CCSC	406,774	0.031531	0.1747481	0	1
Having connection with CC	406,774	0.0525279	0.2230894	0	1
Having connection with SC	406,774	0.0307689	0.1726913	0	1
Year the firm established	401,345	1,982	19.36	1,600	2,007
Number of firms	86,827				
Panel B: Firms that never had political Connections					
State Capital (log 10,000 RMB)	352,280	4.119	4.626	0	18.22
Subsidy (log 10,000 RMB)	351,832	1.097	2.510	0	14.02
Markup	338,709	.0220536	28.92998	-199.1	16826.4
Employee (log)	352,420	5.175	1.641	0	12.02
Yearly Sales (log 10,000 RMB)	352,398	9.509	2.864	0	18.89
Total actual received capital (log 10,000 RMB)	336,542	9.049	1.921	-0.119	18.22
Yearly profit (10,000 RMB)	352,420	8,818	174,529	-5.194e+06	2.742e+07
Year the firm established	347,367	1,982	19.40	1,600	2,007
Number of firms	76,540				
Panel C Firms that ever had political connections					
State Capital (log 10,000 RMB)	54,349	3.131	4.425	0	19.07
Subsidy (log 10,000 RMB)	54,277	1.077	2.478	-2.671	13.64
Markup	53,019	-.0095539	.3886813	-53.66667	10
Employee (log)	54,353	5.051	1.667	0	12.18
Yearly Sales (log 10,000 RMB)	54,349	9.865	2.657	0	18.98
Total actual received capital (log 10,000 RMB)	52,823	9.196	2.059	-0.119	19.07
Yearly profit (10,000 RMB)	54,353	28,473	1.016e+06	-4.436e+06	1.108e+08
# of CCSC connected	54,354	0.273	0.526	0	2
# of CC connected	54,354	0.724	1.252	0	9
# of SC connected	54,354	0.294	0.556	0	3
Year the firm established	53,978	1,983	19.08	1,837	2,007
Number of firms	10,287				

Note: CCSC, Central Committee & State Council; CC, Central Committee; SC, State Council, same in all tables. Monetary amounts are deflated by CPI, all in 1998 RMB currency value.

Panel B and Panel C report the statistics of firm characteristics for firms that are never connected and connected at some point in time, respectively. Firms that are never connected and firms that are connected at some point in

time have a closer mean value and a standard deviation of subsidies, but for state capital, firms that were connected at some point in time have a much lower mean. Firms that were connected at some point in time show a much lower mean of the markup than those that were never connected, but they also have a much lower standard deviation than what the similarity within the group suggests. For other characteristics, firms that were connected at some point in time and those that were never connected show similar mean values and standard deviations for the number of employees, yearly sales and total received capital. Firms that were connected at some point in time have a mean profit that is three times larger than those that have never been connected.

The sample of firms that were connected at some point in time and those that were never connected can be very different. As most of the leaders on which I focus were selected from industrial firms to governments in the very early years of the reform of the economy, it means that some regions and industries are much less likely to be the origins of the leader. Before the economy reform, China was not even well industrialized so that quite a few counties/cities have no or not enough necessary infrastructure for the industrial sector to develop at all. Also in the early years of the reform of the economy, the types of industries were not as many as today so that the politicians can never be selected from some industries. Therefore, firms in these industries and counties/cities can be very different from those where current top leaders worked at some point in time had in many respects. In order to have a better control group, I will limit the analysis to firms that had political connections at some point in time during 1998-2007.

That a firm was connected with a top leaderat some point in time does not mean it has these political connections every year, because the politicians can be in and out of positions across years for various reasons. The number of connected leaders that hold positions on both the Central Committee and the State Council ranges from 0 to 2; the number of connected leaders from the Central Committee ranges from 0 to 9; the number of connected leaders from the State Council ranges from 0 to 3.

Table 2 shows the statistic of all 131 politicians that were ever connected with firms across years: the status of in or out of power each year. For the three types of politicians, the number of connected leaders who hold positions on both the Central Committee and the State Council are always the fewest, the number from the Central Committee is the highest, and the number from the State Council accounts for one fourth to half of the number of those from the Central Committee. The data period covers two government periods of the two types of politicians, which are the period 1997-2002 and the period 2002-2007 for the Central Committee of CCP; the period of 1998-2003 and the period of 2003-2008 for the State Council. Therefore, the period of 2002-2004 is when most changes were observed. From table 2, we can see that the year 2002 and the year 2003 are the most volatile years. There is less change in the leaders from the State Council compared to the leaders on the Central Committee. It might be because the departments on the State Council involved in the economic intervention usually require professional knowledge and experience so that the turnover of leaders is less frequent.

The turnover of leaders can also occur in years outside the years when there is a change of government periods. Such irregular appointments are more likely to happen with the State Council and vice heads because of the contingent needs. A replacement on the Central Committee can only occur for unpredictable reasons (sick, dead, investigated/arrested due to malpractice etc.). In order to maintain the fixed number of Central Committee members, new politicians are elected to fill the absence in this situation,. Table 3 lists the number of changes each year by reasons. Among these reasons, dismissed/arrested/fled due to malpractice, term limit, and retired can be regarded as a purely exogenous shock, which accounts for 8% of the total variance. Given the selection process of the top leaders in the national government and the shock of replacement, the amount of politicians that firms were connected with each year is arguably exogenous to firms.

Table 2: Types of Politicians Connected with Firms across Years

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Not in power	57	56	51	49	26	53	58	58	60	61
Central Committee	49	49	53	54	81	44	46	47	46	48
State Council	19	20	21	22	18	23	19	18	16	13
Both CC & SC	6	6	6	6	6	11	8	8	9	9
Total	131	131	131	131	131	131	131	131	131	131

Table 3: Reasons for Connected Leaders to Vary across Years

Type of change	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
placed in CC		1		25					1	27
placed in SC	3	2	2	1	7		1	2		18
leave due to position change	2	1	1	2	2	1	2	3	3	17
change from Central Committee to Both					5	1	1			7
change from State Council to Central Committee				1						1
change from State Council to Both				2						2
change from Both to Central Committee				2	1	2				5
change from Both to State Council					1					1
dismissed due to abusing power					1					1
flee due to corruption case					1					1
arrested due to corruption									1	1
retire					4	1				5
Leave after term terminated					28	2				30
term limit						1				1
Total	5	4	3	33	50	8	4	5	5	117

Note: The difference in the numbers of politicians between year n and n-1 corresponding to various reasons is list in the table.

2.3.3 Methodology

The core difficulty in identifying the impact of political connections on preferential treatment from governments is the endogeneity concern. Some firms are important and influential to the country so that politicians that worked there at some point in time are more likely to be promoted and, at the same time, more government resources are directed to firms; or such firms have received government preferential treatment for a long time, and would further lobby the decision makers to elect the politicians who are connected with the firms to the positions. Given this concern, a convincing estimation strategy is to exploit the variation for the same firm across years by using firm fixed effects (Khwaja and Mian (2005):

The main estimator in the analysis is the fixed effect estimator for panel data,

$$\begin{aligned} y_{it} = \quad & c_i + \lambda_t + Political\_connection_{it}\tau + Industry_{it} * \lambda_t + province_i * \lambda_t \\ & + G_i * \lambda_t + Ownership_{it} * \lambda_t + \epsilon_{it} \quad (1) \end{aligned}$$

where y_{it} are the results of interest: state capital, subsidies and markup of firm i in year t. y_{it} can also be other firm characteristics in auxiliary regressions and checks. The reason why I do not scale the state capital and subsidies by yearly sales or the total number of employees is that either sales or employees can be affected by the political connection. Similarly, because many firm characteristics such as measures of the performance might be affected by the political connection, I exclude them from the regressions. λ_t is the vector of year dummies, and the subscript t denotes year 1998 to 2007. c_i is the firm fixed effects representing unobserved firm characteristics.

$Political\_connection_{it}$ is the vector of political connection indexes for firm i in year t, which are the key independent variables of interest: *# of CCSC politicians*, *# of CCSC politicians* , *# of SC politicians*. CC refers to the Central Committee, SC refers to the State Council, and CCSC refers to the Central Committee and the State Council. Since one politician can be in and out of office across years, the number of politicians that are connected with firms changes across years.

$Industry_{it} * \lambda_t$, $province_i * \lambda_t$, are interaction terms between industries dum-

mies (two-digit industry code, 40 categories in total), province dummies (24 provinces out of a total 31 provinces in China) and year dummies, respectively. These interaction terms are included to control for the provincial trend and the industry trend that may affect the decisions of resource allocation and the appointment of politicians. The reason why the politicians were selected from firms to governments can be that the industry they worked in was important for the economy at that time. Although the year they were selected from firms to governments is many years before the survey years, it is possible that those industries are still important for the national economy nowadays. Similar concerns apply to the provinces. Controlling for the industry trend and the provincial trend in the regressions will cater to these concerns.

Although the sample is limited to firms that were connected with top leaders at some point in time, the connection patterns differ across firms. There are four types of firms: firms switch at least twice between being connected and not connected during the sample periods - type 1; firms have no political connection at the beginning of the sample periods but gain it later on - type 2; firms have the political connection at the beginning but lose it later - type 3; firms have political connections in all survey years - type 4. It is possible that firms with the same connection pattern share some unobservable characteristics. I control for the different connection pattern trends by including the interaction terms between the dummies of four types and year dummies, $G_i * \lambda_t$. G_i is the vector of the connection pattern dummies.

According to Huang (2004), the Chinese government has a political pecking order: the government holds certain political preferences towards different types of ownership, and the preferences are translated into economic policies, regulatory practices, financial support decisions etc. State-owned or state-controlled enterprises are ranked first, and then follow collective firms, firms financed by foreign investments are next, while domestic private firms are the last.[5] I control for the ownership type trend by including the interaction terms between the dummies of ownership and the year dummies, $Ownership_{it} * \lambda_t$.

In all regressions, the standard errors are corrected to account for the

[5]In total, 23 ownership types exist in the data.

correlation of the error terms across observations in different years that correspond to the same firm and thus are clustered at the firm level.

2.4 Main results

2.4.1 The impact of the political connection on state capital, subsidy and market power

Table 4 presents the results of the estimation of equation (1). If the firm is connected with one more leader who holds positions on both the Central Committee and the State Council, it will obtain 23 percent more state capital than the average level, and its markup is increased by 2 percentage points. However, such a connection has no impact on the subsidies the firm receives. In contrast, if the firm is connected with one more leader from the State Council, the subsidies it receives will be 9.4 percent higher than the average. The connection with leaders who only hold positions on the State Council does not help firms obtain more state capital: the point estimate is small and negative and without any statistical significance. The connection with leaders from the Central Committee does not show any effect on all three outcome measures, in terms of both economic and statistical significance.

Table 4: Impact of Political Connection on Resources Obtained and Market Power

VARIABLES	(1) State Capital	(2) Subsidy	(3) Markup
# of CCSC politicians connected	0.207***	0.0250	0.0198***
	(0.0746)	(0.0481)	(0.00588)
# of CC politicians connected	0.0461	-0.0170	0.00181
	(0.0368)	(0.0213)	(0.00355)
# of SC politicians connected	-0.0588	0.0897**	0.00615
	(0.0706)	(0.0373)	(0.00615)
Observations	52,048	52,052	52,046
Number of firms	9898	9898	9,897
R-squared	0.104	0.048	0.015
Year dummy	YES	YES	YES
Firm FE	YES	YES	YES
Industry*year dummy	YES	YES	YES
Province*year dummy	YES	YES	YES
Connection pattern * year dummy	YES	YES	YES
Ownership type*year dummy	YES	YES	YES
F-test for connection variables jointly zero	3.088	2.469	4.267
Prob>F	0.0260	0.0600	0.00510

Note: The dependent variables, "State Capital" and "Subsidies", are the logarithms of the real values that are deflated by CPI plus 1. "Markup" is the ratio of the product profit to the cost.
Robust standard errors clustered at the firm level are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Usually the leader holding positions on both the Central Committee and the State Council ranks at the top of the hierarchy. Hence, it is not surprising to see how they influence the large amount (state capital investment) rather than the small amount (subsidies). Compared with subsidies [what do you mean by "the grant of subsidies"?], the probability of receiving extra state capital investments from the central government is much lower, but the amount is much larger than the subsidies. Therefore, if the powerful top leaders plan to favor their preferred firms, they will not bother about grants of a small amount such as subsidies, rather they will consider big grants like state capital investment. On the other hand, comparatively lower level leaders, who only hold positions on the State Council, for example, may not want to risk and divert the state capital to their preferential firms. This is due to the fact that the amount of state capital investment is usually huge and easily noticed if it goes to some inferior or unqualified firms.

Compared with the resources that are directed to firms through political connections, the market power of the firm is the second-order effect. Holding total resources unchanged, when the connected firms receive more resources,

it may strengthen firms' competence or help maintain their monopoly powers; even if it does not help them compete with other existing firms, it will definitely deter new entries and thus increase their market power.

2.4.2 Why do such political connection work?

As the concept of political connections defined in the paper is different from the existing studies but we do observe the impact, what can explain such an impact? I suggest two mechanisms in this subsection and discuss the appropriateness of them in later sections after more results on the heterogeneous effects and the usage of extra resources have been investigated.

The first mechanism is the information view. Similar to the related lending discussed in La Porta, Lopeiz-de-silanes and Zamarripa (2003), leaders may know more about the firms in the industries and the counties/cities where they worked at some point in time, so they are better able to assess the cost-benefit of the investment. If the leader acts as a government investor and aims at maximizing the profit of investment, the information view predicts that the resources are more likely to go to high quality firms and generate high returns.

The second mechanism is the reputation building view. In China, when the politician became an influential and well-known figure, industries and counties/cities where they have worked at some point in time will attract more attention from the public. If firms there grow well, people or even the superior officers will nevertheless owe some credit to the leader. Such a good image definitely does good for the future career of the leader. At the same time, given the high concentration of the public attention, policies or directives from the leader in these places will be quickly noticed by people. Therefore, it is easier for the leader to build a good image by doing some things that meet public expectations. Hence, when the politician comes into power, she/he is motivated to divert resources to promote the development of the industries in the counties/cities. For the public, it is not easy to observe the profit and even if it is, most people care about employment much more than market value. Then, when choosing what firms to boost, the leader will

favor those firms with a large number of people employed.

To further tell whether one of the mechanisms or both are more appropriate for the case under study, we will need to check what type of firms is more likely to receive the favor from connected leaders. This will be discussed in section 5.

Besides the above two mechanisms, other mechanisms such as social networking or bribery might also explain the impact. However, absent the appropriate measure, it is not possible to make such a hypothesis. I leave this to future work.

2.5 Heterogeneous effects

The political connection occurs at the industry and county/city level, and it is not possible that all firms within the connected industries and counties/cities received the preferential treatment. Certain types of firms might be more likely to be targeted by the leaders. According to the information view, firms with higher sales or profit should be targeted; according to the reputation building view, firms with a larger number of employees should be targeted. To explore what are the characteristics that help firms obtain the preferential treatment, I include some interaction terms to investigate the heterogeneous effects. These are the interaction terms between firm characteristics one year before the firm steps into the connection and the number of political connections in the first connected year, as well as the interaction terms between firm characteristics one year before the firm loses the connection and the dummy of the first disconnected year.

2.5.1 Heterogeneous effects of political connections on state capital investment

Before constructing the interaction terms, I first need to find out when the preferential treatment will emerge or disappear. After checks, I find that getting (losing) the extra resources is more likely to happen in the same year that the firm steps into (out of) political connections, while little is

changed one year after that.[6] Therefore, in addition to the specification of equation (1), I add the interaction terms between the firm characteristics one year before getting connections and the number of connected leaders who hold positions on both the State Council and the Central Committee, and the interaction terms between the firm characteristics one year before losing connections and the dummy of the first year that the firm loses connections. Thus, I run the equation (2) as follows:

$$\begin{aligned} y_{it} &= c_i + \lambda_t + Political\_connection_{it}\tau + \#\ of\ CCSC_{it*}\alpha \\ &\quad + \#\ of\ CCSC_{it*} \times Charact_{it*-1}\Phi + CCSC_{it^0}\beta + CCSC_{it^0} \times Charact_{it^0-1}\Omega \\ &\quad + Industry_{it} * \lambda_t + province_i * \lambda_t + G_i * \lambda_t + Ownership_{it} * \lambda_t + \epsilon_{it} \quad (2) \end{aligned}$$

where subscription $t*$ denotes the year when the firm gains political connections, and t^0 denotes the year when the firm loses political connections. $\#\ of\ CCSC_{it*}$ denote the number of connected leaders that holds positions on both the Central Committee and the State Council. $CCSC_{it^0}$ is the dummy for the year that the firm loses the connection with leaders holding positions in both.

The result is reported in table 5, column (1). Firms with more employees are more likely to receive more state capital when they get connected. However, yearly sales and profits predict the extra state capital in the opposite way: firms with lower yearly sales and less profit are more likely to receive the state capital investment from the central government. The point estimate is interpreted as: given that the firm is connected with a top leader who holds positions on both the Central Committee and the State Council at year $t*$, if the firm has 1 percent more employees than the average, it will obtain 0.12 percent more state capital investment as compared to firms that are connected with such a leader; if the firm earns 10,000 RMB less profit, it will receive 0.00005 percent more state capital investment than the average; if the firm has 1 percent lower yearly sales than the average, it will receive 0.08 percent more state capital investment. The effect associated with the number of employees is large and suggests the larger weight of employment concern when leaders decide where to invest the state capital. The level of total other capital does not seem to help attract more state capital invest-

[6] Results will be provided upon request.

ment from the central government, since the point estimate has no statistical significance at all.

Table 5: Heterogeneous Effects with Different Firm Characteristics

	(1)		(2)
VARIABLES	State Capital	VARIABLES	Subsidy
# of CCSC politicians connected	0.252***	# of CCSC politicians connected	0.0262
	(0.0852)		(0.0485)
# of CC politicians connected	0.0477	# of CC politicians connected	-0.0164
	(0.0371)		(0.0216)
# of SC politicians connected	-0.0626	# of SC politicians connected	0.0944**
	(0.0721)		(0.0422)
# of CCSC politicians connected_t*	-0.124	# of SC politicians connected_t*	-0.671***
	(0.310)		(0.225)
CCSC_t ^{0}	-0.287	CCSC_t ^{0}	0.376
	(0.460)		(0.236)
# of CCSC politicians connected_t* X employee_t*-1	0.123**	# of SC politicians connected_t* X employee_t*-1	-0.0309
	(0.0608)		(0.0379)
# of CCSC politicians connected_t* X profit_t*-1	-8.84e-08**	# of SC politicians connected_t* X profit_t*-1	-6.26e-08
	(3.52e-08)		(8.76e-08)
# of CCSC politicians connected_t* X yearly sales_t*-1	-0.0799*	# of SC politicians connected_t* X yearly sales_t*-1	0.0784***
	(0.0464)		(0.0288)
# of CCSC politicians connected_t* X total other capital_t*-1	0.0318	# of SC politicians connected_t* X total other capital_t*-1	0.00241
	(0.0196)		(0.0126)
CCSC_t ^{0} X employee_ t ^{0}-1	0.0539	SC_t ^{0} X employee_ t ^{0}-1	-0.0550
	(0.0864)		(0.0462)
CCSC_t ^{0} X profit _ t ^{0}-1	2.40e-06*	SC_t ^{0} X profit _ t ^{0}-1	-2.55e-08
	(1.39e-06)		(1.56e-07)
CCSC_t ^{0} X yearly sales _ t ^{0}-1	0.0340	SC_t ^{0} X yearly sales _ t ^{0}-1	-0.0169
	(0.0582)		(0.0328)
CCSC_t ^{0} X total other capital _ t ^{0}-1	-0.0237	SC_t ^{0} X total other capital _ t ^{0}-1	0.0151
	(0.0347)		(0.0124)
Observations	51,531	Observations	51,535
R-squared	0.104	R-squared	0.049
Number of idpanel	9,829	Number of idpanel	9,829
Year dummy	YES	Year dummy	YES
Firm FE	YES	Firm FE	YES
Industry*Year dummy	YES	Industry*Year dummy	YES
Province*year dummy	YES	Province*year dummy	YES
Connection pattern* year dummy	YES	Connection pattern* year dummy	YES
Ownership type*year dummy	YES	Ownership type*year dummy	YES

Note: t* denotes the year that the firm steps into connections, t*-1 denotes one year before the firm steps into connections. t ^{0} denotes the year that the firm loses connections, t ^{0}-1 denotes one year before the firm loses connections.
Robust standard errors clustered at the firm level are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Let us move to the interaction terms between firm characteristics and the dummy of the year when the firm loses connections. Except the number

of employees, the interaction terms associated with yearly sales and profit do show opposite signs to those interacting with the number of connected leaders. It suggests that firms with lower yearly sales and less profit lose the state capital in the year when they lose the connection. Firms with more employees still maintain the level of state capital when they lose the connection. However, except for the interaction term associated with the profit, the point estimates for other interaction terms do not have enough statistical power to be concluded.

The results suggest that state capital does go primarily to firms with an explicitly better performance, but towards larger firms in terms of the number of employees. The purpose of state capital does not seem to be to maximize the investment return. The top leaders do not really take advantage of their knowledge of the connected firms. Thus, the information view does not seem to work but the reputation building view is consistent with the results. The top leaders tend to build a good image for themselves by boosting employment in the industries and counties/cities where they worked for at some point in time.

Is the state capital investment towards large firms in terms of employment size efficiency? It depends. If the central government cares more about big firms with more employees, such preferential treatment from the leaders is efficiency in the sense that it helps the government achieve its equality goal. If this is not the case, the efficiency in the economy is sacrificed and the national economy then pays for the individual leader's ambitions.

No matter what is the real target of the central government, state capital does help maintain large employment with the presence of such political connections. Leaving the efficiency issue aside, large employment is always what the people like. Surprisingly, in an autocracy and developing country like China, the career concern of leaders drives the behaviors of leaders somehow towards what people expect.

2.5.2 Heterogeneous effects of political connections on subsidies

As described in section 2, there are various names of subsidies with different aims: subsidies for laying off redundant employees, subsidies for restructuring productions, subsidies for science and technology innovations etc. It is difficult to predict what types of firms are more favored before looking into the results. Replacing the interaction terms in equation (2) with those between the firm characteristics and the number of connected leaders who hold positions only on the State Council, I run the following equation (3)

$$\begin{aligned} y_{it} &= c_i + \lambda_t + Political\_connection_{it}\tau + \#\ of\ SC_{it*}\alpha + \#\ of\ SC_{it*} \times Charact_{it*-1}\Phi \\ &\quad + SC_{it^0}\beta + SC_{it^0} \times Charact_{it^0-1}\Omega + Industry_{it} * \lambda_t + province_i * \lambda_t \\ &\quad + G_i * \lambda_t + Ownership_{it} * \lambda_t + \epsilon_{it} \quad (3) \end{aligned}$$

The timing variables $t*$ (t^0) are defined as the year when the firm gets connected (disconnected) with leaders holding positions on the State Council, because we only observe that this kind of connections helps to obtain more subsidies in section 4. The result is reported in table 5, column (2). We can see that only the estimate for yearly sales has any statistical significance: firms with higher yearly sales receive more subsidies. This suggests that leaders on the State Council seem to care more about firms with active business transactions. However, other firm characteristics seem to be trivial in decisions on subsidy allocation, as both the magnitude of the point estimate and statistical significance are small.

2.6 Usage of resources due to political connections

In this section, I discuss the usage of the extra resources that are obtained through political connections. If the extra resources are given to firms with specific individual goals, for example to build more projects, we should observe that related firm characteristics change with the political connections at the same time. If the projects target a long-run return, or there is no specific requirement and firms are allowed to maneuver the resources by themselves,

and if the extra resources are used appropriately, we may observe that some firm characteristics change in a comparatively long run. To examine this question, I first check the short-run effect of political connections in subsection 6.1, and then the long-run usage of the extra resources since the year when the firm receives the preferential treatment in subsections 6.2 to 6.4.

To check the long-run usage of the resources, I limit the analysis to only firms which actually obtain (lose) more resources in the year or one year after they gain (lose) political connections. By standardizing the years into *ith* years before or after the year when the firm gains (loses) connections and exploring the variation across them, I can draw a clear graph indicating what is going on along the time axis. When analyzing the state capital investment, I construct the standard years according to connections with leaders who hold positions both on the Central Committee and the State Council; when it applies to the analysis of subsidies, I construct them according to connections with leaders who hold positions only on the State Council.

2.6.1 Is the extra resource accompanied by more projects?

Bertrand, Kramarz, Schoar and Thesmar (2007) find that politically connected CEOs hire more employees during the election periods but such an increase does not entail more projects or contracts. Similarly, I ask what is the goal for the extra resources from governments to firms. Is it because the connected firms are promising in terms of investment returns as suggested by the information view?If so, the increase in state capital or subsidies will come with more projects. In this case, we should observe a larger production size, or higher yearly sales, or even a higher profit when they are connected with top leaders. Moreover, if the extra state capital is issued to create more projects, but not to substitute other investment, we should observe that the total capital of the firms increased with the connections with leaders holding positions on both the Central Committee and the State Council.

Replacing the dependent variable with the number of employees, yearly sales, profits and total amount of capital, I re-estimate equation (1). Table 6 presents the estimates of political connections on the above four firm char-

acteristics. From columns (1), (2) and (4), we cannot reject the zero effect of the connections with leaders who hold positions in both top authorities, and with leaders who hold positions only on the State Council. The two types of leaders are shown to bring more resources to firms in section 4.

Table 6: Political Connections and other Firm Characteristics

VARIABLES	(1) Employee	(2) Yearly Sales	(3) Total Capital	(4) Profit
# of CCSC politicians connected	-0.00685	0.0263	-0.0228	30,309
	(0.0146)	(0.0199)	(0.0157)	(23,919)
# of CC politicians connected	0.0191**	0.0187*	0.00923	-478.8
	(0.00800)	(0.0105)	(0.00724)	(3,185)
# of SC politicians connected	0.00454	-0.00610	0.0204	-7,405
	(0.0134)	(0.0175)	(0.0127)	(6,626)
Observations	52,052	52,049	52,044	52,052
R-squared	0.151	0.144	0.069	0.262
Number of idpanel	9,898	9,898	9,898	9,898
Year dummy	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Industry*Year dummy	YES	YES	YES	YES
Province*year dummy	YES	YES	YES	YES
Connection pattern*year dummy	YES	YES	YES	YES
Ownership type*year dummy	YES	YES	YES	YES

Note: "Employee" is the logarithm of the total number of employees. "Yearly Sales" is the logarithm of the real value of sales that is deflated by CPI plus 1. "Total Capital" is the logarithm of the real value of total received capital that is deflated by CPI. "Profit" is the real value of the profit, which is not in logarithm form due to the negative observations.
Robust standard errors clustered at the firm level are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

Column (3), surprisingly, presents a zero effect on total capital of connections with leaders who hold positions on both the Central Committee and the State Council: the estimate is negative and statistically insignificant. Why does extra state capital investments to firms not increase total capital? A possible explanation is: when the state capital is increased due to the political connections, it does at the same time crowd out other sources of capital, by an equivalent or even larger amount.

2.6.2 Capital structure changes around years of getting (losing) connections

From section 6.1, we do not observe any increase in the total capital when the firm is connected with leaders who hold positions on both the Central

Committee and the State Council, while such connections bring more state capital to firms. In this subsection, I check what happens to the capital structure when firms receive an extra state capital investment due to their political connections. I limit the sample to firms that obtain (lose) extra state capital in the year or 1 year after they gain (lose) connections with leaders holding positions on both the Central Committee and the State Council, and then run the following regression:

$$\begin{aligned} K_{it} &= c_i + \lambda_t + CCSC_{it'-1}\alpha_1 + CCSC_{it*}\alpha_2 + CCSC_{it*+1}\alpha_3 + CCSC_{it*+2}\alpha_4 \\ &\quad + CCSC_{it^0}\beta_1 + CCSC_{it^0+1}\beta_2 + CCSC_{it^0+2}\beta_3 + Industry_{it} * \lambda_t \\ &\quad + province_i * \lambda_t + G_i * \lambda_t + Ownership_{it} * \lambda_t + \epsilon_{it} \quad (4) \end{aligned}$$

K_{it} denotes one of the specific types of capital: state capital, collective capital (from local governments), domestic private capital, legal person capital (capital invested by domestic companies), Hong Kong or Macao capital, foreign capital and total actual capital received. Subscript $t*$ denotes the year when the firm gets the connections, t^0 denotes the year when the firm losses the connections. The results are reported in table 7. From table 7, except for foreign capital, all other types of capital start decreasing in the same year, or one to two years after getting the connections, and the decrease remains even until the year when the firm loses the connections. In one to two years after losing the connections, other types of capital start increasing.

Table 7: Capital Structure Change around Years into and out of Connections with CCSC

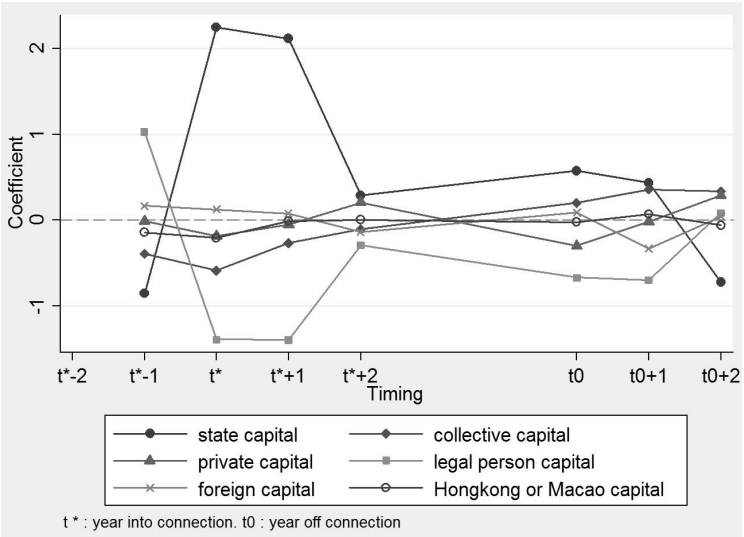
VARIABLES	(1) State Capital	(2) Collective Capital	(3) Private Capital	(4) Legal person Capital	(5) HK & Makao Capital	(6) Foreign Capital	(7) Total Capital
CCSC__t*-1	-0.851**	-0.393*	-0.00816	1.027**	-0.139	0.167	-0.0576
	(0.421)	(0.234)	(0.156)	(0.445)	(0.127)	(0.140)	(0.0475)
CCSC__t*	2.243***	-0.583**	-0.184	-1.389**	-0.205	0.126	-0.121**
	(0.528)	(0.294)	(0.229)	(0.545)	(0.173)	(0.188)	(0.0603)
CCSC__t*+1	2.114***	-0.264	-0.0510	-1.395**	-0.0102	0.0786	-0.00113
	(0.549)	(0.295)	(0.223)	(0.546)	(0.189)	(0.207)	(0.0644)
CCSC__t*+2	0.289	-0.102	0.208	-0.290	0.00623	-0.137	-0.0916
	(0.507)	(0.234)	(0.214)	(0.482)	(0.124)	(0.109)	(0.0657)
CCSC_t ^{0}	0.576	0.200	-0.299	-0.668	-0.0214	0.0891	-0.0421
	(0.529)	(0.309)	(0.195)	(0.502)	(0.148)	(0.144)	(0.0636)
CCSC_t ^{0}+1	0.431	0.360	-0.0177	-0.697	0.0709	-0.328*	-0.121
	(0.565)	(0.407)	(0.287)	(0.588)	(0.230)	(0.194)	(0.0912)
CCSC_t ^{0}+2	-0.721	0.334	0.286	0.0856	-0.0619	0.0422	-0.0112
	(0.485)	(0.360)	(0.177)	(0.506)	(0.206)	(0.205)	(0.0626)
Observations	3,748	3,748	3,748	3,747	3,748	3,748	3,747
R-squared	0.325	0.331	0.397	0.299	0.589	0.568	0.206
Number of firms	524	524	524	524	524	524	524
Year dummy	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES
Industry*Year dummies	YES	YES	YES	YES	YES	YES	YES
Province*year dummies	YES	YES	YES	YES	YES	YES	YES
Connection pattern* year dummies	YES	YES	YES	YES	YES	YES	YES
Ownership type*year dummies	YES	YES	YES	YES	YES	YES	YES

Note: Except for Total capital, all other dependant variables are the logarithm of the real value that is deflated by the CPI plus 1. Total capital is the real value that is deflated by the CPI. t* denotes year into the connection, t*-1 denotes one year before get into the connection, t*+1 one year after, etc. t 0 denotes the year out of connection, t 0+1 denotes one year after the year losing connection, etc. The sample is limited to firms that do get (lose) more state capital when they step into (out of) connections with leaders who hold positions on both the Central Committee and the State Council.

Robust standard errors clustered at the firm level are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

To clearly see the pattern , I plot the coefficient estimates α_1-α_4, and β_1-β_3 of regressions for each type of capital in figure 3. From figure 3, we can see that the level of state capital increases starting from the year when firms get the connections, but only two years after getting the connections, the state capital has almost fallen back to the level of the time before the connections. When extra state capital kicks in, all other domestic capital is crowded out and capital from local governments (collective capital) and domestic legal person capital decrease all the time even until the two years after the year when getting the connections. Domestic private capital finally goes back and beyond the level of the years before being connected two years after the year getting the connections. Hongkong & Macao capital and foreign capital have the flattest patterns: they are barely affected by the extra state capital. The most crowded out capital is legal person capital and collective capital, while legal person capitalcan hardly return to the original level.

