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Essays on Public Economics and Banking

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Essays on Public Economics and Banking

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Essays on Public Economics and Banking

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This dissertation presents two lines of research on public finance and banking respectively. The research on public finance explores the source of China's state capacity, including fiscal capacity and the bureaucracy, and whether such state capacity promotes economic development. The research on banking discusses the discrimination in China's bank loan markets, and the role of political connections and policy uncertainty in affecting bank risk-taking in the United States.

My first chapter is about the state capacity in China. We offer a comprehensive study on the causal effects of state capacity in explaining China's spectacular economic growth, using rich historical variation and various outcomes in economic performance, education, health care, finance, and social unrest. Our estimates indicate that fiscal capacity has significantly positive impacts. However, a large size of bureaucracy plays a much weaker role, and it cannot reduce the incidence of protests, suggesting the existence of overstaffing in the public sector.

The second chapter analyzes costly discrimination related to physical attractiveness and gender in bank loan markets using a market structure-based method.

The rationale is that a concentrated market provides more space for loan officers to discriminate against a certain group of borrowers. We find that loan officers prefer good-looking people and males in relatively risky commercial/industrial loan markets. On the other hand, females and especially young good-looking females have an advantage in mortgage loan markets. We interpret these different patterns of favoritism as a result of differential risk levels associated with the two types of loans.

The third chapter studies how political connections and their interaction with economic policy uncertainty affect banks' risk-taking. Our hypothesis is that policy uncertainty increases the option value of waiting but political connections can reduce such option value. We find when policy uncertainty is low, politically connected banks have a weaker tendency to take on more risk than those without political connections and enjoy the quiet life. However, when policy uncertainty is high, politically connected banks have much larger amounts of loans, but smaller amounts of loss provision than those without political connections.

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Chapter 1

State Capacity and China's Economic Development[1]

State capacity, such as government revenue and the size of bureaucracy, can support public goods provision, but is not necessarily beneficial for economic development if the taxation cost is high. This is especially relevant for developing countries where both the benefit from public goods provision and the taxation cost are larger than developed countries. We offer a comprehensive study on the causal effects of state capacity in explaining China's spectacular economic growth, using rich historical variation and various outcomes in economic performance, education, health care, finance, and social unrest. Our estimates indicate that fiscal capacity has significantly positive impacts. However, a large size of bureaucracy is not associated with better economic development, and it cannot reduce the incidence of protests, suggesting the existence of overstaffing in the public sector. Furthermore, the counties located in a provincial capital do not have better outcomes. The consistent pattern based on various datasets supports the robustness of our conclusions.

1.1 Introduction

The idea that state capacity, the presence of state functionaries and agencies, is vital for economic development attracts attention among economists (Acemoglu et al., 2015). It has several components including fiscal capacity, the size of bureaucracy, legal capacity and others. The strong state capacity, according to a series of books by Johnson (1982), Amsden (1989), Wade (1990) and Evans (1995), is a key to the economic success of East Asian economies. Others, such as Herbst (2000) and Centeno (2002), link the

[1] I wish to thank for Kishore Gawande's joint effort.

economic failure of African or Latin American nations to their limited state capacity. This hypothesis receives support from the cross-country empirical evidence presented in Gennaioli and Rainer (2007) and the within-country evidence in Michalopoulos and Papaioannou (2013) and Bandyopadhyay and Green (2012), who find a positive association between measures of historical political centralization and present-day outcomes. Dincecco and Katz (2014) show that a state's capacity to extract greater tax revenues is an important determinant of long-run economic growth in European countries. Acemoglu et al. (2015) document municipalities with a larger size of bureaucracy have better outcomes in Colombia.

However, strong state capacity is not necessarily beneficial for economic development if the taxation cost is high. This is especially relevant for developing countries where both the benefit from public goods provision and the taxation cost are larger than developed countries. Although China's experience in the last three decades is an impressive part of the ``East Asian Miracle'', there is not a paper investigating the association between its state capacity and economic development using plausibly exogenous variation. Although China is widely believed to have strong state capacity, it is not clear that the spectacular economic growth is a result of such capacity as the debate between two Chinese economists shows[2]. On one hand, building on the inheritance from the two-thousand-year empire period and the totalitarian Leninist party, China's government maintains a much firmer control over resources compared to most other developing countries including most other East Asian economies. The unprecedented infrastructural construction and the promotion of mass education, two of the most vital

[2] Justin Lin and Weiying Zhang, two well-known Chinese economists in Peking University, recently renewed their debate on whether the Chinese government's industrial policies promote economic growth. For example, the Caixin Online has an article on their debate: ``Top Chinese Economists Debate Role of Gov't in Economy.'' See http://english.caixin.com/2014-07-11/100702693.html.

determinants in economic growth, have been actively undertaken by the government, though the efficiency of these investments is highly debated.

On the other hand, Acemoglu et al. (2015)'s discussions focus on Colombia; however, although establishing order is of great importance to Colombia, curbing corruption and wasteful public expenditure is more relevant to China. Colombia does not have a tradition of strong bureaucracy and experienced long-lasting military conflicts in the past century; however, the converse is true for China. China's fiscal revenues increased by around 30 percent every year in the first decade of the new century, three times the GDP growth rate. Corruption and abuse of public resources trigger widespread anger, which partly explains why the anti-corruption movement raised by the new leader wins much grassroots support.

In this paper, we offer a comprehensive study on the causal effects of state capacity in explaining China's economic miracle. Using historical variation designed by ourselves, we discuss the impacts related to economic performance, education, health care, finance, and social unrest of county-level government revenue, the number of public employees and whether a county is located in a provincial capital, three dimensions of state capacity. To the best of our knowledge, China is the only developing country that we can obtain such extensive county-level variables (Henderson et al., 2012).

Our first historical variation is related to three concurrent rebellions (Taiping Rebellion, Nian Rebellion and Dungan Revolt) in 1851-1880, which were repressed by local armed forces. To finance the wars, the local armed forces usually set tax bureaus to collect a form of transit/commercial tax (Lijin), which led to large variation in fiscal capacity across the country. Although the Sino-Japanese War (1937-1945) and Civil War between the Nationalist Party and Communist Party (1946-1950) were also large-scale wars, there was not a comparable change in local variation in fiscal capacity since the

central government commanded army forces and mobilized the resources across the country (and obtained international aids).

Following Sng (2014)'s use of the number of counties as a measure of the size of bureaucracy, we introduce the number of ancient counties in an ancient prefecture as an instrumental variable for the current size of bureaucracy. Since the setting of prefectures changed radically, there should be not direct impact from this historical variation on present-day outcomes after controlling a rich set of covariates. A prefecture in China is a level of jurisdiction between the provincial level and the county level, similar in size to a metropolitan statistical area (MSA) in the United States. On the other hand, our use of the distance to the ancient postal route as an instrumental variable for the current size of bureaucracy is similar to Acemoglu et al. (2015)'s use of royal roads in Colombia. In the counties closer to the route, the government maintained more control. This comparable instrumental variable with Acemoglu et al. (2015) makes it possible for a direct comparison between our results. The distance to the ancient postal route had no direct impact on current outcomes since these roads are no longer used. Furthermore, in regressions using both instrumental variables together, we obtain very similar estimates of the impacts of the size of bureaucracy, and the overidentifying test cannot reject the validity of these instrumental variables.

We find very significantly positive impacts of per capita government revenue on almost all the indicators of economic development. For example, with 100 percent higher per capita government revenue, the night lights scaled by population are 120 percent higher, the probability having treated water is 30 percentage points higher, and the average educational attainment is 1 year longer. In other words, counties with per capita government revenue at the 75 percentile have 100 percent more night lights, are 25 percentage points more likely to have treated water, and have 0.9 year longer average

educational attainment than counties at the 25 percentile. Since GDP reporting in China is widely criticized for manipulation, these variables are more likely to provide us the real picture of economic development. Moreover, the number of manufacturing firms and their production, the number of telephones, deposits, loans, the number of hospital beds are all improved significantly. These results are robust with a large set of covariates and province fixed effects. Taxation is costly, and hence if the value of public goods provided by the government cannot offset the costs in collecting taxes (e.g., Feldstein, 1978; Browning, 1987; Snow and Warren, 1996), we may see a negative impact of government revenue. Therefore, our results imply that the value of public goods provided by the government is high.

Moreover, we also conduct more tests to show the better economic outcomes are not direct impacts of ancient economic development. For example, if the population change from 1851 to 1880 reflects the economic development before the wars, then it is reasonable to think the population change from 1776 to 1820 and population change from 1820 to 1851 also reflect such pre-war economic development, and consequently we should document similar strong first-stage effects when using the first two population changes. However, we cannot find any impact of the population change from 1776 to 1820 (from 1820 to 1851) on current government revenue.

On the other hand, the impacts of per capita public employees are much weaker and even negative. It can neither improve economic performance significantly nor reduce the incidence of protests. These protests might target the government, but can also target firms such as polluting firms or employers that delay wage payment. Because of long-term military conflicts, it is important to have a sufficient number of government employees to maintain social order in Colombia. Moreover, military conflicts make it more dangerous to become a government employee and tend to restrict the size of

bureaucracy and the productivity of the limited government employees should be relatively high (Downs, 1993). On the other hand, China does not experience large-scale wars during the last 60 years. Wide evidence shows that it is attractive to become a public employee and the size of China's bureaucracy experiences stable expansion. Therefore, the existence of overstaffing in the public sector can reduce the productivity of public employees.

Finally, although it is commonly thought that a provincial capital has some privileges in China, we find that counties located in a provincial capital do not have better outcomes except a slightly a higher educational attainment. These results are useful for us to understand which ingredients of a strong government are vital for economic development.

The structure of the paper is as follows. The rest of Section 1 is a review of the related literature. Section 2 describes the datasets; Section 3 and 4 demonstrate the empirical strategies and results for government revenue using the two instrumental variables; Section 5 and 6 report the results for the size of bureaucracy and being located in a provincial capital. Finally, Section 7 concludes.

1.1.1 Related Literature

China's state capacity building has received attention among economists. Sng and Moriguchi (2014) compare ancient state capacity in China and Japan. They find that before 1850, China's ruler kept taxes low and government small compared to Japan. In a large domain, the ruler's inability to closely monitor bureaucrats creates opportunities for the bureaucrats to exploit taxpayers. To prevent overexploitation, China's ruler had to keep taxes low and government small. Therefore, they conjecture that a greater state capacity might have prepared Japan better for the transition from stagnation to growth in

the 19th century. Mattingly (2015) studies the impact of Japanese colonialism on state building in Manchuria. The Japanese invested in state capacity but governed through extractive institutions. Relying on the fact that the provincial borders between Manchuria and nearby Inner Mongolia were drawn to divide a previously unified and homogenous region, Mattingly (2015) implements a regression discontinuity design that compares Manchuria with neighboring areas in Inner Mongolia. He finds that Japanese rule was associated with both higher state capacity and higher levels of long-run economic development. Focusing on Sichuan, Lu et al. (2016) instrument for state capacity by collecting data on the path of the Central Red Army during the Long March. They show that counties along the path of the Red Army had more Communist party members. If the path taken by the Red Army was conditionally exogenous, controlling for geographic factors, it should only affect future development outcomes via its impact on local state capacity. They find that their measure of stare capacity-the number of party officials-is positively correlated with several measures of economic development after the introduction of market reforms in 1978, but had a negative impact on grain output prior to 1978. They interpret this finding as consistent with the argument that state capacity has a positive impact on development when it complements markets, as has been the case in the post 1978 reform period, but that it has no such positive effects when the state attempts to substitute directly for the market. Cheng (2016) finds the differential enforcements of the one-child policy in China's public sector and non-public sector, and attributes this phenomenon to the different levels of state capacity in the two types of sectors.

Beyond China, our focus on the long-run impacts of state capacity is closely related to Dincecco and Katz (2014) and Acemoglu et al. (2015). Using fiscal centralization and the establishment of a limited government in 11 European countries

during four centuries as plausibly exogenous variation, Dincecco and Katz find that a higher per capita government revenue is an important determinant of long-run economic growth. Part of our discussion also focuses on per capita government revenue; however, we make use of rich county-level variation in state capacity and outcomes, which can eliminate the confounding impacts of other factors and provide strong identification. Our discussions on the size of bureaucracy are related to Acemoglu et al. (2015)'s research on Colombia. The major difference is that although establishing order is of great importance to Colombia, curbing corruption and wasteful public expenditure is more relevant to the latter. This could explain why we cannot find a comparable productive impact of a larger size of bureaucracy in China. We notice that Acemoglu et al. (2015) also discuss the spillover effects of neighboring municipalities; unfortunately, our historical variation is measured at the ancient prefecture level and we do not realize that any nationwide data exist at the ancient county level. Since a current county and many of its neighboring counties are located in the range of the same ancient prefecture, it is difficult to identify spillover effects separately in our case.