Figure 3: Capital Structure Change across Years since Becoming Connected



2.6.3 Usage of the extra state capital.

In this subsection, I investigate the usage of the extra state capital that is due to political connections in a comparatively longer run. Will it be used to

increase the production or capability of making a profit? I limit the sample to firms which actually obtain more state capital in the year or 1 year after getting connections. I replaced K_{it} with employees, yearly sales and profit, and re-estimate equation (4).

The results are reported in table 8. In the same year and one year after the firm gets the connections, all three measures are decreased but without statistical significance. The three characteristics show mixed signs in the years around the year when the firm loses the connections, but still without any statisticalsignificance. Actually, we cannot reject the zero effects of political connections on the performance indexes of all three firms.

Table 8: Firm Characteristics around Years into/out of Connections with CCSC

	(1)	(2)	(3)
VARIABLES	Employee	Yearly sales	Profit
CCSC__t*-1	0.0340	-0.0256	-9,227
	(0.0525)	(0.0677)	(6,945)
CCSC__t*	-0.0375	-0.00967	-25,152
	(0.0647)	(0.0878)	(21,471)
CCSC__t*+1	-0.0164	-0.000982	-22,156
	(0.0788)	(0.0909)	(23,041)
CCSC__t*+2	-0.0181	0.0665	2,071
	(0.0582)	(0.0743)	(8,475)
CCSC_t ^{0}	0.0186	0.0669	-17,421
	(0.0507)	(0.0883)	(15,418)
CCSC_t ^{0}+1	-0.000117	0.0447	-43,304
	(0.0684)	(0.0986)	(28,067)
CCSC_t ^{0}+2	0.0189	0.0740	-28,790
	(0.0548)	(0.0867)	(31,900)
Observations	3,748	3,748	3,748
R-squared	0.282	0.264	0.440
Number of firms	524	524	524
Year dummies	YES	YES	YES
Firm FE	YES	YES	YES
Industry*year dummies	YES	YES	YES
Province*year dummies	YES	YES	YES
Connection pattern*year dummies	YES	YES	YES
Ownership type*year dummies	YES	YES	YES

Note: "Employee" is the logarithm of the total number of employees. "Yearly Sales" is the logarithm of the real value of sales that is deflated by CPI plus 1. "Profit" is the real value of the profit, which is not in logarithm form due to the negative observations. t* denotes the year into connection, t*-1 denotes one year before get into the connection, t*+1 one year after, etc. t ^{0} denotes the year out of connection, t ^{0}+1 denotes one year after the year when losing the connection, etc. The sample is limited to firms that do receive (lose) more state capital when stepping into (out of) connections with CCSC.
Robust standard errors clustered at the firm level are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

In sum, I did not find any statistically significant change in firms' employment, yearly sales and profit during the year and until two years after the firm obtains the connections with leaders who hold positions on both the Central Committee and the State Council. This type of connections, however, brings more state capital to firms. Combing this result with the result from subsection 6.1, I conclude that the extra state capital does not come with more or better projects, and at least, it does not improve production size, nor yearly sales or profit.

2.6.4 Usage of extra subsidy

Compared with the state capital investment, subsidies are of a smaller amount and more like cash flows. Firms are supposed to spend the subsidies right after obtaining them. Therefore, the effect of extra subsidies, if there is any, should be observed immediately after the firm obtains (loses) the connections. Revising equation (4), I run the estimate for equation (5) as follows:

$$\begin{aligned} Charact_{it} &= c_i + \lambda_t + SC_{it'-1}\alpha_1 + SC_{it*}\alpha_2 + SC_{it*+1}\alpha_3 + SC_{it*+2}\alpha_4 \\ &\quad + SC_{it^0}\beta_1 + SC_{it^0+1}\beta_2 + SC_{it^0+2}\beta_3 + Industry_{it} * \lambda_t \\ &\quad + province_i * \lambda_t + G_i * \lambda_t + Ownership_{it} * \lambda_t + \epsilon_{it} \quad (5) \end{aligned}$$

$Charact_{it}$ denotes the firm characteristics of interest, employee, yearly sales and profit.

The results are reported in table 9. From table 9, we can see that in the year when the firm gets the connections with leaders from the State Council, the profit of the firm increases by an additional 23.572 million RMB. Given that the average level of yearly profit is 28.473 million RMB, this estimate is really huge, accounting for almost 83% of the average level. The yearly sales at the same time will at most increase by 9.6 percent, and the number of employees will increase by 5.4 percent, but these estimates have no statistic significance at all. Hence, it is hard to believe that the increased profit is generated by the enlarged production or sales. And the effect on profit drops dramatically one year later and even turns negative two years after the firm steps into connections. Therefore, the increased profit is probably simply driven by the increased income source - subsidies. Still, no sustainable

effects on firms' performance are found for the extra subsidies obtained.

Table 9: Firm Characteristics around Years into/out of Connections with SC

	(1)	(2)	(3)
VARIABLES	Employee	Yearly sales	Profit
SC__t*-1	-0.00427	0.119	5,048
	(0.0770)	(0.0741)	(8,096)
SC__t*	0.0528	0.0917	23,572**
	(0.0756)	(0.0825)	(11,187)
SC__t*+1	-0.0291	0.0681	11,546
	(0.0760)	(0.0757)	(15,501)
SC__t*+2	-0.0292	0.0231	-1,128
	(0.0678)	(0.0731)	(17,542)
SC_t ^{0}	-0.00404	-0.165*	-21,591
	(0.0708)	(0.0863)	(13,139)
SC_t ^{0}+1	-0.0561	-0.203*	-18,282
	(0.0764)	(0.112)	(27,864)
SC_t ^{0}+2	-0.0110	-0.177*	-2,374
	(0.0924)	(0.0960)	(13,344)
Observations	2,878	2,878	2,878
R-squared	0.353	0.350	0.467
Number of firms	389	389	389
Year dummies	YES	YES	YES
Firm FE	YES	YES	YES
Industry*year dummies	YES	YES	YES
Province*year dummies	YES	YES	YES
Connection pattern*year dummies	YES	YES	YES
Ownership type*year dummies	YES	YES	YES

Note: "Employee" is the logarithm of the total number of employees. "Yearly Sales" is the logarithm of the real value of sales that is deflated by CPI plus 1. "Profit" is the real value of the profit, which is not in logarithm form due to the negative observations. t* denotes the year into connection, t*-1 denotes one year before getting into the connection, t*+1 one year after, etc. t ^{0} denotes the year out of connection, t ^{0}+1 denotes one year after the year when losing connection, etc. The sample is limited to firms that do get (lose) more subsidies when they step into (out of) connections with leaders who hold positions only on the State Council.
Robust standard errors clustered at the firm level are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

2.7 Conclusion

A special historical fact about the leader component of the Chinese government this decade is that many individuals with working experience in enterprises are enrolled and promoted into government offices (Huang, 2008). Taking advantage of this, I collect individual information on the top leaders from top government authorities and the party in power during 1998-2007 and then match it with the survey data on the above-scale manufacturing

firms to obtain a panel data set of firms and political connections. I investigate the effects of political connections - defined as a top leader who worked in the same industry and city/county where the firm is located at some point in time - on the preferential favor from governments to firms. The impact is measured by state capital, subsidies, as well as market power - the product markup.

My results suggest that firms connected with leaders from the State Council are more likely to obtain more subsidies from governments, but it does not seem to help to get more state capital. A connection with leaders from the Central Committee neither seems to help firm obtain more resources nor to get higher market power. It somehow suggests that the Party Central Committee does not cross the line to intervene in the decisions of allocating resources to firms. The connections with leaders who hold position on both the Central Committee and the State Council bring more state capital to firms. Given the extra investment, I further check whether this increased capital comes with more projects or contracts planned by the government. However, this is not supported by the result.

By examining firm characteristics in the years right before (after) the year when the firm gets (loses) connections, I find that larger firms in terms of number of employees and worse performing firms in terms of yearly sales and profit are more likely to obtain more state capital, given that they are connected to leaders who hold positions on both the Central Committee and the State Council. This supports the reputation building view. For firms that do receive more state capital, no statistically significant change of other firm characteristics is found in the first year to the third year of being connected, nor in the first year to the third year after the connections have ceased.

Firms with a larger sales size are more likely to obtain more subsidies when they get connections with leaders from the State Council. In the first year of being connected, the profit shows an incredible increase but dramatically decreases after that, while no change happens to sales or number of employees in the same time period. This suggests that the extra subsidies due to political connections actually do not bring any sustainable improvement to firms.

There might be other mechanisms that can explain the impact of political connections, for example bribery. However, due to the availability of appropriate data, I do not explore other possible stories, but it would be an interesting topic for future study.

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Chapter 3

The Determinants of Media Bias in China

3.1 Introduction

Political thinkers have long recognized that free media play an essential role for accountability in democracies. The role of unfree media in autocracies, in particular for accountability, is less studied, as is the degree of political control of unfree media. In this paper, we aim at filling this gap by addressing two questions.

The first question is: what do autocratic leaders use the media for? They may suppress bad news that is relevant for accountability (Besley and Prat, 2006). More actively, they may maneuver propaganda to promote policy implementation and sustain regime stability. They may also use media to monitor lower-level government officials (Egorov et al., 2009), or in general as an intelligence device to mitigate the problem of inadequate and unreliable communication within the state bureaucracy and among self-interested government officials. These uses have opposing implications for accountability.

The second question is: what accounts for variation in political control of media in autocracies? This question has been posed in a number of studies at the country level (e.g. Djankov et al., 2003; Egorov et al., 2009). We address it using variation within China and across time.

We investigate the above two questions for the particular example of newspapers in China. In China, no newspaper is free from political control. However, the political leaders allow newspapers different degrees of freedom to serve the market or to further political goals. We call the newspapers that are more inclined to further political goals "politically controlled." Based on a unique large-scale data set that we construct, we document the evolution of Chinese newspapers and the variations in their news content to answer to the question of how leaders use newspapers. Then, we analyze the determinants of political control. We construct an index of political control, analyze political control in a simple model, and use a reform in 2003 to close down all county-level newspapers to identify the effects of competition on political control.

China is an interesting object of study because of its economic and political importance, because of the increasing tension between economic and political goals in China, and because of data availability. Traditionally, Chinese newspapers, regarded as the mouthpiece of the Communist Party of China (CPC hereafter), strictly followed the Party line in their editorial decisions. The main newspaper organs were the tightly controlled *Party Dailies*. However, economic growth in China has spurred consumers' demand for media service and producers' demand for advertising channels. A number of more commercial newspaper products (evening papers and subsidiaries) were introduced. The Chinese newspaper sector now features an unusual combination of political control and commercial motive. On the one hand, China is regarded as one of the countries with the lowest degree of press freedom. On the other hand, the Chinese newspaper market is today the world's largest, with a daily circulation of around 100 million;[1] the Chinese advertising market is the third largest in the world after the US and Japan and is expected to surpass Japan in 2013. In contrast to countries in the West, the circulation of newspapers in China is growing fast, with a 13% increase in 2009-2010. In 2009, the audience contact rate of newspapers in China is 64%, only below that of TV (91%) and far above that of the Internet (38%) (Cui, 2011).

Data on Chinese newspapers are scatteringTo the best of our knowledge,

[1]Source: World Association of Newspapers.

we construct the most comprehensive directory of Chinese newspapers. We gather information on the location, starting and termination dates, owner, government affiliation, and content type of all Chinese newspapers that existed between 1981 and 2011. Then, we merge this directory with data on newspaper content from a digital archive of 110 general-interest Chinese newspapers from 1998 to 2011. Our study of news content is based on around 48 million articles published by these general-interest newspapers during this sample period.

We first investigate how Chinese newspapers produce propaganda for policy implementation and regime stability. In Chinese politics, this role of the media is called the "Party Line." In accordance with the Party line, newspapers routinely cover policy directives from national and regional leaders, visits of Party and government leaders to subordinate government divisions, mass organizations, and workplaces, the study of government policies and the works of the paramount leader, and the achievements of individual factories, counties or persons. The Xinhua News Agency is a key tool to produce news stories that enforce propaganda objectives. We define three content categories to reflect this media use. The first is the count of articles mentioning each of 1,978 political leaders at the central, provincial and prefectural levels (3 million such articles in the data set). The second is the count of articles citing the Xinhua News Agency (4.8 million articles). The third is the coverage of the most important annual news stories listed by the regime critical newspaper *Epoch Times*, relative to the coverage of the counterpart stories from the Xinhua News Agency.

We find striking differences between the newspapers that we, on a priori grounds, suspect to be more or less tightly controlled. In the *Party Dailies*, the dominant newspaper format until the economic reform, 21 percent of their published articles mention the top political leaders. In contrast, the more recently launched and commercially oriented newspapers, classified as *Evening* and *Subsidiary* papers to be distinguished from *Party Dailies,* only mention political leaders in 8 and 4 percent of their news coverage, respectively. Similar differences are found for stories listed by Xinhua and *Epoch Times*. It seems that the introduction of more commercially oriented newspa-

pers has dramatically reduced the amount of propaganda exposure. However, a caveat appears that the introduction of new newspaper formats may lead to such a pattern of product differentiation that the *Dailies* are now more controlled than they would have been absent the new formats, as suggested by our model.

The second role of the media that we investigate is in the monitoring of bureaucrats and providing information to political leaders – called the "Mass Line" in Chinese media policy. Once more, we define three categories to capture this media use. The first is the number of newspaper stories covering corruption subjects (50,000 stories of this type in the data set). The second is the coverage of disasters and the third is the coverage of accidents (such as train de-railings or coal-mine accidents) that often involve a mismanagement by local officials. We find 140,783 stories about disasters and 32,193 about accidents. These three categories of news reports may conflict with the Party Line, because they may reflect a defective political leadership.

Somehow surprisingly, we find that the more tightly-controlled *Party Dailies* cover corruption and disasters to a significantly larger extent than their more commercial competitors. The corruption stories are typically about the misbehavior of lower-ranked bureaucrats, such as taking bribes. This constitutes evidence that political leaders use newspapers to monitor and discipline lower-ranked bureaucrats, as well as an intelligence device. We only find 13 cases of corruption that involve any of the 1,978 top Chinese political leaders in newspaper coverage. This suggests that the accountability effects of the media are different for lower-level bureaucrats and for top political leaders. More politically controlled papers carry more corruption stories; the monitoring motive dominates for lower-level officials, whereas the regime stability motive dominates for higher-level officials.

We also measure the commercial use of media, the Bottom Line. This is captured by coverage of sports, entertainment, and crime. Not surprisingly, the more commercial newspapers cover these topics more extensively.

The second goal of this paper is to understand the determinants of political media control. To this end, we first construct an index of political control. We first note that the content characteristic of more politically-controlled

newspapers predicts less advertising revenue, indicating a trade-off between political and economic goals. Then, we perform a principal component analysis of our nine content categories. The first principal component, explaining 40 percent of the variation, puts a large weight on exactly the type of content that characterizes less advertising revenue (and high political control). This suggests that the most important dimension of product differentiation in the Chinese newspaper market is the degree of political control. We use this first component as our primary measure of political control.[2] The correlation of this index with the predicted advertising revenue ranking of a newspaper is -0.7, its correlation with an indicator for a tightly-controlled newspaper is 0.9, and its correlation with the share of censored microblog posts at the provincial level is 0.8.

Then, we develop a simple model of political media control to analyze the effects of competition between media owners with multiple goals (political and economic). In the typical model of government influence on media (e.g., Besley and Prat, 2006), the competition is between profit-maximizing firms, whereas the politician is an outside agent trying to influence the media. In the Chinese context, politicians own the media. Only CPC Committees (the highest decision-making body at each level of party/government) can obtain a license to run a general interest newspaper. Consequently, different politicians compete for profit while caring about political goals. In this setting, it is not obvious whether more competition will promote the economic goal or the political goal. The theory illustrates that the effect of competition will depend on the degree of initial control of the newspaper and what type of newspaper (party versus commercial newspapers) that enters the market.

Empirically, we find that the political control is significantly lower in newspapers run by lower-levels of government (and for *Evenings* and *Subsidiaries*). We find weak evidence that regions with a higher GDP have less-politically-controlled newspapers. This result is present in the cross section, but not across prefectures within provinces or over time. Furthermore, we find that the effect of GDP on political control is largest for newspa-

[2]Using the predicted advertising revenue or the probability of being a *Party Daily* would yield very similar results.

pers run by lower-level governments, which care less about political control. Consequently, an increase in GDP is related to an increased gap in political control between the newspapers run by central and lower-level governments.

Finally, we investigate the effect of competition on political control, exploiting a policy reform that forced the closing-down of most county-level *Party Dailies* (one third of all general-interest newspapers) in 2003. Of 330 general-interest county papers existing in 2002, fewer than 90 existed in 2004 with the others' licenses being withdrawn by the central government, which implemented this reform to reduce the public expenditure for subscribing Party newspapers borne by county and village level government agencies. We find that the average effect of the resulting increased concentration on newspapers was less political control. The effect is driven by the more commercial *Evening* and *Subsidiary* papers, while the *Dailies* became more politically controlled.

3.2 Background

In what follows, we present a short description of the institutional background of Chinese newspapers, partly as an aid to understanding the data section. Further details will be discussed later.

Political control of the media in China is exercised through ownership and supervision, propaganda campaigns and news emission through the Xinhua News Agency, and through pre- and post-publication monitoring. To date, all Chinese newspapers are required to have a total or dominant state ownership. They must also be affiliated with a party/government supervisor that is responsible for licensing, the appointment of top personnel, and the monitoring of important editorial matter. Eligible supervisors include the Party Committees at different administrative levels, CPC divisions, government departments, and government-sponsored mass organizations. The nature of the supervisor regulates the content of a newspaper. Most notably, only a Party Committee can obtain licenses to publish general-interest newspapers. Party Committees are the highest and most powerful political decision-making bodies in China, at each level of government (central,

provincial, prefecture, county). The newspaper licenses are issued by SAPP – the State Administration for Press and Publication.

The newspapers come in variants indicated by their names. The *Dailies* are "official" papers, where subscriptions are taken out with public money and circulated among offices, classrooms, factory workshops, and government officers. The *Evenings,* reaching readers in the evenings (non-working hours), are allowed to carry softer news, be more entertainment oriented, and less strictly controlled than the *Dailies*. *Evenings* have mainly been introduced after the economic reforms in the 1980s. They rely on private subscriptions and street vendors for most of their circulation. The *Metro* papers, thriving after the 1990s, essentially compete with *Evenings* but reach readers in the mornings. An innovation in the newspaper sector during the 1990s was the creation of *Subsidiaries*, or newspapers owned by parent newspapers which, in turn, were owned by Party Committees.

3.3 Data

This section explains the data collection and describes the main variables we will use. A more detailed description can be found in the on-line appendix.

3.3.1 Newspaper directory

We construct a detailed directory of all Chinese newspapers from 1981 to 2011. The directory is mainly based on four data sources: (i) the *Comprehensive Chinese Newspaper Directory* (2003, 2006, 2010), published by SAPP – the authority that issues licenses for publishing newspapers; (ii) *the Annual China Journalism Yearbooks* (1982-2010), published by the Chinese Academy of Social Science; (iii) *the China Newspaper Industry Yearbooks* (2004-2010), published by a Beijing-based research institute; and (iv) an eight-volume collection of the front pages of major newspapers on the date of first publication.

From these data sources, we obtain information on each newspaper's location, address, starting date, termination date, direct owner (head unit),

supervisor (Party/government affiliation), ranking in the administrative hierarchy of the Chinese government, type of readership (general or specialized), and other information such as the names of chief-editors and business scopes. For major newspapers in certain years, we also collect information on the annual circulation number, the revenue composition, annual advertising revenues, and the ranking of advertising revenues in the provincial market from publicly available reports submitted to SAPP, central and local governments, and the Association of Chinese Journalists.

Three variables are particularly important for our analysis: the newspaper's owner, supervisor, and content scope. Starting with content, we will focus on the general-interest newspapers that provide comprehensive news regarding all fields of journalism and target a general readership. These newspapers account for the major share of newspaper circulation and readership. Within the general newspapers, we distinguish among "Daily", "Evening", and "Metro" papers according to a newspaper's name.[3] These three types of general newspapers reflect different degrees of Party/government control in terms of ownership, financial structure, and editorial autonomy.

The ownership determines who the residual claimant is and how to distribute the profits. Based on the nature of the direct owner, a newspaper can be classified into one of four ownership categories: *Party-state capital*, if a newspaper is owned by a Party Committee or a Party/government division; *Media capital*, if a newspaper is a subsidiary of another newspaper

[3]A newspaper is coded as "Daily" when its name contains the word "Daily (Ri Bao in Chinese)" or "News (Bao)" followed by the name of a province, prefecture, or country. A small number of newspapers whose names do not contain the names of the region where the newspaper is based are still coded as "Daily" if the newspaper in question is explicitly stated as the Party organ of a CPC committee and is published on a daily basis. A newspaper is coded as "Evening" if its name contains the word "Evening News (Wan Bao in Chinese)". A newspaper is coded as "Metro" if its name contains the word "Metro News (Dushi Bao)", "City News (Cheng Bao)", "Express (Kuai Bao)", "Times (Shi Bao)", or "Morning Post (Chen Bao)." Some newspapers whose names contain "Business News (Shang Bao)", "Youth News (Qingnian Bao)," are also coded as "Metro" if their content scope is reported as a "general-interest" paper. These are the newspapers that are converted from special-interest newspapers but still carry their previous names.

or other mass media[4]; and *Societal capital*, and *SOE*.[5] The first two categories are most relevant for our analysis of the general-interest newspapers. Regarding the type of supervisor, which determines who appoints the top personnel of newspapers and who is responsible for editorial policies, we distinguish among five mutually exclusive categories: First, *Party Committee,* if a newspaper is directly supervised by the propaganda department of a CPC Committee; Second, *Parent Newspaper*, if a newspaper is a subsidiary of other newspapers and supervised by its parent newspaper; and *Party/government Bureau*, *Other media* and *Internal supervisor as the remaining categories*.[6] Once more, the first two categories are most relevant for our analysis. It should be noted that , in most cases, the owner is also the supervisor. We distinguish between these two classifications to more accurately capture the political and economic control of Chinese media, as will become clear in the analysis.

To simplify the matter, we will analyze three newspaper categories defined by both supervisor and content type: *Party Dailies, Party Evenings,* and *Subsidiaries*. *Party Dailies* and *Evenings* have a Party Committee as the supervisor and the content categories "Daily", and "Evening or Metro", respectively. *Subsidiaries* are supervised by a parent newspaper. This distinction is in accordance with some studies of Chinese journalism (e.g., Zhao 1998, 2008; Fang 2000, 2009).

Table 1 shows an example of our coding: Fuzhou prefecture, Fujian province, in 1998. The provincial Party Committee supervised two newspapers: one *Party Daily* and one *Subsidiary*. Note that the subsidiary has the Fujian Newspaper office as its supervisor, rather than a Party Committee. The prefecture Party Committee also has two newspapers, a *Daily* and

[4]Within the "media capital" category, we create a subgroup: "media capital with private share", if a newspaper is partially financed by capital from the private sector, including private companies, state-owned enterprises, and listed companies.

[5]A newspaper is coded as *Societal capital*, if it is financed by a government-sponsored mass organization. A newspaper is coded as *SOE* if it is owned by a state-owned-enterprise and circulated within that enterprise.

[6]*A newspaper is coded as Party/governmentbureau, if it is supervised by a specific Party/government divisions; as Other media, if it is a subsidiary of other media such as news agency, broadcaster, and press; as Internal supervisor, if a newspaper is only internally distributed within a mass organization or state-owned enterprises.*

an *Evening*. Finally, the county-level Fuqing Party Committee has a *Party Daily*.

Table 1: Newspaper Types in Fujian-Fuzhou 1998

Type	Level	Category	Newspaper	Supervisor
Party Daily	Province	Daily	Fujian Daily	CPC Fujian Provincial party committee
Subsidiary	Province	Metro	Channel metropolis newspaper	Fujian Newspaper office
Party Daily	Capital city	Daily	Fuzhou Daily	CPC Fuzhou Municipal party committee
Party Evening	Capital city	Evening	Fuzhou Evening News	CPC Fuzhou Municipal party committee
Party Daily	County	Daily	Fuqing Times	CPC Fuqing Municipal party committee

Data source: Chinese newspaper directory data constructed by the authors.

Historical development Based on the directory, we illustrate the evolution of the newspaper industry in China. After the foundation of PRC, "Party journalism" was strictly applied to all mass media.[7] Newspapers were official products, subscribed to with public money and consumed in offices, classrooms, and factory workshops. The *Party Dailies* published by the Party Committees at different administrative levels dominated people's consumption of news.[8]

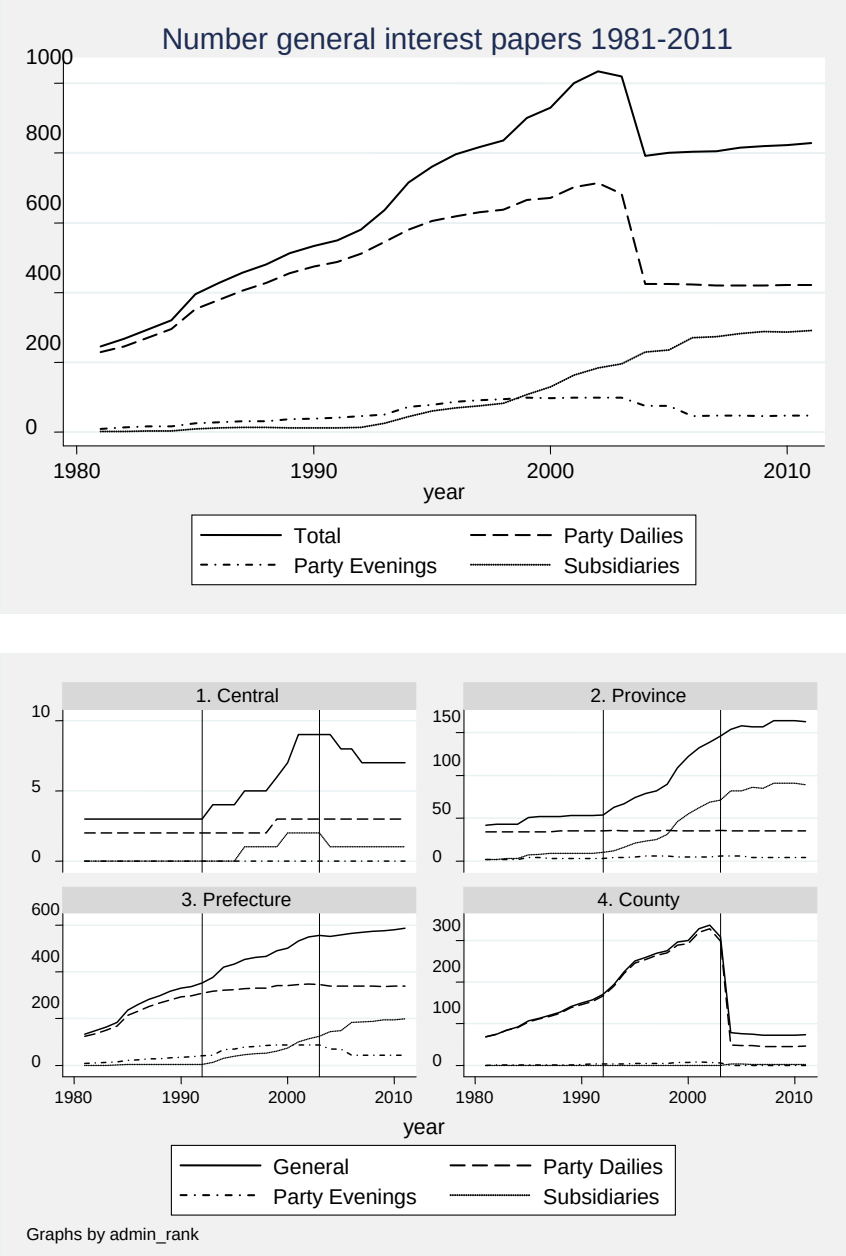
The upper panel of Figure 1 shows the number of general-interest newspapers in China from 1981 to 2011 in the directory. The lower panel of Figure 1 shows the breakdown by the administrative rank of the Party Committee that owns the newspaper. In 1981, there were 246 general-interest newspapers, the vast majority (229) of which was *Party Dailies*. At that time, the central and all provincial Party Committees had *Party Dailies*, while many prefec-

[7] A small number of commercial newspapers were allowed to continue into the early 1950s. There numbers dropped from 58 in March 1950 to 25 in August 1951 to zero in 1952 (Fang 2000).

[8] In the late 1950s and the early 1960s, recognizing the need for newspapers as a form of popular culture and entertainment for the urban population, the CCP permitted some regional committees in central cities to launch 13 evening dailies. Also responsible for propagating Party policies and directives, these "Party Evening Papers" were more readership-oriented, with the contents being more diversified and closer to everyday urban life. During the Cultural Revolution, all 13 evening papers were forced to close down because their orientation was viewed as incompatible with the ideology of the time. In the early 1980s, these 13 Evening papers all resumed publication (Fang 2000).

ture and county level governments did not. The subsequent rapid growth of *Party Dailies* was mainly driven by the prefecture and county *Dailies*. It is extremely uncommon that a Party Committee has more than one *Daily*.

Figure1: Number of General Interest Newspapers by Level and Type



With the economic and social reforms in 1978, the demand for non-Party journalism – informative news coverage, diversified reports, and entertainment – started to grow. Firms increasingly wanted to advertise their products through media that could reach a wide readership. Advertising became one of China's fastest-growing industries. At the same time, the government gradually cut subsidies and encouraged commercial financing. This shift in funding sources required market-oriented journalism.

The newspapers that took the first step towards market-oriented journalism were the *Party Evening* papers. While maintaining some features of Party journalism, these evening papers published "soft" news about personal life and entertainment and provided more informative reports on economic and social activities. Although small in numbers, they soon attracted a large readership and became the top earners of advertising revenues. As indicated in the lower panel of Figure 1, the *Party Evenings* were mainly introduced by prefecture-level Party Committees in provincial capital cities, the most urbanized areas and the most lucrative regional markets. These *Evenings* became a serious threat to the advertising profits of the provincial-level newspapers.

In 1992, after Deng Xiaoping's Southern Tour, the open endorsement of the market economy by political leadership stimulated the boom of advertising and media industries.[9] During the 1990s, the most fundamental reform concerning media commercialization is the permission to establish *Subsidiary* newspapers by existing Party newspapers. Although indirectly owned by the Party-state and still subject to party journalism, a *Subsidiary* newspaper did not receive any government funding. Many of them absorbed non-state capital – typically funding from mass organizations and state-owned-enterprises – and enjoyed a high degree of financial and managerial autonomy. In Figure 1 with the first vertical line marking the year 1992 of Deng's tour, the increased trend in the number of *Subsidiaries* after this year is clearly visible. The pattern is particularly pronounced for the provincial Party Committees,

[9]In 1993, the advertising revenues in the whole country reached 13.4 billion Yuan, a 98% percent increase over 1992. Newspaper advertising revenues doubled from 1992 to 1993.

which actively launched commercial *Subsidiaries* to compete the Prefectural Evenings.

In the 2000s, the market trend has been towards consolidation. In 2003, the SAPP withdrew the licenses of most county-level newspapers, with the stated purpose of reducing the financial burden borne by bottom-level government agencies that were required to subscribe to Party *Dailies*.[10] A few exemptions were made based on historical, cultural, and economic factors. In Figure 1, with the second vertical line marking the year 2003, the number of county-level newspapers dropped from 337 in 2002 to 78 in 2004. Another trend starting from the late 1990s has been towards building newspaper conglomerates, which organize a large number of newspapers under major newspaper groups.

3.3.2 News content

We conduct a content analysis of the digital texts of the Chinese newspapers that are available in WiseNews, a Hong Kong-based newspaper data provider. WiseNews provides digital archives of 259 newspapers based in Mainland China from 2000 to date. Among them, 125 are general-interest newspapers, from which we are able to identify 110 as Party *Dailies*, *Party Evenings*, and *Subsidiaries* (see Table 2). Geographically, these newspapers cover 29 out of 31 provinces. In terms of government affiliation, ownership, and type of readership, the WiseNews sample, to a large extent, represents the whole newspaper industry in Mainland China. However, WiseNews only contains newspapers located in provincial capital cities and some major prefectural areas. The newspapers in rural areas and less-developed prefectures will not

[10]Before the policy reform in 2003, it was compulsory for every government agency to subscribe to all *Party Dailies* above their administrative rank. For example, a village-level government agency was required to subscribe to the county *Daily*, the prefectural *Daily*, and the provincial *Daily* in the province to which the village belonged and the *People's Daily* (the central Party organ). The subscription fees (summed across all government agencies) amounted to a significant burden for the public expenditure in less developed counties. Some government agencies even shifted this financial burden by collecting additional fees from local residents to pay the subscription. The resistance from local residents, particularly in the rural areas, directly triggered the closing-down policy (SAPP Internal Documentation, *China Journalism Yearbook*, 2004).

be represented in this sample.

Table 2: General Interest Newspapers in WiseNews

	daily	evening	metro	Total
parent newspaper	2	16	40	58
party	37	12	3	52
Total	39	28	43	110

Based on key-word searches and article counts, we construct a series of content measures that reflect different types of journalism and bias towards the Party/government. The central ideology underpinning the CPC's domination over the media in China is the so-called "Party principle," under which newspapers play a dual role in the Chinese political system: the "Party line" that defines newspapers as the Party's mouthpiece and the "Mass line" that assigns an intelligence mission to mass media for political leaders' decision making. Moreover, to understand the effect of commercialization on political accountability, it is important to investigate whether commercialization in China has led to more investigative stories of corruption, to more sensationalism, or both. Therefore, we differentiate three types of journalism according to the stated goals and tools of political control: 1) the Party-line journalism enforced by the CPC propaganda departments and the Xinhua News Agency; 2) the Mass-line journalism that gives the media the intelligence mission to assist political leadership and monitor government bureaucrats; 3) the bottom-line journalism that is oriented towards readership and advertising. All the measures are for each newspaper on a yearly basis.

The Party Line – Leaders, Xinhua and Epoch The Party Line is one basic principle of the classic Maoism, "The role and power of newspapers consists in their ability to bring the Party program, the Party line, the Party's general and specific policies, its tasks and methods of work to the people in the quickest and most extensive way" (Zhao, 1998, p25). News content along this line is highly positive, didactic, and openly value-oriented. We construct three measures – leader mention, Xinhua citation, and negative coverage (*Epoch*) over positive coverage (Xinhua) – to approximate the Party-line journalism.

Central in the Party-line journalism is the coverage of the Party and government leaders whose activities are not only related to policy making and important social events, but also represent the image of the Party and indicate regime stability. Thus, we calculate the number of articles that mention the names of 1,978 top political leaders at the central, provincial and prefectural level in China.[11] About 3 million out of the total 48 million articles mention these leaders: 1.3 million for central leaders, 1 million for provincial leaders, and 700,000 for prefectural leaders. We define a variable *LeaderMentions:* the share of articles mentioning all political leaders among all articles published by a newspaper normalized by multiplying 100. The mean of "LeaderMentions" is 5 with a standard deviation of 11. Most of these articles routinely cover policy directives endorsed by central and provincial leaders, the leaders' visits to subordinate government divisions, mass organizations, and workplaces, the study of government policies and the works of the paramount leader, and the achievements of individual factories, counties or Party members positively appraised by the leaders.

As mentioned, the Xinhua News Agency (Xinhua for short), under the direct control of the CPC Central Propaganda Department, is a key tool to produce news stories and enforce the Party-line journalism. For many important propaganda campaigns, national political events, and the activities of central leaders, newspapers are required to carry Xinhua copies to avoid "political incorrectness" and ideological inconsistency. Based on the search for articles containing the words "Xinhua News Agency" (新华社 in Chinese, 4.8 million of this type of articles found), we define a variable Xinhua Cites to be the percentage of articles that mention "Xinhua News Agency" among all published articles. By newspaper and year, the mean of "Xinhua Cites" is 6% with a standard deviation of 12%.

Complementary to the practices of promoting propaganda through Xin-

[11] At the central level, the name list includes all members in the Political Bureau of the CPC Central Committee and the affiliated Commissions, heads of all ministries on the Chinese Central State Council. In total, we search for 108 central level politicians. The search is set from the beginning of the year when they are promoted to this level of office to the end of the year when they leave office. We search for the names of CPC secretaries and governors/mayors at the provincial (785 names) and prefectural (1085 names) Party Commission and Administration.

hua, one important tool to enforce the Party-line is through depressing and censoring negative reports on the Party. Thus, we construct a third measure of the Party-line journalism based on the relative coverage of the top events listed by *Epoch Times* – an overseas-based anti-CPC Chinese newspaper – and those listed by Xinhua. *Epoch Times* publishes a significant number of negative reports on the CPC government, most of which are suppressed or censored in the media outlets in mainland China.[12] Using 46 top events listed by *Epoch Times* and 108 top events listed by Xinhua from 2001 to 2010, we search relevant articles in a window around the events.[13] In total, we find around 600,000 articles covering the *Epoch Times* top stories and 1.6 million articles covering the Xinhua top stories. We define a variable "Epoch Stories" to be the ratio of the number of articles covering the top events listed by *Epoch Times* over the number of articles covering the top events listed by Xinhua. At the newspaper and year level, the mean of "Epoch Stories" is 23% with a standard deviation of 15%.

The Mass Line – Corruption, disasters and accidents The mass line is a political and organizational method developed by the CPC during the Chinese revolution.[14] The mass line view recognizes the role of the media as an intelligence mission to assist political leaders in their decision making. The

[12]Examples of the top events listed by *Epoch Times* are "China's largest residential fire happened in Shanghai", "Google announced its withdrawal from the Chinese market", "The truth of HIV in China revealed by Professor Gao Yaojie in a speech in Washington on Dec. 1", "The scandal of defense attorney Li Zhuang during local CCP boss Bo Xilai's campaign against organized crime in Chongqing City".

[13]Xinhua News Agency started to publish its annual list of top 10 events from 2001 and *Epoch Times* made its counterpart lists from 2002. We search all these listed events. A significant number of events listed by *Epoch Times* were censored and no coverage of them was found in any newspaper in mainland China. This is why the searched events in *Epoch Times* constitute a considerably smaller amount than the Xinhua events. A full list of the events, the key words and time periods that we use to identify the newspaper articles are available in the online appendix.

[14]In the words of Liu Shaoqi, the chief theoretician of the CPC mass line, "You [the Party media workers] travel to all locations. The people depend on you to voice their demands, difficulties, experiences and even to describe mistakes in our work. You turn them into news, features and reports to Party Committees at various levels, and to the Central Committee. In this way, you make a connection between the Party and the masses." (Liu, 1968)

media carry out the tasks of reporting people's opinions and concerns and informing leaders of the performance of the cadres who are working directly with the people (Zhao 1998). In more recent years, one important practice of the mass line is the so-called "supervision by public opinion (Yulun Jiandu)," which permits the media to report on corruption and wrongdoings of Party officials and government agencies.[15]

Whether the Chinese press can act as an effective watch dog is disputed. Some argue that as an institution that is relatively autonomous from other parts of the state bureaucracy and now with a commercial logic rooted outside the government bureaucracy itself, the reformed and commercialized news media are playing an increasingly important surveillance role. By bringing certain issues to the public arena, media-originated exposures sometimes help shape the terms of public discourse and lead to the formation of specific reform policies (Gordon, 1999). On the other hand, criticisms tend to solely be aimed at low-ranked officials and bureaucracies that fail to adequately carry out the Party directive, for poor working style, and for failing to live up to the Party standards (Nathan, 1986; Zhao 1998). Furthermore, information that may trigger collective social actions, create political division, or threaten the leadership of CPC is strictly censored (Zhao 1998, 2008).

To measure the Mass-line journalism, we search for articles about corruption cases (excluding those on how governments advocate, initiate, and implement anti-corruption activities), disasters, and serious accidents.[16] We find around 50,000 articles covering corruption cases. These articles mostly involve corruption of government officials below the prefectural level, typically for taking bribes.[17] We define a variable *corruption* to be the share of articles covering corruption cases among all articles published by a newspaper

[15]During a long period after the foundation of the People's Republic of China, the criticism of Party officials and government agencies was collected into a special bulletin called "Internal References," which was only distributed among Party cadres whose position was above a certain level.

[16]We use the following string of Chinese characters to search for the coverage of corruption cases:
(腐败 or 贪污 or 受贿 or 金钱) and (双规 or 调查 or 审查 or 检察机关) and (免去 or 罢免 or 查处 or 惩处 or 撤消 or 撤除)

[17]We only find 13 corruption cases involving any of the 1,978 political leaders at the central, provincial, and prefectural levels.

at the yearly level.

For the CPC and Chinese government, disasters and serious accidents, particularly those that are not caused by natural reasons, are negative news because the appearance of these is an indication of the poor performance of government agencies and the detachment from the people.[18] Based on the EM-DAT database constructed by the Brussels-based Center for Research on the Epidemiology of Disasters, we search for 224 disasters from 1998 to 2010, in which more than 30 people were killed. In total, 140,783 stories cover these disasters. Among these disasters, we isolate 129 non-natural disasters - called "accidents" in this paper - to capture the type of events that are more relevant from a government-monitoring perspective.[19] 32,193 articles are found to cover these accidents. We define a variable "Disasters" to be the share of the articles covering the above disasters among the total number of published articles by a newspaper during a year. The variable "Accidents" is similarly defined.

The Bottom Line – Crime, entertainment, sports We finally construct a category to capture the bottom-line journalism: the type of journalism that attracts readership and advertisement. This type of material is another perceived dividing line between the more and less strictly-controlled papers. The more commercialized newspapers tend to carry more entertaining and sensational news articles. This tabloid-journalism, which is popular in many Western countries, has been attacked by CPC Party officials in campaigns against "Spiritual Pollution".[20]

We define three variables "Sports," "Entertainment," and "Crime" to be the shares of articles covering these three subject matters. In particular, we

[18]For example, in July 2011, two high-speed trains collided in Wenzhou, Zhejiang province, killing 40 people. The Ministry of Railways announced that three high ranking railway officials were fired immediately after the crash under charges of corruption. (http://www.guardian.co.uk/world/2011/jul/25/chinese-rail-crash-cover-up-claims)

[19]The accidents include 81 industrial accidents (of which 55 are coal mine accidents), 29 transport accidents and 19 are miscellaneous accidents. Responsibility of government officials is claimed in most of these accidents.

[20]See e.g. Zhao (1998), p. 131.

search for sport stories with a string consisting of the most popular sports.[21] This yields around 2.4 million articles, or an average share of 4.6 percent by newspaper and year. To identify entertainment material, we use a string including key words such as movie, television, musical, concert, record, etc.[22] We find 5.7 million stories covering entertainment, or an average share of 11 percent. Finally, we search for crime stories covering serious violent crimes (murder, rape, robbery) or organized crime.[23] We identify 175,963 such stories. The average share of articles covering crime is less than 0.3 percent by newspaper and year.

3.4 Measurement of political control

What content characterizes politically controlled papers? Our first goal is to find what type of news content is characteristic of more tightly controlled newspapers. Our strong prior is that the *Party Dailies* are more tightly controlled. We first describe what type of news content is characteristic of *Party Dailies* compared to *Party Evenings* and *Subsidiaries* in the same market (prefecture) and year. Our second strategy is to regress

[21] We use the string:
"体育比赛 or 运动会 or 足球 or 篮球 or 乒乓球 or 羽毛球 or ((游泳 or 蛙泳 or 蝶泳 or 仰泳 or 自由泳) and 比赛) or 排球 or (田径 and 比赛) or 长跑 or 短跑 or 冬泳 or 保龄球 or 网球 or 台球 or 桌球"
which translates into "Artic contest or games or soccer or basketball or Ping-Pong or badminton or (swimming or breaststroke or butterfly stroke or backstroke or crawl and competition) or volleyball or (track and field and competition) or long-distance race or dash or wintertime swimming or bowling or tennis or Ping-Pong or pool".

[22] The string is
"电影 or 电视 or 话剧 or 戏剧 or 戏曲 or 主演 or 演员 or 歌手 or 歌星 or 影星 or 音乐剧 or 演唱会 or 演奏会 or ((流行 or 主流 or 摇滚 or 民俗 or 民族) and 音乐) or 唱片 or 演唱会 or 歌迷会 or 影迷会"
which translates into "Movie or television or modern drama or play or drama or acts the leading role in or actor or singer or singer or movie star or musical or concert or concert or (the popular or mainstream or rock and roll or folk customs or nationality and music) or phonograph record or concert or fan club or movie fan meeting".

[23] We use the search string: 歹徒 or 行凶 or 凶犯 or 罪犯 or 杀人 or 强奸 or 抢劫 or 黑社会 which translates into "Scoundrel or commits murder or murderer or criminal or murder or to rape or to rob or organized crime". The search is limited to a search among article titles, because we need to differentiate the crime stories from the officer's talk on anti-crime campaigns. Articles telling such stories tend to use such salient words in the title, while articles for the officer's talk can contain such words in content but are very less likely to use them in the title.

content on advertising ranking. The idea is that there is a conflict between profit maximization and political control, so that tighter political control has a price in terms of less advertising revenue. Thus, we analyze what type of news content predicts high advertising revenues.

To compare *Party Dailies* with *Party Evenings* and *Subsidiaries*, we first look at the raw data. Table 3 shows content by newspaper type. The last column contains the average number of articles that we found in each newspaper and year. *Party* E*venings* and *Subsidiaries* have around 30 percent more articles than *Party Dailies*. We next look at the content characterizing the "Party Line" function of the newspapers. *Party Dailies* mention top political leaders in 22 percent of their articles. This is vastly more than *Party Evenings* (8 percent) or *Subsidiaries* (5 percent). *Party Dailies* also cite Xinhua News in 34 percent of their articles, again substantially more than *Party Evenings* (25 percent) or *Subsidiaries* (18 percent). This means that a shift in demand from *Party Dailies* to *Evenings* and *Subsidiaries* will have a massive impact on people's exposure to political leaders and Xinhua News stories. The third column shows that also the selection of news stories is systematically different between the two categories. *Party Dailies* tend to cover less of the top stories listed by the regime critical *Epoch Times*, as a share of all top stories covered.

Table 3: Content Categories by Newspaper Type

	I	II	III	IV
		Party Line		
	Leader Mentions	Xinhua Cites	Epoch Stories	Number Articles
Party Daily	21.83	34.32	20.31	16,695
Party Evening	8.4	25.08	23.33	21,655
Subsidiary	4.8	17.99	26.63	23,936
		Mass Line		
	Corruption	Disasters	Accidents	
Party Daily	0.20	0.62	0.15	
Party Evening	0.15	0.44	0.15	
Subsidiary	0.14	0.42	0.11	
		Bottom Line		
	Sports	Entertainment	Crime	
Party Daily	5.74	10.70	0.31	
Party Evening	7.12	13.08	0.70	
Subsidiary	6.96	13.80	0.65	

Data source: Chinese newspaper directory data constructed by the authors.

The next three categories relate to the "Mass Line" role of newspapers. Here, our priors are less strong. On the one hand, these stories might be suppressed because they reflect poor performance of government agencies and a negative image of the CPC. On the other hand, they might be encouraged because of the intelligence mission of the newspapers to report the misconduct at lower level party cadres and by government bureaucrats. We find that *Party Dailies* report more on corruption and disasters than the less tightly politically controlled *Party Evenings* and *Subsidiaries*.

The final three categories capture the bottom-line journalism. *Evenings* and *Subsidiaries* cover more sports and entertainment than *Party Dailies*. In particular, they cover crime more than twice as frequently as *Party Dailies*.

These differences could partly reflect the fact that our sample of *Dailies, Evenings* and *Subsidiaries* is drawn from different places. It could, for example, be that *Dailies* in our sample are predominantly from places with more corruption and this is why we find more corruption coverage in these newspapers. To address this concern, Table 4 regresses the content categories on the type of newspaper, including prefecture-by-year fixed effects. Essentially, we compare the content of *Party Dailies*, *Evenings* and *Subsidiaries* within

the same prefecture and year, and consequently with the same available news material. The differences in content are similar to those in raw means reported in Table 3. Notably, corruption and disaster coverage are lower in the less politically controlled *Evenings* and *Subsidiaries*.

Table 4: Content by Newspaper Type, Prefecture by Year Fixed Effects

VARIABLES	Leader mentions	Xinhua cites	Epoch Stories	Corruption	Disasters	Accidents
Party Evening	-13.593***	-12.786***	4.462***	-0.076***	-0.154***	-0.010
	(2.269)	(3.167)	(0.676)	(0.014)	(0.051)	(0.014)
Subsidiary	-18.591***	-15.000***	5.949***	-0.067***	-0.236***	-0.015
	(1.593)	(1.762)	(0.527)	(0.011)	(0.044)	(0.014)
Observations	718	718	718	718	718	718
R-squared	0.724	0.798	0.915	0.627	0.743	0.592

Standard errors clustered by newspaper: *** p<0.01, ** p<0.05, * p<0.1.

Table 4, cont. Content by Newspaper Type, Prefecture by Year Fixed Effects

VARIABLES	Sports	Entertainment	Crime
Party Evening	1.652***	3.199***	0.274***
	(0.527)	(0.559)	(0.096)
Subsidiary	1.203***	2.857***	0.358***
	(0.335)	(0.453)	(0.053)
Observations	718	718	718
R-squared	0.715	0.826	0.685

Since this was somewhat surprising, we further investigated the result that the *Party Dailies* covered more disasters and corruption. It might be that the type of coverage in the *Party Evenings* and *Subsidiaries* is more aggressive. One way of exploreing this is to look at the speed of coverage. When a sensitive event takes place, Xinhua typically gives a recommendation on whether and how it should be covered. An aggressive newspaper should hurry up to cover it before the Xinhua makes its recommendation. To investigate this, we added coverage of all disasters killing more than 30 people in Asia, but outside of China. Consistent with newspapers waiting for Xinhua, disasters happening in China are, on average, covered almost one day later than similar disasters outside of China. The average first day of coverage of a disaster in Asia outside of China is 2.5 days compared to 3.4 days for disasters in China.

Then, we compared the speed of coverage by type of newspaper. Compared to *Party Dailies* in the same prefecture, *Party Evenings* are faster in covering disasters (around eight hours on average). However, this is true for disasters both in China and outside. There is no significant difference in the relative speed of coverage inside and outside China. *Subsidiaries* are not significantly different from *Dailies* in their coverage. We also explored a dummy variable for being the first newspaper covering a disaster. Once more, there were no significant differences.

What content characterizes newspapers with high advertising revenues? We will now investigate what type of content characterizes newspapers with high advertising revenues. For around half of the newspaper-year observations, we have data on the advertising ranking of the newspapers. We use this to analyze what type of content characterizes newspapers with high advertising ranking. Using an ordered probit, we regress the advertising ranking on our content categories and prefecture-by-year fixed effects.

The result is shown in Table 5. The first column shows the results of nine regressions with only one content category included, and prefecture-by-year fixed effects. The general picture is that the content categories that we found to be characteristic of strictly controlled newspapers are also characteristic of

newspapers with low advertising revenues. This also holds when we control for the type of newspaper. Leader Mentions , Xinhua cites, corruption, disaster and accident coverage are negatively correlated with advertising revenues. *Epoch Times* stories, sports, crime and entertainment coverage are positively correlated with a good advertising ranking. Column 2[sth is missing here] shows the result from one regression including all content categories. Because of multicollinearity and few observations, these relationships are rarely statistically significant.

Table 5: Advertising Ranking and Party Daily

	Advertising Ranking				Party Daily	
PCA 1st dim			7.242***	5.712***		3.327***
			(0.618)	(0.975)		(0.187)
Leader mentions	0.067***	0.026*			0.019***	
	(0.006)	(0.014)			(0.004)	
Xinhua cites	0.054***	0.008			0.011***	
	(0.007)	(0.018)			(0.003)	
Epoch Stories	-0.058***	0.016			-0.011***	
	(0.010)	(0.013)			(0.003)	
Corruption	7.734***	3.156*			0.584	
	(1.005)	(1.786)			(0.374)	
Disasters	2.713***	0.770*			-0.170***	
	(0.366)	(0.448)			(0.058)	
Accidents	3.726***	2.394*			0.335***	
	(1.089)	(1.222)			(0.105)	
Sports	-0.193***	-0.055			-0.024*	
	(0.032)	(0.064)			(0.013)	
Entertainment	-0.197***	-0.079			-0.014	
	(0.024)	(0.052)			(0.009)	
Crime	-1.917***	-0.970*			-0.247**	
	(0.218)	(0.505)			(0.120)	
Party Daily				0.381*		
				(0.218)		
Party Evening				-0.425**		
				(0.211)		
Observations		521	521	521	718	718
R-squared					0.774	0.727

The dependent variable in the first four columns is minus the advertising ranking of each newspaper. The dependent variable in the last two columns is an indicator for the newspaper being a Party Daily. All specifications include prefecture by year fixed effects. Standard errors clustered by newspaper in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

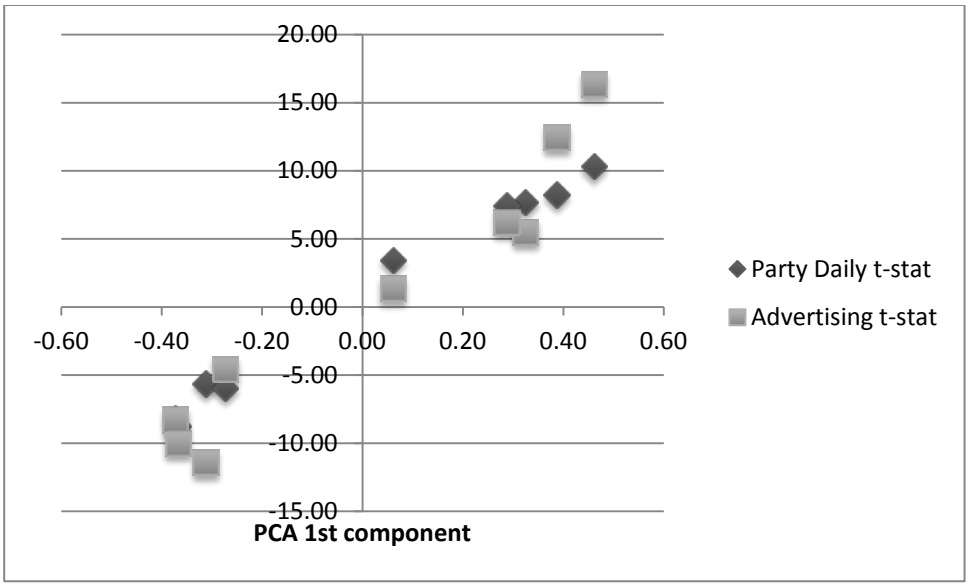
Index of political control In order to simplify our analysis, we are interested in constructing an index of political control. To this end, we now

perform a principal component analysis of our content categories. To remove news availability that may vary by prefecture and year, we analyze the residuals from a regression of content categories on prefecture by year fixed effects. The result is shown in Table 6. The first component explains 40 percent of the variation in news coverage. The factor loadings look very similar to what we earlier found to be positively (negatively) correlated with political control (good advertising ranking). Leader Mentions [see question above] have the strongest positive factor loading, followed by Xinhua News citations and corruption stories. Entertainment, crime and coverage of *Epoch Times* top stories have the strongest negative factor loadings. Figure 2 plots the factor loadings of the PCA first component against t-statistics from regressions of advertising ranking on each of the content categories individually and prefecture-by-year fixed effects (Table 5, column 1) and the equivalent t-statistics using the Party Daily dummy as the dependent variable.

Table 6: Principal Components Analysis

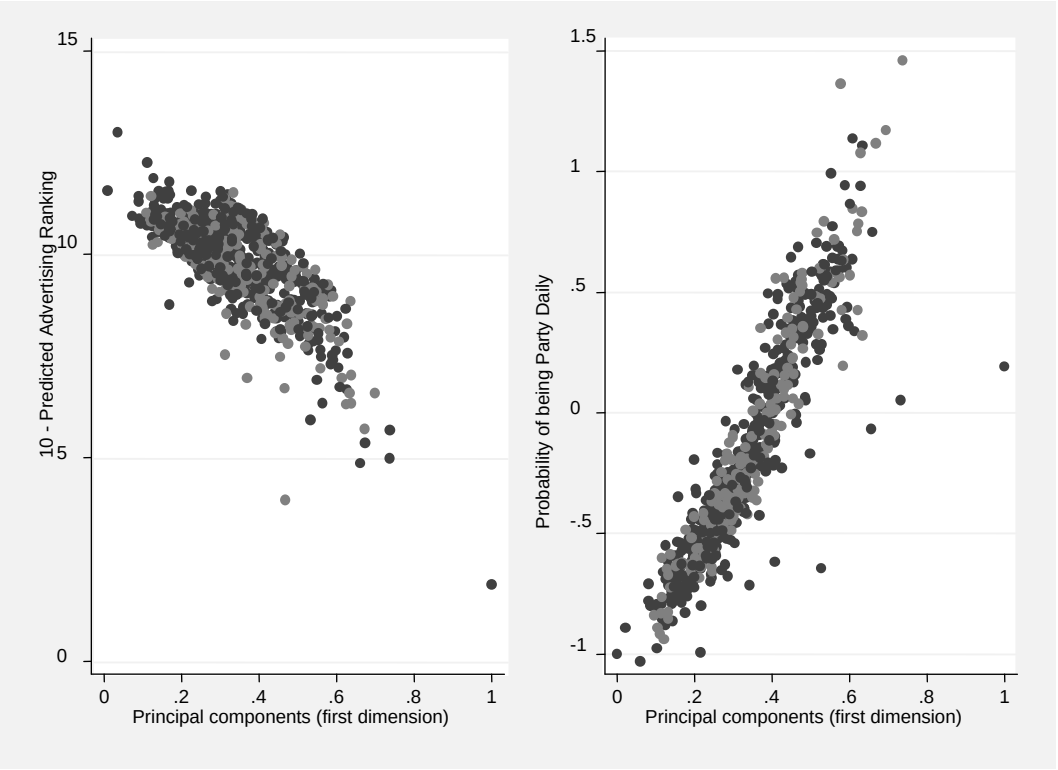
Component	Eigenvalue	Proportion	Variable	Comp1
Comp1	3.60	0.40	Leader Mentions	0.46
Comp2	1.33	0.15	Xinhua cites	0.39
Comp3	1.07	0.12	Epoch Stories	-0.31
Comp4	0.93	0.10	Corruption	0.33
Comp5	0.62	0.07	Disasters	0.29
Comp6	0.51	0.06	Accident	0.06
Comp7	0.43	0.05	Sports	-0.27
Comp8	0.30	0.03	Entertainment	-0.37
Comp9	0.20	0.02	Crime	-0.37

Figure 2: PCA 1*st* Component and t-stats



It seems that the first dimension of differentiation in the Chinese newspaper market (captured by the first principal component) measures the trade-off between political control and advertising revenue. To further make this case, from columns 2 and 5 of Table 5, we compute the expected advertising ranking and probability that a newspaper is a *Party Daily*. Figure 3 plots these against the first dimension from the principal component analysis. The first principal component is clearly negatively related to good advertising ranking (raw correlation -0.73) and positively correlated with the probability of being a *Party Daily* (correlation 0.92). The correlation between the expected advertising ranking and the probability of being a *Party Daily* is -0.64. In a regression including prefecture by year fixed effects, the first principal component is negatively correlated with advertising ranking (t-stat well above ten, Table 5 column 3) and positively correlated with the probability that a newspaper is a *Party Daily* (again very high t-stat, Table 5 column 6). It is not the case that the advertising ranking is correlated with the principal component only through type of newspaper. Column 4 controls for the type of newspaper, and the principal component is still significant and the size of the coefficient is not affected to any considerable extent.

Figure 3: PCA 1st Component and Advertising Ranking – Political Control

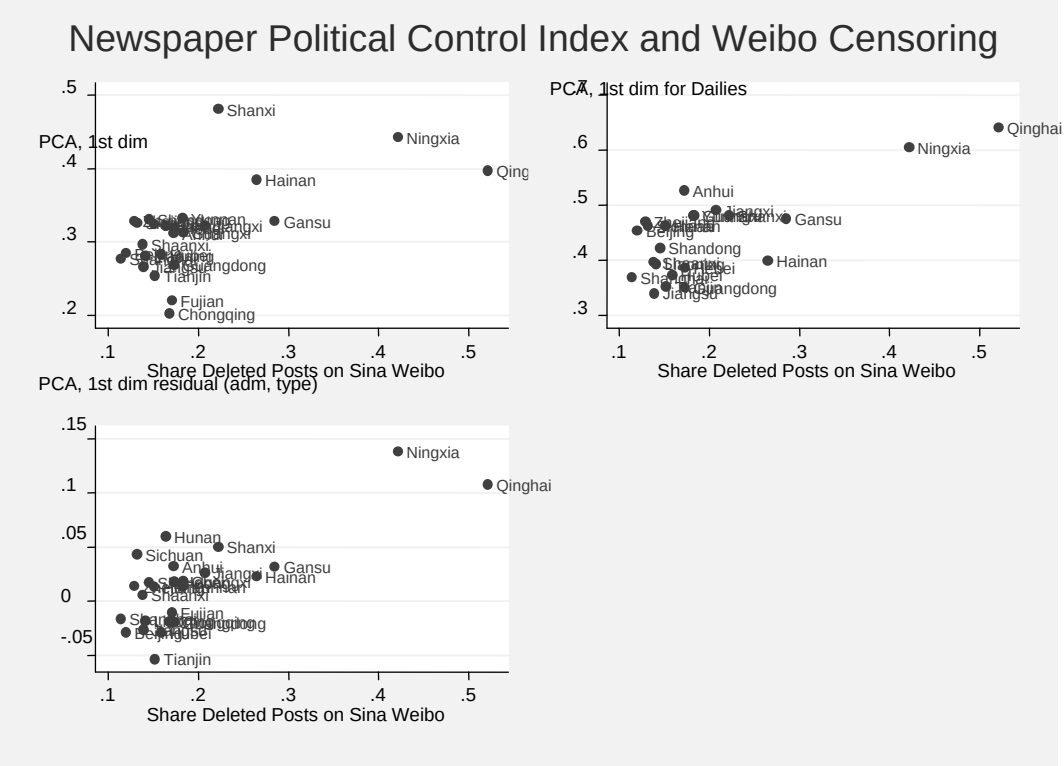


We will use the first principal component as our index of political control. The picture is very similar if one instead uses the predicted probability that a newspaper is a *Party Daily*, or the newspaper's predicted advertising ranking, based on the coefficients estimated in Table 5. The first principal component is a mix of these that is more strongly correlated with both than either with the other.

To further validate the fact that our index captures political control, we compare it with the share of censored posts on Sina Weibo. Sina Weibo is the largest micro blog in China by far, with over 300 million registered users. Bamman et al. (2012) estimate the share of censored posts by Chinese province. The upper left graph in Figure 4 plots the average political control index against the share of deleted posts. Average political control is affected by sampling of newspapers in different provinces, e.g. by type

and administrative level. The upper right graph shows average political control for *Party Dailies* only. The lower graph shows average political control, where newspaper type and level of government have been partialled out.

Figure 4: PCA First Component and Censoring of Weibo Microblogs



The average political control index of newspapers in a province has a raw correlation of 0.64 with the of share censored posts. Comparing only the political control of *Party Dailies*, the correlation with the share of censored posts increases to 0.72. Removing the residual from newspaper type and level of government, the correlation rises to 0.81. The two outliers (in both dimensions) are Ningxia and Qinghai. In these provinces, the share of deleted posts is around 50 percent, and the average index of political control for *Party Dailies* is around 0.6. If these two provinces are removed, the raw correlation is still 0.55.

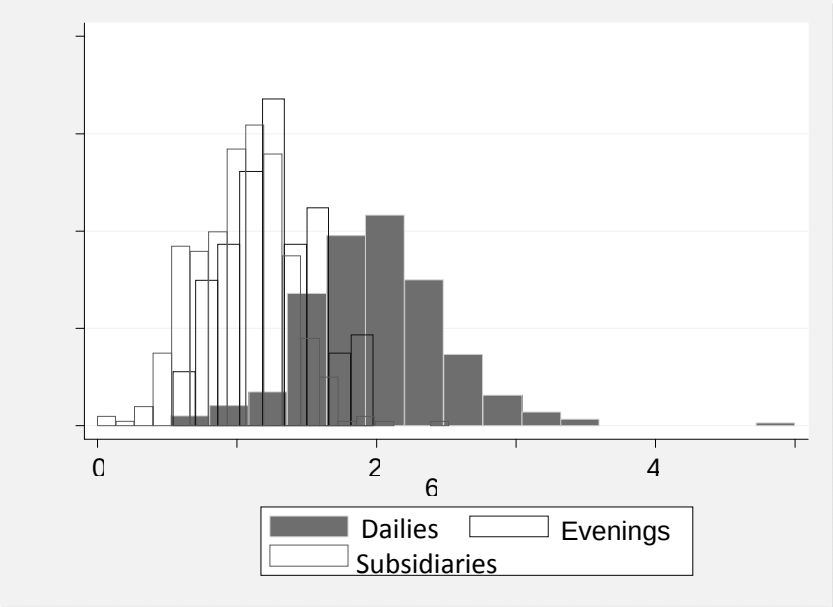
Table 7 contains a table of the newspapers that have the highest and lowest average political control in our sample. The most controlled papers are *Party Dailies* at the central and provincial level. The least controlled are *Subsidiaries* and one *Party Evening* at the provincial and prefecture level.

Table 7: Most and Least Controlled Newspapers

Political control	Newspaper name	Newspaper type	Level	Province	Prefecture
0.68	QINGHAIDAILY	Party Daily	province	Qinghai	Xining
0.64	NINGXIADAILY	Party Daily	province	Ningxia	Yinchuan
0.59	GANSUDAILY	Party Daily	province	Gansu	Lanzhou
0.59	ANHUIDAILY	Party Daily	province	Anhui	Hefei
0.56	PEOPLE'SDAILY	Party Daily	central	Beijing	Beijing
0.54	YUNNANDAILY	Party Daily	province	Yunnan	Kunming
0.54	SICHUANDAILY	Party Daily	province	Sichuan	Chengdu
0.54	SHANXIDAILY	Party Daily	province	Shanxi	Taiyuan
0.54	JIANGXIDAILY	Party Daily	province	Jiangxi	Nanchang
0.53	GUANGXIDAILY	Party Daily	province	Guangxi	Nanning
0.21	CHUTIANMETROPOLISDAILY	Subsidiary	province	Hubei	Wuhan
0.21	DUSHISHIBAO	Party Evening	prefecture	Yunnan	Kunming
0.21	SHENZHENEVENINGNEWS	Subsidiary	prefecture	Guangdong	Shenzhen
0.19	WUHANEVENINGNEWS	Subsidiary	prefecture	Hubei	Wuhan
0.17	WUHANMORNINGPOST	Subsidiary	prefecture	Hubei	Wuhan
0.16	LIAOSHENEVENINGNEWS	Subsidiary	province	Liaoning	Shenyang
0.16	INFORMATIONTIMES	Subsidiary	prefecture	Guangdong	Guangzhou
0.15	BEIJINGEVENINGNEWS	Subsidiary	province	Beijing	Beijing
0.13	THEFIRST	Subsidiary	province	Beijing	Beijing
0.03	BEIJINGDAILYMESSENGER	Subsidiary	province	Beijing	Beijing

Finally, Figure 5 plots the distribution of the political control index, by newspaper type. *Party Dailies* are most controlled, followed by *Party Evenings* and *Subsidiaries*.