Moreover, our use of variation in local government revenue induced by the differential scales of the wars in 1851-1880 is closely related to the literature on the relationship between wars and state building. This literature takes inspiration from historical works that investigate the relationship between external conflicts and fiscal innovations that enabled states to gather greater wartime funds. Tilly (1990) famously argued that ``states made war, and war made states". North and Weingast (1989) and Dincecco et al. (2011) build theoretical frameworks that explain how armed conflicts gave monarchs the incentive to create an effective fiscal infrastructure. Specifically, with more opportunities for territorial expansion or threats of outside attack and internal risks of overthrow, monarchs had more military expenditures to replenish their injured and

dead soldiers, and needed to gather larger tax revenues. Therefore, they had to increase the tax level or expand its tax base. Economic historians have shown that warfare was a major driver for European states to expand fiscal capacity (Hoffman and Rosenthal, 1997; O'Brien, 2005; Besley and Persson, 2009; Gennaioli and Voth, 2015). In this view, the absence of interstate competition in China and the resulting low fiscal demand were the primary reasons for low taxation in Qing China before 1850 (Rosenthal and Wong, 2011), and the large-scale civil wars in 1851-1880 could explain the rapid increase in tax revenue after then. An excellent review on the state capacity literature can be found in Johnson and Koyama (2016).

1.2 Data and Descriptive Statistics

Similar to most other studies using historical variation in China such as Sng and Moriguchi (2014) and Bai and Jia (2016), our historical variation is from the ancient prefectures in China Proper as shown in Figure 1, where the ethnic Han group dominates in both ancient times and now. For border regions, the ancient Chinese government could only maintain some military control and did not establish effective jurisdictions in general, and hence there was no historical variation in state capacity we need in this study. Our historical variation corresponds to the 18th and 19th centuries, when this country was ruled by the Qing dynasty (1644-1911). We notice that most other papers on China's economic history are confined to the Qing dynasty because of relatively richer data available than earlier periods. Our major explanatory variables and outcomes are measured at current counties in the 23 provinces and province-level municipalities (Beijing, Tianjin, Shanghai and Chongqing) in China proper. We drop counties in Ganzi and Aba, two Tibetan prefectures in Sichuan province and similar to Bai and Jia (2016),

counties in Chengde prefecture of Hebei province (except one) because of missing historical variation. Finally, we drop about 100 counties missing local government revenue or the number of local public employees, our main measures of state capacity. Our final sample includes 2104 non-district counties and county-level districts, though in some regressions the number of observations is slightly smaller.

There are two main types of counties in China: non-district counties and county-level districts. In general, the former have a long history and are more distant from the prefecture government seat. Some county-level districts were transferred directly from non-district counties; however, the majority of county-level districts were established by cutting parts of a non-district county or combining parts of several different non-district counties. Therefore, the majority of county-level districts were established after 1930. Not surprisingly, we document stronger first-stage effects for non-district counties because they usually have a much longer history than county-level districts. We notice that more non-district counties transformed to county-level districts over time after 2000, and hence non-district counties in this paper refer to the status in 1999.

The data on local government revenue and public employees, our main explanatory variables, are obtained from the National Prefecture and County Finance Statistics Compendium, published by China's Ministry of Finance. The yearbooks started in 1993, but many provinces reported data only for non-district counties but not for county-level districts. The 1999 yearbook was the first issue that reports full fiscal statistics for both types of counties. Variable definitions changed radically in the yearbooks after 2006, and hence most authors use the 1999 to 2006 yearbooks (Han and Kung, 2015; Lu and Landry, 2014). Because we will also make use of outcomes in 2000 population census, we use the logarithm of average per capita government revenue in 1999 and 2000 (after translating 2001 GDP in 2000 yuan using CPI deflators provided by

the National Bureau of Statistics) and the logarithm of average per capita public employees in these two years as our two main explanatory variables. This practice reduces the impacts of skewness and makes the impacts of different dimensions of state capacity comparable. Government revenues referred in these yearbooks include two major categories: budgetary revenues and government fund revenues. Budgetary revenues includes value-added tax, business tax, personal income tax, corporate income tax, urban maintenance tax, agricultural tax accruing to county governments. The same kind of tax revenue can accrue to different levels of government according to a certain sharing rule (Liu, 2015)[3]. Government fund revenues include land use fees and various extra-budgetary items. Notice that although land use fees became a very important part of local government revenue after 2000, they were not very important in 1999 or 2000. Moreover, These government revenues do not include transfers from upper-level governments because they reflect state capacity of upper-level governments. Local public employees include those working in governments, semi-government organizations (such as women's union, writers' union) and state-owned enterprises, but do not include those working in collective firms or retired. This is partly because the dataset does not distinguish the three types of public employees. Moreover, these sectors are all tightly controlled by the state and serve policy purposes, and their managers have administrative rankings, especially in our sample period.

China's GDP is probably manipulated as many observers criticize. In this hierarchical bureaucratic structure, lower-level government officials are appointed by upper-level government officials, and hence government officials have a strong incentive to increase their chance for promotion by manipulating GDP reporting (Li and Zhou,

[3] For example, 75 and 25 percents of value-added tax accrue to the central government and prefecture/county governments respectively; 60, 15, 25 percents of corporate and personal income tax accrue to the central government, provincial governments and prefecture/county governments.

Landry, 2008; Jia et al., 2015). With more public employees, the inflation in GDP reporting could be higher and introduces an overestimation bias for the size of bureaucracy. On the other hand, government officials in more developed areas (and more government revenue) are more willing to stay in their place, and therefore have a weaker incentive to manipulate GDP reporting. This tends to induce an underestimation bias for local government revenue.

To avoid this additional source of endogeneity, we make use of high-resolution data on light density measured by satellites at night and processed by the National Oceanic and Atmospheric Administration. Each satellite-year dataset is a grid reporting the intensity of lights, for every 30 arc-second output pixel (approximately 0.86 square kilometers at the equator). The digital number measuring the intensity of lights is an integer between 0 (no light) and 63. We count and aggregate the digital number for a county using the Arc-GIS software, normalize by the population (in 10,000 people) and then take logarithm. Because the light measures are not strictly comparable across year (Henderson et al., 2012), we use the light data in 2000 in the main analysis, though we find the light data in 2001 provide the same results. These data have been used by Bleakley and Lin (2012), Michalopoulos and Papaioannou (2013), Pinkovskiy (2013), Lu and Landry (2014), Lowe (2014), Baum-Snow et al. (2015), Pinkovskiy and Sala-i-Martin (2016), Storeygard (2016), and have been shown to proxy well for local economic activities and correlate strongly with other welfare proxies (Henderson et al., 2012). Similar to them, we also find the county-level night light variable is highly correlated with GDP (both in logarithm).

Our ancient variables, including the population change from wars in 1851-1880, the number of counties per 10 thousand people in 1820, our major instrumental variables, and the set of covariates from Bai and Jia (2016), are recorded at the ancient prefecture

level (except distance to the ancient postal route, which is recorded at the ancient county level). To obtain a clean measure of the scale of the wars, we define the population change from wars as follows:

$$Popchange = [Pop_{1880} - Pop_{1851} * \frac{Pop_{1851}}{Pop_{1820}}] / Pop_{1851} \quad (1)$$

where we assume a constant population growth rate during 1820-1851 and 1851-1880 without the wars. That is, we first calculate the potential population growth rate without wars as $\frac{Pop_{1851}}{Pop_{1820}}$. In the pre-industrial era, the population growth was relatively stable during 3 decades without wars. Therefore, if the population growth rate is the same between 1820-1851 and 1851-1880 without wars, we should have a hypothetic population in 1880 of $Pop_{1851} * \frac{Pop_{1851}}{Pop_{1820}}$. However, because of the wars, the actual population in 1880 deviates from the hypothetic population, and thus the gap between them can be attributed to the wars. This practice is similar to Chen and Zhou (2007), who measure the severity of the 1959-1961 famine using the excess mortality rate in famine years over normal years. To mitigate the impacts of outliers, we winsorize the population change at the largest and smallest 1 percentiles. Alternatively, we also consider the case simply using the population change between 1851 and 1880 as the scale of the wars, and the results are identical. We notice that migrating to safe areas do not pose an issue: since we want to measure of the scale of the wars, population increase from migration means this area was affected by the wars to a smaller extent. However, more than 95 percent of population changes in our sample are smaller than 0, most variation in the population change should result from casualties rather than migration.

The data on population are obtained from the China Population History edited by Ge (2005), a widely cited book in China's economic history papers, while the number of

counties in an ancient prefecture in 1820 is calculated based on the Comprehensive History of Administrative Divisions in China edited by Zhou (2013). Using the Arc-GIS software, we calculate the distance from a current county to the ancient postal route, another instrumental variable for current local government revenue, based on the shape file provided by Tuan-Hwee Sng. Sng plotted the ancient postal route according to the description in the Collected Statutes of the Qing Dynasty (Da Qing huidian, 2006, Yongzheng edition).

Most of the information on whether a current county is located in the range of a certain ancient prefecture can be approximately observed from CHGIS. The setting and boundaries of prefectures changed radically after the collapse of the Qing dynasty, and hence a current prefecture usually spans several ancient prefectures. Therefore, a distinct advantage in using data at the current county level is that we can link a current county to the ancient prefecture its area belongs to much easily, while it is difficult and arbitrary to link a current prefecture to a certain ancient prefecture. In practice, we also try to link a current county to the ancient prefecture its area belongs to using Zhou (2013), which provides ancient maps for every province with details about ancient prefectures and counties. When Zhou (2013) does not provide enough cues, we search the information on the Baidu Baike, an online dictionary like Wikipedia and usually contains details about the administrative changes for prefectures and counties. In occasional cases, a current county spans more than one ancient prefecture, then we select the ancient prefecture where the county government seat is located.

1.2.1 Full Sample

Table 1 reports the descriptive statistics of main variables for the full sample. The mean and median per capita county government revenue are 261 yuan and 182 yuan,

about 4 percent of the corresponding mean and median per capita GDP. These ratios are low, because the 1994 tax-sharing reform deprived of a large share of revenue accruing to local governments originally (Zhang and Zou, 1998; Zhang, 2006) and the land user fees had not yet become a significant part of local government revenue at that time. Public employees take up about 2 percent of the total population on average. There are about 14 percent of counties located in provincial capitals, both in the Qing dynasty and now; however, as we discuss later, the composition of counties in provincial capitals changed to some extent. On average, the mean population loss in 1851-1880 is about 25 percent of the 1851 population or around 100 million nationwide, reflecting the devastating impacts of the wars. Although the median population loss from wars is much smaller than the mean in magnitude, we remember the normal population change without wars should be well larger than 0. The mean number of counties per 10 thousand people in an ancient prefecture is 0.05, that is, one county has 200 thousand residents on average, coinciding with what was reported by Sng and Moriguchi (2014). The mean distance to the ancient postal route is 80 kilometers with a large standard deviation, which can potentially provide large variation in local government revenue.

The ratio of households having treated water, average educational attainment, and unemployment rate, are constructed from the 2000 population census. Although it is a wide complaint that China's GDP is misreported, the population census is of high quality and these variables are hence much more reliable than GDP. The poor quality of drinking water has been a serious threat to human health in the underdeveloped areas around the world for centuries. As of 2008, almost 900 million people still relied on unsafe drinking water (World Health Organization, 2011). The health benefits of treated water have been extensively studied, including Merrick (1985), Jalan and Ravallion (2003) Cutler and

Miller (2005); Kremer et al. (2011), Bennett (2012), Zhang and Xu (2016). On average, 46 percent of households have treated water and the standard deviation is large.