Figure 5: PCA First Component and Newspaper Type



Why do Ningxia and Qinghai control their newspapers more than other provinces? They are inland provinces far from the main engines of growth. Still, they are not particularly poor, although they are below the mean in terms of per capita GDP. These provinces are small and media competition might be weaker for this reason. To discuss what factors might matter and how, we now set up a simple model of political media control.

3.5 Determinants of political control: Model

3.5.1 Motivating example

As an example of the type of competition we are trying to capture, consider the Chengdu prefecture. It is a pretty representative example of the evolution of the newspaper market in urban areas. Chengdu, the capital city of the

Sichuan province, is a central city in Southwest China. With a population of 14 million and a GDP of RMB 390 billion (about 62 billion in US dollars) in 2008, the Chengdu district is constantly ranked as No. 13 among all Chinese cities during the 2000s.

In the early 1980s, the dominating newspaper in Chengdu was the *Sichuan Daily*, run by the provincial level Party Committee. Its only competition was a county level *Party Daily*. In 1983, the prefecture-level Party Committee started the *Chengdu Evening News*, which quickly became the leader of the local press market. In 1995, the *Sichuan Daily* launched a commercial subsidiary, the *West China City News*. Before the start of this subsidiary, the *Chengdu Evening News* had advertising revenues 3.4 times as large as those of the *Sichuan Daily*.[24] Within four years, the *West China City News* earned advertising revenues of RMB130 million, while the advertising revenue of its parent paper, the *Sichuan Daily,* fell from RMB40 million to 20 million. However, the *Chengdu Evening News* experienced an even greater fall as its advertising revenue plunged from a peak of RMB 160 million to RMB80-90 million. In response, the Chengdu Party Committee — the owner of *Chengdu Evening News*, launched a new Daily newspaper in 2001, *Chengdu Daily*, to replace the *Evening* as the Party newspaper. The "liberalized" *Chengdu Evening News* became a subsidiary of *Chengdu Daily* and enjoyed the same autonomy as the *West China City News*. The *Chengdu Evening News* revived. In 2003, competition was reduced as the county-level *Party Daily Dujiang Yang Newspaper* was closed down.

3.5.2 Model

We now develop a simple model to discuss how Party Committees adjust the level of political control of their newspapers to trade off economic and political goals. A newspaper n can locate on the line at $x_n \in [0,1]$, where a higher x_n means less political control. There is a continuum of consumers with ideological blisspoints, x_i, uniformly distributed on $x_i \in [0,1]$. The consumer's

[24]The numbers in this example are from Huang (2001).

utility from newspaper n with ideological profile n is

$$u(x_i, x_n) = \frac{1}{2} - |x_i - x_n|.$$

We abstract from price competition and set the price of the newspaper to zero. In practice, the subscription prices were set by national regulation for each category (*Daily, Evening, Subsidiary*) until 2005. Even after this, the price dispersion is small and the subscription fees are a small share of total revenue, which mainly comes from advertising. Consumers only buy one newspaper. They buy the newspaper that gives them the highest utility and they do not buy newspapers that give a negative utility.

The newspapers earn a profit that is $\overline{R}$ times their demand in the market. The Party Committee which owns the paper cares about this profit and about consumer exposure to political information in the paper. The Party Committee's ideological blisspoint is $x = 0$. Its utility from ideology is $-\alpha$ times the average consumed ideology. A newspaper at $x_n = 0$ is thus most preferred from a political influence perspective while a newspaper at $x_n = \frac{1}{2}$ maximizes consumer demand.

Party Committee Monopoly The most common market structure in China is that one Party Committee owns all newspapers in a prefecture. We start by analyzing this case. Suppose that the Party Committee chooses to have only one *Party Daily*, located at $x_n = d$. Demand is then

$$X(d) = \frac{1}{2} + d,$$

and the utility of the Party Committee is,

$$U(d) = \underbrace{X(d)\,\overline{R}}_{\text{revenue}} - \alpha \underbrace{X(d)\,d}_{\text{political exposure}}.$$

The provincial Party Committee will select d to maximize utility. This is a simple quadratic problem with the solution

$$d^* = \begin{array}{ll} 0 & \text{if } \frac{\overline{R}}{\alpha} \leq \frac{1}{2} \\ \frac{\overline{R}}{2\alpha} - \frac{1}{4} & \text{if } \frac{1}{2} < \frac{\overline{R}}{\alpha} < \frac{3}{4} \\ \frac{1}{2} & \text{if } \frac{\overline{R}}{\alpha} \geq \frac{3}{4} \end{array} \quad (1)$$

The *Daily* will be less ideological the larger is the market $\overline{R}$ and the less the Party Committee cares about political control, α.

Now consider the case where the Party Committee owns both a *Party Daily* and an *Evening* with positions d and e. In this case, the demand for the *Daily* will be

$$X_d = \frac{d+e}{2},$$

and those reading it will be exposed to ideological content d. The demand for the *Evening* is

$$X_e = e + \frac{1}{2} - \frac{d+e}{2},$$

and those reading it will be exposed to ideological content e. The Party Committee's utility from the newspaper profiles (d, e) is

$$U(d,e) = \overline{R}\left(e + \frac{1}{2}\right) - \alpha\left(X_d d + X_e e\right).$$

In this case, it will set $d = 0$, since $\frac{\partial U}{dd} = -\alpha_p d < 0$. The existence of an *Evening* will increase the political control of the *Daily*. The reason is that a more commercialized *Daily* will only steal readers from the *Evening* and hence not generate more profits.

Given $d = 0$, the Party Committee will set e to maximize

$$U(d,e) = \overline{R}\left(\frac{1}{2} + e\right) - \frac{\alpha}{2}(1+e)\,e.$$

This has the solution

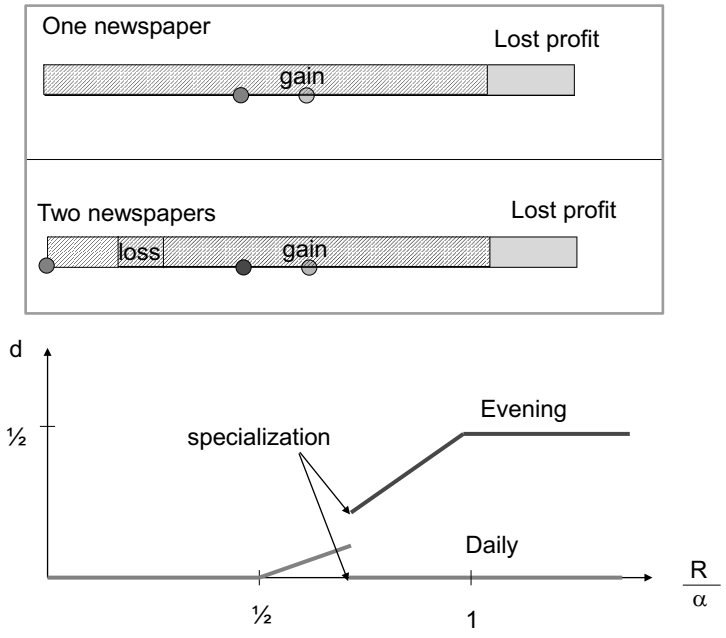
$$e^* = \begin{array}{ll} 0 & \text{if } \frac{\overline{R}}{\alpha} \leq \frac{1}{2} \\ \frac{\overline{R}}{\alpha} - \frac{1}{2} & \text{if } \frac{1}{2} < \frac{\overline{R}}{\alpha} < 1 \\ \frac{1}{2} & \text{if } \frac{\overline{R}}{\alpha} \geq 1. \end{array} \qquad (2)$$

If $\frac{\overline{R}}{\alpha_p} < \frac{1}{2}$, there will only be a *Daily* paper, since there is no point in having two perfect substitutes.

Comparing d and e from equations (1) and (2), it is clear that an *Evening* paper in the two-paper case will be more commercialized than a *Daily* in the one-paper case, given the same $\frac{\overline{R}}{\alpha}$. To see why, consider a decrease in commercialization under both cases; see Figure 6. The effect on total Party Committee profits is the same in both cases, but the effect on ideological exposure is different. As the monopoly *Party Daily* becomes less commer-

cialized, this influences all readers. However, as the *Party Evening* becomes less commercialized, this only influences the readers of the *Evening*, and some readers are even stolen from the *Party Daily* causing these to be exposed to a more commercial content. As the ideological benefits from making the *Evening* more politically controlled are lower, it will be less controlled.

Figure 6: Monopoly Party Committee



Consequently, a *Daily* and an *Evening* will be specialized, or differentiated, around the position a single *Daily* would occupy at the market conditions. As an *Evening* paper enters, it will become more commercialized than the *Daily* was just before entry and the *Daily* will become more controlled.

When will the Party Committee choose to start an *Evening* paper? If it were costless, the monopoly Party Committee would like to start an *Evening* if $\frac{\overline{R}}{\alpha} > \frac{1}{2}$. In this range, the *Daily* in the one-paper case would be located at $d > 0$. If the Party Committee started an *Evening* located at this position and moved the *Daily* to $d = 0$, it would gain the same profits and get better political exposure as some readers would remain with the *Daily*. If $\frac{\overline{R}}{\alpha} < \frac{1}{2}$, then the Party Committee would not like to start an *Evening* paper, since

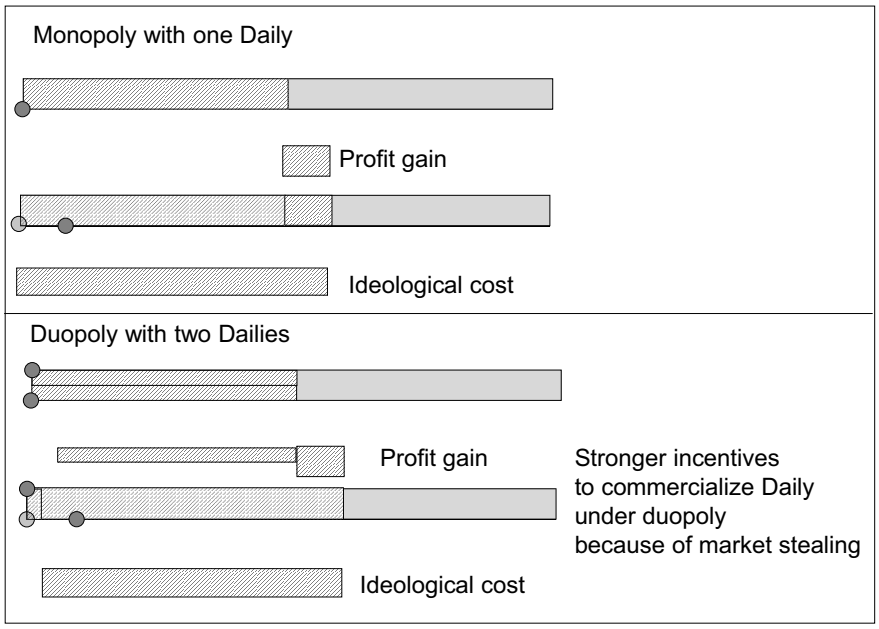
$e^* = 0$ in this case and there is no point in having two papers located at the same position.

Party Committee Duopoly We now consider the case with two competing Party Committees. This is the second most common market situation overall and the most common market structure in the sample of prefectures for which we have content data for at least some newspapers. We call one the Province Party Committee and the other the county Party Committee. One committee may care more about political control than the other. We label their preferences for political control α^p and α^c. We will use this model to discuss the exit of the county papers, which overwhelmingly were Party *Dailies*. Hence, we will analyze the case where a county *Daily* competes against a provincial *Daily* or a provincial *Daily* and an *Evening*. To make this problem tractable, we will reduce the strategy space and only allow the *Dailies* to be located at two positions $d = \{0, d_H\}$.

Consider a market where $\frac{\overline{R}}{\alpha_p} < \frac{1}{2}$. Under monopoly, the provincial Party Committee runs a *Daily* located at $d = 0$. We now consider the game where a provincial *Daily* and a county *Daily* simultaneously decide whether to locate at 0 or d_H. In this case, there exists a unique Nash Equilibrium where both dailies locate at 0 if $\frac{\overline{R}}{\alpha_p} < 2d_H^2$. In this region, locating at 0 is a dominant strategy. In the region $2d_H^2 < \frac{\overline{R}}{\alpha_p} < d_H$, there exist two Nash equilibria: (0,0) and (d_H, d_H). In the region $d_H < \frac{\overline{R}}{\alpha_p} < \frac{1}{2}$, playing d_H is a dominant strategy and the only equilibrium is (d_H, d_H).

In comparison, under monopoly the only equilibrium is $d = 0$. Consequently, the existence of a competing *Daily* makes other *Dailies* less politically controlled. The reason is that competition amplifies the effects on profits and diminishes the effects on political exposure. This is shown in Figure 7. The upper panel shows the effect of moving from $d = 0$ to $d = d_H$ in the monopoly case. The monopoly *Daily* trades off the increased profits against the worse political exposure. The lower panel shows the trade-off in the duopoly case. Moving to $d = d_H$ increases the profits more because of market stealing from the competing *Daily*. On the other hand, the cost in terms of worse political exposure is lower as some of the readers remain with the competing *Daily*.

Figure 7: Market Structure and Incentives to Commercialize Daily



Consider now the case where a provincial and a county *Daily* are both located at some point d, and the Provincial Party Committee considers where to position a *Party Evening*, e. The *Party Evening* is positioned to maximize

$$X_e R + \frac{1}{2} X_d R - \alpha_P \left(X_e e + X_d d \right),$$

where

$$\begin{aligned} X_e &= \frac{1}{2} + \frac{e-d}{2}, \\ X_d &= \frac{d+e}{2}. \end{aligned}$$

This has the solution

$$e^* = \begin{array}{ll} 0 & \text{if } \frac{\overline{R}}{\alpha} \leq \frac{2}{3} \\ \frac{3}{4}\frac{\overline{R}}{\alpha} - \frac{1}{2} & \text{if } \frac{2}{3} < \frac{\overline{R}}{\alpha} < \frac{4}{3} \\ \frac{1}{2} & \text{if } \frac{\overline{R}}{\alpha} \geq \frac{4}{3}. \end{array} \qquad (3)$$

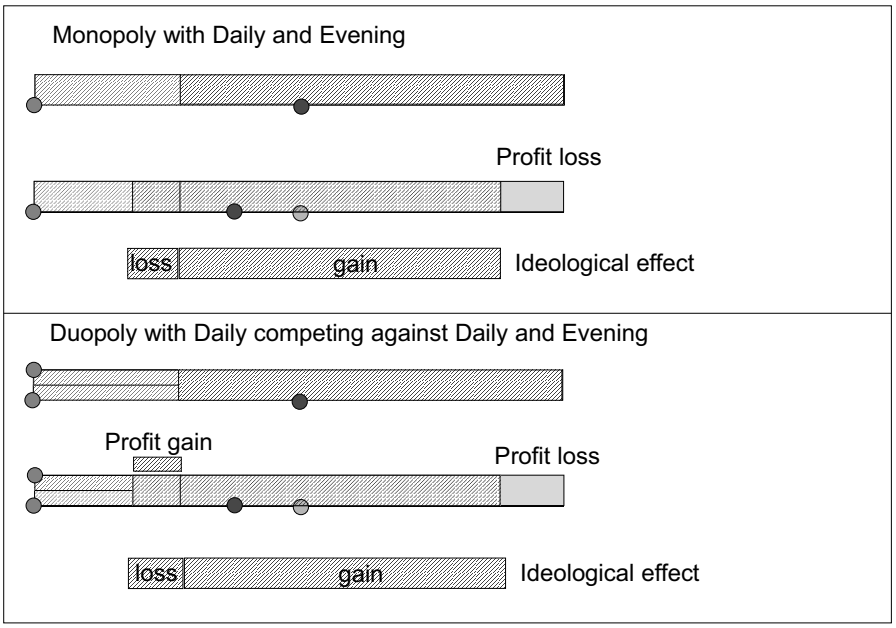
Comparing this to the positioning of the *Evening* in the monopoly case, equation (3), we see that the *Evening* paper is more politically controlled when there is a competing county *Daily* than when there is not. Figure 8

shows how the trade-off changes. The upper panel shows the effect of an *Evening* becoming more politically controlled in the monopoly case and the lower panel shows the same situation in the duopoly case. The effect on political content exposure is the same in both cases. However, in terms of profits, the existence of a competing *Daily* reduces the *Evening*'s incentives to differentiate from the position of the *Party Dailies*. Because of market stealing from the county *Daily*, it is less important for the *Evening* paper to differentiate. For this to be an equilibrium, the *Dailies* would also like to remain in their positions. This implies that

$$U^J\left(d_H, d_H, e^*\right) \geq U^J\left(0, d_H, e^*\right), \qquad j = P, C,$$

which holds if $\overline{R}$ is large enough.

Figure 8: Market Structure and Incentives to Commercialize Evening



We have the following predictions. The level of ideological control is falling in the size of the advertising market, and more so for levels of government that care less about political control, and rising in the preference for political control. The probability of entry of an *Evening* is increasing in the size of the advertising market. At entry, the *Daily* and the *Evening* will

differentiate around the position of the pre-existing *Daily,* with the *Daily* becoming strongly politically controlled and the *Evening* being commercialized. Finally, a competing *Daily* will make other *Dailies* more commercialized, and *Evenings* less commercialized. We will now investigate a subset of these.

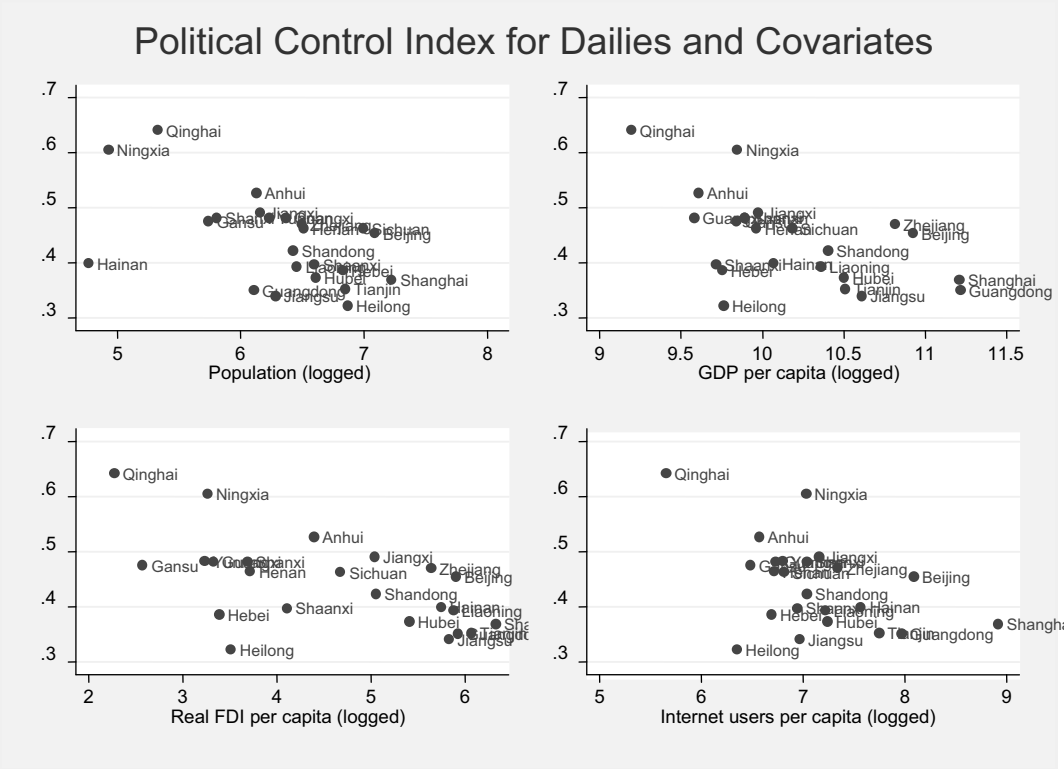
3.6 Determinants of political control: empirics

We now investigate the determinants of political control. We first look at how our political control index correlates with a number of factors such as GDP, population size and internet penetration. Then, we study the effect of competition using the reform in 2003 to close down all county-level newspapers as exogenous variation.

The model focuses on advertising market size and competition. We will also investigate other variables, such as the degree of internet penetration, the distance to Beijing and the level of government. The size of the advertising market is probably increasing economic development, which is positively related to income, wages, education levels, internet penetration and FDI. Internet penetration may also affect the political control of media by providing an alternative information channel.

We first look at provincial cross-sectional relationships between these variables. Figure 9 plots the average political control index for each province against population, GDP per capita, real foreign direct investment and internet users per capita. From the graph, it is clear that there is a negative relationship between newspaper control and all these variables. Ningxia and Qinghai are two of the very smallest provinces. Qinghai is also poor, attracts little FDI and has few internet user. There is no time trend, political control of newspapers seems to have remained roughly constant over our sample period.

Figure 9: Political Control Index and Covariates



The first column of Table 8 shows how our measure of political control of newspapers correlates with a number of variables at the provincial level. The strongest negative correlation is with sheer province size, measured by population. Political control is also significantly negatively correlated with proxies for economic development, such as FDI per capita, GDP per capita and average wages. Our two measures of competition in the newspaper market, the number of newspapers and the number of Party Committees running newspapers are both negatively correlated with the political control of newspapers. For comparison, Column 2 shows the same correlations for the share of censored posts by province, as measured by Bamman et al. (2012). The share censored on the micro blog Sina Weibo correlates very much in the same way as our political control index, a further indication that they essentially measure the same thing. None of these correlations should be interpreted as measuring causal relationships.

Table 8: Provincial Cross-sectional Correlations

	Political control index	Share censored Weibo posts
Population (log)	-0.7031	-0.7078
Real FDI (log)	-0.5287	-0.6154
Longitude	-0.4661	-0.5833
GDP per capita (log)	-0.4654	-0.4426
Average wage (log)	-0.4072	-0.2382
Number of newspapers	-0.4072	-0.2382
Government exp. per capita (log)	-0.3983	-0.2688
Internet users per capita (log)	-0.3696	-0.4926
Number of Party Committees running newspapers	-0.3696	-0.4926
Number employed per capita (log)	-0.1022	-0.129
Latitude	0.0163	0.1267
University students per capita (log)	0.0335	-0.2632
Distance to Beijing	0.053	0.0242
Industrial share	0.0661	0.0323

We investigate these relationships in a regression framework. Table 9 shows results from regressing the political control index of each newspaper on newspaper and prefecture characteristics. The first column includes year fixed effects. There is a clear cross-sectional relationship between political control and population size and GDP per capita. The cross sectional relationships are stronger than those found by Djankov et al. (2003) across countries. They find weak correlations between GDP per capita and concrete measures of media freedom such as the number of journalists jailed, controlling for state ownership. When we control for prefecture or newspaper fixed effects, the standard errors increase by a factor of five, and these relationships lose statistical significance. The same is true for the other variables, such as internet penetration, that were correlated with political control at the provincial level. The robust findings are with respect to variables that vary by newspaper: the level of government and type of newspaper. Newspapers by lower levels of governments are less strictly controlled: central level papers are most controlled, followed by province papers and finally prefecture papers. The second to last row shows a test of the province and prefecture fixed effects being equal. *Party Dailies* are most controlled, followed by *Evenings* and *Subsidiaries*.

Table 9: Dependent Variable: Political Control Index

GDP per capita (log)	-0.026***	-0.023	-0.016
	(0.008)	(0.049)	(0.051)
Population (log)	-0.031**	0.008	-0.014
	(0.013)	(0.051)	(0.049)
# general interest papers	-0.003*	0.001	0.002
	(0.002)	(0.002)	(0.002)
Province	-0.111***	-0.101***	
	(0.016)	(0.010)	
Prefecture	-0.148***	-0.158***	-0.067***
	(0.023)	(0.019)	(0.011)
Party Evening	-0.152***	-0.157***	0.037
	(0.016)	(0.017)	(0.033)
Subsidiary	-0.195***	-0.201***	
	(0.013)	(0.014)	
Observations	714	714	714
R-squared	0.699	0.744	0.849
Fixed Effects	Year	Prefecture and Year	Newspaper and Year
Province=Prefecture	0.01	0.00	
Evening=Subsidiary	0.01	0.01	

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1.

We know from Table 9 that lower-level governments impose less strict political control. The model suggests that these governments would react more to changes in GDP than the more controlled central level newspapers. Table 10 investigates whether the response to GDP differs by different types of government. The first specification controls for year effects only. In the second column, prefecture fixed effects are added. The third column instead adds newspaper fixed effects. The results show that lower level governments react more than the center. A higher GDP thus seems to increase the difference in political control between different levels of government.

Table 10: Dependent variable: Political Control Index

	I	II	III	IV	V	VI
GDP (log)	0.061***	0.043	0.060	-0.026**	-0.024	0.069
	(0.013)	(0.050)	(0.050)	(0.012)	(0.044)	(0.053)
Prefecture * GDP	-0.095***	-0.099***	-0.111***			
	(0.015)	(0.014)	(0.018)			
Province * GDP	-0.080***	-0.075***	-0.088***			
	(0.008)	(0.016)	(0.020)			
Party Evening * GDP				-0.020	-0.014	-0.097***
				(0.013)	(0.013)	(0.021)
Subsidiary * GDP				0.009	0.010	-0.093***
				(0.014)	(0.014)	(0.018)
Population (log)	-0.009	0.030	0.007	-0.004	0.021	-0.014
	(0.015)	(0.040)	(0.028)	(0.014)	(0.043)	(0.027)
# general interest papers year	-0.004*	-0.001	0.000	-0.004**	0.001	-0.001
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
Province	1.329***	1.249***		-0.115***	-0.109***	
	(0.148)	(0.282)		(0.023)	(0.017)	
Prefecture	1.542***	1.579***	0.335	-0.159***	-0.171***	-0.098***
	(0.244)	(0.256)	(0.341)	(0.029)	(0.025)	(0.011)
Party Evening	-0.161***	-0.167***	0.027	0.173	0.073	0.084
	(0.017)	(0.014)	(0.036)	(0.223)	(0.212)	(0.353)
Subsidiary	-0.195***	-0.201***		-0.353	-0.374	
	(0.013)	(0.013)		(0.234)	(0.227)	
Observations	714	714	714	714	714	714
R-squared	0.703	0.750	0.853	0.704	0.747	0.870
Fixed Effects	Year	Prefecture and Year	Newspaper and Year	Year	Prefecture and Year	Newspaper and Year

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1.

The last three columns of Table 10 investigate whether *Party Evenings* and *Subsidiaries* also react more to an increase in GDP than the *Party Dailies*. Our model suggests that this would be the case as the *Evenings* would react to larger advertising profits while the *Dailies* would remain at the maximum political control point (for Party Committees that own both a *Daily* and an *Evening*). Here, the evidence is more mixed. In the strongest specification with newspaper fixed effects, the *Party Evenings* and *Subsidiaries* react more to increasing GDP than the *Party Dailies*.

The positive correlation between increases in GDP and political control for the central level newspapers and the *Party Dailies* suggests that our model may be missing something. Some people argue that there is cross-subsidization between *Party Dailies* and the more commercially oriented papers under the same Party Committee. This could explain why the political control of *Party Dailies* seems to increase (if anything) when GDP increases. Another possibility is that the value of political control, α in the model, also increases with GDP. The value of holding power may be increasing in GDP and political control may partly be used to ensure regime stability.

Competition and political control We now investigate the effect of competition on bias using a reform aimed at closing down county-level newspapers. With the stated purpose of reducing the fragmentation in the media market, most county-level newspapers lost their newspaper license in 2003, thus forcing them to close. A few exemptions were made: county-level newspapers started by the Party before 1949; papers published by county-level, autonomous, ethnic minority administrations or in ethnic minority languages; papers in counties with a population of at least half a million, a GDP of 10 billion Yuan, a volume of consumer goods sales of 3 billion Yuan and above, and where the advertising revenue of the party organ exceeded 4 million Yuan.[25]

The dramatic effect of this reform on the total number of general interest newspapers can be seen in Figure 1. The effect was as large in the WiseNews prefectures for which we have newspaper content data. There were close

[25]For a description, see Zhao (2008).

to 60 county *Dailies* in WiseNews prefectures in 2002, by 2004 this figure had dropped to less than 10. This had strong effects on the market structure. Figure 10 shows the number of Party Committees involved in running newspapers in the prefectures covered in the WiseNews sample. The reform caused a large increase in the number of monopoly and duopoly markets. Thus, the reform caused a significant fall in competition for the newspapers in our sample. We do not have any content data for any county newspapers. Consequently, what we can measure is the effect of county *Dailies* closing down on newspapers that remain in the market.

We first estimate the effects of this fall in competition on the political control of the newspapers by regressing the political control index on the number of competing *Party Dailies* and *Party Evenings*. The number of competing Party Dailies is computed as the number of *Party Dailies* in the prefecture that are run by a Party Committee other than the one that runs the paper whose content data we analyze in this observation. The result is shown in Table 11. The first column includes newspaper and year fixed effects. The second column adds controls for GDP, population, wage, industrial share of GDP, real FDI, the number of university students, the number of employees, total government expenditures, and the number of internet users.

Table 11: Dependent Variable: Newspaper Political Control

	I	II	III	IV
# Competing Party Dailies	0.007***	0.006**	-0.008*	-0.009*
	(0.002)	(0.002)	(0.004)	(0.005)
Party Evening * # Competing Party Dailies			0.018**	0.018**
			(0.007)	(0.007)
Subsidiary * # Competing Party Dailies			0.017***	0.017***
			(0.004)	(0.004)
# Competing Evenings and Subsidiaries	0.007	0.007	0.009	0.010
	(0.010)	(0.011)	(0.007)	(0.008)
Party Evening * # Competing Evenings and Subsidiaries			-0.019	-0.020
			(0.027)	(0.029)
Subsidiary * # Competing Evenings and Subsidiaries			-0.009	-0.013
			(0.019)	(0.018)
Observations	652	652	652	652
R-squared	0.870	0.873	0.875	0.878
Controls	No	Yes	No	Yes
Fixed Effects	Newspaper and Year	Newspaper and Year	Newspaper and Year	Newspaper and Year
Party Evening			0.06	0.10
Subsidiary			0.01	0.01

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1

All specifications control for newspaper type and administrative level. Controls include GDP, population, wage, industrial share of GDP, real FDI, number of university students, number of employees, total government expenditures, number of internet users.

More competing *Party Dailies* are correlated with more political control across all specifications. The coefficient on the number of competing *Evenings* and *Subsidiaries* is completely insignificant. There is little variation in the data and the standard errors are 4-6 times as large as those on competing *Party Dailies*.

Our model suggests that the effect of more competing *Party Dailies* would differ by newspaper type. Other *Dailies* would become less politically controlled, because the demand elasticity increases while the political exposure effects become smaller. On the other hand, *Evening* papers become more politically controlled, as they would have less of an incentive to differ from the position ofthe *Party Dailies*.

The last two columns of Table 11 test for these heterogeneous effects. The main effect in the first row measures the effect for *Party Dailies* (the omitted category). The number of competing *Party Dailies* is negatively correlated with the political control of *Party Dailies*, although this is insignificant. For *Party Evenings* and *Subsidiaries*, more competing *Dailies* are associated with more political control. The last two rows show F-tests for the coefficient being different than zero for *Party Evenings* and *Subsidiaries* (the main effect plus interactions).

Certainly, the number of competing *Party Dailies* could be endogenous to many factors that also influence the degree of political control of newspapers. For this reason, we only want to use only the variation generated by the 2003 reform to identify the causal effect of competition on political control. For this reason, we create a variable, which we call "# Competing *Party Dailies* by Reform", which is minus the number of county-level newspapers in this prefecture in 2002, multiplied by an indicator variable for the year 2003 or later. Defined this way, the variable becomes comparable to the OLS estimates above. This variable measures the fall in the number of newspapers a prefecture would have due to the reform if all county papers that existed in 2002 were closed down. For a prefecture with one county paper in 2002, this variable would be zero before 2003 and then minus one after 2003.

Table 12 shows the results. The first two columns show the average effect across all newspapers. This is positive and significant. The last two

columns show the differential effect across newspaper types. The coefficient on *Party Dailies* is negative and marginally significant whereas the coefficient on *Evenings* and *Subsidiaries* is positive and significant. Once more, the last two columns show an F-test for effects for *Evenings* and *Subsidiaries*.

Table 13 adds a placebo reform in 2002. The variable Placebo Reform 2002 is constructed by leading the "# Competing Party Dailies by Reform" variable one year. The Reform 2002 variable is insignificant, as are the interactions in columns three and four.

Table 14 analyzes the dynamic effects of the reform. It seems that around half of the changes in political control were implemented already in 2003 and the remaining in 2004, although many of these coefficients are insignificant due to multicollinearity.

Table 12: Dependent Variable: Newspaper Political Control

	I	II	III	IV
# Competing Party Dailies by Reform	0.006***	0.005**	-0.008*	-0.010*
	(0.002)	(0.003)	(0.004)	(0.005)
Party Evening * (# Competing Party Dailies by Reform)			0.020***	0.020***
			(0.005)	(0.005)
Subsidiary * (# Competing Party Dailies by Reform)			0.021***	0.021***
			(0.005)	(0.005)
Observations	652	652	652	652
R-squared	0.869	0.871	0.874	0.877
Controls	No	Yes	No	Yes
Fixed Effects	Newspaper and Year	Newspaper and Year	Newspaper and Year	Newspaper and Year
Party Evening			0.00	0.01
Subsidiary			0.00	0.00

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1
All specifications control for newspaper type and administrative level. Controls include GDP, population, wage, industrial share of GDP, real FDI, number of university students, number of employees, total government expenditures, number of internet users.

Table 13: Dependent Variable: Newspaper Political Control

	I	II	III	IV
# Competing Party Dailies by Reform	0.005***	0.005**	-0.008	-0.009
	(0.002)	(0.002)	(0.006)	(0.006)
Party Evening * (#Competing Party Dailies by Reform)			0.018**	0.018**
			(0.008)	(0.008)
Subsidiary * (# Competing Party Dailies by Reform)			0.018**	0.019**
			(0.007)	(0.007)
Placebo Reform 2002	0.002	0.000	-0.000	-0.001
	(0.004)	(0.004)	(0.006)	(0.006)
Party Evening * placebo reform			0.003	0.003
			(0.007)	(0.007)
Subsidiary * placebo reform			0.004	0.003
			(0.007)	(0.007)
Observations	652	652	652	652
R-squared	0.869	0.871	0.874	0.877
Controls	No	Yes	No	Yes
Fixed Effects	Newspaper and Year	Newspaper and Year	Newspaper and Year	Newspaper and Year
Party Evening 2002			0.59	0.66
Subsidiary 2002			0.32	0.57
Party Evening			0.02	0.02
Subsidiary			0.00	0.00

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1
All specifications control for newspaper type and administrative level. Controls include GDP, population, wage, industrial share of GDP, real FDI, number of university students, number of employees, total government expenditures, number of internet users.

Table 14: Dependent variable: Newspaper Political Control

Reform 2002	0.002	0.000	-0.000	-0.001
	(0.003)	(0.004)	(0.006)	(0.006)
Party Evening * reform 2002			0.002	0.003
			(0.008)	(0.007)
Subsidiary * reform 2002			0.003	0.003
			(0.007)	(0.007)
Reform	0.006**	0.003*	-0.003	-0.006
	(0.003)	(0.002)	(0.004)	(0.004)
Party Evening * reform			0.010**	0.010**
			(0.004)	(0.004)
Subsidiary * reform			0.013**	0.013**
			(0.005)	(0.006)
Reform 2004	0.001	0.003	-0.004	-0.003
	(0.004)	(0.002)	(0.007)	(0.005)
Party Evening * reform 2004			0.009	0.009
			(0.008)	(0.008)
Other * reform 2004			0.007	0.007
			(0.006)	(0.006)
Observations	718	652	718	652
R-squared	0.852	0.872	0.857	0.878
Controls	No	Yes	No	Yes
Fixed Effects	Newspaper and Year	Newspaper and Year	Newspaper and Year	Newspaper and Year
Party Evening			0.05	0.18
Subsidiary			0.01	0.01
Party Evening 2002			0.77	0.66
Subsidiary 2002			0.40	0.62
Party Evening 2004			0.05	0.18
Subsidiary 2004			0.43	0.07

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1

All specifications control for newspaper type and administrative level. Controls include GDP, population, wage, industrial share of GDP, real FDI, number of university students, number of employees, total government expenditures, number of internet users.

Table 15 shows the effect of the reform by specific content category. For most categories, the signs are the expected, but the effects on individual categories are seldom significant. For the categories in Table 15a (other than *Epoch* stories), we expect the sign of the main effect to be negative and the interaction terms to be positive. This is true for all but three of 18 coefficients. It is not true for the content category corruption, which was weakly correlated with political control. In Table 15b, we expect the main effect to be positive and the interaction effects to be negative. This is true for all coefficients. Once more, none are significant.

Table 15a: Reform and Type of Content

VARIABLES	Leader Mentions	Xinhua Cites	Epoch Stories	Corruption	Disasters	Accidents
Reform	-1.180***	-0.509	0.490	0.013	-0.043**	-0.009
	(0.380)	(0.796)	(0.642)	(0.009)	(0.018)	(0.020)
Party Evening * reform	1.378***	1.864	-0.808	-0.008	0.068***	0.021
	(0.414)	(1.132)	(0.535)	(0.009)	(0.020)	(0.018)
Subsidiary * reform	1.676***	1.166*	-1.325**	-0.008	0.080**	0.022
	(0.438)	(0.631)	(0.521)	(0.008)	(0.031)	(0.016)
Observations	652	652	652	652	652	652
R-squared	0.846	0.844	0.883	0.617	0.602	0.396
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Newspaper and Year	Newspaper and Year	Newspaper and Year	Newspaper and Year	Newspaper and Year	Newspaper and Year
Party Evening	0.45	0.05	0.49	0.37	0.16	0.41
Subsidiary	0.06	0.12	0.02	0.21	0.10	0.20

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1
Controls include GDP, population, wage, industrial share of GDP, real FDI, number of university students, number of employees, total government expenditures, number of internet users.

Table 15b: Reform and Type of Content

VARIABLES	Sports	Entertainment	Crime
Reform	0.077	0.243	0.025
	(0.109)	(0.153)	(0.023)
Party Evening * reform	-0.007	-0.454**	-0.034
	(0.198)	(0.183)	(0.025)
Subsidiary * reform	-0.037	-0.403**	-0.029
	(0.131)	(0.186)	(0.021)
Observations	652	652	652
R-squared	0.756	0.880	0.770
Controls	Yes	Yes	Yes
Fixed Effects	Newspaper and Year	Newspaper and Year	Newspaper and Year
Party Evening	0.64	0.27	0.64
Subsidiary	0.66	0.08	0.71

Standard errors clustered by prefecture in parenthesis: *** p<0.01, ** p<0.05, * p<0.1
Controls include GDP, population, wage, industrial share of GDP, real FDI, number of university students, number of employees, total government expenditures, number of internet users.

To sum up, we find that the average effect of the reform to close down county papers was to lower the political control among the remaining papers, or equivalently, to increase commercialization. This is driven by the *Evenings* and *Subsidiaries*. The remaining *Dailies* move in the opposite direction and become more politically controlled.

3.7 Conclusion

In this paper, we investigate what the recent economic growth and subsequent changes in the Chinese media market have meant for media freedom, and what implications this may have for political accountability. To this end, we first investigate the uses of political control. We find that more tightly controlled newspapers cover more political leaders and news from the Xinhua News Agency, presumably for propaganda and policy implementation reasons. We also find that these newspapers cover corruption of lower level officials and disasters more than their commercial competitors. We interpret this as the political leaders using newspapers to monitor and discipline

lower level bureaucrats. We find little evidence that newspapers of any sort cover corruption of higher level politicians, unless these are already under attack from within the CPC. However, we do find that the commercial papers cover the top stories by the regime critical *Epoch Times* to a relatively larger extent.

Consequently, the trend towards commercialization is likely to decrease the newspaper monitoring of lower level bureaucrats. Political accountability at higher levels may increase, as indicated by the stronger coverage of *Epoch Times* stories, but without much direct individual monitoring of top leaders. The trend towards commercialization is likely to reduce the propaganda exposure of newspaper readers. The effects that we find are dramatic. The commercialized papers only have 4-8 percent newspaper stories mentioning leaders' names, compared to 22 percent for tightly controlled papers, and around ten percent less of their articles mention Xinhua News Agency.

We construct an index of political control. This is essentially based on content which characterizes newspapers that we, on apriori grounds, strongly suspect to be more politically controlled and to have lower advertising revenues. We investigate the covariates and determinants of this index. We find no trend in political control over the last ten years. In the cross section, the index correlates negatively with GDP per capita, population size, FDI per capita and competition (the number of newspapers in the prefecture). This is similar to the correlations found by studies using country-level data on press freedom, e.g. Egorov et al. (2009) or Djankov et al. (2003). We find that newspapers controlled by lower levels of government react more to increases in GDP. Consequently, increases in GDP magnify the gap in political control between newspapers controlled by higher and lower levels of government.

We finally investigate the effect of competition on political control using a reform in 2003 to close down all county-level newspapers. We find that this reform, on average, reduced political control. This is driven by the commercial papers which become significantly less controlled after the exit of the county-level papers. This makes sense as the exiting papers were *Party Dailies* which are typically more controlled.

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3.8 Appendix

3.8.1 Equilibrium with duopoly Dailies

Suppose that the provincial *Daily* paper is located at $d = 0$. If the county Party Committee also locates at $d = 0$, it gets half the market and utility

$$U^c(0,0) = \frac{1}{4}\overline{R}$$

.If it enters at $d = d_H$, it gets demand

$$X = (d_H + \frac{1}{2} - \frac{1}{2}d_H) = \frac{1}{2}(1 + d_H)$$

and utility

$$U^c(d_H, 0) = \frac{1}{2}(1 + d_H)\overline{R} - \alpha^c \frac{1}{2}(1 + d_H)\, d_H.$$

It prefers to locate at d_H if

$$U^c(d_H, 0) > U^c(0,0),$$

which is true if and only if $d_H < \frac{\overline{R}}{\alpha_p}$.

Suppose instead that the provincial *Daily* is located at d_H. The county *Daily* can locate at d_H and get utility

$$U^c(d_H, d_H) = \frac{d_H + \frac{1}{2}}{2}\overline{R} - \alpha_c \left(d_H + \frac{1}{2}\right) d_H.$$

If it instead locates at $d_L = 0$, it gets utility

$$U^c(0, d_H) = \frac{d_H}{2}\overline{R} - \alpha_c \left(d_H + \frac{1}{2} - \frac{d_H}{2}\right) d_H.$$

It will choose d_H if

$$U^c(d_H, d_H) > U^c(0, d_H)$$

which holds if

$$2d_H^2 < \frac{\overline{R}}{\alpha_p}.$$

This condition is automatically fulfilled if $d_H < \frac{\overline{R}}{\alpha_p}$ and $\frac{\overline{R}}{\alpha_p} < \frac{1}{2}$. The analysis is analogous for the provincial Party Committee choice. Consequently, there exists a unique Nash Equilibrium where both *Dailies* locate at 0 if $\frac{\overline{R}}{\alpha_p} < 2d_H^2$. In this region, locating at 0 is a dominant strategy. In the region $2d_H^2 < \frac{\overline{R}}{\alpha_p} < d_H$, there exist two Nash equilibria: (0,0) and (d_H, d_H). In the region

$d_H < \frac{\overline{R}}{\alpha_p} < \frac{1}{2}$, the only equilibrium is (d_H, d_H)

Chapter 4

Chinese Microblogs and Drug Quality[1]

4.1 Introduction

Counterfeit drugs constitute more than 10% of the global medicine market, and up to 25% of the drugs consumed in poor countries are counterfeit or substandard (WHO, 2003). This has serious consequences. In developing countries, millions of people are killed by bad drugs each year, of which 200,000 to 300,000 are in China (Putze et al., 2012; Jia, 2007). The prevalence of bad drugs in developing countries may reflect a lack of competitive markets and accountable governments (WHO, FAQ; Torstensson and Pugatch, 2010). In this situation, the media can play a key role by delivering information to consumers and imposing pressure on regulators to drive the

[1]Institute for International Economic Studies, IIES, Stockholm University, email: bei.qin@iies.su.se. I am very grateful to Jakob Svensson, David Strömberg, Philippe Aghion, Masayuki Kudamatsu and Torsten Persson for extensive guidance and feedback on the project. Special thanks go to Tomas Larsson for data collection assistance and Qin Li for the instruction on drug category coding. The work has also benefitted a great deal from discussions with Konrad Burchardi, Pamela Campa, Jin Feng, Jinfeng Ge, Nathaniel Lane, Maria Perrotta, Abdulaziz Shifa, Zheng Michael Song, Yanhui Wu, David Yanagizawa, Shengxing Zhang and Shuang Zhang. Participants in seminars at the IIES, the Development Study Group at Stockholm University, Department of Economics at the Stockholm School of Economics, China Economic Research Center at SSE, Stockholm Institute of Transition Economics and Northeast Universities Development Consortium (NEUDC) 2012 are greatly acknowledged. All errors are my own.

bad drugs out of the market.

This paper investigates whether Sina Weibo, the most popular microblog in China, has improved the drug quality on the market. In a country like China, a microblog is an especially cheap, accessible and relatively free type of media. Sina Weibo can circulate information among millions of users widely and quickly. Once a bad drug is found and posted on the microblog, followers and re-posts can spread the information immediately and informed consumers can respond. The more severe is the problem, the more attention it gets. For example, when the 2010 vaccine scandal broke out, information flooded the microblog; thousands of parents called for joint action and refused to have their children vaccinated by official Disease Control Centers. The vaccine producers and government regulators involved were subsequently punished.

I first develop a simple moral-hazard model to discuss these effects. The model highlights two mechanisms. First, for a given number of bad drugs, an increase in Sina Weibo use induces an effort from administrators overseeing the drug market. This will lead to more bad drugs being found. Second, over time, increased monitoring drives drug providers to produce and distribute fewer bad drugs. Consequently, fewer bad drugs will be found. I refer to the former as the screening effect and the latter as the discipline effect. The model predicts that the discipline effect only dominates when the Weibo use is high enough, so that the number of bad drugs found is non-monotonic in Weibo use. Moreover, both effects imply that the number of bad drugs in existence is always decreasing in Weibo use.

Then, I turn to the empirical analysis, which combines data on drug quality from the Chinese State Food and Drug Administration (SFDA) from 2008 to 2011 with unique data on Sina Weibo use. Every quarter, the SFDA performs a uniform drug audit on around 85% of all Chinese prefectures. The complete audit results since 2008 have been made publicly available.[1] I use the number of bad drugs found by the SFDA to measure drug quality in a prefecture, and the number of drugs examined is my measure of administrator effort.

Sina Weibo started in September 2009 and quickly became the leading

[1]Before 2008, only the results for bad drugs found are released.

microblog in China. By February 2012, it had more than 300 million registered users (out of the Chinese population of 1.3 billion people) and about 100 million messages posted per day.[2] This rapid expansion in the aggregate reflects considerable geographical variation, which we measure in Larsson et al. (2012). Weibo use is defined as the number of posts including a neutral Chinese interjection word, *hei*, which has a high correlation with the total number of Weibo posts (0.999) and yet a low appearance rate (0.0034). Importantly, my drug data predates Sina Weibo.

I use a difference-in-differences identification strategy to estimate the effect of Weibo use on drug quality. My results suggest that the introduction of the microblog significantly reduced the amount of bad drugs in the market. The size of the effect is substantial. Evaluated at the sample mean, if the Weibo use is doubled, the number of bad drugs found will be reduced by 21 percent. Moreover, gauging the dynamic effects of Weibo's introduction, I find evidence of the screening effect and the discipline effect implied by my model. The findings strongly suggest that microblogging can be an efficient way for consumers in developing countries of dealing with poor quality of products or services.

Assuming that the introduction of Sina Weibo is exogenous to the drug market, my results have a causal interpretation. My study addresses this identification assumption: I test for and find no evidence of pre-trends. Importantly, I find that the introduction of Sina Weibo is driven by the number of mobile phone users, educational expenditures, and the tertiary sector share of GDP; but these factors are uncorrelated with the quantity of bad drugs. Moreover, I reject reverse causality by testing whether the number of bad drugs found predicts the introduction of Sina Weibo. Finally, I exclude that the effect I attribute to Sina Weibo is driven by general media pressure. When I replace the Weibo use measure with the number of newspapers, I find no significant effect.

I further explore the mechanisms behind my results. I find evidence that the Sina Weibo use increased the monitoring efforts of the SFDA officers, inducing them to check more drugs. The effect is also, at least partly, driven

[2]According to SINA Corporation

by deterring the production of bad drugs (not just distribution and sales).

This study contributes to a relatively thin literature within development economics that looks for effective ways of curbing bad drugs. Björkman-Nyqvist et al. (2012) find that enhanced market competition can improve drug quality: by exogenously increasing the amount of authentic drugs in the local market, fake drugs are driven out. Other studies discuss drug quality control from the regulatory perspective (Oxfam, 2011). The solutions suggested by these studies may not be effective for autocracies or countries plagued by government corruption, while the use of media, especially microblogs, may be a better alternative.

This paper also relates to literature examining the impact of media on consumer markets and government policy. Media may provide vital information relevant for assessing product quality and promoting well-functioning markets (Akerlof, 1970; Shapiro, 1982). While there exist studies on the effect of media on market prices (Jensen, 2007; Svensson and Yanagizawa, 2009), there are few studies investigating its effects on product quality. My paper fills this gap.

Furthermore, media coverage and access have been found to influence government policy and the effort of politicians (Strömberg, 2004; Reinekka and Svensson, 2005; Snyder and Strömberg, 2010). However, most of these studies have been conducted under more democratic regimes and it is unclear how and whether these effects can be generalized to the autocratic regime, like China.

I show that an autocratic regime may care about public opinion. It may be argued that the Chinese central government, though authoritarian, still has an interest in social welfare and holding local administrators accountable – in particular, by removing poorly-performing ones (Besley and Kudamatsu, 2007). For these reasons, the Weibo posts about bad drugs can survive the censorship, even if they unveil government corruption or involve politicians. Although the theory about why an autocrat should care about social welfare and the public opinion remains unclear and incomplete, I provide evidence that autocratic regimes may be responsive to citizens. The SFDA is found to put more effort into drug monitoring where the Weibo use is higher.

The microblog is also a special media format. Its marginal delivery and marginal production costs are low: as long as there is Internet access or a smart phone, it is accessible. This has implications for the government's ability to silence it. Besley and Prat (2006) argue that when the number of news outlets increases, silencing the media becomes increasingly difficult. In the case of a microblog, each user can be regarded as a news outlet so it is indeed difficult for the government to silence all of them without shutting down the medium altogether. Another implication of this characteristic is the heterogeneous effects. I find that the regions with the middle level of GDP per capita, the regions with the lowest education level, the regions with the middle level of the distance between the market and producers tend to have a higher marginal effect of Sina Weibo use in terms of reducing the number of bad drugs found on the market.

The paper is structured as follows. Section 2 describes the background of Sina Weibo and the bad drug issue in China. The model is developed in section 3. Section 4 presents the data and section 5 describes the econometric methods I use. The main results are reported in section 6, and some endogeneity concerns are addressed in section 7. Section 8 discusses the mechanism and heterogeneous effects. Section 9 concludes the paper.

4.2 Background

4.2.1 Sina Weibo

Two months after Facebook and Twitter were banned by the Chinese government, a Chinese microblog – Sina Weibo – launched its first official version in September, 2009. Sina Weibo is akin to a hybrid between Facebook and Twitter and it allows for at most 140 Chinese characters per post; pictures and videos can be embedded; (private) message, comment and re-post are available. Weibo is accessible whenever an Internet connection or a smart phone is available. Both were already widely available in China in 2009.

Weibo quickly became the leading microblog in China. Topics on Weibo vary from daily life to international political events, and users range from

celebrities to ordinary people. By February 2012, Sina Weibo had more than 300 million registered users (out of the Chinese population of 1.3 billion people) and about 100 million messages posted per day.[3] The growth of Sina Weibo use has been dramatically fast, in terms of both use intensity and geographical diffusion.

Before I show the statistics and graphs of Weibo use growth, I will first explain how I measure Weibo use. The data on Weibo use comes from another coauthored project (Larsson et al. 2012). An ideal measure of Weibo use would be the total number of Weibo posts in each prefecture each day. However, it is technically too demanding to gather such a huge data set. Instead, we count the number of posts that contain some neutral Chinese interjection words that have a high correlation with the total number of posts but with a much lower appearance rate. In the paper, the Chinese word used to construct the measure is *hei* (嘿). We validated this on a subsample where we collected data on all posts. We found that posts containing *hei* had a correlation of 99.9% with the total number of posts, across prefectures and days, and an appearance rate of 0.0034. Then, we downloaded all posts including the word *hei*, which finally gave the measurement in the paper: the number of Weibo posts including the word *hei* in the prefecture and the quarter.

Table 1 shows the growth in Weibo use over time. By this measure, only 45 prefectures introduced Weibo in the first quarter that Weibo existed. Only one year later, around 309 prefectures (around 90% of the total number) had Weibo users. The mean number of posts including *hei* increased from 2.5 to 96.6 in two years, and the standard deviation is two or three times the mean in each quarter, suggesting a large variation across regions.

[3] According to SINA Corporation.

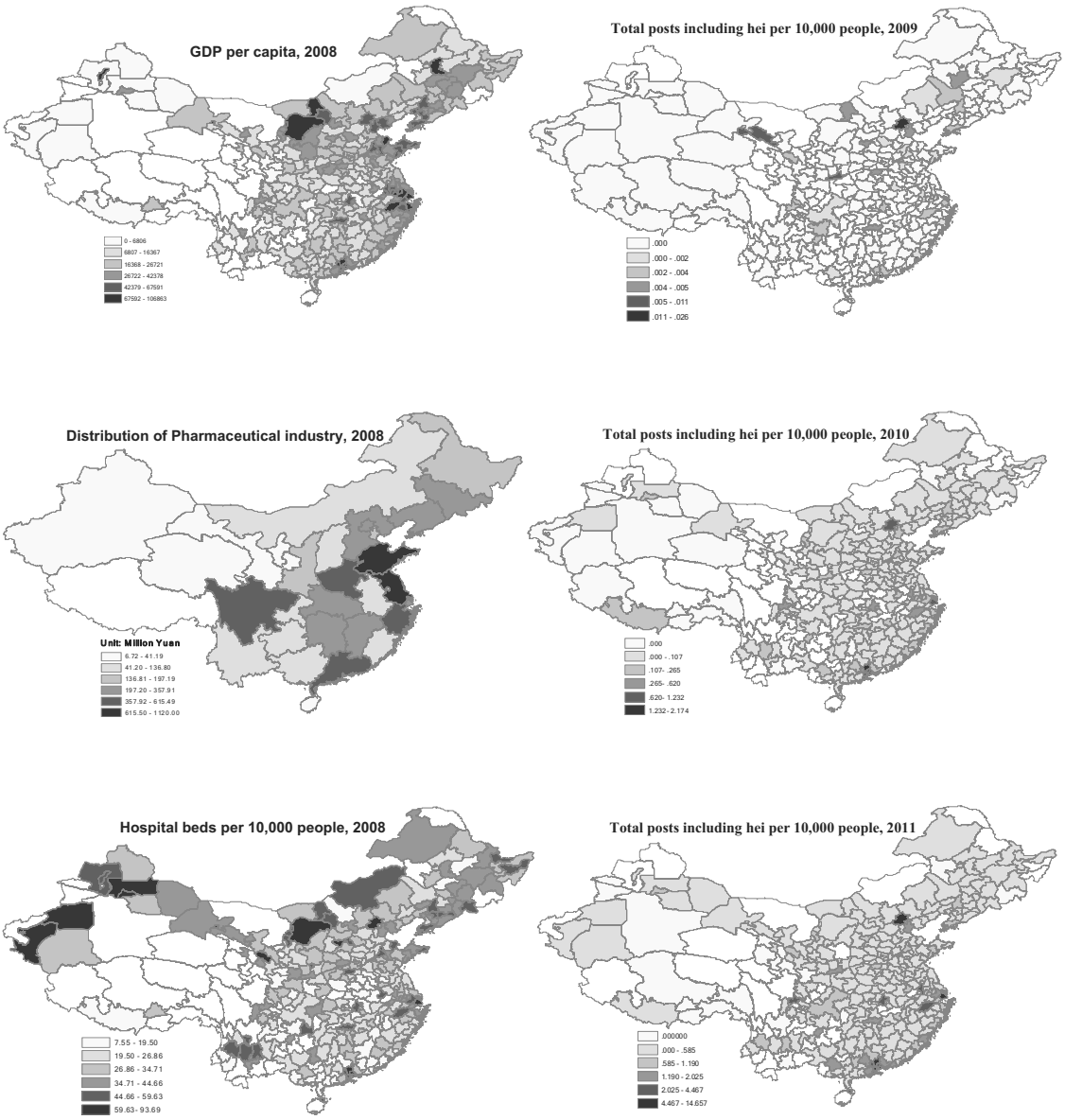
Table 1: Statistics for Prefectures with Weibo Entry

Quarter	Obs	Mean	Std. Dev.	Min	Max
4th 2009	44	2.523	4.742	1	32
1st 2010	83	3.759	7.381	1	61
2nd 2010	154	6.006	15.549	1	120
3rd 2010	230	13.078	44.677	1	429
4th 2010	280	26.261	97.732	1	998
1st 2011	309	41.019	161.314	1	1762
2nd 2011	317	53.735	206.890	1	2344
3rd 2011	328	89.470	339.193	1	3556
4th 2011	334	96.638	351.660	1	3697

Note: The statistics in the table are those from the Weibo use data only (Larsson et al, 2012). The measure is the number of Weibo posts including the Chinese word *hei* in the prefecture in the quarter.

Figure 1 shows the distribution of Weibo use across regions and years. A more detailed analysis of the predictors of early Weibo entry will follow in sections 5 and 7. For now, note that the strong regional differences in economic development in China, with southeast coast cities being much richer than northwest cities, do not seem to be the dominant determinant of Weibo use. Instead, I identify the use of cell phones, educational expenditures and the tertiary sector share of the GDP sector as the main predictors. This makes sense since smart phones constitute the main vehicle for Weibo communication and education and tertiary sector production indicates more advanced regions and may proxy the taste for using new technologies. I will show that none of these factors are significantly correlated with the drug market needs by their own.Sina Weibo clearly has the potential of influencing drug quality. Drugs is a popular topic in Weibo. According to the search word ranking by Sina Weibo in August 2012, “Vitamin” ranked No. 2 and “OTC” (over-the-counter, non-prescription drugs) ranked No. 9 in the category of “life”. People can post information immediately revealing the stores or producers that provide the bad drugs. Given the high attention given to this issue, such posts will likely be spreading quickly to followers and by re-posting. Informed consumers can then avoid these bad drugs, while the administrator will go and check the bad drug providers.

Figure 1: Weibo Use and Prefecture Characteristics



Note: The statistics of GDP per capita and hospital beds per 10,000 individuals in 2008 are from the *China City Statistical Yearbook* 2009, by prefecture. The distribution of the pharmaceutical industry in 2008 comes from *the China Statistics Yearbook on High Technology Industry 2009* and it plots the product value of the pharmaceutical industry, by province. The total posts including *hei* per 10,000 individuals 2009-2011 are the measures for Weibo use from Larsson et al. (2009), aggregated at a yearly level by prefecture. The total posts including *hei* per 10,000 individuals in 2009 constitute the number from the 4*th*

quarter in 2009 only since Sina Weibo became available in September, 2009. The blank patches are prefectures (provinces) that have no data in the corresponding data sources.

Sina Weibo is subjected to censorship. However, Weibo evidently disseminates stories about bad drugs, even scandals involving government officials. This could be because censorship is mainly applied to issues sensitive to party regime or political reforms, and the bad drug issue is not one of them. The central government, which organizes the censoring, may even use Weibo to monitor local governments' performance and crack down on corrupt officers. However, the central government still can and might censor some news or comments on Sina Weibo related to bad drugs. Even if they do, information spreads very quickly on Sina Weibo and censoring takes time. Millions of users might have read the post before it is deleted. There are also ways of circumventing censoring. Censorship is implemented by filtering sensitive key words. Censoring can be avoided by using words with a similar pronunciation but totally different characters to deliver the same message without being sent to the censoring server. Therefore, in spite of the censorship, all kinds of news and comments, even ones that the government does not like, are widely circulated across all of China. Sina Weibo is regarded as the freest media in mainland China. Whether Sina Weibo will have an effect on both people's lives and government accountability in China is an empirical question that this paper tries to answer.

4.2.2 Drugs in China

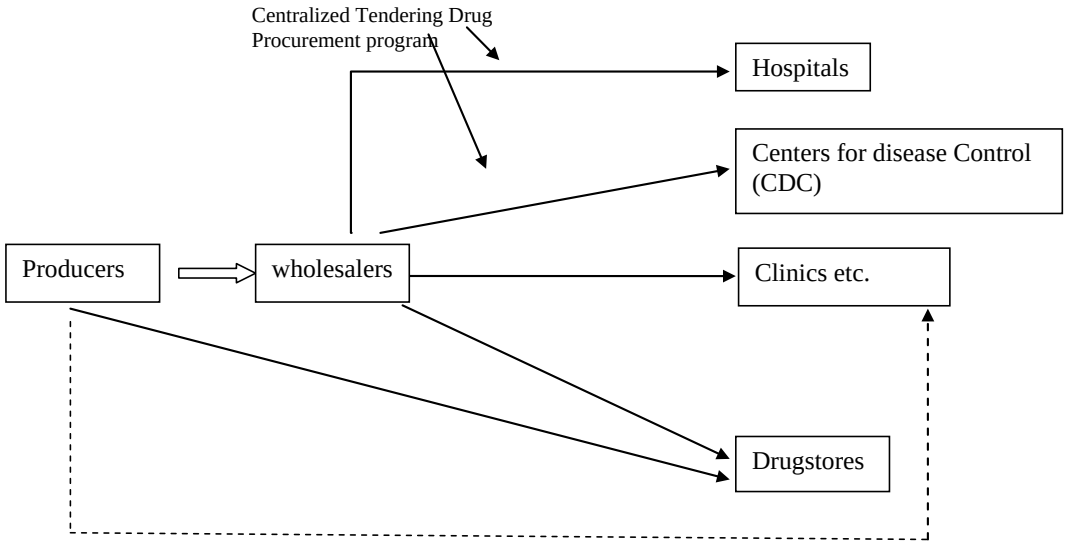
I will now discuss the drug industry sector, involving production, delivery and sales, and when bad drugs may be introduced in this chain. In this paper, a bad drug is defined as a counterfeit or substandard drug.

China has become one of the largest pharmaceutical producers in the world. In 2010, the annual growth rate of the Chinese pharmaceutical industry was around 17% and the value of total output amounted to $240 billion.[4]

[4]The figures come from the National Development and Reform Commission.

Figure 2 explains how drugs are distributed in China. The Centralized Tendering Drug Procurement Program (CTDP) regulates health expenditure procedures and the drug market. Public health institutions can only purchase drugs from the wholesalers that won the bid in CTDP. Other health service institutions (non-public clinics and drugstores) are encouraged (but not required) to use the system. CTDP does not test the quality of the drugs that it circulates, but it does check the certificates associated with all drug providers. Since CTDP is a complicated and costly system, not only drugstores but also some small hospitals and clinics skip the system and go directly to the producers (Dong et al., 1999).

Figure 2: Drug Distribution in China



The pharmaceutical market in China is highly fragmented. By 2010, there were 7,039 domestic pharmaceutical manufacturers (National Bureau of Statistics of China et al., 2011) and more than 13,000 distributors (Atkearney, 2011). Thousands of domestic pharmaceutical companies account for 70% of the market, while most of the manufacturers are small producers of generic drugs and vary a great deal in quality (Sun et al., 2008). Because most drug producers in China are of a small size and do not fulfill the specific drug

delivery requirements, there are usually some wholesalers between the drug producers and the drug retailers. Retailers include four types: hospitals, Centers for Disease Control, clinics or similar small health service centers, and drugstores. Among them, hospitals are dominant, accounting for 70% of all drug sales, and drugstores are the second largest seller. Prescription drugs are mainly allowed to be sold in hospitals and only limited numbers of drugstores are permitted to sell them. In China, drugstores mainly distribute over-the-counter (OTC) drugs.

The State Food and Drug Administration is the national regulatory and enforcement agency that oversees all drug manufacturing, trade and registration. Below the national level, there are provincial and prefecture level FDAs, which actually carry out the daily monitoring and enforcement jobs.

China is one of the largest producers of bad drugs and also has a large presence of bad drugs in its domestic market (Christian et al., 2012). Bad drugs can be introduced in the long and complicated delivery chain. The large number of small drug producers and distributors in China make effective control by a single regulatory agency difficult.

Corruption severely aggravates the problem. It is the most frequently cited reason for the prevalence of bad drugs in China (Christian et al., 2012; Torstensson and Pugatch, 2010). It can appear in the form of exemptions of pharmaceutical enterprises from regular inspections by the FDA. The pharmaceutical industry is one of the main tax sources of local governments, so that local officers have economic incentives to help these firms. Consequently, a large number of pharmaceutical enterprises have obtained such exemptions. Many bad drug stories revealed by the media are often related to these firms. Further, it has been argued that the pay of local leaders is too low to motivate them to enforce drug regulation standards (Christian et al., 2012). In the 2007 and 2010 vaccine scandals, a couple of provincial governments were found guilty by allowing substandard vaccines to flow into the disease control centers where children get vaccines. However, the punishment is also harsh. For example, in 2007, the former director of the SFDA, Zheng Xiaoyu, was executed for taking bribes to approve counterfeit medicines.

4.2.3 Motivating examples

In this section, I use two stories to exemplify the effect of Sina Weibo on the bad drug issue.

Case 1 : 2010 Problematic Vaccine Scandal.

On March 17, 2010, Keqin Wang, a famous journalist, published an article in the newspaper *China Economic Times*, and on Sina Weibo, "An Investigation into Vaccinations that Went Horribly Wrong". It pointed out that hundreds of children in the Shanxi province were affected by strange illnesses or died because of the vaccine with which they had been injected in 2007.

The next day, the State Information Office ordered the deletion of the newspaper stories, and the Central Propaganda Department required traditional media to only use official releases from the Xinhua News Agency. However, reports and comments were still spreading widely on Sina Weibo. Subsequently, similar vaccine scandals from other provinces also broke out; thousands of parents denounced the governments and refused to have their children vaccinated.[5] On March 29, directors, vice directors of the Center for Drug Evaluation and the Center for Certification of Drug within SFDA were removed from office, and many officers from the provincial and state FDAs were arrested.