The average educational attainment is 7.5 years, slightly less than the complete primary and junior middle schooling (8 or 9 years), suggesting the success of this country in promoting junior middle schooling. The mean unemployment rate is 0.03, lower than those in western countries. However, at that time the country was still dominated by state-owned enterprises in urban areas and agriculture in rural areas, where the hidden unemployment was prevalent. As documented by many papers, such as Song et al. (2011), and Cheng (2015, 2016), state-owned enterprises may pursue policy objectives and not see the maximization of profits as the only major concern. Therefore, a low unemployment rate is not necessarily a signal of a good economy, and may reflect the dominance of state-owned enterprises and agriculture.

Although we find that a large size of bureaucracy is not as productive as government revenue, it may still perform a role in maintaining social stability, another important concern of the Chinese government. From a practical point of view, we can determine whether more local government employees reduce the incidence of protests. Recently, economists have become interested in learning the causes of protests (Jia, 2014a; Kung and Ma, 2014; Cao and Chen, 2016; Liu, 2016). We obtain the number of protests at the county level from the Global Data on Event, Location and Tone (GDELT) Project, and use the logarithm of 1 plus average protests per million people in 2000-2001 and the dummy variable for having protests as two dependent variables. These protests might target the government, but can also target firms such as polluting firms or employers that delay wage payment. The GDELT Project monitors the world's print, broadcast, and web news (Schintler1 and Kulkarni, 2014). It claims that ``through its ability to leverage the world's collective news media, GDELT moves beyond the focus of

the Western media towards a far more global perspective on what's happening and how the world is feeling about it." Therefore, it should be the best dataset available on the incidence of protests in this country. We find that on average 40 percent of these counties had protests 2000-2001, and the number of protests per million people was 5 with a noticeable skewness.

1.2.2 Non-district Counties

For almost all the non-district counties, we can obtain more measures of economic development from the China County Socioeconomic Statistical Yearbooks and Annual Surveys of Industrial Firms. Non-district counties are usually large and have a long history, and for this reason our historical variation can have stronger first-stage effects. We notice that more non-district counties transformed to county-level districts over time after 2000, and hence we remind readers that non-district counties in this paper refer to the status in 1999. These outcomes include the per capita number and the value of production of above-scale (annual sales revenue larger than 5 million yuan) manufacturing firms, the number of telephones per capita, per capita residents' deposits, per capita amount of loans, the share of middle school students in population aged 10 to 19, the share of primary school students in population aged 5 to 14, and the per capita hospital beds. We use the average of 2000 and 2001 for these outcomes except the share of middle school and primary school students (and deflate 2001 value into 2000 yuan for firm production, residents' deposits and loans). For the share of middle school and primary school students, we use the data in 2000 because only the 2000 population census contains the number of population in different age groups (in five years). This share can reflect the local educational achievements better than the normalization with the total population since we can mitigate the impacts of age composition. Furthermore,

we use the logarithm of these variables to account for their skewness except the shares of middle school and primary school students.

As shown in Table 2, because non-district counties are usually more distant from the prefecture core than county-level districts, the average per capita government revenue in non-district counties is 20 percent lower than county-level districts, and average per capita GDP is also 18 percent lower, though the per capita number of public employees is very similar to that of county-level districts.

1.2.3 Preliminary Check

As a preliminary check, in Figure 2 and 3, we present the scatter plots of the correlation between outcomes and logged per capita government revenue or logged per capita public employees for the full sample. The strong positive relationship between night lights scaled by population, ratio of households having treated water, average educational attainment and per capita government revenue is consistent with the regression results in Section 3. Interestingly, the relationship between the unemployment rate and per capita government revenue is also positive. Although in western countries a lower unemployment is usually associated with a higher GDP growth (Okun's law), China's economy was not very market-oriented around 2000, and a lower unemployment rate might reflect the dominance of state-owned enterprises and agriculture. With a larger share of private firms, worker's mobility is stronger.

Figure 3 shows a very weak relationship between night lights scaled by population and per capita public employees and a negative relationship between other outcomes and per capita public employees. These graphs suggest that more public employees are not as productive as government revenue. This is reasonable. Although a higher amount of government revenue usually can bring more public goods, more public

employees cannot necessarily perform the same role. However, we realize a possibility that a county with a large share of public employees might not accommodate a large number of population because of worse geographic or climatic conditions, which also has a negative impact on economic development. This means that the simple correlation might present a stronger negative relationship than the conditional one.

Box plots in Figure 4 show the differences in outcomes between counties in non-provincial capitals and provincial capitals. Consistent with the general impression, counties in provincial capitals have a higher level of economic development. Different from the U.S., a provincial capital in China usually controls more resources than other prefectures in the corresponding province, and it is not surprising that counties in a provincial capital are more developed. Provincial capitals are usually along the Yangtze River and Yellow River (the two major rivers in China) or are coastal areas, which should give them an economic advantage. However, a provincial capital is usually located in the central part of the province, which make it convenient to control the whole province but the place is not necessary associated with best natural conditions. Therefore, it is too early to assert a positive impact of being in a provincial capital on economic development before accounting for such confounding factors.

1.3 Local Government Revenue

1.3.1 OLS Results

This section analyzes the impacts of county government revenue on various outcomes. In linear regressions, we will estimate the following equation:

$$y_{is} = \beta_1 + \beta_2 Statecap_{is} + \beta_3 X_{is} + \lambda_s + \varepsilon_{is} \quad (2)$$

In this equation, i indicates the county i in province s. The variable y represents the outcomes such as the logarithm of night lights scaled by population, share of households having treated water, average educational attainment and unemployment rate in 2000 for the full sample and many other outcomes for non-district counties. *Statecap*, the variable of major interest, is the logarithm of average per capita government revenue in 1999-2000 (after translating 1999 revenue in 2000 yuan using the CPI deflators). X is a rich set of county characteristics. λ_s are province fixed effects.

X include two set of covariates. The first set of covariates are measured at the current county level, including the logged area of a county, an indicator whether the county is located in a coastal prefecture, an indicator whether the county is located in a provincial capital, latitude, and longitude terms[4] (we call them ``Covariate set 1"). We notice that counties in coastal areas and provincial capitals are usually more developed. Most counties located in the current provincial capitals are also located in ancient provincial capitals, and hence we treat the indicator whether the county is located in a provincial capital as exogenous. In Section 5 we relax this assumption and consider the impacts of being located in a provincial capital. Latitude and longitude can capture the remaining spatial correlations not fully accounted for by province fixed effects (Bai and Kung, 2015). For example, latitude can affect crop adoption by virtue of its association with climate (Gallup, Mellinger, and Sachs 1998; Sachs 2001). Since China is affected by the monsoon characteristics of northeast Asia (Zhang and Lin 1992) and in the summer the monsoon blows from southeast to northwest but reverses in the winter, it is necessary to also control longitude.

[4] We do not add squared terms because of the collinearity.

The second set of covariates are measured at the ancient prefecture (the current county is located in) level (Bai and Jia, 2016), including an indicator whether there is a main river, logged river length, the incidence of drought/flood in 1800-1899, average transportation condition, logged population in 1820, three types of crop (foxmillet, rice and sweet potato) suitability (Jia, 2014a), language fragmentation index, the number of presented scholars (Jinshi), an indicator for treaty ports (we call them ``Covariate set 2''). These covariates can account for the impacts of other factors affecting the outcomes directly. For example, fragmentation indices can proxy differences in racial and ethnic groups in a certain place, which potentially have a negative impact on economic development (Alesina and Ferrara, 2005). China Proper is dominated by ethnic Han, and hence language fragmentation can reflect more group differences than the usual racial and ethnic fragmentations. Culture might have a causal effect on economic development, such as Tabellini's (2010) findings using European regions, and Jiang and Kung (2015), Chen, Kung and Ma (2016)'s analysis on China. Similar to other papers (Bai and Jia, 2016; Chen, Kung and Ma, 2016; Yan, 2016), here we use the number of presented scholars as a proxy for culture. Jia (2014b) finds that being a treaty port during 1841-1943 promotes long-run economic development even if the treaty ports were abolished for half a century.

Table 3 reports the OLS results of the impact on night lights scaled by population. With 100 percent higher per capita government revenue, the night lights scaled by population are 60 percent higher. In other words, counties with per capita government revenue at the 75 percentile have 50 percent more night lights than counties at the 25 percentile (the gap of logged per capita government revenue of the two percentiles is 0.86). This impact is highly significant and robust with different sets of covariates and fixed effects.

1.3.2 Population Change from Wars as an IV

The reverse causality may exist here, for example, a county with better economic performance can provide more revenue to the local government. Specifically, a strong economy can usually bring more value-add tax, personal and corporate income taxes. In addition, a strong economy also pushes up housing price, and in turn boosts land use fees. Moreover, the geographic and climate conditions may be not fully controlled, which can bias up or down the estimates. For example, many cities were built in strategically important places with inconvenient transportation conditions. To deal with the endogeneity issues concerning with government revenue, I use the percentage of population change in 1851-1880 mainly due to three concurrent wars (Taiping Rebellion, Nian Rebellion and Dungan Revolt), defined in Equation (1), as the instrumental variable. These wars enhanced the local governments' ability of tax collection in affected areas permanently but should have few direct impacts on current economic development after controlling a rich set of covariates. Thus, I will estimate a first stage in the following:

$$Statecap_{is} = \delta_1 + \delta_2 HIS_{is} + \delta_3 X_{is} + \lambda_s + e_{is}, \quad (3)$$

where *Statecap* is the logarithm of average per capita government revenue in 1999-2000, and *HIS* is the percentage of population change in 1851-1880 mainly due to the three concurrent wars.

Compared with most European countries and Japan at the same time, Qing China had collected lower tax revenue. Land taxation was the most important source of government revenue in Qing China before 1850. Every land-holding household was obligated to pay the land tax, the amount of which was determined based on the size and quality of the land the family held (Chu, 1962). Although the government also imposed head tax, starting from 1712, the government decided not to collect additional tax

revenue from the extra number of population. According to Sng and Moriguchi (2014), Chinese state's annual revenue on the eve of the Opium War (1839-1842) was equivalent to 2 % of its national income at the maximum, while the comparable number for the Tokugawa shogunate was more than 15 %, even if the two countries had similar economy and cultural tradition. A peaceful environment and the Confucian ideology of ``benevolent rule" (Elliott, 2009; Rowe, 2009) can explain the difference between China and European countries partially. On the other hand, Sng and Moriguchi (2014) argue that severer agency problems in a bigger country like China explain why the Qing government tried to keep taxes low and government small compared to Japan. Agency problems increase with the geographical size of a domain. In a large domain, the ruler's inability to closely monitor bureaucrats creates opportunities for the bureaucrats to exploit taxpayers. To prevent overexploitation, the ruler has to keep taxes low and government small.

The Taiping Rebellion (1851-1872) was the largest war in China since the Qing conquest in 1644, and perhaps the largest civil war in world history (Ho, 1959). The estimates of war deaths range from 20 to 70 million, as well as millions more displaced. The major affected areas by this rebellion was the southern part of this country, including Jiangsu, Zhejiang, Anhui, Jiangxi, Hubei and Hunan, the most populous and developed provinces, as shown in the southeastern part of Figure 5. The Nian Rebellion was an armed uprising that took place in northern China from 1851 to 1868 influenced by the Taiping Rebellion with about 0.1 million deaths. Qing government usually called them together as ``Fa (Taiping) and Nian". The Dungan Revolt (1862-1877) was a uprising by members of the Muslim Hui and other Muslim ethnic groups in China's Shaanxi, Gansu and Yunnan provinces, as well as in Xinjiang. When the Qing government sent army in these provinces to help repress the Taiping rebels, Muslims realized such an opportunity

for their own agenda. A recorded 20.77 million people died in Shaanxi and Gansu (Yunnan was also affected by the Muslim rebellion), as shown in the northwestern part and southwestern parts of Figure 5, due to massacres or deaths in battle, as well as the disruption of farming and supply lines during the war. The total deaths was therefore close to 100 million and hence three times of the deaths during the Sino-Japanese War (1937-1945) as part of the World War II. Although not every death can be attributed to the wars, we do not realize any other reason can explain such a scale of deaths, and the varying scales of deaths across areas.

Since the most influential and earliest rebellion is the Taiping Rebellion, we provide more background about it based on Luo (2013) and Jiang (2012). From this background we can see the plausible exogeneity of the rebellion and the large variation across areas it provides. This rebellion was initiated by Xiuquan Hong, born in Guangdong province in 1814. After the defeat of Qing China by the British Navy, Hong Kong became a colony of the British and Christianity began to influence the neighboring Guangdong province heavily. In 1847 Hong studied with the American Southern Baptist missionary, Reverend Issachar Jacox Roberts, for two months in Guangzhou, during which time he gained most of his knowledge of Christianity (De Bary and Lufrano, 2000). After then, he established a distorted version of Christianity, and by 1850 he had between 10,000 and 30,000 followers in Guangxi province, a neighboring province of Guangdong. Most of these followers were Hakka (a branch of ethnic Han), a group reaching the southern China relatively late, and the conflicts between them and the earlier arriving groups were an important reason for the uprising because the local governments in Guangxi province usually stood with the earlier arriving groups (the group conflicts were not important beyond the origin of the uprising). In January 1851, Hong declared the founding of the ``Heavenly Kingdom of Transcendent Peace (Taiping Tianguo)'' and

initiated the rebellion in Guangxi. In March 1853, Hong's forces managed to take Nanjing, the most strategically important city in the southern China, and made it as the capital of their movement till 1864. During this period, his forces were once sent to as north as Hebei province (close to Beijing) and as west as Tibet. The Qing government did not have enough soldiers and funds to repress Taiping rebels, and hence encouraged the gentry class to organize army and collect a form of transit/commercial tax (Lijin) to finance the battles. In a place with more battles and more deaths, generals needed greater tax capacity to replenish their injured and dead soldiers, and hence more Lijin collected. On the other hand, because of Hong's anti-Confusion ideology and practice, most members of the gentry class supported the Qing government. In 1864, Nanjing was captured by the local forces organized by the gentry class. In 1872, the last Taiping rebels were cleared.

We emphasize there existed large variation including within-province variation in the scales of the wars. Although the Taiping Rebellion influenced most parts of the country, it never captured a whole province. In addition, these three rebellions were repressed by local armed forces rather than the national armed forces, and the funds for military expenditure were collected locally. For these reasons, there was large variation in fiscal capacity across the country induced. Although the Sino-Japanese War (1937-1945) and Civil War between the Nationalist Party and Communist Party (1946-1950) were also large-scale wars, there was not a comparable change in local variation in fiscal capacity since the central government commanded army forces and mobilized the resources across the country (and obtained international aids).

Starting in two thousand years ago, China's government encouraged agriculture and discouraged commercial and industrial activities. The newly introduced commercial tax stood for an important transformation in China's tax system. Beginning in Yangzhou

prefecture of Jiangsu province in 1853, Lijin was soon collected by local governments in most provinces (Luo, 1936; Luo, 2013). The nationwide Lijin revenue was 1170 silver taels, about 11 percent of the total government revenue (105 million). This number increased to 4318 silver taels in 1911, about 14 percent of the total government revenue (302 million). Since Lijin accrued to local governments, the share of Lijin revenue in local government revenue should be much higher. Lijin was canceled in 1931, but the Nationalist government and the Communist government introduced new commercial taxes in 1931 and 1950 respectively. The persistence of the government revenue size can be explained in at least two ways. Firstly, since these new governments claimed themselves as ``liberators'', it was hard for them to cut spending on public service and hence the tax revenue, as widely documented in the political science literature. Second, in a nondemocratic regime, there are few restrictions on the expansion of the government, and the existing tax collection capacity is effective in supporting such expansion. Overtime, Commercial tax becomes very important now, whereas land tax, the major tax in ancient China, becomes trivial. Therefore, these wars enhanced the local governments' ability of tax collection in affected areas permanently but should have few direct impacts on current economic development after controlling a rich set of covariates.

1.3.3 A Quantitative Test of Lijin and the Wars

Although data on nationwide Lijin collected at the ancient prefecture level are not available, we can obtain the ancient prefecture-level Lijin collected in Zhejiang province in the Late Qing period from Luo (1936). Zhejiang is one of the most developed provinces in China, and more importantly, its northern and western parts were influenced by the wars heavily, while the rest were intact. We normalize the Lijin revenue by the

population in 1880 and take logarithm, and then regress it on the population change from the wars.

We find that with one more percentage point change in population, per capita Lijin revenue increases by 3 percent. This is significant under the 1 percent level, and the R-squared is above 0.4. This result confirms our explanation of the relationship between the wars and Lijin.

1.3.4 2SLS Results: Full Sample

Using the population change as a proxy for the strength of the wars, we find a strong impact of the wars on current government revenue as shown in the lower part of Table 4. With one more percentage point change in population, per capita government revenue increases by 0.5 percent. Both Cragg-Donald Wald F statistic and Kleibergen-Paap Wald rk F statistic are well larger than 16.38, the Stock-Yogo weak identification test (Stock and Yogo, 2005) critical value for 10 % maximal IV size (1 endogenous variable and 1 instrumental variable), and well larger than 10 suggested by the rule of thumb, thus we can reject the weak IV hypothesis firmly. With a larger scale of wars and more deaths, generals needed greater tax capacity to replenish their injured and dead soldiers, will be important. This verifies North and Weingast (1989)'s and Dincecco et al. (2011)'s theoretical predictions.

The 2SLS results of the impact on night lights scaled by population, as we can see in Table 4, are twice the magnitude of the OLS results. These suggest that many currently prosperous counties were not located with great geographic and climate conditions, and strong fiscal capacity can alleviate the disadvantages. This is not very surprising since many important cities, such as Beijing, Nanjing and Luoyang, were built mainly due to their strategic positions even if natural conditions were not more favorable than

neighboring places. With 100 percent higher per capita government revenue, the night lights scaled by population are 120 percent higher. In other words, counties with per capita government revenue at the 75 percentile have 100 percent more night lights than counties at the 25 percentile. This impact is significant and robust with different sets of covariates. The weak-IV-robust Anderson-Rubin Wald test also shows a significantly positive impact of per capita government revenue. We prefer the regression results with province fixed effects. In their paper about Colombia, Acemoglu et al. (2015) just present the results with department (province) fixed effects. In a much larger and more diverse country like China, the differences across provinces might affect both historical and current local government revenue in ways that cannot be fully controlled, and hence the exclusion constraint might be violated without province fixed effects. For example, we try a simple linear regression with logged night lights scaled by population on province fixed effects, and find a significantly negative impact of Hebei province dummy. However, after adding log per capita government revenue, its sign turns opposite and significant. This fact implies that it is necessary to control province fixed effects.

Table 5 reports the impacts on the ratio of households having treated water, average educational attainment and unemployment rate in 2000. With one hundred percent higher per capita government revenue, the probability having treated water is 30 percentage points higher, and the average educational attainment is 1 year longer. In other words, counties with per capita government revenue at the 75 percentile are 25 percentage points more likely to have treated water, and have 0.9 year longer average educational attainment than counties at the 25 percentile. The effects are very precisely estimated. These extra outcomes are constructed from the 2000 population census, which is generally regarded as having high quality. Interestingly, there is not an effect on the unemployment rate, which perhaps reflects the impacts of the two counteracting factors.

As explained before, a strong economy can boost employment, however, in a transitional economy like China, a lower unemployment could also reflect the dominance of state-owned enterprises and agriculture and hence an underdeveloped labor market.

1.3.5 2SLS Results: Non-district Counties

Table 6 reports more outcomes for the sample of non-district counties. These outcomes include the per capita number and the value of production of above-scale (annual sales revenue larger than 5 million yuan) manufacturing firms, per capita number of telephones, per capita residents' deposits, per capita amount of loans, the share of middle school students in population aged 10 to 19, the share of primary school students in population aged 5 to 14, and the per capita hospital beds. We use the logarithm of these dependent variables except the shares of middle school and primary school students to account for their skewness. Compared with GDP, these outcomes should have experienced a less amount of manipulation, partially because they are less aggregated than GDP. We find significantly positive impacts of per capita government revenue on all the outcomes except the share of primary school students. In China, primary schooling is almost universal, and hence a further increase in local government revenue should have a very limited impact. Overall, these results suggest strong positive impacts of local government revenue on economic development. Furthermore, we notice that the first-stage effect for these non-district counties is stronger than that for the full sample. As explained earlier, non-district counties usually have a long history and hence our historical variation can have a stronger first-stage effect on them, while the majority of county-level districts were established after 1931.

Similar to the U.S., China's county governments undertake the task in building local infrastructure and providing education and health care service. For example,

extensive media coverage and scholars' reports focus on the difficulties of poor counties in providing public goods after the 1994 tax sharing reform. This reform deprived of a large share of taxation power from local governments. On the other hand, counties in good standing in taxation can provide more high-quality public service. Unlike corruption, taxation is rarely a pure rent-seeking activity. For example, Sng and Moriguchi (2014) provide extensive evidence that the higher government revenue in ancient Japan explains why it could provide more public service and prepare Japan better for the transition from stagnation to growth. Devarajan, Xie and Zou (1998) show that if the government subsidizes private providers of public capital, economic growth and welfare are higher than under laissez-faire. Taxation is costly, and hence if the value of public goods provided by the government cannot offset the costs in collecting taxes, we may see a negative impact of government revenue. Therefore, our results clearly show that the value of public goods such as education, health care, treated water and others provided by the government is high.

1.3.6 Robustness Check

For the validity of our instrumental variable, population change from wars should not related to pre-war economic development. Although in our main regressions we already control logged population size in 1820, which could have a relationship with pre-war economic development. In this part, we conduct two tests on this problem. Firstly, we do a placebo test by constructing population change using prefecture-level population data in 1776, 1820, 1851, 1880. For example, the population change from 1776 to 1820 is defined as population in 1820 minus population in 1776 divided by population in 1776. If the population change from 1851 to 1880 reflects the economic development before the wars, then it is reasonable to think the population change from 1776 to 1820 and

population change from 1820 to 1851 also reflect such pre-war economic development, and consequently we should document similar strong first-stage effects when using the first two population changes. However, using the three population changes in the first-stage regression (3) with a full set of covariates and province fixed effects, we find that estimates of the population change from 1776 to 1820 (from 1820 to 1851) on the logged per capita government revenue is -0.03 (-0.26) with p-values of 0.15 and 0.43, whereas the estimates for the population change from 1851 to 1880 is -0.5 with p-value of 0.00.

Second, As explained by Acemoglu et al. (2002), Nunn and Qian (2011) and others, urbanization level is a good indicator of ancient economic development. Therefore, we use Rozman's (1974) four-part classification of Chinese urbanization level for ancient prefectures in the Qing dynasty: largest (population of 300,000 and above), mid-level (population between 70,000 and 300,000), small (population between 30,000 and 70,000), and smallest (population below 30,000), similar to Bai and Jia (2016). We regress population change from wars on the dummy variables for a largest city and a smallest city and the full set of covariates, and cannot find an impact of either dummy variable under the 10 percent significance level, and the p-value of the joint test is 0.18. This suggests that population change from wars is unrelated to ancient economic development. However, in the 2SLS regressions with the share of urban population or (other outcomes related to economic development in the following tables) as dependent variables, we find significant impacts of government revenue under the 1 percent level. Moreover, we classify current counties (though not for prefectures because the total population and urban population in prefectures are much higher than those in ancient prefectures on average) into four categories with the same cutoffs, we find that more government revenue significantly decreases the chance of being a smallest city under the

5 percent level, and increases the chance of being a largest city with a p-value close to 0.1[5].

There are two questions related to the other channels. First, a higher tax level might reduce the opportunity cost of becoming a rebel, which means that the wars could be the result of taxation. North and Weingast (1989) describe how the increased tax level led to a coalition formed against the English Crown in 17th century. However, as explained earlier, Qing China had collected lower tax revenue before these wars, and the major cause of the wars were the influence of Christianity and the conflicts between groups. Second, population losses might increase marginal productivity and wage level (North and Thomas, 1976). This argument might be effective for manufacture and agriculture, but is less plausible for commercial activities which the newly introduced tax (Lijin) was targeting. In particular, population losses could lead to a decline in commercial activities, and hence the impacts of government revenue are likely underestimated in our study.

To enhance our argument that the wars in 1851-1880 transformed the tax system from a mainly land tax based system to a system in which commercial and industrial taxes are important, we gather ancient prefecture-level land tax revenue in 1820 from Liang (1981). This land tax revenue could reflect the ``natural'' tax level.

We find a strong relationship between logged land tax revenue per capita and current per capita government revenue, significantly under the 5 percent level, in an unconditional regression. However, after conditioning on other covariates and province fixed effects, the relationship disappears completely. This fact implies that the land tax

[5] In this regression we include the logarithm of the number of current population besides other covariates, since in the regression of population change from wars on the dummy variables for a largest city and a smallest city we also include logged ancient population.

revenue reflected the impacts of these covariates. And after the wars, the land tax was no longer very important and hence left few impacts on current government revenue.