The Shanxi scandal revealed in 2010, however, had actually been observed earlier than in 2010. Actually, as early as in 2007, a couple of regional newspapers and TV channels reported on these stories. The health department of the Shanxi province promised to investigate the case but ended up finding no guilty parties among the vaccine producers and administrative officers.

The success in cracking down on the problematic vaccines in 2010 as opposed to the failure in 2007 was largely due to Sina Weibo: the scandal could not be suppressed on Sina Weibo and it obtained huge attention due to the microblogging.

[5] All vaccines are ordered, distributed and injected by the government offices in China, the Centers for Disease Control and Prevention.

Case 2: 2012 Poison Capsule Scandal

Besides attracting the attention of the public after a scandal has been revealed, Weibo can also urge scandals to be exposed.

On April 9, 2012, a famous China Central Television (CCTV) presenter, a journalist and a famous Internet speaker all entered posts on their Sina Weibo blogs suggesting that industrial gelatin is added to some yogurt and jelly products. Immediately, countless discussions flooded the Internet. Some anecdote story told that the CCTV presenter was shut outby the government after publishing his post. In this scenario, CCTV was actually forced to air an investigation video on April 15, 2012. The video discovered that 13 commonly used drugs from nine pharmaceutical companies were found to be packed into capsules, which were made from industrial gelatin retrieved from waste leather materials that contains excessive chromium.

The Chinese government reacted very promptly this time. Within one week, the Ministry of Public Security initiated a big poison capsule combating campaign all over the country: hundreds of drug producers were controlled and hundreds of people who were found to be guilty in the scandal were arrested, and over 77 million faulty capsules were forfeited.

Microblogging thus turns out to be a candidate for drug quality control.

4.3 Mechanism

Before the empirical part, a theoretical framework about how Sina Weibo affects the drug quality in the market will be discussed. Based on Holmstrom (1979, 1999) and Prat and Strömberg (2011), I build a simple two-period moral-hazard model to explain the mechanism. In the model, there is a drug provider, an administrator, and consumers who cannot observe the drug quality but receive information either from the administrator or the media, i.e. Sina Weibo. Both the drug provider and the administrator can be kicked out of the market/office at the end of the first period, if they are found to be bad or irresponsible. Although the issue addressed in the paper is under autocracy and there is no such voting mechanism to hold the

government accountable, the governor still has a motivation to replace the irresponsible regulator/bureaucrat because he cares about the consolidation of the governance and thus the reputation, which can be weakened by the revealed government scandals. The aim of the model is to disentangle the different effects of Sina Weibo on the administrator and the provider, and describe how the Weibo use affects the drug quality in the market. Some hypotheses are derived from the model for empirical tests.

Basic setting

In period 1, an exogenously selected provider supplies the whole market with amount 1, and an administrator pays some effort to oversee the drug market. At the end of the first period, consumers decide whether they want to change providers at the end of the first period according to the information from the administrator or Sina Weibo. Assume there to be no discounting.

There are two possible types of providers, $\theta \in \{g, b\}$, where g refers to "good" and b refers to "bad". The provider is type g with probability $Pr(\theta = g) = \gamma \in (0, 1)$. The provider can choose the amount of bad drugs to provide, $x \in [0, 1]$, and $1 - x$ is the amount of good drugs. The type b provider benefits linearly from providing bad drugs $\Pi^b = x$, but for every amount of bad drugs she provides, a signal that the provider is the bad type will be sent out, $S(x) \in [0, 1]$. The type g provider benefits zero from providing bad drugs and always provides good drugs $x = 0$, $\Pi^g = 1$, so that no signal is sent out, $S(0) = 0$. In reality, some providers are associated with advance equipments and technologies, so that the cost of providing good drugs for them is so low that it is not worth risking providing bad drugs at all. These are good providers. Some providers are poorly equipped and using backward technologies, and it is very costly for them to provide good drugs. Hence, the bad provider can benefit from providing bad drugs only.

I further assume that the signal is a convex function on x , $S(x) = e^{\alpha x} - 1$, where $\ln \frac{3}{2} \leq \alpha \leq \ln 2$, $S' = \alpha e^{\alpha x} > 0$, $S'' = \alpha^2 e^{\alpha x} > 0$. The function suggests that the more bad drugs that are provided, the more signals that the provider is type b will be sent. If all provided drugs are bad, the signal suggests that

the provider is of a bad type with more than half the probability.

Consumers can only benefit from good drugs, $1-x$, but cannot observe the drug quality at the time of selection. Consumers collect information about the provider type from either the administrator or Sina Weibo, and I assume that a $\lambda \in [0,1]$ share of consumers get information from the administrator while the remaining$1-\lambda$ use Sina Weibo to get the information.

Suppose that Sina Weibo catches the signal $S(x)$ with probability $w \in [0.1]$. Here, w also stands for the intensity of Weibo use: the more Weibo use, the higher is the probability that the signal is caught by at least one of the Weibo users and then revealed on Weibo. As discussed in section 2, it is difficult to impose the censorship on Weibo and the marginal cost for reporting on Weibo is very low, so it is reasonable to assume that Weibo always reports the signal if it is perceived. Hence, Sina Weibo catches the signal that the provider is b type with probability $S(x)w$.

An exogenously selected administrator is in the office in the first period and works with effort $\epsilon \in [0,1]$ to catch the signal, and then she catches the signal that the provider is type b with probability $S(x)\epsilon$. The administrator benefits from being in power, receives A if in power, and suffers from every effort she pays by $A\epsilon$. The administrator will lose her job at the end of period 1 if she fails to catch the signal that is caught by Sina Weibo, i.e., with probability $(1-\epsilon)S(x)w$. The assumption is realistic since, in reality, we do observe that when some scandals were revealed by Sina Weibo, the corresponding officers, who were supposed to regulate it but did not, were dismissed from office.[6]

Now let us set up the timing. At the beginning of period one, the level of Sina Weibo use is given, and the nature choose the type of drug provider with γ probability as good. Then, I assume that the administrator moves first and chooses the effort ϵ. The drug provider can observe the effort ϵ and then she makes the decision of how many bad drugs will be provided x .

At the end of the first period, consumers believe that the current provider is type b and replace her at the end of the first period with probability $\lambda S(x)\epsilon + (1-\lambda)S(x)w$. Therefore, the probability that the type b provider is

[6]By modeling the administrator's behavior in this way, I actually do not take the possibility that the administrator will use information from Sina Weibo into account. I have also proved that if this possibility is taken into account, by assuming a cost reduction by directly using the information from Weibo , the prediction of the model is the same. The proof is available upon request.

found and replaced depends on the amount of bad drugs she produces, x, the administrator effort ϵ and the intensity of Weibo use w. That is

$$P_{found} = \lambda(e^{\alpha x} - 1)\epsilon + (1 - \lambda)(e^{\alpha x} - 1)w$$

where P_{found} also refers to the amount of bad drugs that was found and revealed to consumers, and it is also the outcome variable that my empirical analysis will check. The more bad drugs that were revealed, the higher is the probability that the provider is believed to be type b and kicked out of the market. If the current provider is kicked out, another provider will be randomly selected from the pool, still with γ probability of being good.

From the equation that P_{found} is determined, there are three factors affecting the number of bad drugs found. As shown in the the following diagraph, given the amount of bad drugs provided, x , when the administrator effort or the Weibo use increases, the number of bad drugs found increases; if there is a decrease in the number of bad drugs provided, the number of bad drugs found will decrease.

$$\begin{cases} \uparrow \epsilon, \uparrow w \Rightarrow \uparrow \lambda(e^{\alpha x} - 1)\epsilon(w) + (1 - \lambda)(e^{\alpha x} - 1)w \text{ given } \hat{x} \\ \downarrow \hat{x} \Rightarrow \downarrow \lambda(e^{\alpha x} - 1)\epsilon(w) + (1 - \lambda)(e^{\alpha x} - 1)w \end{cases}$$

In period 2, if the provider is type b, without motivation to remain in the market, she will provide all bad drugs in the second period $x = 1$. If the administrator remains in office until period 2, she will not work $\epsilon = 0$ and receives the benefit A.

Provider problem

If the provider is type b in the first period, she chooses x considering the trade-off between the benefit of bad drugs and the probability of remaining in the market until the second period. The more bad drugs she provides, the higher is the probability that she will be found to be a bad type either by the administrator or by Sina Weibo.

The provider knows the level of Sina Weibo use w and observes the admin-

istrator effort. The type b provider chooses x in the first period to maximize

$$\max_x x + 1 - (\lambda(e^{\alpha x} - 1)\hat{\epsilon} + (1-\lambda)(e^{\alpha x} - 1)w)$$
$$\Longrightarrow \text{optimal } \hat{x} \text{ satisfies } \alpha e^{\alpha \hat{x}}(\lambda\hat{\epsilon} + (1-\lambda)w) = 1 \ \ (*)$$

where the left-hand side is the marginal cost of providing bad drugs due to the stronger signal that the provider is type b , and the right-hand side is the marginal benefit from providing bad drugs.

Administrator problem

In the first period, the administrator works with the effort level that can at least retain her in power until the second period. The administrator chooses ϵ in the first period to solve the following problem

$$\max_{\epsilon} A(1-\epsilon) + A[1 - (1-\epsilon)(e^{\alpha x} - 1)w].$$

Substituting with $(*)$, the problem becomes

$$\max_{\epsilon} A(1-\epsilon) + A[1 - (1-\epsilon)(\frac{1}{\alpha(\lambda\epsilon + (1-\lambda)w} - 1)w].$$

The first-order condition is

$$F(\epsilon, w) = A[-1 - w + \tfrac{w}{\alpha(\lambda\epsilon + (1-\lambda)w)} + \tfrac{(1-\lambda)w\lambda}{\alpha(\lambda\epsilon - (1-\lambda)w)^2}] = 0$$
$$\Longrightarrow \text{the optimal } \hat{\epsilon}\text{satisfies } \lambda\epsilon + (1-\lambda)w = (\tfrac{(1-\lambda)w^2 + w\lambda}{\alpha(1+w)})^{\frac{1}{2}} \ (\Delta).$$

Solution and comparative statics for the provider problem

Since the drug provider can observe the effort of the administrator, by equation $(*)$ and (Δ), the drug provider will provide

$$\hat{x} = \frac{1}{\alpha}\ln(\frac{1}{\alpha(\lambda\hat{\epsilon} + (1-\lambda)w)}) = \frac{1}{2\alpha}\ln(\frac{1+w}{\alpha((1-\lambda)w^2 + \lambda w)}).$$

However, there is a corner solution, for $w \leq w*$, i.e. the provider always provides $x = 1$. (The proof is listed in Appendix Proof 1.) Therefore, the provider chooses the amount of bad drugs $\hat{x}$ according to the Sina Weibo use

level:

$$\hat{x} = \begin{cases} 1 & \text{if } w \leq w* = \frac{\sqrt{(\alpha e^{2\alpha}\lambda - 1)^2 + 4\alpha e^{2\alpha}(1-\lambda)} - (\alpha e^{2\alpha}\lambda - 1)}{2\alpha e^{2\alpha}(1-\lambda)} \\ \frac{1}{2\alpha}\ln(\frac{1+w}{\alpha((1-\lambda)w^2+\lambda w)}) & \text{if } w > w* = \frac{\sqrt{(\alpha e^{2\alpha}\lambda - 1)^2 + 4\alpha e^{2\alpha}(1-\lambda)} - (\alpha e^{2\alpha}\lambda - 1).}{2\alpha e^{2\alpha}(1-\lambda)} \end{cases}$$

As long as $w \leq w*$, the optimal amount of bad drugs provision does not change so that the derivative of $\hat{x}$ with respect to w is zero, $\frac{d\hat{x}}{dw} = 0$. When $w > w*$, the derivative is

$$\frac{d\hat{x}}{dw} = \frac{1}{2\alpha}(\frac{\alpha(1-\lambda)w^2 + \lambda w}{1+w}) * (-\frac{(1-\lambda)w^2 + 2(1-\lambda)w + \lambda}{\alpha((1-\lambda)w^2 + \lambda w)^2}) < 0.$$

The amount of bad drugs provided on the market is decreasing in Sina Weibo use once the Sina Weibo use exceeds a cutting point $w*$.

Solution and comparative statics for the administrator problem

Under the corner solution of the drug provider's problem, the administrator's utility function becomes linear since $S(\bar{x} = 1) = e^{\alpha x} - 1$. It is now

$$\max_e \Pi^A = A(1-\epsilon) + A[1 - (1-\epsilon)(e^{\alpha} - 1)w].$$

The solution is obviously $\hat{\epsilon} = 0$. When $w > w*$, the utility function is the original non-linear one and the optimal effort satisfies the first-order condition (Δ), Therefore, the full solution for the administrator is

$$\hat{\epsilon} = \begin{cases} 0 & \text{if } w \leq w* \\ \frac{1}{\lambda}((\frac{(1-\lambda)w^2 + w\lambda}{\alpha(1+w)})^{\frac{1}{2}} - (1-\lambda)w) & \text{if } w > w*. \end{cases}$$

If $w \geq w*$, the optional ϵ satisfies

$$F(\epsilon, w) = A(-1 + \frac{w}{\alpha(\lambda\epsilon + (1-\lambda)w)} - w + \frac{(1-\epsilon)w\lambda}{\alpha(\lambda\epsilon + (1-\lambda)w)^2}) = 0.$$

Because $\frac{d\hat{\epsilon}}{dw} = -\frac{F'_w}{F'_\epsilon}$ and $F'_\epsilon = A(-\frac{w\lambda}{\alpha(\lambda\epsilon+(1-\lambda)w)^2} - \frac{w\lambda}{\alpha(\lambda\epsilon+(1-\lambda)w)^2} - \frac{2(1-\epsilon)w\lambda^2}{\alpha(\lambda\epsilon+(1-\lambda)w)^3}) < 0$, the sign of $\frac{d\hat{\epsilon}}{dw}$ is the same as F'_w. I prove that $F'_w > 0$ and then $\frac{d\hat{\epsilon}}{dw} > 0$. (The proof is listed in Appendix Proof 2.)

$$\frac{d\hat{\epsilon}}{dw} = \frac{1}{\lambda}(\frac{1}{2}(\frac{(1-\lambda)w^2+w\lambda}{\alpha(1+w)})^{-\frac{1}{2}}(\frac{2(1-\lambda)w+(1-\lambda)w^2+\lambda}{\alpha(1+w)^2}) - (1-\lambda)) > 0.$$

Then, I get the second-order derivative of effort ϵ with respect to w as:

$$\begin{aligned}\frac{d^2\hat{\epsilon}}{dw^2} = \quad & \frac{1}{\lambda}(-\frac{1}{4}(\frac{(1-\lambda)w^2+w\lambda}{\alpha(1+w)})^{-\frac{3}{2}}(\frac{2(1-\lambda)w+(1-\lambda)w^2+\lambda}{\alpha(1+w)^2}) \\ & +(\frac{1}{2}(\frac{(1-\lambda)w^2+w\lambda}{\alpha(1+w)})^{-\frac{1}{2}})(\frac{2(1-2\lambda)}{\alpha(1+w)^3}) < 0.\end{aligned}$$

Therefore, the optimal effort $\hat{\epsilon}$ is increasing in Weibo use once the Sina Weibo use exceeds a certain level $w > w*$. The administrator works harder if the level of Weibo use is higher, but the marginal increase cannot be maintained all the time since the second-order derivative is negative $\frac{d^2\hat{\epsilon}}{dw^2} < 0$. This suggests that the increased effort caused by the increase in Weibo use $\frac{d\hat{\epsilon}}{dw}$ will decrease with the increase in Weibo use w, and drop towards zero.

The amount of bad drugs found on the market

Although I have shown that the amount of bad drugs provided on the market is decreasing in Sina Weibo use, the effect of w on the amount of bad drugs found, which is also the probability of the provider being regarded as type b, is ambiguous.

Holding the amount of bad drugs provided fixed, the larger is the use of Weibo, the more bad drugs are revealed by Weibo; the more Weibo use, the harder the administrator works, and thus the more bad drugs are revealed by the administrator. This is the screening effect of Weibo. However, where there is a larger Weibo use and more effort from the administrator, providers tend to to provide fewer bad drugs, so that fewer bad drugs can be found and the provider is less likely to be changed. This is the discipline effect. The two effects have opposite directions so that the net effect of w on P_{found} is ambiguous, which can be seen from the following equation

$$\begin{aligned}&\frac{dP_{found}}{dw} = S(\hat{x})(\lambda\epsilon' + (1-\lambda)) + S(\hat{x})'(\lambda\epsilon + (1-\lambda)w)\frac{d\hat{x}}{dw} \\ \text{i.e. } &\frac{dP_{found}}{dw} = (e^{\alpha x}-1)\frac{1}{2}(\frac{(1-\lambda)w^2+w\lambda}{\alpha})^{-\frac{1}{2}}(\frac{2(1-\lambda)w+\lambda}{\alpha}) + \frac{d\hat{x}}{dw}.\end{aligned}$$

The first part refers to the screening effect, and the second part represents the discipline effect. The sign of the derivative depends on the level of w. When w starts with a low level, the discipline effect is zero, but the screening effect

is positive and the net effect will be positive on P_{found}.

When $w \leq w*$, $\frac{d\hat{x}}{dw} = 0$ and $\epsilon' = 0$, $\frac{dP_{found}}{dw} = S(1)(1-\lambda)$ is positive as long as there are at least some consumers taking information from Sina Weibo $1-\lambda > 0$. It also makes sense that $\frac{dP_{found}}{dw}$ can be also zero if the level of Sina Weibo use is so low that no consumer uses Sina Weibo to get information, $(1-\lambda) = 0$.

When $w > w*$, the first part $(e^{\alpha x}-1)\frac{1}{2}(\frac{(1-\lambda)w^2+w\lambda}{\alpha})^{-\frac{1}{2}}(\frac{2(1-\lambda)w+\lambda}{\alpha}) > 0$, and the second part $\frac{d\hat{x}}{dw} < 0$. It is easily seen that $\lim_{w\to 0+} \frac{dP_{found}}{dw} \geq 0$ and $\lim_{w\to 1-} \frac{dP_{found}}{dw} < 0$. Hence, when the Sina Weibo use is low, the screening effect still dominates but the discipline effect will dominate ($\frac{dP_{found}}{dw}<0$) when the Sina Weibo use (w) is high enough. The amount of bad drugs found is expected to be decreasing on w only when w is high.

Consumer's Welfare

Although the effect of w on the amount of bad drugs found is ambiguous, the consumer's welfare is always increasing in w. Consumers only care about the real drugs they consumed, and the welfare function is given by the following equation:

$$V(x;\, w) = 2\gamma + (1-\gamma)[1 - \hat{x} + (\lambda S(\hat{x})\hat{\epsilon}(w) + (1-\lambda)S(\hat{x})w)\gamma].$$

The first part of the equation is the welfare for consumers when the type g provider is selected in the first period, and the second part is welfare if the type b provider is instead selected in the first period. The type b provider provides $\hat{x}$ in the first period, leaves $1-\hat{x}$ to consumers, and thus generates the probability $\lambda S(\hat{x})\hat{\epsilon} + (1-\lambda)S(\hat{x})w$ of being replaced by another provider, with the probability of γ being the good type. By the Envelope Theorem, we have:

$$\frac{dV}{dw} = (1-\gamma)S(\hat{x})(\hat{\epsilon}'(w) + 1 - \lambda)\gamma > 0.$$

As long as there is a bad drug provided on the market, $\frac{dV}{dw} > 0$, consumers can benefit from the increase in Sina Weibo use with certainty. And the marginal benefit is even larger once the Sina Weibo use exceeds the certain level $w > w*$ and thus the administrator also reacts to Sina Weibo $\hat{\epsilon}(w) > 0$. It is easily seen that under the assumption that when the administrator reacts to the Weibo use, it is better for the consumer welfare than if the administrator does not react, i.e. $\hat{\epsilon}' = 0$.

Hypotheses and test:

In sum, the moral hazard model gets:

Proposition 1: There is a cut off point for Sina Weibo use $w*$: when the Sina Weibo use is lower than that point, $w \leq w*$, the amount of bad drugs provided on the market does not respond to Sina Weibo use and does not change. The marginal effect of Sina Weibo use on the amount of bad drugs found can either be zero if $1-\lambda=0$ or positive if $1-\lambda>0$. Once the Sina Weibo use exceeds this point, $w>w*$, the amount of bad drugs provided on the market is decreasing in Weibo use, $\frac{d\hat{x}}{dw}<0$. However, the amount of bad drugs found is ambiguously affected by Weibo use because of the coexistence of the screening effect and the discipline effect, $\frac{dP_{found}}{dw}=S(\hat{x})(\lambda\hat{\epsilon}'+1-\lambda)+S'(\hat{x})(\lambda\hat{\epsilon}+(1-\lambda)w)\frac{d\hat{x}}{dw}$. The amount of bad drugs found is decreasing in the Weibo use w only when w is high.

Proposition 2: There is the same cut off point $w*$: if the Sina Weibo use is too low, $w \leq w*$, the administrator does not respond to the Sina Weibo use either $\hat{\epsilon}'=0$. Once, the Sina Weibo use exceeds this point, $w>w*$, the administrator works harder when there is a higher Weibo use, but the increase in the effort decreases in the Sina Weibo use, $\hat{\epsilon}'(w)>0$, $\hat{\epsilon}''(w)<0$.

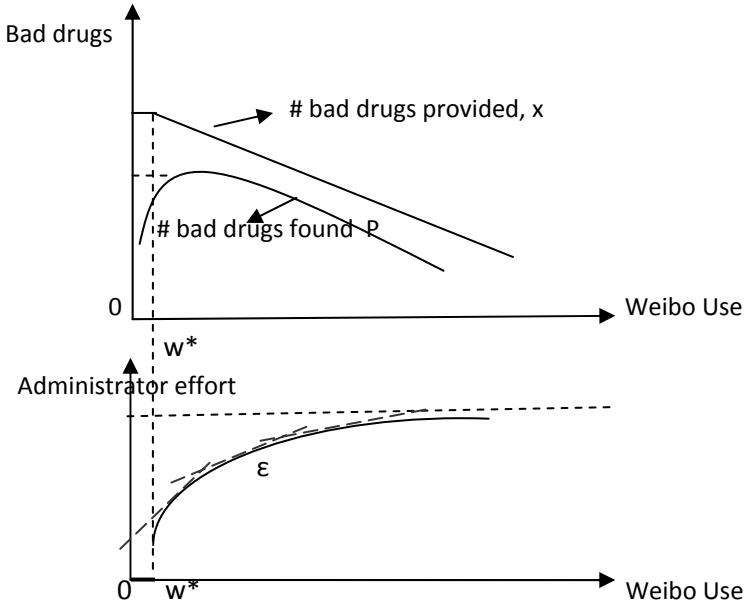
Corollary 1: The consumer's welfare is increasing in the Weibo use $\frac{dV}{dw}>0$, and it is better for consumers if the administrator reacts to Sina Weibo, i.e. if $\hat{\epsilon}'(w)>0$.

The prediction of the model consists of two separable parts: proposition 1 is the aggregated market outcome, which is established regardless of whether proposition 2 is established or not; proposition 2 is the effect of Weibo use on the regulator, which strengthens the effect of Weibo use on the market outcome.

I summarize the main prediction of the model in figure 3. When the Weibo use increases, the number of bad drugs provided on the market decreases, while the number of bad drugs found can first be increasing and

then definitely decreasing when there is a certain amount of Weibo use. The administrator's effort increases with the Weibo use but the increase becomes smaller and smaller. The number of bad drugs provided, $\hat{x}$, is not observable, and then $\frac{d\hat{x}}{dw} < 0$ is not directly testable. The relationship between Weibo use and the number of bad drugs found and the relationship between Weibo use and the administrator effort are the main hypotheses that will be tested in the following sections.

Figure 3: Model Prediction



Note: The upper panel plots the relationship described in proposition 1, and the bottom panel plots the prediciton of proposition 2.

The study tests the prediction using a measure of Weibo use for w, and the number of bad drugs found as P_{found}, as well as the total number of drugs audited as a proxy for the administrator effort ϵ. (More details about the data are discussed in section 4). The level of Weibo use after its introduction increases over time and the estimate of the net effect of Weibo use using the panel data can be either negative or positive, depending on the average level of Weibo use in the sample period. If there are sufficiently long time periods for Weibo use to grow, the discipline effect will dominate from a certain point in time and then we can observe the negative sign for the estimate of the

aggregated effect. And if the turning point does show up among the dynamic effects, it definitely suggests that both effects existed, because the sign of the estimate effect would not change if only one of them existed.

Similarly, I examine the relationship between the administrator effort and the Weibo use by exploring the dynamic effects. Proposition 2 is actually based on an implicit assumption that the governor does care about the bad drug issue and will replace the regulator if she fails to fulfill her job. Although the reasoning why an autocracy cares about social welfare, namely the bad drug issue in the study, is theoretically not comprehensively explained by the literature, it is an empirical question in this paper. If proposition 2 holds, the marginal effect of the Weibo use on the administrator effort is expected to be positive but the magnitude should be decreasing towards zero over time. Under the model setting, if the amount of bad drugs found is decreasing in Weibo use and the administrator effort is increasing in Weibo use, I can derive the conclusion that the amount of bad drugs provided on the market is decreasing in Weibo use.

There is only one provider in the model but, realistically, drug providers consist of two separate parts: producers and distributors. Drugs can become bad either due to producers or distributors. The number of bad drugs found that is discussed in the main part of the empirical analysis refers to bad drugs found at any point in the distribution process, so it does not differentiate the reasons for which drugs deteriorate. To shed some light on the mechanism of the effect of Sina Weibo, I also use the producer information of each drug checked to test whether there is a discipline effect on the drug producer.

When both screening effects and discipline effects are proved to exist, and the administrator works harder with a higher Weibo use, corollary 1 is derived: the consumer's welfare is better off with a higher Weibo use.

4.4 Data

4.4.1 Drug data

I explore the drug quality using the data from the quarterly published *National Drug Quality Announcement* by the Chinese State Food and Drug Administration[7] from 2008 to 2011, including 16 quarters, i.e. 43,726 drugs from 317 prefectures. The bad drugs are drugs that are found not to be qualified by SFDA, including counterfeit and substandard drugs. I count the number of bad drugs found in each prefecture in the quarter (corresponding to P_{found} in the model), and the number of drugs checked (corresponding to the administrator effort ϵ).

Every quarter, the SFDA audits drugs in around 300 (out of a total of 340) prefectures. They first decide what kind of drugs to audit, for example, aspirin, and the cities to audit. Subsequently, they sample one doze(box) of listed drugs from different sample places (drugstore, hospital etc.) in the city and then test the drug sample they collected. About two months after the control, the result of the audit – the *National drug quality announcement* – is published on the SFDA website. The announcement includes the record of every drug they checked: drug name, producer, sample source where the drugs are sampled, test result etc. (Part of the record from the table has been cut out and listed in the appendix, figure A). I code the prefecture information according to the sample source (when studying the drug quality on the market) and producer names (when investigating the drug quality in production).

The quarterly drug audit from SFDA is comprehensive and representative and hence, this data is suitable for exploring the drug quality in China. From production to distribution, all types of drug providers are sampled, including six categories – (1) clinics, (2) Disease Control and Prevention Centers/Anti-epidemic Stations and other similar offices under the Health department, (3) drugstores (4) hospitals, (5) wholesalers/intermediary drug companies and (6) producers. The distribution of the sample sources is proportional to the number of providers on the market (A summary of the provider categories for the full sample and the bad drug sub-sample is listed in appendix Table A.).

[7] http://www.sfda.gov.cn/

Among the retailers, the bad drug rate is overrepresented in the drugstores. This makes sense since many drugstores in China are small, and privately owned, which makes the monitoring more difficult.

The SFDA checking list[8] contains the most widely used drugs, drugs that were reported to have a severe adverse drug reaction, and drugs that were ever found to be unqualified in the past etc. Drugs on the list can be traditional Chinese medicine, synthetic drugs or biotech-related drugs (Table B in the appendix summarizes the categories of drugs in the audit, where the synthetic drugs account for the main part and are further categorized into sub-groups[9]). In the sample periods, a total of 21 categories of drug types are checked; among them, the most overrepresented are the non-immunization other biotech-related drugs, which are fragile either in distribution or in production.

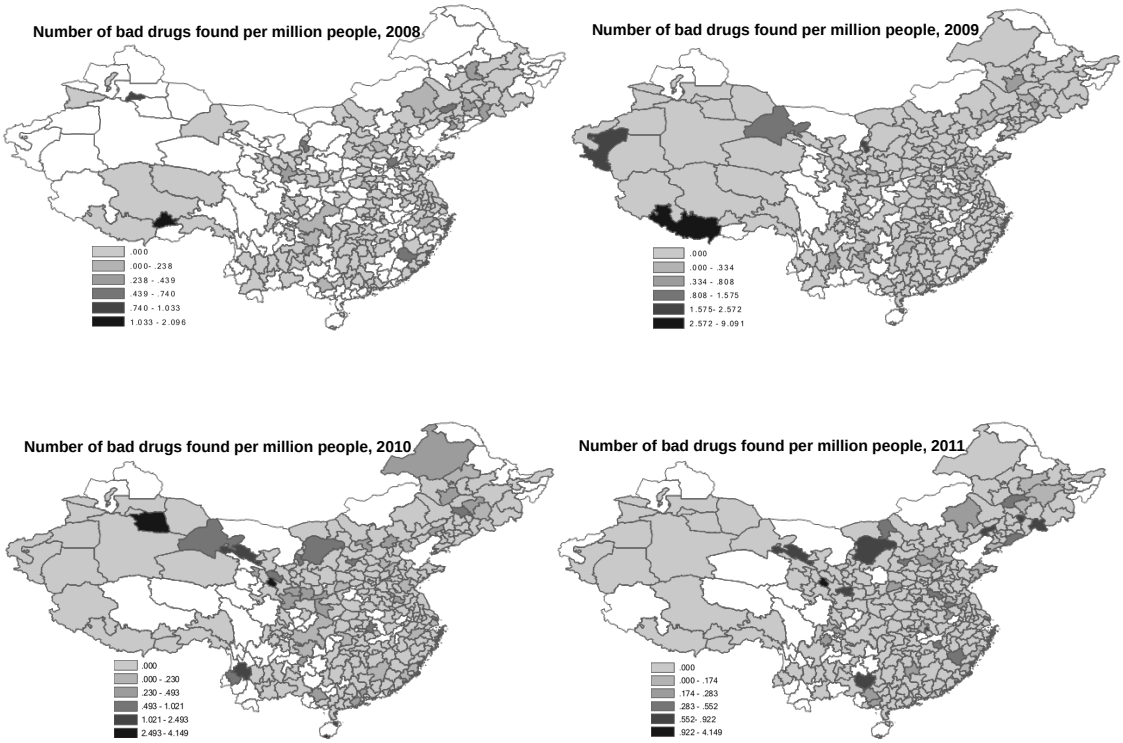
It is appropriate to use the bad drugs reported in the announcement as an index for P_{found}, even if , by the model setting, this includes both bad drugs revealed by the administrator and those discovered by Sina Weibo. Although these bad drugs are announced by SFDA, not all of them are found through SFDA's effort. If some bad drugs have been exposed on Sina Weibo, the SFDA will directly go and catch them without any additional effort. In this sense, using the data on the bad drugs announced by SFDA is justified.

To give a rough idea of the bad drug distribution across regions, figure 4 plots the yearly number of bad drugs found per million people on the map, at the prefecture level. From figure 4, we can see that bad drugs are actually not concentrated to certain regions: it is hard to conclude that bad drugs are more likely to be found in the east or west, south or north of China.

[8]For the sampling rules and checking scheme, please refer to http://www.gov.cn/gongbao/content/2003/content_62323.htm.

[9]I categorize the drugs according to the method SFDA used for the Essential Drug list. http://www.moh.gov.cn/publicfiles/business/htmlfiles/mohywzc/s3580/200908/42506.htm

Figure 4: Distribution of the Number of Bad Drugs Found



Data source: The *National Drug Quality Announcement* from SFDA, 2008-2011. The number of bad drugs found per million people is aggregated at prefecture by year level. The blank patches are prefectures that were not included in the drug audit by SFDA in the respective year.

4.4.2 Data on Weibo Use

The measure of the Weibo use is collected by Larsson et al. (2012). It is the total number of posts including the Chinese character *hei* by prefecture and quarter, which covers 340 prefectures and 9 quarters.[10] The population of each prefecture is used to scale the measure for the regression used. The construction of the data has been discussed somewhat in section 2.

In order to locate the appropriate Chinese character, we collected a subsample including all Weibo posts. We downloaded all newly entered Weibo

[10]Sina Weibo has been available since September 2009 and the time period in the paper is in quarters. Thus, I take the last quarter of 2009 as my first observation of Weibo use.

posts for 10 minutes four times a day – morning, noon, evening and midnight, and for two weeks. Next, we analyzed the total number of posts and the number of posts containing each Chinese character in the subsample of posts. A pool of Chinese characters was selected, which has a high correlation with the total posts but a low appearance rate. We further narrowed down to some non-meaningful and neutral words: *hei* was chosen. We downloaded all posts including *hei*, decoded the location and the time information for each post and finally obtained the measure.

The introduction of Sina Weibo does not correlate with GDP per capita and, more importantly, does not correlate with some other factors that may influence the drug market, pharmaceutical industry distribution and medical needs (proxy by hospital beds per 10,000 individuals). Figure 1 graphically compares the distribution of the Weibo use measure with GDP per capita, the pharmaceutical industry product value and hospital beds. The Weibo use is not obviously related to any of these three factors. Empirical evidence about what determined the Weibo introduction is shown in section 5.