We notice that beyond local government revenue, there were limited changes in other dimensions of local governments in Qing dynasty, especially those in the same province. Although provincial governors gained more power relative to the central government, local governments are too small to gain additional power. Moreover, there was almost no change in the structure of prefecture and county governments after the wars. We also notice that the size of bureaucracy was not affected by the wars too much. Using logged per capita public employees as an additional covariate does not affect the impacts on any outcome. This means that the effects of population change resulting from these wars mainly enter the current government revenue rather than the number of current public employees.

In addition, although the taxation power was decentralized very much during and after the wars, the power of appointing local government leaders was still controlled by the central government. For example, provincial governors usually could stay in a province for less than 5 years (Li, 2012, 2015).

1.4 Local Public Employees: Number of Ancient Counties as an IV

1.4.1 OLS results

In this section, we estimate the impacts of the size of bureaucracy, another dimension of state capacity. For this purpose, we replace *Statecap*, the variable of major interest, with the logarithm of average per capita public employees in 1999-2000 in Equation (2). Table 7 shows the OLS results of the impact on per capita GDP. In the regressions with different sets of covariates and province fixed effects, we cannot find

any significant effect of per capita public employees. This result coincides with the simple correlation shown in Figure 3. Since we use log-log regressions in the two sections, the magnitudes can be compared in a consistent way.

1.4.2 Number of Ancient Counties as an IV

The reverse causality may exist here as well. For example, a county with better economic performance can afford a larger number of public employees. Not surprisingly, people tend to attain a position in a more developed area or a place with better economic potential, as suggested by the tremendous differential in the numbers of testers in civil service examinations across different parts of contemporary China. This issue tends to inflate the real impact of the size of bureaucracy on the economic development. On the flipside, we realize a possibility that a county with a large share of public employees might not accommodate a large number of population because of worse geographic or climatic conditions, which have a negative impact on economic development.

To solve this issue, an ideal instrumental variable is the number of ancient public employees. However, these data are not available. In the Ming and Qing dynasties, only the county magistrate and a very limited number of formal employees were paid by the government, whereas the majority of public employees were employed and paid by the county magistrate, and hence there was not official statistics on the actual number of public employees (Chu, 1962). In 1800, there were only around 20,000 ranked officials governing a population that might have exceeded 300 million, or a ratio of one official per 15,000 people (Sng, 2014), which underestimates the real size of bureaucracy to a large amount. As Needham and Huang (1974) put it, ``Chinese bureaucratic government always appeared impressive in breadth while remaining shallow in depth." Moreover, we do not know the number of ranked officials at the ancient prefecture level.

For this reason, following the similar practice of Sng (2014), we use the logged number of ancient counties in an ancient prefecture scaled by population in 1820 as an instrumental variable. Counties in the Qing dynasty are comparable in size, with a population ranging from 100 thousand to 300 thousand (Sng and Moriguchi, 2014). Sng (2014) finds that the number of ancient counties in an ancient prefecture declines with the distance from Beijing, the national capital, and this cannot be fully explained by the spatial distribution of the population. His explanation is that the weakening monitoring in a longer distance induced the emperor to downsize the government there. In our paper, we implicitly control the distance to Beijing through the inclusion of latitude and longitude. After controlling these, the number of counties still maintains a large explanatory power as we see later. Sng (2014)'s use of the number of counties as a measure of the size of bureaucracy and his explanations are also in line with G. William Skinner's observation that there were more counties in China during periods of disunity than during periods of unification. In the sixth century when China was divided into three empires, the three administrations of Northern Zhou,

Northern Qi, and Chen together governed approximately 2300 counties. Less than half a century later, when Sui, an offshoot of Northern Zhou, reunified China, the number of counties, now under a single central authority, shrunk to 1255 (Skinner, 1977, 21). Furthermore, we notice that the setting and boundaries of prefectures changed radically from the Qing dynasty till now, and hence there should be very limited direct impacts of county density at ancient prefectures on current outcomes.

Moreover, our use of the number of ancient county density gains support from Chu (1962), a famous book discussing the local governments in the Qing dynasty. He notices a county government in the Qing dynasty was the dictatorship by the magistrate. To carry out taxation, justice and other aspects of administration, he usually employed

clerks, runners, personal servants, private secretaries and etc. Though under different titles, these employees usually involved the functions nominally belonging to others, which facilitated the control by the magistrate. The result is that the government size tended to inflate to a comparable size across counties, even if a county was relatively smaller. Indeed, the fixed cost in establishing a county government and setting up its main structure is large compared with the marginal cost in employing an extra employee, and hence a relatively small county still has an incentive to maintain a large number of public employees.

Consider a numerical example. At the beginning, there are two types of employees under titles A and B in county X, with one employee under each title. To monitor the title A employee, the county magistrate employs another title B employee; and to monitor the original title B employee, the county magistrate employs another title A employee. In this way, the total number of employees increases to 4. Now consider county Y, with two employees under each title at the beginning. Suppose the similar expansion mechanism works, then the number of employees increases to 6. Therefore, the ratio of public employees for these two counties increases from 1/2 to 2/3. When the government size is large, the numbers of public employees in different counties tend to converge to a similar value. For this reason, an ancient prefecture with a large number of ancient counties tended to have more public employees. Moreover, the number of counties in a prefecture was very stable and does not change with population growth, even after the three horrifying wars mentioned above.

Figure 6 plots the number of counties per 10 thousand people in the 19th century. We notice that prefectures close to Beijing (the Northern part) had a higher county density indeed, as found by Sng (2014). Many western prefectures also had a relatively higher county density, partly resulting from a relatively lower population density, which

suggests the need for controlling the ancient population size and province fixed effects as we do.

1.4.3 2SLS Results: Full Sample

Similar to the OLS results, we find a weaker and unstable impact of local public employees on night lights as shown in Table 8. In the regression with a full set of covariates, the p-value is just about 0.5, and hence the estimate is much noisier than the regression results for government revenue. The ancient county density is indeed highly positively correlated with per capita current public employees. With a full set of covariates, the Cragg-Donald Wald F statistic is larger than 16.38, the Stock-Yogo weak identification test critical value for 10 % maximal IV size (1 endogenous variable and 1 instrumental variable), and the Kleibergen-Paap Wald rk F statistic is close to 8.96, the test critical value for 15 % maximal IV size, and is also close to 10 suggested by the rule of thumb. We also notice the R-squared in the first-stages are large either including covariates or not, suggesting the validity of the instrument (Cameron and Trivedi, 2005). Moreover, we notice that the weak-IV robust Anderson-Rubin Wald test gives the similar results, and hence mitigates the concern about a weak IV.

To gain more insights on the real impacts of the size of bureaucracy, in the first three columns of Table 9 we report the impacts on the ratio of households having treated water, average educational attainment and unemployment rate in 2000. In stark contrast with the results for public revenue, we cannot find any impact of per capita public employees on these economic indicators. The weak-IV robust Anderson-Rubin Wald test confirms this fact with large p-values.

Although we find that a large size of bureaucracy is not as productive as government revenue, it may still perform a role in maintaining social stability, another

important concern of the Chinese government. For example, more local government employees might reduce the incidence of protests. We use two dependent variables constructed from the GDELT Project: the logarithm of 1 plus average per million people protests in 2000-2001, and an indicator variable for having protests in 2000-2001. As reported in columns (4) and (5) of Table 9, we do not find an impact of per capita public employees on the incidence of protests. It seems that more public employees just eat more public funds, and the governments cannot constrain their tendency to expand (Downs, 1993).

1.4.4 2SLS Results: Non-district Counties

In Table 10, we further explore more outcomes for the sample of non-district counties as in Table 8. These outcomes include the per capita number and the value of production of above-scale (annual sales revenue larger than 5 million yuan) manufacturing firms, per capita number of telephones, per capita residents' deposits, per capita amount of loans, the share of middle school students in population aged 10 to 19, the share of primary school students in population aged 5 to 14, and the per capita hospital beds. Compared with GDP, these outcomes are measured more accurately. We use the logarithm of these variables (after scaled by population) except the shares of middle school and primary school students to account for their skewness. In contrast with the results in Table 6 for government revenue, the impacts of per capita public employees are much smaller and noisier. The weak-IV robust Anderson-Rubin Wald test gives the similar results.

Interestingly, we observe a significant increase in the number of hospital beds per capita. Of course, one possibility is that a large size of bureaucracy might be effective in providing better health care service. In China, most high-quality hospitals are public, and

hence the public employees might promote the development of a better health care system. On the other hand, till recently, the medical service payment for public employees is managed under a separate system from that for other citizens. Public employees do not need to pay medical insurance and usually can enjoy higher quality service, which encourages wasteful use of medical resources by them. Therefore, it is not clear whether the increase in the number of hospital beds represents the real improvement in general welfare.

Together, the impacts of local government employees are much limited for almost all the outcomes. This finding is very different from what found by Acemoglu et al. (2015) for Colombia. Because of long-term military conflicts, it is important to have a sufficient number of government employees to maintain social order. Moreover, military conflicts make it more dangerous to become a government employee and tend to restrict the size of bureaucracy and the productivity of the limited government employees should be relatively high (Downs, 1993). On the other hand, China does not experience large-scale wars during the last 60 years. Wide evidence shows that it is attractive to become a public employee and the size of China's bureaucracy experiences stable expansion. Although taxation is rarely a pure rent-seeking activity, the extra public employees may not provide more public goods and may be associated with more rent-seeking activities. Therefore, the existence of overstaffing in the public sector can reduce the productivity of public employees.

1.4.5 Robustness Check

For the validity of our instrumental variable, logged ancient county density should not related to ancient economic development. To test this, we regress logged ancient county density on the dummy variables for a largest city and a smallest city and the full

set of covariates, and cannot find an impact of either dummy variable under the 10 percent significance level, and the p-value of the joint test is 0.12. This suggests that logged ancient county density is unrelated to ancient economic development.

1.5 Local Government Employees: Distance to Ancient Postal Route as an IV

1.5.1 2SLS Results: Full Sample

In this section, we consider an alternative instrumental variable for local government employees: the distance from a current county to the ancient postal route. This is similar to Acemoglu et al. (2015)'s use of the distance to the royal roads in Colombia. We find that the distance is highly correlated with current government employees, but not local government revenue. This is in line with the fact that closer to the postal route, the more control by the government in the Qing dynasty. Since these roads were no longer used, they had limited direct impacts on current outcomes. The distance to the ancient postal route is calculated using the shape file provided by Tuan-Hwee Sng in the Arc-GIS software. Sng plotted the route according to the description in the Collected Statutes of the Qing Dynasty (Da Qing huidian, 2006, Yongzheng edition). Therefore, the postal route refers to the mid-18th century, though there were few changes in the route during the Qing dynasty (1644-1911).

Figure 6 shows the map of the ancient postal route (green lines). The most salient feature of these roads is that they were designed to connect Beijing and provincial capitals, which facilitated the central government's control over the country. In addition to achieving this purpose, they generally choose the most cost-saving route. Therefore, after controlling the indicator for being located in a provincial capital and other

covariates in our regressions, the distance to the ancient postal route is plausibly exogenous, as noticed by Banerjee, Duflo and Qian (2012).

We present the results for the full sample in Table 11. With 100 percent higher per capita government revenue, the night lights scaled by population are 270 percent lower, and the average educational attainment is 3.4 years shorter. These estimates are economically large and statistically significant. The weak-IV-robust Anderson-Rubin Wald test also reports the similar results. The results using the distance to the ancient postal route is particularly intriguing since the route is directly comparable with Acemoglu et al. (2015)'s ancient royal roads in Colombia. The Cragg-Donald Wald F statistic is close to 16.38, the Stock-Yogo weak identification test critical value for 10 % maximal IV size (1 endogenous variable and 1 instrumental variable), and the Kleibergen-Paap Wald rk F statistic is close to or larger than 8.96, the test critical value for 15 % maximal IV size, and hence mitigates the concern about a weak IV.

1.5.2 2SLS Results: Non-district Counties

Table 12 reports the results for non-district counties. We find that the size of bureaucracy has negative impacts on all these outcomes, though not always significant. These results are in line with those obtained using ancient county density as an instrumental variable. Overall, both types of treatment effects identified for different ``complier'' groups indicate negative impacts of the size of bureaucracy on economic development.

Furthermore, in regressions using both instrumental variables together, we obtain very similar estimates of the impacts of government revenue, and the overidentifying test cannot reject the validity of these instrumental variables.

1.6 Being in a Provincial Capital

In this section, we explore whether being in a provincial capital promotes economic development (Kung and Ma, 2014). Box plots in Figure 4 show that counties in provincial capitals have a similar level of night lights as other counties, but a higher ratio of households having treated water and a higher average educational attainment. A provincial capital is usually located in the central part of the province, which make it convenient to control the whole province but the place is not necessary associated with best natural conditions. On the other hand, provincial capitals are usually along the Yangtze River and Yellow River (the two major rivers in China) or are coastal areas, which should give them an economic advantage. In this section we relax the assumption of exogeneity of being in a provincial capital and use the indicator of being in a provincial capital in ancient times as the instrumental variable.

Although most of counties maintain the same status in ancient times and now, we notice some counties changed their status. Notably, the prefectures that serve as a provincial capital in Anhui, Henan, Guangxi, and Hebei changed; moreover, though the prefectures that serve as a provincial capital in other provinces are the same, their boundaries might have changed, and hence there were still some counties in these provinces changing their status. In this section, we exclude counties in the four province-level municipalities directly under the central government - Beijing, Shanghai, Tianjin and Chongqing, because being located in a provincial capital is not meaningful for these counties.

As shown in Table 13, we find that counties located in a provincial capital do not have a higher level of night lights. The average educational attainment is 0.6 years higher and significant under 10 percent level. We also find a higher unemployment rate in counties located in a provincial capital. Both Cragg-Donald Wald F statistic and

Kleibergen-Paap Wald rk F statistic are well larger than 16.38, the Stock-Yogo weak identification test critical value for 10 % maximal IV size (1 endogenous variable and 1 instrumental variable), and well larger than 10 suggested by the rule of thumb. It seems that being in a provincial capital is only barely beneficial for economic development.

When looking at more measures of economic development in Table 14, we generally find that counties located in a provincial capital achieved worse performance, though they are statistically insignificant. These results imply that the apparent advantage for these counties could result from better geographic or climate conditions to a large extent, rather than stronger state capacity.

1.7 Conclusion

Although China's experience in the last three decades is an important part of the ``East Asian Miracle", there is not a paper discussing the association between its state capacity and economic development using possibly exogenous variation. In this paper we offer a comprehensive study on the causal effects of state capacity in explaining China's economic development, using rich historical variation and various outcomes in economic performance, education, health care, finance, and social unrest. Our estimates indicate that a state's capacity to extract greater revenues has significantly positive impacts on economic development. However, a large size of bureaucracy performs a much weaker and even negative role, and it cannot reduce the incidence of protests. Furthermore, the counties located in a provincial capital do not have better outcomes. The consistent results based on various datasets support the robustness of our conclusions.

To the best of our knowledge, China is the only developing country that we can obtain such extensive county-level variables (Henderson et al., 2012), and hence we can

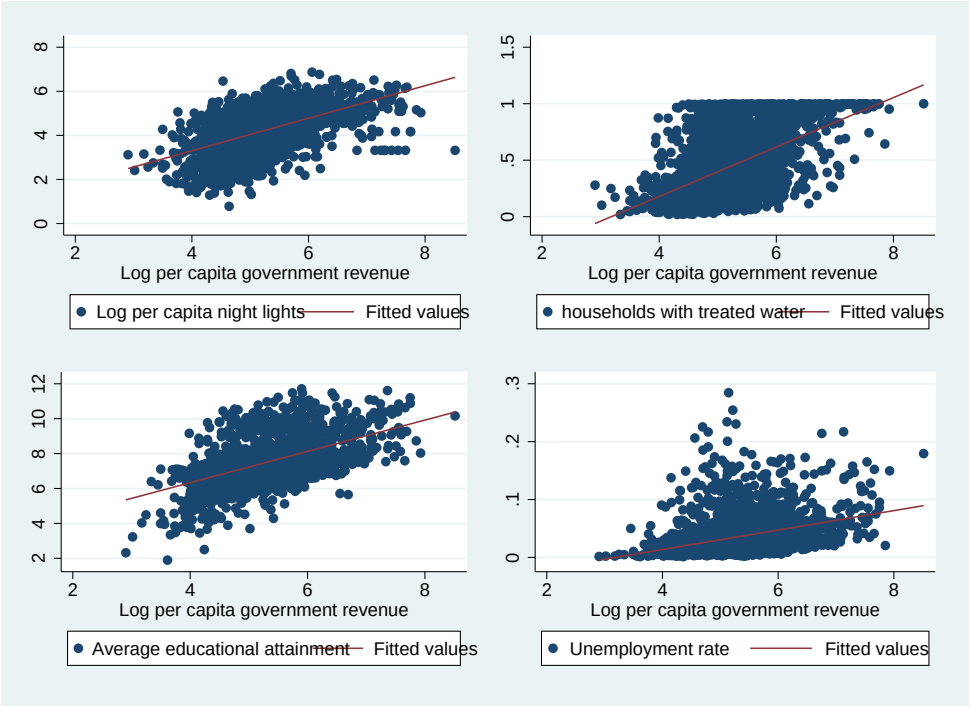
make use of rich variations in state capacity and outcomes across the country. Since the existing literature usually focuses on one dimension of state capacity or a limited number of outcomes, our study can be also valuable in understanding the role of state capacity in other countries. Moreover, further research could verify whether there is a relationship between conflicts and the role of the size of bureaucracy using data from more countries.

1.8.1 Figures

Figure 1.1: Sample Selection: China Proper

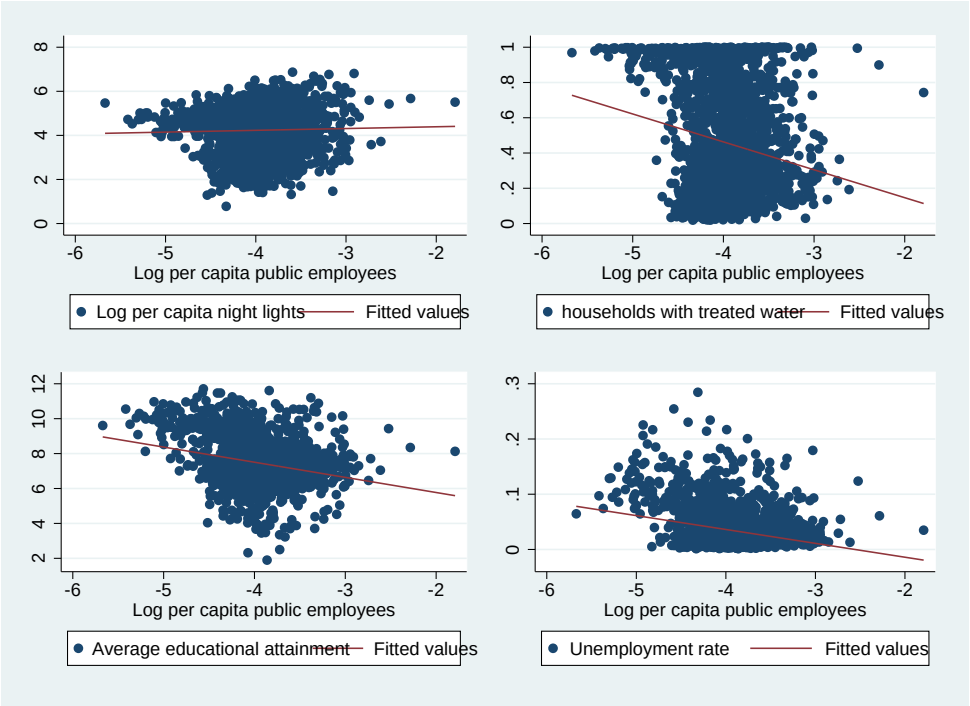
Note: the green part is China Proper, where our historical variation is available; the yellow part are border regions. Source: CHGIS, Version 4, Cambridge: Harvard Yenching Institute, January 2007.

Figure 1.2: Correlation between outcomes and logged per capita government revenue



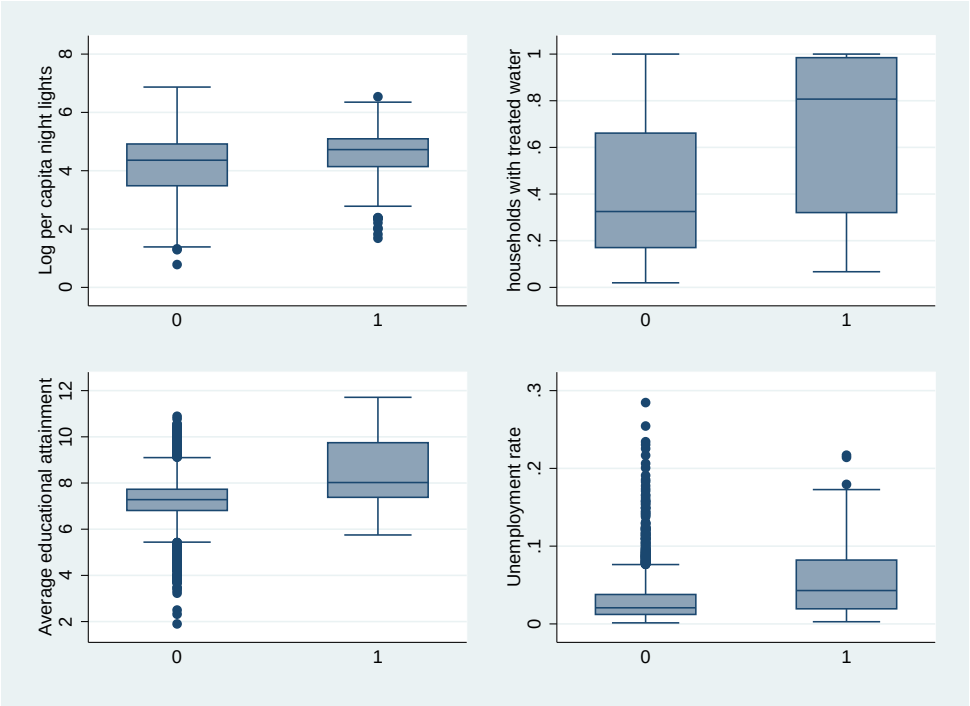
Note: these graphs show the correlation between logged night lights scaled by population, ratio of households having treated water, average educational attainment, unemployment rate with logged per capita government revenue for the full sample.

Figure 1.3: Correlation between outcomes and logged per capita public employees



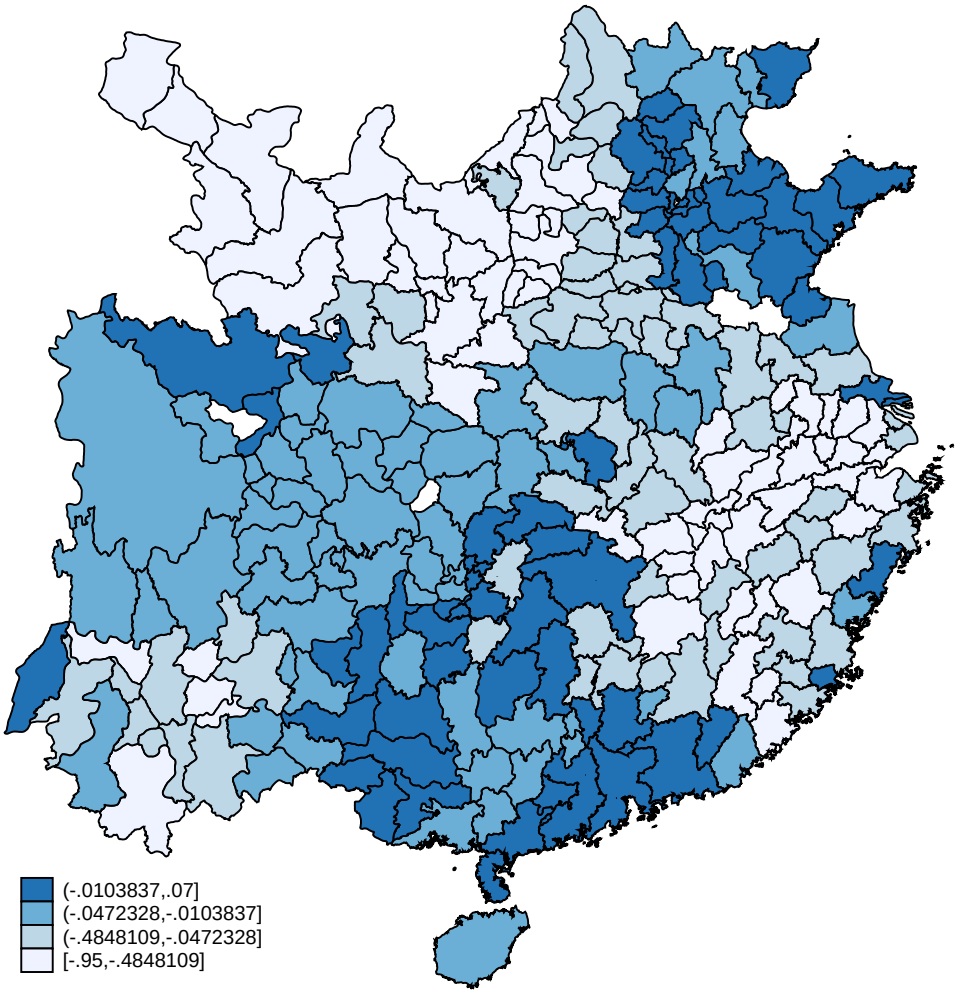
Note: these graphs show the correlation between logged night lights scaled by population, ratio of households having treated water, average educational attainment, unemployment rate with logged per capita public employees for the full sample.