There are two points that I want to emphasize here. First, the number of posts containing *hei* is only a proxy for the total number of posts. When we observe the Weibo use measure as zero, it does not mean that there are no Weibo post from the prefecture at all, but it definitely means that Sina Weibo has not gained the minimum popularity to be shown by the index. Second, the Weibo posts we count are posts about anything and thus, have no specific relation to the drug market issue. For convenience, the paper uses the term "Weibo enters" or "Weibo entry" as the Weibo use measure turns positive.

4.4.3 Other Data

Prefecture Characteristics

The data on prefecture characteristics come from China City Statistical Yearbooks 2009-2011, which report 2008-2010 statistics. The variables used include population, GDP per capita, the number of Internet users per 10,000 individuals, the number of cellphone users per 10,000 individuals, the num-

ber of hospital beds per 10,000 individuals, education expenditure per capita, the share of the agricultural sector labor force and the tertiary sector share of GDP. Due to the lack of 2011 statistics, I duplicate the data from 2010 to 2011.

Merging the drug data, Weibo use data and prefecture characteristics, I get the data set used in the main analysis. Without adding the prefecture controls, the data set contains 2,977 observations from 290 prefectures and 16 quarters. Among the 290 prefectures, 7 have no Weibo entry in any sample quarters. When adding the prefecture controls, 271 prefectures, 2,783 observations from 16 quarters remain.

Distance between Prefectures

When discussing the determinants of Weibo entry, I use the distance between the prefecture and Beijing that might be one factor that affects the ideology preference and then Weibo use. The distance between the drug market and producers is addressed when discussing the heterogeneous effects. The two distance variables come from the Stata module – CHINA_SPATDWM (Yu, 2009), which includes the distance between all main cities in China. The distance to Beijing is defined as the great circle distance, in kilometers. The distance between the market and its producers is the mean of distances between retailers in the prefecture and the prefecture of their producers. Due to some missing data, when adding the distance variable, the number of prefectures covered in the data set decreases to 246.

Number of Newspapers

The placebo test in section 7 will use the number of newspapers in the prefecture, which come from Qin et al. (2012). We compile a newspaper directory 1981-2010 according to three resources: 1) *Comprehensive Chinese Newspaper Directory* (2003, 2006, 2010), published by the Chinese State Administration for Press and Publications; 2) *Annual Chinese Journalism Yearbooks* (1982-2010), published by the Chinese Academy of Social Science; and 3) *China Newspaper Industry Year Books* (2004-2010), published by a Beijing-

based research institute. The number of newspapers in the prefecture is a yearly measure including all newspapers that were issued in the prefecture.

Summary statistics are given in table 2. Bad drugs are found at some point in 43% of the prefectures. For each quarter, on average, bad drugs are found in 5% of the prefectures. The average number of bad drugs found per quarter is 0.065. I divide this number by the prefecture population in millions (the average population of the prefectures is around 4 million).

Table 2: Summary of Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of total drugs checked	2977	13.938	21.364	1	216
Number of total drugs checked per million people	2977	4.620	9.849	0.088	227.273
Number of bad drugs	2977	0.065	0.294	0	4
Number of bad drugs per million people	2977	0.028	0.243	0	9.091
Ever had bad drugs found (prefecture i)	2977	0.432	0.495	0	1
Have bad dummy (prefecture i at quarter t)	2977	0.054	0.227	0	1
Number of Weibo posts (per 10,000 individuals)	2977	0.062	0.282	0	4.864
Population (Unit: 10,000 people)	2979	450	339	10.6	3303
GDP per capita (Yuan)	2824	34124	23159	99	175125
Number of Internet users (per 10,000 individuals)	2825	1372	2557	0.604	36634.76
Number of cellphone users per capita	2838	0.816	0.861	0.106	8.983
Number of hospital beds (per 10,000 individuals)	2977	36.359	15.624	7.273	126.941
Education expenditure per capita (Yuan)	2838	793.97	599.57	140.56	5799.24
Agriculture sector share of labor force (%)	2807	2.98	6.32	.01	73.97
Distance between the market and producers (km)	2789	1001	800	0	7580
Distance to Beijing (km)	2804	1162.52	708.89	0	5577.5
Number of newspapers per million people	2971	2.108	3.328	0.142	25.147
Period	3150	9.599	4.231	1	16

Note: "Ever had bad drugs found" is a dummy that is equal to 1 for observations in all quarters if the prefecture was ever found with bad drugs in any quarter within the sample period.

4.5 Econometric model

This study aims at estimating the causal effect of Weibo use on drug quality in the market. Sina Weibo has only been available since September 2009, i.e.

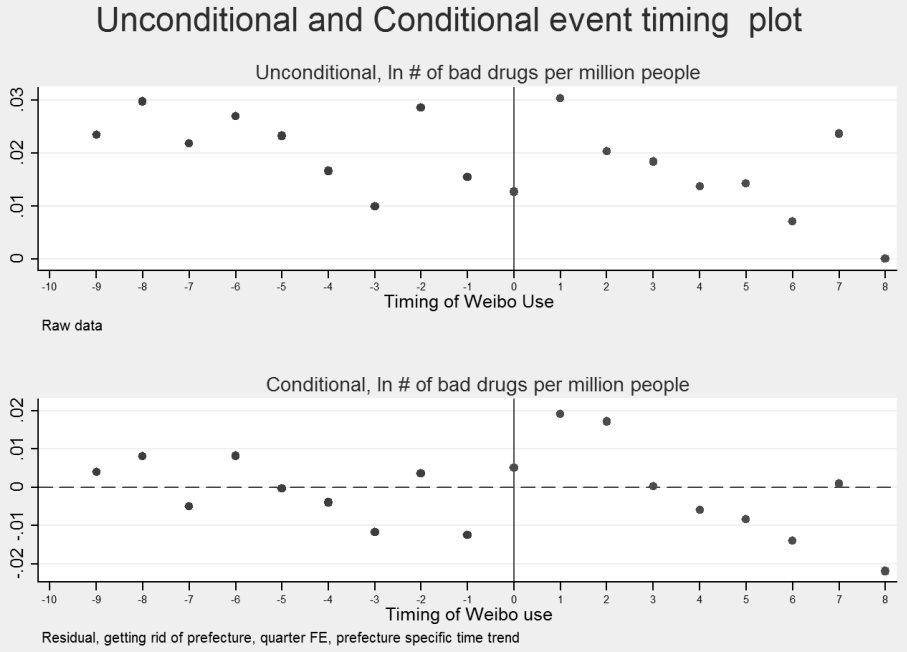
after the point in time when SFDA started the drug quality check.[11] This suggests the possibility of using difference-in-differences as the identification. Figure 5 gives a rough idea of why the difference-in-differences identification is applied. Both graphs show the relationship between the number of bad drugs found[12] and the timing of the Weibo introduction. The Xaxis labeled 0 refers to the first quarter that Sina Weibo enters, 1 as one quarter after Weibo enters while -1 refers to one quarter before.[13] The Y axis represents the level of bad drugs found: the upper panel uses the raw data of the number of bad drugs found while the bottom panel uses the number of bad drugs found that gets rid of the prefecture fixed effects, quarter fixed effects, and the prefecture specific time trend. Both graphs give a similar implication: when Weibo has entered, there is a clearly declining trend in the number of bad drugs found. So it is reasonable to use the timing of Weibo introduction as the identification.

[11] SFDA starts the quarterly checking from 2003, but complete data are only available online since 2008.

[12] The logarithm of the number of bad drugs found per million people plus 1.

[13] Since Weibo enters different prefectures in different quarters, the total number of event quarters is larger than the number of real quarters. See table 1 – after the 2nd quarter of 2010 about half of all prefectures have Weibo entry, which means that fewer prefectures can experience 10 quarters before Weibo entry (the total number of quarters is 16). Therefore, in the graph, I only show event timing from -9 to 8 that includes 9 time periods before and 9 time periods after Weibo entry.

Figure 5: Identification: Difference-in-Differences



Note: Points present the mean of the logarithm of the number of bad drugs found per million people plus 1. The X axis indicates the event quarter: "0" refers to the first quarter when Sina Weibo entered and "1" to 1 quarter after. The sample period covers 16 calender quarters, and Sina Weibo became available in the $8th$ quarter ($4th$ quarter 2009), so the maximum event quarter is 8 quarters after Weibo entry. Different prefectures introduce Sina Weibo in different quarters. For prefectures that did introduce Weibo, the latest ones picked it up in the $2nd$ quarter 2011, so they have 14 event quarters before Weibo entry. By the $3rd$ quarter 2010, over 70% prefectures had introduced Sina Weibo (table 1) so that only 30% of the prefectures experienced event quarters smaller or equal to -10. Therefore, I only choose the representative points: 9 event quarters before and 9 event quarters after Weibo entry.

The upper figure shows the mean of the raw data – the logarithm of the number of bad drugs found per million people plus 1, against the event quarter.

The lower figure is obtained by averaging the residuals from the following regression for each event quarter.

$$\ln(\text{number of bad drugs found per million people} + 1)_{it} = \alpha_i + \lambda_t + \alpha_i * t + u_{it}$$

where i refers to prefecture i ; t refers to quarter t ; and $\alpha_i * t$ is the vector of the linear form of prefecture-specific time trend.

Furthermore, as the prefectures pick up Weibo at different times, the intensity of the Weibo use varies across regions in each quarter. Then, I use the time varied and regional varied Weibo use measure to estimate the impact on the number of bad drugs found, fitting the following equation:

$$P_{found\_it} = \eta \ln pop_{it} + \beta W_{it} + \alpha_i + \lambda_t + \gamma_i * t + \theta X_{it} + u_{it}. \tag{4.1}$$

The dependent variable P_{found_it} is the logarithm of the number of bad drugs found by SFDA per million people plus 1[14] in prefecture i at quarter t. Ideally, the analysis should normalize the number of bad drugs found by the drug market size in prefecture i at quarter t, but instead the population is used as the weight because of the absence of such a data set. To allow for different forms of the correlation between the population and local drug market size, I also add the population variable, $\ln pop_{it}$, as one of the explanatory variables on the right-hand side.

W_{it} is the variable of interest, the Weibo use measure, and is defined as the logarithm of the total number of Weibo posts including the Chinese word *hei* per 10,000 individuals plus 1[15] from prefecture i at quarter t. Under the assumption that the introduction of Weibo is exogenous to the drug market, the parameter β is interpreted as the percentage change in the number of bad drugs found that is caused by a 1 percentage point move on the measure of Weibo use.

α_i is the vector of the prefecture fixed effects that accounts for the time invariable unobservable prefecture characteristics. λ_t is the vector of the quarter fixed effects that captures the time variable shocks. There are at least seven periods before Weibo entered, which is possibly long enough for the pretreatment data to establish a trend that can be extrapolated into the post-treatment periods. Therefore, I control for the prefecture specific time trend in the regression, $\gamma_i * t$.

To test the robustness, I include a set of prefecture level controls X_{it} in the regressions. It includes the time varying factors that are often cited as the causes of the bad drug issue: GDP per capita, the number of hospital

[14] 1 is added for everyone because many observations have the value of the number of bad drugs found per million people as 0 or close to 0, which makes the simple logarithm go to negative infinity.

[15] 1 is added for the same reason as in footnote 13.

beds per 10,000 individuals, the agricultural sector share of the labor force, X_{it}, also includes terms that are composed of determinants of Weibo entry, and I will discuss them in section 6. Finally, u_{it} is the error term.

The model also gives a prediction of the time pattern of Weibo influence that I want to explore. The Weibo use can influence the number of bad drugs found both positively (as a larger share of the bad drugs is being found through the screening effect) and negatively (as the number of bad drugs fall through the discipline effect). The negative effect dominates when W is high. Since the Weibo use increases over time, it is important to check the dynamic effects of Weibo use to reveal the whole picture of how the screening effect and the discipline effect work with different levels of Weibo use. I apply the event study model to discuss the dynamic effects using the following regression:

$$P_{found\_it} = \eta \ln pop_{it} + \sum_{j=0}^{8} \beta_j W_{it} 1(\tau_{it} = j) + \alpha_i + \lambda_t + \gamma_i * t + \theta X_{it} + u_{it}. \tag{4.2}$$

Compared with equation (4.1), one more index is added, the event quarter τ_{it}, the event quarter. This is defined so that $\tau_{it} = 0$ is the first quarter that W_{it} turns to positive and $\tau_{it} = 1$ refers to the first quarter after Weibo enters the prefecture. The largest value for the possible τ_{it} is eight. The number of coefficients of interest in equation (4.2) is nine, β_j, from the first period of Weibo entry $\tau_{it} = 0$ to the last possible period of Weibo use $\tau_{it} = 8$.

Although the investigation of the determinants of Weibo use on the observable prefecture characteristics lends some support to the exogeneity argument of Weibo use to the drug market, there are still some concerns related to unobservable characteristics. Section 7 will discuss the possible concerns in more detail and tests will be carried out to secure the argument that the effects estimated from equations (4.1) and (4.2) are causal.

I also investigate through which channel the Sina Weibo effects work. In order to control the relationship between Weibo use and the administrator effort, $\hat{\epsilon}'(w) > 0$ and $\hat{\epsilon}''(w) < 0$, I rerun equations (4.1) and (4.2) with the dependent variable replaced by the total number of drugs checked by SFDA per million people in prefecture i in quarter t, which is the proxy for the

administrator effort. The results of the following equations will provide the empirical evidence for how the administrator responds to Weibo use

$$Ln\#\_check_{\mathrm{it}} = \eta \ln pop_{it} + \beta W_{it} + \alpha_i + \lambda_t + \gamma_i * t + \theta X_{it} + u_{it} \tag{4.3}$$

$$Ln\#\_check_{\mathbf{it}} = \eta \ln pop_{it} + \sum_{j=0}^{8} \beta_j W_{it} 1(\tau_{it} = j) + \alpha_i + \lambda_t + \gamma_i * t + \theta X_{it} + u_{it}. \tag{4.4}$$

To check whether Weibo use can help reduce the bad drugs by disciplining the drug producers, I re-construct the data by the location information of the producers and then re-estimate equation (4.1) with the corresponding variables measured by producer location instead of market location. If the discipline effect works through the producer, we expect to see the same sign of the coefficient estimate in the producer regression as in the market place regression (equation (4.1)).

In all regressions in the paper, standard errors are clustered at the prefecture level.

4.6 Results

4.6.1 Determinants of Weibo Entry

The introduction of Sina Weibo is definitely not random, but it is arguably to be exogenous to the drug market. To support this argument and justify the identification as well as the specification, I first explore the determinants of the Sina Weibo introduction. To test the robustness of the estimate, the factors that determine Weibo use are then added into the regression.

To investigate which factors predict the Weibo introduction, I regress the calendar quarter that Weibo entered and the average growth of the Weibo use measure since Sina Weibo became available on the baseline prefecture characteristics from 2008.[16] The results are reported in table 3. From column 1 and column 2, we can see that the tertiary sector share of GDP mainly predicts the timing of Sina Weibo entry. From column 2, we can see that

[16]The control variables are statistics by year and Weibo has been available since the 4th quarter of 2009, so the 2008 prefecture characteristics are used as the baseline.

this factor, together with the number of cellphone users, and the education level (indicated by the education expenditure per capita) strongly predict the speed of Weibo increase after its introduction. However, the regression of the average number of bad drugs found before Weibo became available on the baseline characteristics shows an almost zero correlation between them (column 3, table 3). I conduct the F-test for the three factors that show an impact on Weibo entry to test the hypothesis that they are jointly equal to zero for each regression in table 3. The results suggest that I can reject the hypothesis that the estimate of three factors is jointly equal to zero in the regressions of determinants of Weibo entry at the 1% level (columns 1 and 2), but I cannot reject that they are jointly equal to zero in the regression of the average number of bad drugs found (column 3). It ensures that the introduction of Sina Weibo is exogenous to the bad drugs issue in terms of observable prefecture characteristics.

Table 3: Determinants of Weibo Entry and Bad Drugs

	The quarter that Weibo entered	Δ Log (number of Weibo posts per 10,000 people+1)	Avg. Log (number of bad drugs found per million people before Weibo was available+1)
Log GDP per capita in 2008	-0.362	-0.001	0.004
	(0.545)	(0.006)	(0.014)
Log number of Internet users per 10,000 individuals in 2008	0.191	-0.001	-0.009
	(0.379)	(0.004)	(0.007)
Log number of cellphone users per capita in 2008	-1.006	0.024***	0.008
	(0.639)	(0.007)	(0.018)
Log number of hospital beds per 10,000 individuals in 2008	0.605	-0.004	0.020
	(0.660)	(0.007)	(0.015)
Log education expenditure per capita in 2008	0.101	0.027***	-0.012
	(0.535)	(0.008)	(0.011)
Log distance to Beijing (km)	0.064	-0.004	-0.008
	(0.409)	(0.005)	(0.005)
Log tertiary sector share of GDP (%) in 2008	-2.747***	0.029***	0.027
	(0.596)	(0.006)	(0.017)
Province FE	YES	YES	YES
Observations	246	232	220
R-squared	0.330	0.801	0.165
N_prefecture	246	232	220
F-test for the three factors jointly equal to zero	10.60	19.43	1.696
Prob>F	0.000	0.000	0.169

Note: All regressions in this table use cross sectional OLS estimates, and each observation is one prefecture. The quarter that Weibo enters refers to the order number of the quarter in the sample periods, from 1 to 16. Δ Log (number of Weibo posts per 10,000 people+1) is the quarterly average increase of Weibo posts per 10,000 individuals for the prefecture since Weibo became available. Avg. Log (number of bad drugs found per million people before Weibo available+1) is the mean of the numbers before Weibo became available. F-test is conducted to test the Log number of cellphone users per 10,000 individuals in 2008, Log education expenditure per capita in 2008 and Log tertiary sector share of GDP in 2008 are jointly equal to zero.

Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%

The estimate result also suggests a set of baseline controls that should be included in the regression for the robustness test. Hence, X_{it} includes the interaction terms between the three baseline characteristics and the year dummies. Besides that, to exclude the possible time variable confounders, X_{it} also includes the time varied value of the three variables, and factors that are often cited as the causes of the bad drug issue: GDP per capita, the number of hospital beds per 10,000 individuals, the agricultural sector share of the labor force, all in logarithm.

4.6.2 Main Results

Table 4 reports the estimated βs and their clustered standard errors from equation (1). Column (1) reports the estimate on the number of bad drugs found, while column (2) reports the same estimate but including the prefecture level controls, X_{it}.

Table 4: Impact of Weibo Use on the Number of Bad Drugs Found on the Market

	(1)	(2)
Log (number of Weibo posts per 10,000 individuals +1)	-0.107**	-0.101**
	(0.0416)	(0.0470)
Quarter FE	YES	YES
Prefecture FE	YES	YES
Prefecture-specific trend	YES	YES
Controls		YES
Observations	2,977	2,783
R-squared	0.232	0.251
N_prefecture	290	271

Note: The dependent variable is the logarithm of the number of bad drugs found per million people plus 1. In both regressions, the logarithm of population measured in million is controlled for. Prefecture specific trend is the vector of interaction terms between prefecture dummies and the linear order of the quarter in the sample periods. Controls include the logarithm of GDP per capita, the logarithm of the number of hospital beds per 10,000 individuals, the logarithm of the agricultural sector share of the labor force, and the three sets of interaction terms between year dummies and the prefecture characteristics from the baseline year (2008): the logarithm of the tertiary sector share of GDP, the logarithm of the number of cellphone users, the logarithm of education expenditure per capita.
Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%

The coefficient estimates in both columns of table 4 are statistically significant at the 5% level. The coefficient estimate is not affected to any larger extent by adding controls. This might be expected as the determinants of Weibo use are not correlated with the number of bad drugs.

The magnitude of the effect estimate is considerable. The estimated effect of Weibo use on the number of bad drugs found is around -0.1. This implies that if the Sina Weibo use is doubled, the number of bad drugs will be reduced by 21%.[17] One standard deviation of the number of Weibo posts including *hei* per 10,000 individuals is 0.28 per quarter, which means 0.0082 posts per person each quarter (since the word *hei* appears in 0.34 percent of the Weibo posts).

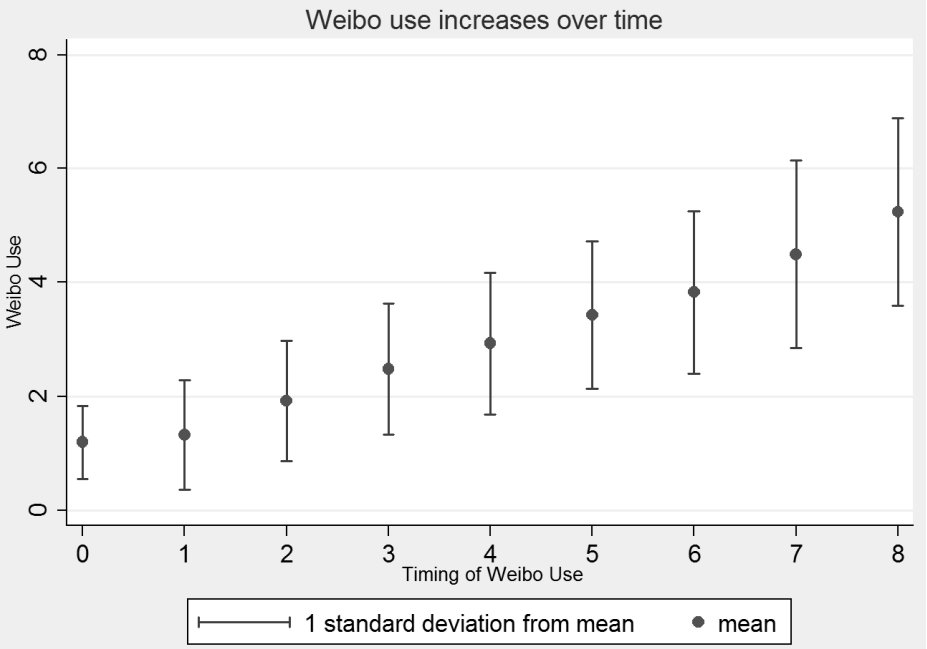
Before discussing the dynamic effects, I show the growth of Weibo use after its introduction in figure 6. Scatters in figure 6 represent the mean value of each event quarter ($\tau_{it} = j$), while the lower cap is the value of one standard deviation below the mean and the upper cap is one standard deviation above the mean. Bearing this figure in mind, I explore the screening effect and the discipline effect along with the growth of Weibo use by investigating the dynamic effects.

[17] $\ln(P_{found}+1) = -0.1\ln(W+1) + \alpha \ln pop + + \alpha_i + \lambda_t + \alpha_i * t + \theta X_{it} \Longrightarrow P_{found}+1 = const. * (W+1)^{-0.1}$

The mean for the number of Weibo posts per 10,000 individuals is 0.062.

Hence, $P_{found\_mean} + 1 = const. * (0.062+1)^{-0.1}$ and $P'_{found} + 1 = const. * (0.062+.062+1)^{-0.1}$. It gives $\frac{P_{found\_mean}+1}{P'_{found}+1} = \frac{(0.062+1)^{-0.1}}{(0.062+.062+1)^{-0.1}} = 1.0057 \Longrightarrow P'_{found} = \frac{0.028+1-1.0057}{1.0057} = 0.022$. Compared to the mean $P_{found\_mean} = 0.028$, it is decreased by 21%.

Figure 6: Weibo Use across Time



Note: Weibo use refers to Log (number of Weibo posts per 10,000 individuals +1). Scatters are mean values, while the caps are 1 standard deviation below or above the mean.

Data Source: Author's tabulation using the part of data since Weibo entered.

Table 5 reports the dynamic effects estimate from equation (2). From column (1) in table 5, we can see that the estimates for $\beta_j s$ are all negative but only become steadily statistically significant fourth quarters after Weibo entry. A similar pattern is also found in column (2) when prefecture level controls are added but with larger standard errors. The estimates are not statistically significantly different from zero at the beginning of the Weibo introduction.

Table 5: Dynamic Effects of Weibo Use on # of Bad Drugs Found

	(1)	(2)
Log (number of Weibo posts per 10,000 individuals the quarter Weibo entered+1)	-0.527*	-0.482
	(0.273)	(0.355)
Log (number of Weibo posts per 10,000 individuals 1 quarter after Weibo entered+1)	-0.0853	0.0224
	(0.0857)	(0.157)
Log (number of Weibo posts per 10,000 individuals 2 quarters after Weibo entered+1)	-0.133	-0.228
	(0.117)	(0.186)
Log (number of Weibo posts per 10,000 individuals 3 quarters after Weibo entered+1)	-0.119	-0.143
	(0.102)	(0.151)
Log (number of Weibo posts per 10,000 individuals 4 quarters after Weibo entered+1)	-0.127*	-0.143
	(0.0690)	(0.0939)
Log (number of Weibo posts per 10,000 individuals 5 quarters after Weibo entered+1)	-0.131**	-0.136*
	(0.0638)	(0.0798)
Log (number of Weibo posts per 10,000 individuals 6 quarters after Weibo entered+1)	-0.134**	-0.134*
	(0.0568)	(0.0685)
Log (number of Weibo posts per 10,000 individuals 7 quarters after Weibo entered+1)	-0.104***	-0.101**
	(0.0386)	(0.0502)
Log (number of Weibo posts per 10,000 individuals 8 quarters after Weibo entered+1)	-0.104***	-0.104**
	(0.0392)	(0.0516)
Quarter FE	YES	YES
Prefecture FE	YES	YES
Prefecture specific trend	YES	YES
Controls	NO	YES
Observations	2,977	2,783
R-squared	0.233	0.253
N_prefectures	290	271

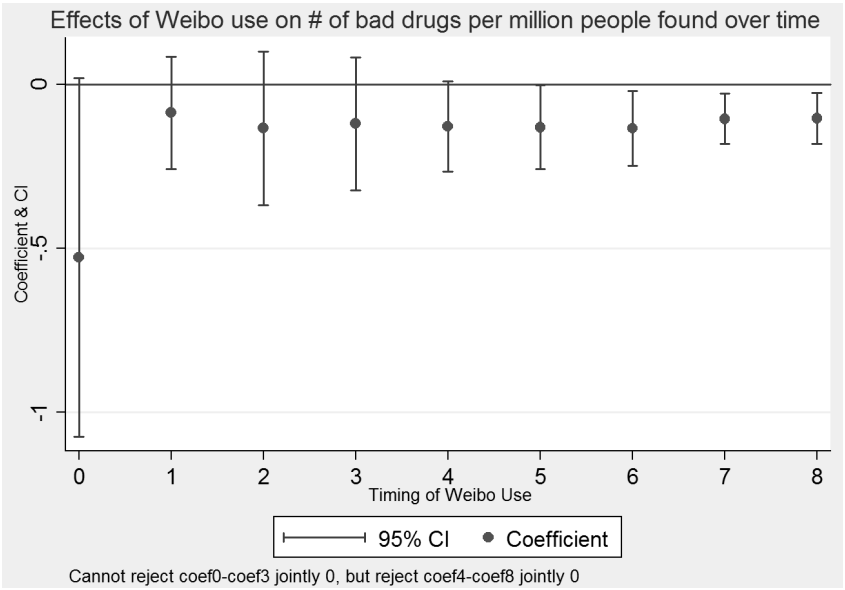
Note: The dependent variable is the logarithm of the number of bad drugs found per million people plus 1. In both regressions, the logarithm of population measured in million is controlled for. Prefecture specific trend is the vector of interaction terms between the prefecture dummies and the linear order of the quarter in the sample periods. Controls include the logarithm of GDP per capita, the logarithm of the number of hospital beds per 10,000 individuals, the logarithm of the agricultural sector share of the labor force, and the three sets of interaction terms between year dummies and the prefecture characteristics from the baseline year (2008): the logarithm of the tertiary sector share of GDP, the logarithm of the number of cellphone users, the logarithm of education expenditure per capita.

Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%.

I interpret this as a result of the opposing screening and the discipline effects. When the level of Weibo use is low, an increase in Weibo use reveals more bad drugs, thus counteracting the discipline effect. When there is an increase in theWeibo use, the discipline effect dominates the screening effect and the number of bad drugs found decreases in Weibo use. Therefore, in the later periods, from the fourth quarter after Weibo entry, we observe that an increasing Weibo use reduces the number of bad drugs found in the market.

Figure 7 plots the point estimate against the time since Weibo's introduction. By figure 7, we can see that from the first quarter when Weibo enters, $\tau_{it} = 0$, to three quarters after Weibo has entered, the estimates are too imprecise to draw any definite conclusions. Four quarters after entry, the 95% confidence intervals shrink considerably to make the estimate statistically significantly negative. Given the different significance patterns, I do two sets of F tests for coefficients β_0 to β_3, and for β_4 to β_8 to be jointly zero, respectively. The F test results suggest that I cannot reject that the coefficients β_0 to β_3 are jointly zero, but I can reject that the coefficients β_4 to β_8 are jointly zero.

Figure 7: The Effect of Weibo Use on the Number of Bad Drugs Found across Time



Note: The coefficients and the 95% confidence interval are from table 5, column (1)

In sum, the estimate of the dynamic effect is consistent with the model prediction in that the discipline effect dominates the screening effects only when the Weibo use is high. We do not observe that the screening effect dominates for low levels of Weibo use. This might be because our measure of Weibo use does not accurately pick up low levels of use, since it is based on a Chinese character with a very low appearance rate, 0.0034.

4.7 Endogeneity concerns

A fundamental question is whether the estimates from section 6 capture any causal effects. There are two main concerns: reverse causality and omitted factors influencing both Weibo use and the drug market. Weibo use may be triggered by bad drugs problems, creating a reverse-causality problem. Another possibility is that some confounding factors affect the number of bad drugs found or the trend in these, for example the general media presence and not Sina Weibo per se. This section suggests some tests to address these concerns.

4.7.1 Reverse-causality and pre-trends

I first investigate whether the pre-existing amount of bad drugs affect the Sina Weibo use. I regress the number of Weibo posts since Weibo became available and the calendar quarter when Weibo enters on the average number of bad drugs found before Weibo entry. If the reverse-causality concern is a problem, we should observe that the lower average number of bad drugs found before Weibo entry predicts the higher Weibo use, and predicts an earlier quarter when Weibo will enter the regions.

The results are reported in table 6 where the coefficients on pre-existing drugs do not significantly predict the timing or speed of Sina Weibo entry. This supports the notion that there is little correlation between the average level of the bad drugs found before Weibo entry and the level of Weibo use in the future. Based on this result, I claim that the lower level of the number of bad drugs found has nothing to do with the Weibo introduction, and if

there is any, it is in another way, so that the reverse-causality problem is not a concern in my study.

Table 6: Effect of # Bad Drugs Found on Future Weibo Use/Weibo Entry

	Log (number of Weibo posts per 10,000 individuals +1)	The quarter that Weibo entered
Avg. Log (number of bad drugs found per million people before Weibo available+1)	0.036	-1.030
	(0.031)	(1.204)
Observations	1,809	244
R-squared	0.606	0.215
N_prefecture	246	244
Province by Quarter FE	YES	
Province FE		YES

Note: The regression in column (1) uses data only since Weibo became available, i.e. 4th quarter, 2009 to the last quarter of the sample period, 4th quarter 2011. Column (2) is the cross sectional OLS estimate. Avg. Log (number of bad drugs found per million people before Weibo available+1) is the quarterly mean of the numbers before Weibo became available. Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%

There might be other unobservable confounders determining the trend of the bad drug issue and the tendency to introduce Sina Weibo simultaneously. I use the staggered timing of Sina Weibo introduction in the identification. As long as the timing of the introduction and the variation in the Weibo use level are exogenous, the identification works. If the introduction is predetermined by some factor which at the same time determines the trend of the bad drug issue, the estimate will be questioned with the causal argument. For example, people in some regions care more about the regulating issue or social order, so that the number of bad drugs in those regions has the declining trend. At the same time, since Weibo has the characteristic of a monitor, those regions tend to use Weibo earlier and more once it becomes available. In this case, the unobservable characteristics of the residents in that region determine the trend of the bad drug issue and the Weibo use even before Weibo entry.

I test whether the introduction of Sina Weibo is predetermined or not by inserting some pseudo points in the event timing. I move the Weibo use measure three periods forward, that is, a pseudo point when "Weibo enters" is three quarters before the real one. Because there are at least seven quarters before Weibo enters, I choose the pseudo point in the middle of the pre-trend periods and three quarters before is chosen.[18] The number of total Weibo

[18]One, two or four quarters before are also tried and all of them give out similar results.

posts including *hei* for the pseudo point is replaced by the number three quarters later. For the placebo test, I only include data before Weibo entry. The regression for the test is as follows:

$$P_{found\_it\tau'} = \eta \ln pop_{it} + \beta_1 W_{it\tau'} + \alpha_i + \lambda_t + \gamma_i * t + \theta X_{it} + u_{it\tau'}, \tau < 0 \qquad (4.5)$$

where τ' is the pseudo timing of the introduction of Weibo, $\tau' = 0$ when $\tau = -3$, and $W_{it\tau'} = W_{it\tau+3}$.

If the introduction and the intensity of Weibo use are predetermined, we should also observe some negative coefficient of $W_{it\tau'}$ since according to what we observe in section 6, β_1 should be statistically significantly negative. Table 7 reports the estimate. The point estimates for β_1 are really small, from -0.01 to 0.01, while the standard errors are huge. Therefore, it rejects the fact that the pseudo number of Weibo posts has some effect on the number of bad drugs found. It excludes the possibility that there are some confounders predetermining the trend of the bad drug issue and the introduction of Sina Weibo, which lends solid support to the identification used in the paper.