Figure 1.4: Correlation between outcomes and being in a provincial capital



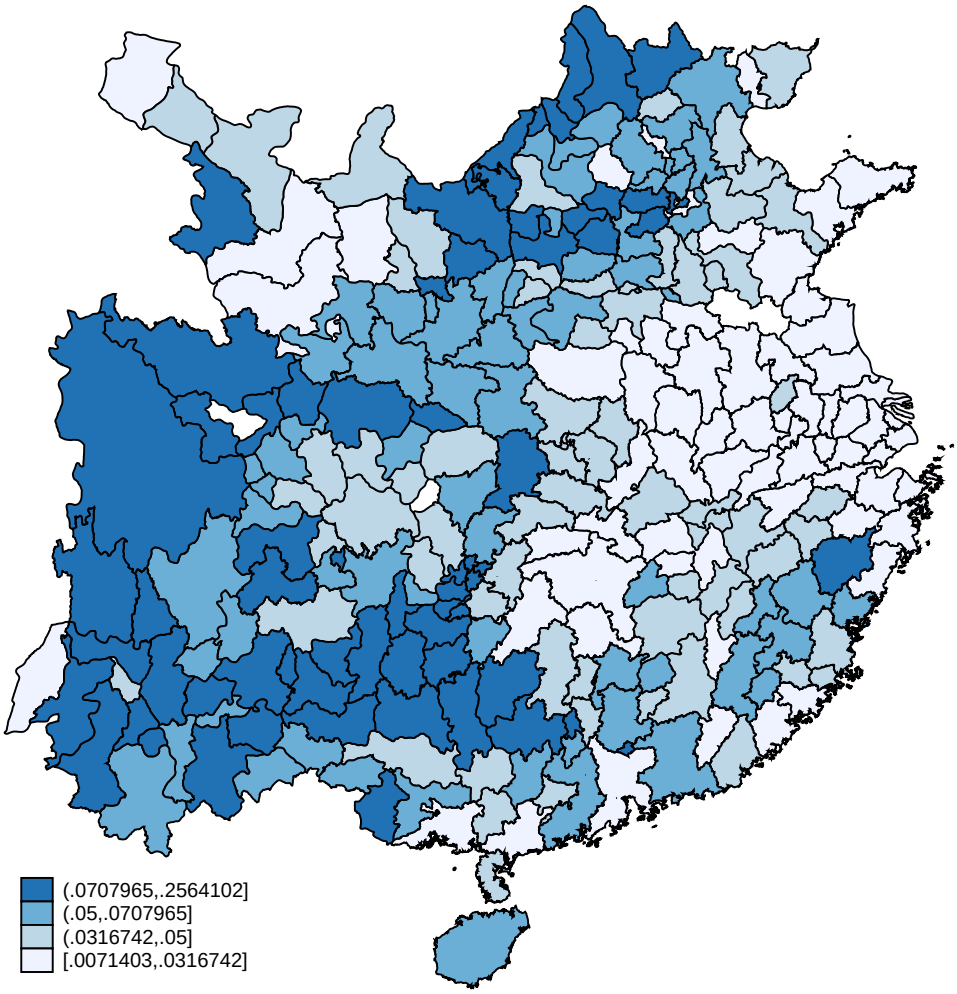
Note: these box plots show the differences in logged night lights scaled by population, ratio of households having treated water, average educational attainment, unemployment rate between counties in a provincial capital and those not for the full sample. Here "1" stands for counties in a provincial capital, while "0" stands for counties not in a provincial capital.

Figure 1.5: Population change resulting from the wars in 1851-1880



Note: this figure shows the population change resulting from the three wars in 1851-1880 at the ancient prefecture level based on Equation (1). The dark color stands for less population loss, while the light color stands for more population loss. The Taiping rellion had the largest impact on the southeastern part, the most populous and developed provinces in this country. On the other hand, the Dungan Revolt had the largest impact on the northwestern and southwestern parts.

Figure 1.6: No. of counties per 10 thousand people in the 19th century



Note: this figure shows the number of counties per 10 thousand people in the 19th century at the ancient prefecture level. The dark color stands for a higher county density, while the light color stands for a lower county density.

Figure 1.7: China's ancient postal route

Note: the green lines stand for the ancient postal route in Qing dynatsy, and the green points are provincial capitals. The shape file is provided by Tuan-Hwee Sng, who plotted it according to the description in the Collected Statutes of the Qing Dynasty (Da Qing huidian, 2006, Yongzheng edition).

1.8.2 Tables

Table 1.1: Descriptive statistics of main variables: full sample

	N	Mean	Stardard dev.	Median
Panel A: Explanatory variables and instruments				
Per capita government revenue	2104	261.1	292.94	181.62
Log per capita government revenue	2104	5.26	0.71	5.20
Pop change from wars (ancient prefecture)	2104	-0.25	0.30	-0.03
Per capita public employees	2104	0.021	0.009	0.019
Logged per capita public employees	2104	-3.95	0.37	-3.96
Counties per 10 thousand people (ancient prefecture)	2104	0.05	0.03	0.05
Logged counties per 10 thousand people (ancient prefecture)	2104	-3.13	0.59	-3.09
Current provincial capital	2104	0.14	0.34	0
Ancient provincial capital (ancient prefecture)	2104	0.15	0.36	0
Distance to ancient postal route	2101	79.85	106.23	40.95
Logged distance to ancient postal route	2101	3.12	2.03	3.74
Panel B: Outcomes				
Per capita GDP	2063	6216.22	6452.34	4409.29
Night lights per 10 thousand people	2100	103.31	96.84	83.83
Logged night lights per 10 thousand people	2100	4.23	0.99	4.44
Have treated water	2104	0.46	0.31	0.36
Average educational attainment	2104	7.46	1.21	7.35
Unemployment rate	2103	0.03	0.04	0.02
Protests per million people	1678	5.19	36.3	0
Have protests	1678	0.40	0.49	0

Note: the full sample, including both county-level districts and non-district counties. Source: China Population History edited by Ge (2005); Comprehensive History of Administrative Divisions in China edited by Zhou (2013); Sng (2014) and Sng and Moriguchi (2014); Bai and Jia (2016); CHGIS, Version 4; National Prefecture and County Finance Statistics Compendium; 2000 Population Census; GDELT Project; National Oceanic and Atmospheric Administration.

Table 1.2: Descriptive statistics of main variables: non-district counties

	N	Mean	Stardard dev.	Median
Panel A: Explanatory variables and instruments				
Per capita government revenue	1569	205.97	159.73	165.15
Logged per capita government revenue	1569	5.13	0.61	5.11
Pop change from wars (ancient prefecture)	1569	-0.25	0.30	-0.03
Per capita public employees	1569	0.022	0.008	0.020
Logged per capita public employees	1569	-3.88	0.31	-3.91
Counties per 10 thousand people (ancient prefecture)	1569	0.06	0.03	0.05
Log counties per 10 thousand people (ancient prefecture)	1569	-3.06	0.58	-3.01
Current provincial capital	1569	0.08	0.28	0.00
Ancient provincial capital (ancient prefecture)	1569	0.11	0.32	0.00
Distance to ancient postal route	1567	85.43	110.22	47.30
Logged distance to ancient postal route	1567	3.37	1.88	3.88
Panel B: Outcomes				
Per capita GDP	1554	5306.67	4492.63	4013.69
No. of firms per 10 thousand people	1568	2.08	3.26	1.32
Per capita firm production	1568	6290.69	11820.94	2561.29
Per capita telphone	1559	0.18	0.11	0.15
Per capita residents' deposit	1557	6001.34	5430.58	4504.07
Per capita loan	1560	5801.69	5143.05	4424.11
Secondary education ratio	1569	0.32	0.08	0.33
Primary education ratio	1569	0.61	0.08	0.61
Per capita hospital beds	1569	0.004	0.002	0.003

Note: non-district counties. No. of firms per 10 thousand people and Per capita firm production refer to manufacturing firms with annual sales revenue larger than 5 million yuan. Secondary education ratio is the number of secondary school students scaled by the number of people aged 10 to 19; Primary education ratio is the number of primary school students scaled by the number of people aged 5 to 14. Source: China Population History edited by Ge (2005); Comprehensive History of Administrative Divisions in China edited by Zhou (2013); Sng (2014) and Sng and Moriguchi (2014); Bai and Jia (2016); CHGIS, Version 4; National Prefecture and County Finance Statistics Compendium; 2000 Population Census; China County Socioeconomic Statistical Yearbooks; Annual Surveys of Industrial Firms.

Table 1.3: Linear regressions of night lights on logged per capita local government revenue

Dep. var: Night lights	(1)	(2)	(3)	(4)
Gov revenue	0.738***	0.695***	0.630***	0.601***
	(0.0650)	(0.0442)	(0.0423)	(0.0419)
Covariate set 1			Y	Y
Covariate set 2				Y
Province FE		Y	Y	Y
N	2100	2100	2100	2100
Adj. R-sq	0.280	0.592	0.603	0.619

Note: night lights are the logarithm of per 10,000 people night light digits in 2000 reported by satellites and processed by the National Oceanic and Atmospheric Administration; Gov revenue is the logarithm of average per capita government revenue in 1999-2000 (after translating 1999 revenue in 2000 yuan). Covariate set 1 are covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals. Covariate set 2 are covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.4: 2SLS regressions of night lights on logged per capita local government revenue

Dep. var: Night lights	(1)	(2)	(3)	(4)
Gov revenue	1.370**	1.016***	1.146***	1.243***
	(0.583)	(0.182)	(0.272)	(0.297)
Covariate set 1			Y	Y
Covariate set 2				Y
Province FE		Y	Y	Y
N	2100	2100	2100	2100
1st-stage Dep. var: Gov revenue	(1)	(2)	(3)	(4)
Pop change from wars	-0.290**	-0.683***	-0.493***	-0.470***
	(0.129)	(0.114)	(0.096)	(0.096)
Cragg-Donald F	31.41	104.41	64.10	50.00
Kleibergen-Paap F	5.04	35.75	26.65	20.11
Anderson-Rubin P-value	0.02	0.00	0.00	0.00
R-squared	0.015	0.330	0.457	0.490

Note: night lights are the logarithm of per 10,000 people night light digits in 2000 reported by satellites and processed by the National Oceanic and Atmospheric Administration; Gov revenue is the logarithm of average per capita government revenue in 1999-2000 (after translating 1999 revenue in 2000 yuan). Covariate set 1 are covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals. Covariate set 2 are covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.5: 2SLS regressions of several outcomes on logged per capita local government revenue

Dep. var:	Have treated water	Edu attainment	Unemp rate
	(1)	(2)	(3)
Gov revenue	0.278***	1.028***	0.012
	(0.088)	(0.247)	(0.009)
Covariates & Province FE	Y	Y	Y
N	2104	2104	2103
1st-stage Dep. var: Gov revenue	(1)	(2)	(3)
Pop change from wars	-0.472***	-0.472***	-0.472***
	(0.104)	(0.104)	(0.104)
Cragg-Donald F	50.37	50.37	50.43
Kleibergen-Paap F	20.44	20.44	20.45
Anderson-Rubin P-value	0.00	0.00	0.16
R-squared	0.491	0.491	0.491