Table 7: Placebo Tests

	(1)	(2)
Pseudo Log (number of Weibo posts per 10,000 individuals +1)	-0.010	0.014
	(0.272)	(0.381)
Observations	1,385	1,287
R-squared	0.306	0.443
N_prefectures	262	247
Quarter FE	YES	YES
Prefecture FE	YES	YES
Prefecture-specific trend	YES	YES
Controls		YES

Note: The dependent variable for column (1) and (2) is the logarithm of the number of bad drugs found per million people plus 1. Pseudo Log (number of Weibo posts per 10,000 individuals +1) is the value of the number from three quarter lags. In all regressions, the logarithm of population measured in million is controlled for. Prefecture-specific trend is the vector of interaction terms between the prefecture dummies and the linear order of the quarter in the sample periods. Controls include the logarithm of GDP per capita, the logarithm of the number of hospital beds per 10,000 individuals, the logarithm of the agricultural sector share of the labor force, and the three sets of interaction terms between year dummies and the prefecture characteristics from baseline year (2008): the logarithm of the tertiary sector share of GDP, the logarithm of the number of cellphone users, the logarithm of education expenditure per capita.
Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%

The test results are available upon request.

4.7.2 Other media

There is a possibility that the estimated effect of Weibo use is not driven by the use itself but just picks up the effect of the general mass media. In general, the mass media may have some effect on alleviating the bad drug problem. As Sina Weibo is one of the various media types, the measure of Weibo use can just pick up the measure of the media pressure in the prefecture at the quarter. If it is not Sina Weibo, the measure of other types of media, newspapers for example, can also show the effect on the number of bad drugs found.

To exclude the possibility that the effect of Sina Weibo is due to the effect of other or general mass media, I implement the test by fitting the following equation

$$P_{found\_it} = \eta \ln pop_{it} + \beta' \ln \_\#\_\text{newspaper}_{iy} + \alpha_i + \lambda_t + \gamma_i * t + \theta X_{it} + u_{it} \qquad (4.6)$$

where $\ln \_\#\_\text{newspaper}_{iy}$ is the logarithm of the number of newspapers per million people in prefecture i and year y . The data for this variable comes from Qin et al. (2012). As the largest and most influential traditional media in China, the number of newspapers from the prefecture is a good measurement for general media pressure. If the effect of Weibo use just picks up the effect of the general media pressure, we should observe that the estimate of β' in equation (4.6) is similar to the estimate of β in equation (4.1).

Columns 1 and 2 in table 8 report the estimate results from equation (4.5), without and with the prefecture level of controls. From columns 1 and 2, we can see that the point estimates are very small positive numbers, 0.037 and 0.039, while the standard errors are too large to give the statistical power for the estimates. The zero effect of the newspaper on the number of bad drugs found cannot be rejected. Therefore, this confirms the analysis that the effect of the Weibo use estimated in section 6 is not driven by general media pressure. The causal effect does run from Weibo use to the number of bad drugs found.

Table 8: Impact of Newspapers on Bad Drugs Found

	(1)	(2)
Log number of newspaper per million people	0.037	0.040
	(0.037)	(0.040)
Observations	2,971	2,785
R-squared	0.230	0.250
N_prefectures	290	272
Quarter FE	YES	YES
Prefecture FE	YES	YES
Prefecture-specific trend	YES	YES
Controls		YES

Note: The dependent variable for columns (1) and (2) is the logarithm of the number of bad drugs found per million people plus 1. In both regressions, the logarithm of population measured in million is controlled for. Prefecture-specific trend is the vector of interaction terms between the prefecture dummies and the linear order of the quarter in the sample periods. Controls include the logarithm of GDP per capita, the logarithm of the number of hospital beds per 10,000 individuals, the logarithm of the agricultural sector share of the labor force, and the three sets of interaction terms between year dummies and the prefecture characteristics from baseline year (2008): the logarithm of tertiary sector share of GDP, the logarithm of the number of cellphone users, the logarithm of education expenditure per capita. Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%

By excluding the two large groups of concern, I claim that the effects of Weibo use on the number of bad drugs found that are estimated in section 6 are causal.

4.8 Mechanisms and Heterogeneous Effects

4.8.1 Mechanisms

Sina Weibo can reduce the number of bad drugs provided in the market by pushing the administrator to work harder in regulating the drug market and by deterring the drug producer from producing more bad drugs. If the administrator checks more drugs in those prefectures where the Weibo use is higher, this is evidence of the screening effect. If the number of bad drugs found from the prefectures where they were produced is lower when the Weibo use is higher, this is evidence of the discipline effect on the drug producer. This section will empirically investigate these two channels.

4.8.1.1 The Administrator Effort : $\hat{\epsilon}'(w) \geq 0$ and $\hat{\epsilon}''(w) < 0$?

I use the total number of drugs checked per million people in the prefecture at the quarter as an index for the administrator – SFDA's effort. Replacing the left-hand side variable with the logarithm of the total number of drugs checked in equations (1) and (2), I re-estimate the equations and report the results in table 9.

Table 9: Impact of Weibo Use on the SFDA Effort of Drug Checking

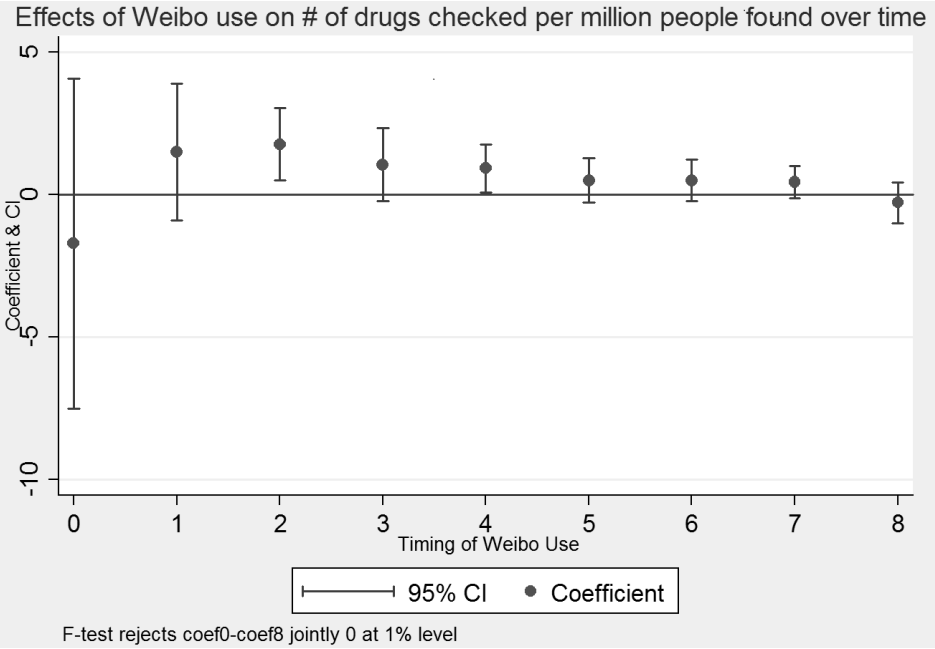
	(1)	(2)	(3)	(4)
Log (number of Weibo posts per 10,000 individuals +1)	0.175		-0.090	
	(0.315)		(0.404)	
Log (number of Weibo posts per 10,000 individuals the quarter Weibo entered+1)		-1.728		-4.628
		(2.890)		(3.144)
Log (number of Weibo posts per 10,000 individuals 1 quarter after Weibo entered+1)		1.486		0.0874
		(1.202)		(1.320)
Log (number of Weibo posts per 10,000 individuals 2 quarters after Weibo entered+1)		1.749***		1.492*
		(0.629)		(0.865)
Log (number of Weibo posts per 10,000 individuals 3 quarters after Weibo entered+1)		1.041		0.894
		(0.644)		(0.856)
Log (number of Weibo posts per 10,000 individuals 4 quarters after Weibo entered+1)		0.903**		0.642
		(0.424)		(0.555)
Log (number of Weibo posts per 10,000 individuals 5 quarters after Weibo entered+1)		0.494		0.446
		(0.392)		(0.485)
Log (number of Weibo posts per 10,000 individuals 6 quarters after Weibo entered+1)		0.489		0.310
		(0.361)		(0.463)
Log (number of Weibo posts per 10,000 individuals 7 quarters after Weibo entered+1)		0.423		0.245
		(0.281)		(0.393)
Log (number of Weibo posts per 10,000 individuals 8 quarters after Weibo entered+1)		-0.291		-0.497
		(0.355)		(0.474)
Quarter FE	YES	YES	YES	YES
Prefecture FE	YES	YES	YES	YES
Prefecture-specific trend	YES	YES	YES	YES
Controls	NO	NO	YES	YES
Observations	2,977	2,977	2,783	2,783
R-squared	0.794	0.796	0.785	0.788
N_prefectures	290	290	271	271
F-test for coef 0-8 jointly 0		3.685		2.789
Prob>F for coef 0-8 jointly 0		0.0002		0.0038

Note: The dependent variable is the logarithm of the number of drugs checked by SFDA per million people plus 1. In all these regressions, the logarithm of population measured in million is controlled for. Prefecture specific trend is the vector of interaction terms between the prefecture dummies and the linear order of the quarter in the sample periods. Controls include the logarithm of GDP per capita, the logarithm of the number of hospital beds per 10,000 individuals, the logarithm of the agricultural sector share of the labor force, and the three sets of interaction terms between year dummies and the prefecture characteristics from baseline year (2008): the logarithm of the tertiary sector share of GDP, the logarithm of the number of cellphone users, the logarithm of the education expenditure per capita.
Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%

Column 1 shows the overall effect of Weibo use on the SFDA effort: where the Weibo use is higher, SFDA invests more effort in drug checking but the estimate has no statistical significance. This might be due to the different reaction levels in different time periods. As Sina Weibo increases over time, the reaction from SFDA is expected to be increasing at the beginning but then decreases towards 0 over time. The average effect may thus conceal large early effects, and it is important to investigate the dynamic effects separately.

As we can see in column 2, SFDA starts to increase its effort one quarter after the introduction of Sina Weibo, but the increase drops significantly from the fifth quarter after the introduction until the last quarter in the sample. The reaction in the first couple of event quarters is quite large: a 1 percentage point increase in the number of Weibo posts means more than a 1 percentage point increase in the number of drugs checked. The statistical significance shares a similar pattern with the point estimate. Figure 8 plots the estimates. The pattern is consistent with the positive slope of the administrator effort curve in figure 3. Columns 3 and 4 are the results with the prefecture level controls included, and they show a similar pattern as columns 1 and 2 but with much larger standard errors. To further confirm the increase in the SFDA effort, I implement an F-test for the estimates of the effect of the Weibo use $\beta_j s$ from equation (4.2) and check whether they are jointly equal to zero. The F values are 3.7 and 2.8 for the regressions without and with the prefecture level controls (columns 2 and 4), while both reject the hypothesis that the coefficients $\beta_j s$ are jointly equal to zero at the 1% significant level.

Figure 8: The Effect of Weibo Use on the SFDA Effort across Time



Note: The coefficients and the 95% confidence interval are from the estimate in table 9, column (2)

An interpretation of the estimated results is that SFDA may need some time to realize that they are subject to the accountability pressure that is caused by the Sina Weibo exposure, and then they will start reacting. After several quarters of the extra effort implemented in regions with the higher Weibo use, the marginal return of the extra effort decreases considerably, so that SFDA decreases the effort. It suggests that when the Weibo use reaches a certain level, the marginal effect of the Weibo use on SFDA's effort drops towards zero, $\hat{\epsilon}'(w) \to 0$.

So far, the paper has shown that the number of bad drugs found decreases in the Weibo use, and the SFDA effort increases in the Weibo use. Then, according to the model, it must be the case that the number of bad drugs provided in the market has been decreasing in the Weibo use. And, by corollary 1, this is better for consumer welfare because SFDA does react to the higher Weibo use.

4.8.1.2 Discipline effect on producers?

This subsection tests whether the discipline effect is associated with the drug producer. Although there is only one homogeneous drug provider in the model, in the real world there are two types: the producer and the distributor. As most bad drugs found are produced by domestic drug manufacturers, the drug producer is expected to be subject to the higher level of monitoring where the Weibo use is higher. Hence, we may observe the discipline effect on the drug producer.

To test the hypothesis, the producer information from each drug checked in the *National drug quality announcement* is extracted and used. Whether the Weibo use in the prefectures where the drug producers are located imposes some monitoring of the local drug producers is a complementary question to the one associated with the drug market location that I previously discussed. Ideally, to answer the question, a data set including a large amount of representative producers' locations and their product quality information is needed. Due to the lack of such a data set, using the location information on the drug producers involved in the *National drug quality announcement* is the alternative.

Collapsing the data by producer location, I obtain a set of data with a similar structure as that used in discussing the number of bad drugs found in the market. The difference is that the number of bad drugs found is now calculated by the prefectures where they were produced. If the drugs in the market are randomly drawn for the check by SFDA, the producers of the drugs will also be randomly drawn. The assumption is that I use this data set to test the hypothesis of the discipline effect on the drug producer. (Appendix Figure B provides a comparison between the distribution of the total product value of the pharmaceutical industry and the total number of drugs produced in that location checked by SFDA. It shows very similar patterns for the two, which ensures the representativeness of the producer data I construct in this way.)

Using the data, I re-estimate equations (4.1) and (4.2), but all variables are now measured in terms of drug producers. Table 10 reports the result.

Very strong aggregate effects are observed in column 1: on average, a 1 percentage point increase in the number of Weibo posts decreases by about 0.3 percentage points of the number of bad drugs found[19] and the estimate is statistically significant at the 1% level. In column 2, the dynamic effects have the same pattern as what we see from the analysis for bad drugs found on the market (table 5): both the screening effect and the discipline effect exist since the aggregate effect is found to be switching from zero to negative. Several quarters after the Sina Weibo entry, the negative aggregate effect is driven by the dominating discipline effect and strongly proves the existence of the discipline effects on the producer.

[19]The mean of the number of bad drugs found per million people is 0.0264, the mean of the number of Weibo posts per 10,000 individuals is 0.087. A one percentage point increase in Weibo posts is then 0.00087. Referring to footnote 16, $\frac{P_{mean}+1}{P_{mean+1\%}+1} = \frac{(0.087+1)^{-0.14}}{(0.087+0.00087+1)^{-0.14}} = 1.0001$, so the number of bad drugs found per million people after the one percentage point increase in Weibo posts is 0.0263, and the decrease is 0.3 percentage points of the mean.

Table 10: Impact of Weibo Use on Bad Drugs in Production

	(1)	(2)
Log (number of Weibo posts per 10,000 individuals +1)	-0.144***	
	(0.045)	
Log (number of Weibo posts per 10,000 individuals the quarter Weibo entered+1)		-0.315
		(0.389)
Log (number of Weibo posts per 10,000 individuals 1 quarter after Weibo entered+1)		-0.172
		(0.254)
Log (number of Weibo posts per 10,000 individuals 2 quarters after Weibo entered+1)		-0.239
		(0.152)
Log (number of Weibo posts per 10,000 individuals 3 quarters after Weibo entered+1)		-0.153
		(0.152)
Log (number of Weibo posts per 10,000 individuals 4 quarters after Weibo entered+1)		-0.167*
		(0.100)
Log (number of Weibo posts per 10,000 individuals 5 quarters after Weibo entered+1)		-0.182**
		(0.0726)
Log (number of Weibo posts per 10,000 individuals 6 quarters after Weibo entered+1)		-0.156***
		(0.0594)
Log (number of Weibo posts per 10,000 individuals 7 quarters after Weibo entered+1)		-0.153***
		(0.0495)
Log (number of Weibo posts per 10,000 individuals 8 quarters after Weibo entered+1)		-0.129***
		(0.0466)
Quarter FE	YES	YES
Prefecture FE	YES	YES
Prefecture-specific trend	YES	YES
Observations	1,750	1,750
N_prefecture	259	259
R-squared	0.291	0.292

Note: The dependent variable is the logarithm of the number of bad drugs found that were produced from the prefecture per million people plus 1. Both the dependent variable and the independent variables are measured in the prefecture where the bad drugs (found by SFDA) were produced. In both regressions, the logarithm of population measured in million is controlled for. Prefecture specific trend is the vector of interaction terms between the prefecture dummies and the linear order of the quarter in the sample periods. Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%.

In sum, I can conclude that Sina Weibo decreases the number of bad drugs found on the market by pushing the administrator to work harder and deterring the drug producers from producing the bad drugs.

4.8.2 Heterogeneous effects

Bate et al. (2011) suggest that the prevalence of poor-quality drugs is associated with the low income level and the literacy rate, so that regions with a higher GDP per capita and a higher literacy rate may have a lower level of bad drugs. Sina Weibo has the low marginal delivery cost and once there is access to Internet or a smart phone, there is access to Weibo. Therefore, some ex ante disadvantaged groups, for example those with a lower income and education level, may benefit more from Weibo use as long as they can afford the entry cost.

A report from SFDA points out that the rural areas in China suffer more from the bad drug issue.[20] In China, the rural area is comparatively poor, so the low price and low quality drugs are especially popular there (Zhu, 2011). In addition, most of the drugstores in the rural areas are small which makes the monitoring more difficult. All these factors can make the rural area the target market of bad drugs. Since there is no technical barrier that will differentiate the rural users of Weibo from the urban users, the introduction of Weibo can be more marginally helpful for rural areas.

Information is another important factor affecting the product quality in the market (Shapiro, 1982). The information cost increases in the distance between producers and the market, so it is reasonable to expect that a market far from its producers tends to have more bad drugs. When Sina Weibo enters, more information can be widely spread regardless of the distance, so it is possible that Sina Weibo is more helpful for markets that are far from their producers.

In sum, bad drugs can be more popular in regions with a lower GDP per capita, regions with a lower education level, markets far from the producers, and more rural regions. This part of the analysis will control the heterogeneous effects that are associated with the four above mentioned factors. Without the education achievement data, I use education expenditure per capita as a proxy for education level. To measure how "rural" a region is,

[20] http://www.safemedicinesindia.in/blog/2012/06/china-cracks-down-on-fake-drug-makers/

I use the agricultural sector share of the labor force as an index. I split the whole sample into three equal partitions according to the baseline value (in 2008) for each of the four factors mentioned above, and then estimate equation (4.1) for each of the 12 data subsets.

The results for the heterogeneous effect estimates are summarized in table 11. From table 11, we can see that the Weibo use seems to have a higher marginal effect on reducing the number of bad drugs found in the group with a middle level of GDP per capita: the point estimate is -0.46, almost four times the general effect estimate in section 6. However, the Weibo use does not seem to have any effect within the group with the lowest GDP per capita. The reason might lie in the entry cost: the group with the lowest GDP per capita may even have problems with access to Internet or smart phone. The group with the lowest education expenditure has the highest marginal effect of Weibo use on reducing the number of bad drugs found, and the estimate is actually marginally statistically significant, at around the 12% level. The middle level of the education expenditure group benefits the least, where both the economic magnitude and the statistical power are very low. The prefectures ranking second further from the producers seem to have a higher marginal effect of Weibo use. For the rural region aspect, the prefectures with the middle level of the agricultural sector share of the labor force seem to have the highest marginal effect of Weibo use, but the statistical power is too low to draw any conclusions.

Table 11: Heterogeneous Effects of Weibo Use on Bad Drugs Found, by Subsets of Prefectures

	Lowest third	Second third	Highest third
Prefectures partitioned by:			
GDP per capita	0.210	-0.463*	-0.0728***
	(0.299)	(0.257)	(0.0258)
Distance between markets and producers	-0.0670*	-0.0804*	-0.348
	(0.0402)	(0.0415)	(0.269)
Education expenditure per capita	-0.189	0.0118	-0.0825*
	(0.122)	(0.0764)	(0.0423)
Agricultural sector share of labor force	-0.0935**	-0.280	-0.153
	(0.0372)	(0.239)	(0.245)

Note: The table shows the coefficients on Weibo posts from regressions of the number of bad drugs found on the number of Weibo posts, equation (1). The dependent variable is the logarithm of the number of bad drugs found per million people plus 1. The coefficient is the estimate for Log (number of Weibo posts per 10,000 individuals +1). Each column gives the coefficient from regressions using only prefectures that fall into the given third of the data, and each row specifies the prefecture characteristics on which prefectures are divided. Robust standard errors clustered at the prefecture level are reported in parentheses. * significant at 10%,** significant at 5%, *** significant at 1%.

What I can conclude from table 11 is that the regions with the middle level of GDP per capita, the regions with the lowest education level, the regions with the middle level of the distance between the market and the producers tend to have a higher marginal effect of Weibo use in terms of reducing the number of bad drugs found in the market. The results suggest that the new format of media, Sina Weibo, compensates some ex ante disadvantaged groups to a certain extent.

4.9 Conclusion

Understanding and combating bad drugs in developing countries is a complex and arduous task. This paper suggests a new avenue to approach this issue, namely to rely on new media. The extensive use of microblogging may be specific to China, but this is just one of the ways of spreading information and calling on public attention through the Internet.

In general, the effect of Sina Weibo on the incidence of bad drugs is a combination of information and public attention. Information enables the consumer to take action and thus disciplines the product provider. Similarly, any other way of bringing more information to the market can help promote product quality. From the study, we observe the power of gathering public attention, as this imposes pressure on regulators and pushes them to work

harder. As long as public opinion has the possibility of influencing or threatening the regime, even in an autocracy, the government may not ignore it and may learn to be accountable to it. The fact that Sina Weibo works in the Chinese context is compelling evidence of such effects.

This study is a first attempt to discuss the possible role of media in solving the product quality problem and creating government accountability under autocracy. Many issues are certainly absent from the analysis, but those missing points definitely deserve more future research. For example, the information discussed in the paper does not distinguish between information that is true or false, both of which exist in Sina Weibo. Moreover, the paper does not analyze the effect of media on drug retailers, nor does it compare the effect on drug producers and retailers. Such a comparison, however, might be crucial for understanding the bad drug issue since drugs can be bad either in the production process or in the delivery process. Pursuing these extensions would be interesting from the viewpoint of academic research as well as practical policy.

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4.10 Appendix

Proof 1: The corner solution for the drug provider problem.

For the optimal amount of bad drugs provided on the market responds to Sina Weibo use and smaller than 1, we need

$$\hat{x} = \frac{1}{2\alpha}\ln(\frac{1+w}{\alpha((1-\lambda)w^2+\lambda w)}) < 1$$

$$\frac{1+w}{\alpha((1-\lambda)w^2+\lambda w)} < e^{2\alpha}$$

$$\alpha e^{2\alpha}(1-\lambda)w^2 + (\alpha e^{2\alpha}\lambda - 1)w - 1 > 0$$

so we need,

$$w > w* = \frac{\sqrt{(\alpha e^{2\alpha}\lambda - 1)^2 + 4\alpha e^{2\alpha}(1-\lambda)} - (\alpha e^{2\alpha}\lambda - 1)}{2\alpha e^{2\alpha}(1-\lambda)}$$

End of Proof 1.

Proof 2: $F'_w > 0$

$$F(\epsilon, w) = A(-1 + \frac{w}{\alpha(\lambda\epsilon + (1-\lambda)w)} - w + \frac{(1-\epsilon)w\lambda}{\alpha(\lambda\epsilon + (1-\lambda)w)^2})$$

$$F(\epsilon, w) = A(-1 - w + \frac{(1-\lambda)w^2 + w\lambda}{\alpha(\lambda\epsilon + (1-\lambda)w)^2})$$

$$F'_w = A(-1 + \frac{2(1-\lambda)w + \lambda}{\alpha(\lambda\epsilon + (1-\lambda)w)^2} - \frac{2((1-\lambda)w^2 + w\lambda)(1-\lambda)}{\alpha(\lambda\epsilon + (1-\lambda)w)^3})$$

$$F'_w = A(-1 + \frac{2(1-\lambda)w + \lambda}{\alpha(\lambda\epsilon + (1-\lambda)w)^2} - \frac{2((1-\lambda)w^2 + w\lambda)(1-\lambda)}{\alpha(\lambda\epsilon + (1-\lambda)w)^3})$$

$signF'_w = signD$, where $D = (-1 + \frac{2(1-\lambda)w+\lambda}{\alpha(\lambda\epsilon+(1-\lambda)w)^2} - \frac{2((1-\lambda)w^2+w\lambda)(1-\lambda)}{\alpha(\lambda\epsilon+(1-\lambda)w)^3})$

Notice that we have $(\lambda\epsilon - (1-\lambda)w)^2 = \frac{(1-\lambda)w^2+\lambda w}{\alpha(1+(1-\lambda)w)}$, substitute it into D, I get the following.

$$\begin{aligned} D = \quad & -1 + \frac{(1-\lambda)w}{\alpha(\lambda\epsilon+(1-\lambda)w)^2} + \frac{\frac{\alpha}{w}(1+w)(\lambda\epsilon+(1-\lambda)w)^2}{\alpha(\lambda\epsilon+(1-\lambda)w)^2} \\ & - \frac{2\alpha(1+w)(\lambda\epsilon+(1-\lambda)w)^2(1-\lambda)}{\alpha(\lambda\epsilon+(1-\lambda)w)^3} \end{aligned}$$

$$D = \frac{(1-\lambda)w}{\alpha(\lambda\epsilon + (1-\lambda)w)^2} + \frac{1}{w} - \frac{2(1+w)(1-\lambda)}{(\lambda\epsilon + (1-\lambda)w)}$$

$$D = \frac{(1-\lambda)w}{\alpha(\lambda\epsilon + (1-\lambda)w)^2} + \frac{\lambda\epsilon + (1-\lambda)w - 2(1-\lambda)w - 2(1-\lambda)w^2}{w(\lambda\epsilon + (1-\lambda)w)}$$

Let $y = \lambda\epsilon + (1-\lambda)w = (\frac{(1-\lambda)w^2+\lambda w}{\alpha(1+w)})^{\frac{1}{2}}$, and $s = (1-\lambda)w$. So $\lambda\epsilon = y - s$, $w = \frac{s}{1-\lambda}$, $y = (\frac{(1-\lambda)w^2+\lambda w}{\alpha(1+w)})^{\frac{1}{2}}$

Notice that we need $0 \leq \hat{\epsilon} \leq 1$, so $s \leq y \leq \lambda + s$

$$D = \begin{array}{c} \frac{s}{\alpha y^2} + \frac{(1-\lambda)(y-2s-2s*\frac{s}{1-\lambda})}{sy} = \frac{s}{\alpha y^2} + \frac{(1-\lambda)(y-2s)-2s^2}{sy} \\ \frac{s^2+\alpha y(1-\lambda)(y-2s)-2\alpha s^2 y}{\alpha s y^2} \end{array}$$

$$sign(D) = sign(s^2 + \alpha y(1-\lambda)(y-2s) - 2\alpha s^2 y) = sign(\alpha(1-\lambda)y^2 - 2s\alpha(1-\lambda-s)y + s^2)$$

$$\Delta = 4\alpha^2 s^2(1-\lambda-s)^2 - 4\alpha(1-\lambda)s^2 = 4\alpha s^2(\alpha(1-\lambda-s)^2 - (1-\lambda))$$

Because $\alpha \leq ln2 < 1$ and $s < 1$, $\Delta < 0$. It suggests that the quadratic function is always larger than 0. That is $F'_W > 0$ is always true.

End of Proof 2.

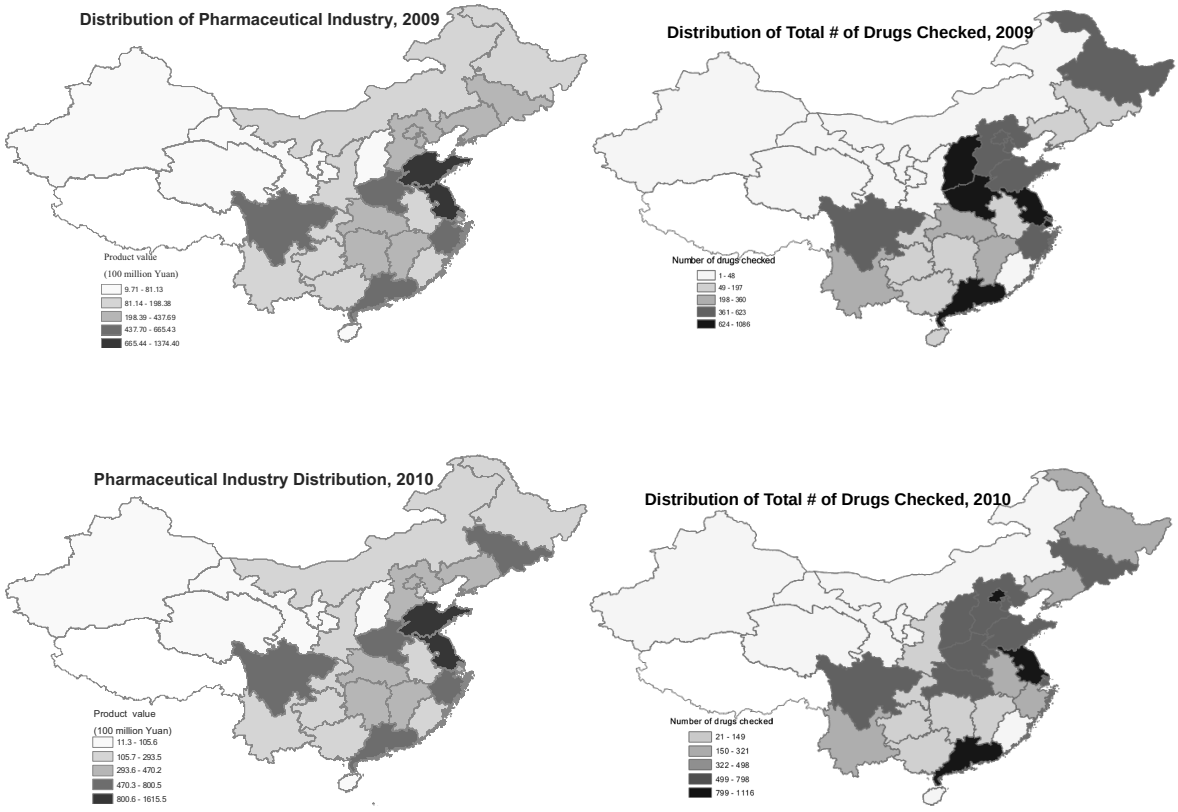
Figure A: A Sample of the Announcement Records

ID	Drug name	Labeled Producer	Production series No.	Format	Sample source	Judging rule	Testing institute	Test results	Unqualified iterm
序号	药品品名	标示生产厂家	批号	规格	检品来源	检验依据	检验机构	检验结果	不合格项目
1	盐酸二甲双胍肠溶片	贵州圣济堂制药有限公司	20080121	0.25g	广西壮族自治区南宁医药有限责任公司	国家食品药品监督管理局标准 YBH25142006	内蒙古自治区食品药品检验所	合格	
2	盐酸二甲双胍肠溶片	贵州天安药业股份有限公司	20071239	0.25g	广西壮族自治区南宁医药有限责任公司	国家食品药品监督管理局标准 YBH23102006	内蒙古自治区食品药品检验所	合格	

Data source: The *National Drug Quality Announcement*.

Figure B: The distribution of the pharmaceutical industry and the number of drugs (by producer location) checked by SFDA

Corr(the product value, the number of drugs checked)=0.68



Note: The distribution of the pharmaceutical industry in 2009-2010 comes from *the China Statistics Yearbook on High Technology Industry 2010-2011*, and it plots the product value of the pharmaceutical industry, by province. The distribution of total # of drugs checked 2009-2010 comes from the *National Drug Quality Announcement* from SFDA, 2009-2010. The number of drugs checked per million people is aggregated at province by year level. The blank patch is the province that was not included in the drug audit by SFDA in the respective year.

Table A: Sampling Sources and Bad Drugs

	Full sample		Bad drugs sub-sample	
Sampling sources	Freq.	Percent	Freq.	Percent
clinics	1,922	4.75	8	4.57
disease control & prevention center, anti-epidemic stations etc. offices under the Health Department	252	0.62	1	0.57
drugstores	5,131	12.68	23	13.14
hospitals	11,298	27.92	42	24
intermediary drug companies	21,861	54.03	101	57.71
producers	3,262		28	
Total	43,726	100	203	100

Note: The category of sampling sources is coded by the author according to the sample source stated in the National Drug Quality Announcement. Percent is calculated by excluding the number of producers from the sample.

Table B: Categories of Drugs

	Full sample		Bad drugs sub-sample	
categories of drugs	Freq.	Percent	Freq.	Percent
pharmaceutical excipient	16	0.04	0	0
respiratory system drugs	2,166	4.95	20	9.85
hormones and endocrine drugs	3,784	8.65	18	8.87
analgesic, antipyretic, anti-inflammatory, anti-rheumatic, anti-gout drug	1,848	4.23	10	4.93
treatment of mental disorders drugs	293	0.67	3	1.48
anti-allergy drug	1,757	4.02	16	7.88
anti-microbial drugs	5,436	12.43	20	9.85
antineoplastic drugs	60	0.14	1	0.49
the anesthetic	531	1.21	0	0
urinary system drugs	716	1.64	5	2.46
the immune system drugs	228	0.52	5	2.46
the nervous system drugs	2,381	5.44	4	1.97
non-immunization other biotech-related drugs	42	0.1	3	1.48
vitamins, minerals, medicines	1,277	2.92	1	0.49
digestive system drugs	4,512	10.32	18	8.87
cardiovascular system drugs	4,540	10.38	9	4.43
blood system drugs	1,360	3.11	3	1.48
immunization drugs	467	1.07	1	0.49
the diagnosis of drug	124	0.28	0	0
Traditional chinese medicine	11,551	26.41	61	30.05
specialty drugs	640	1.46	5	2.46
total	43,729	100	203	100

Note: The category of drugs is coded by the author according to the drug name and the National Essential Drugs List, 2009 version, published by the Ministry of Health of the People's Republic of China. http://www.gov.cn/gzdt/2009-08/18/content_1395524.htm.

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