Note: Have treated water is the ratio of households having treated water in 2000; Edu attainment is the average educational attainment in 2000; Gov revenue is the logarithm of average per capita government revenue in 1999-2000 (after translating 1999 revenue in 2000 yuan). Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.6: 2SLS regressions of more outcomes on logged per capita local government revenue, non-district counties

Dep. var:	No.firms	Firm production	Telephone	Deposit	Loan	Sec school	Pri school	Hospital bed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gov revenue	0.850***	1.295***	0.724***	0.760***	0.759***	0.068***	0.014	0.667***
	(0.177)	(0.213)	(0.118)	(0.140)	(0.115)	(0.022)	(0.017)	(0.114)
Covariates & Province FE	Y	Y	Y	Y	Y	Y	Y	Y
N	1568	1568	1559	1557	1560	1569	1569	1569
1st-stage Dep. var: Gov revenue	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pop change from wars	-0.636***	-0.636***	-0.630***	-0.632***	-0.635***	-0.638***	-0.638***	-0.638***
	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)
Cragg-Donald F	79.29	79.29	72.29	76.87	77.59	79.16	79.16	79.16
Kleibergen-Paap F	41.64	41.64	40.81	40.60	40.93	41.64	41.64	41.64
Anderson-Rubin P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00
R-squared	0.393	0.393	0.387	0.391	0.392	0.392	0.392	0.392

Note: Gov revenue is the logarithm of average per capita government revenue in 1999-2000 (after translating 1999 revenue in 2000 yuan). We use the logarithm of these dependent variables (after scaled by population) except the shares of middle school and primary school students. Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.7: Linear regressions of night lights on logged per capita public employees

Dep. var: Night lights	(1)	(2)	(3)	(4)
Public employees	0.0811	-0.137*	0.0568	0.0779
	(0.110)	(0.0808)	(0.0738)	(0.0722)
Covariate set 1			Y	Y
Covariate set 2				Y
Province FE		Y	Y	Y
N	2100	2100	2100	2100
Adj. R-sq	0	0.417	0.488	0.521

Note: night lights are the logarithm of per 10,000 people night light digits in 2000 reported by satellites and processed by the National Oceanic and Atmospheric Administration; Public employees is the logarithm of average per capita public employees in 1999-2000. Covariate set 1 are covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals. Covariate set 2 are covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.8: 2SLS regressions of night lights on logged per capita public employees

Dep. var: Night lights	(1)	(2)	(3)	(4)
Public employees	-0.833	-0.508	0.206	0.568
	(0.547)	(0.509)	(0.594)	(0.765)
Covariate set 1			Y	Y
Covariate set 2				Y
Province FE		Y	Y	Y
N	2100	2100	2100	2100
1st-stage Dep. var: Public employees	(1)	(2)	(3)	(4)
No. of counties	0.173***	0.170***	0.131***	0.103***
	(0.029)	(0.033)	(0.035)	(0.036)
Cragg-Donald F	175.97	79.24	44.40	20.36
Kleibergen-Paap F	35.76	26.23	13.64	8.28
Anderson-Rubin P-value	0.09	0.30	0.74	0.48
R-squared	0.077	0.240	0.334	0.360

Note: night lights are the logarithm of per 10,000 people night light digits in 2000 reported by satellites and processed by the National Oceanic and Atmospheric Administration; Public employees is the logarithm of average per capita public employees in 1999-2000; No. of counties is the logarithm of the number of ancient counties in the ancient prefecture (the current county is located in) scaled by 1820 population. Covariate set 1 are covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals. Covariate set 2 are covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.9: 2SLS regressions of several outcomes on logged per capita public employees

Dep. var:	Have treated water	Edu attainment	Unemp rate	No. of protests	Have protests
	(1)	(2)	(3)	(4)	(5)
Public employees	-0.033	-0.294	-0.003	0.105	-0.095
	(0.233)	(0.887)	(0.022)	(0.850)	(0.400)
Covariates & Province FE	Y	Y	Y	Y	Y
N	2104	2104	2103	1678	1678
1st-stage Dep. var: Public employees	(1)	(2)	(3)	(4)	(5)
No. of counties	0.104***	0.104***	0.105***	0.103***	0.103***
	(0.036)	(0.036)	(0.036)	(0.033)	(0.033)
Cragg-Donald F	20.68	20.68	21.10	24.00	24.00
Kleibergen-Paap F	8.41	8.41	8.59	9.71	9.71
Anderson-Rubin P-value	0.89	0.74	0.88	0.90	0.81
R-squared	0.359	0.359	0.359	0.377	0.377

Note: Have treated water is the ratio of households having treated water in 2000; Edu attainment is the average educational attainment in 2000; Public employees is the logarithm of average per capita public employees in 1999-2000; No. of protests is the logarithm of 1 plus average per million people protests in 2000-2001; Have protests is an indicator variable for having protests in 2000-2001. No. of counties is the logarithm of the number of ancient counties in the ancient prefecture (the current county is located in) scaled by 1820 population. Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.10: 2SLS regressions of more outcomes on logged per capita public employees, non-district counties

Dep. var:	No.firms	Firm production	Telephone	Deposit	Loan	Sec school	Pri school	Hospital bed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Public employees	1.306*	0.325	0.253	0.412	0.645	-0.048	-0.064	0.941**
	(0.777)	(1.201)	(0.551)	(0.663)	(0.564)	(0.098)	(0.072)	(0.382)
Covariates & Province FE	Y	Y	Y	Y	Y	Y	Y	Y
N	1568	1568	1559	1557	1560	1569	1569	1569
1st-stage Dep. var: Public employees	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No. of counties	0.091***	0.091***	0.091***	0.090***	0.090***	0.091***	0.091***	0.091***
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Cragg-Donald F	18.83	18.83	18.76	18.31	18.33	18.78	18.78	18.78
Kleibergen-Paap F	7.18	7.18	7.16	7.03	7.03	7.16	7.16	7.16
Anderson-Rubin P-value	0.12	0.79	0.67	0.57	0.27	0.60	0.37	0.05
R-squared	0.402	0.402	0.401	0.402	0.402	0.402	0.402	0.402

Note: Public employees is the logarithm of average per capita public employees in 1999-2000; No. of counties is the logarithm of the number of ancient counties in the ancient prefecture (the current county is located in) scaled by 1820 population. We use the logarithm of these dependent variables (after scaled by population) except the shares of middle school and primary school students. Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.11: 2SLS regressions of several outcomes on logged per capita public employees

Dep. var:	Night lights	Have treated water	Edu attainment	Unemp rate
	(1)	(2)	(3)	(4)
Public employees	-2.749**	0.142	-3.370***	0.008
	(1.268)	(0.296)	(1.275)	(0.031)
Covariates & Province FE	Y	Y	Y	Y
N	2100	2101	2101	2100
1st-stage Dep. var: Public employees	(1)	(2)	(3)	(4)
Postal route	0.103***	0.104***	0.104***	0.105***
	(0.036)	(0.036)	(0.036)	(0.036)
Cragg-Donald F	13.24	13.70	13.70	13.55
Kleibergen-Paap F	8.93	9.25	9.25	9.17
Anderson-Rubin P-value	0.00	0.62	0.00	0.79
R-squared	0.360	0.359	0.359	0.359

Note: night lights are the logarithm of per 10,000 people night light digits in 2000 reported by satellites and processed by the National Oceanic and Atmospheric Administration; Have treated water is the ratio of households having tap water in 2000; Edu attainment is the average educational attainment in 2000. Postal route is the logarithm of the distance to the ancient postal route. Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.12: 2SLS regressions of more outcomes on logged per capita public employees, non-district counties

Dep. var:	No.firms	Firm production	Telephone	Deposit	Loan	Sec school	Pri school	Hospital bed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Public employees	-1.652	-4.396**	-0.527	-1.640*	-2.078**	-0.198*	-0.073	-0.239
	(1.084)	(1.967)	(0.619)	(0.939)	(1.000)	(0.117)	(0.077)	(0.501)
Covariates & Province FE	Y	Y	Y	Y	Y	Y	Y	Y
N	1566	1566	1557	1555	1558	1567	1567	1567
1st-stage Dep. var: Public employees	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Postal route	0.091***	0.091***	0.091***	0.090***	0.090***	0.091***	0.091***	0.091***
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Cragg-Donald F	13.85	13.85	13.46	14.04	14.11	13.87	13.87	13.87
Kleibergen-Paap F	10.60	10.60	10.25	10.76	10.79	10.60	10.60	10.60
Anderson-Rubin P-value	0.05	0.00	0.37	0.03	0.00	0.03	0.31	0.07
R-squared	0.402	0.402	0.401	0.402	0.402	0.402	0.402	0.402

Note: Postal route is the logarithm of the distance to the ancient postal route. We use the logarithm of the dependent variables (after scaled by population) except the shares of middle school and primary school students. Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures, indicator for locating in provincial capitals; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.13: 2SLS regressions of several outcomes on being located in a provincial capital

Dep. var:	Night lights	Have treated water	Edu attainment	Unemp rate
	(1)	(2)	(3)	(4)
Current capital	0.069	0.034	0.617*	0.015*
	(0.242)	(0.057)	(0.323)	(0.009)
Covariates & Province FE	Y	Y	Y	Y
N	2023	2027	2027	2026
1st-stage Dep. var: Current capital	(1)	(2)	(3)	(4)
Ancient capital	0.457***	0.457***	0.457***	0.457***
	(0.087)	(0.087)	(0.087)	(0.087)
Cragg-Donald F	383.31	383.45	383.45	383.52
Kleibergen-Paap F	27.13	27.04	27.04	27.05
Anderson-Rubin P-value	0.78	0.57	0.08	0.07
R-squared	0.337	0.337	0.337	0.337

Note: night lights are the logarithm of per 10,000 people night light digits in 2000 reported by satellites and processed by the National Oceanic and Atmospheric Administration; Have treated water is the ratio of households having tap water in 2000; Edu attainment is the average educational attainment in 2000. Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 1.14: 2SLS regressions of more outcomes on being located in a provincial capital, non-district counties

Dep. var:	No.firms	Firm production	Telephone	Deposit	Loan	Sec school	Pri school	Hospital bed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Current capital	-0.046	-0.455	-0.344	-0.471	-0.383	-0.010	0.006	-0.374*
	(0.384)	(0.615)	(0.342)	(0.382)	(0.319)	(0.036)	(0.029)	(0.219)
Covariates & Province FE	Y	Y	Y	Y	Y	Y	Y	Y
N	1533	1533	1524	1522	1525	1534	1534	1534
1st-stage Dep. var: Current capital	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ancient capital	0.339***	0.339***	0.337***	0.339***	0.336***	0.336***	0.336***	0.336***
	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)
Cragg-Donald F	181.10	181.10	177.47	179.75	177.98	179.19	179.19	179.19
Kleibergen-Paap F	17.46	17.46	17.15	17.46	17.25	17.25	17.25	17.25
Anderson-Rubin P-value	0.90	0.42	0.25	0.14	0.16	0.78	0.83	0.03
R-squared	0.198	0.198	0.198	0.198	0.196	0.196	0.196	0.196

Note: we use the logarithm of these dependent variables (after scaled by population) except the shares of middle school and primary school students. Covariates include covariates measured at the current county level, including logged county area, latitude, longitude, indicator for locating in coastal prefectures; and covariates measured at the ancient prefecture (the current county is located in) level, including whether there's main river, logged river length, the incidence of drought/flood in 1800-1899, logged population in 1820, transportation condition, three types of crop suitability (rice, sweet potato and foxmillet), language fragmentation index, the number of presented scholars (Jinshi), and treaty ports. Standard errors are clustered at prefecture, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Chapter 2

Product Market Structure and Discrimination in Bank Loan Markets[1]

This paper analyzes costly discrimination related to physical attractiveness and gender in bank loan markets using a market structure-based method. The rationale is that a concentrated market provides more space for loan officers to discriminate against a certain group of borrowers. Using several unique datasets and online maps containing information on market structure and household finance, we find that loan officers prefer good-looking people and males in relatively risky commercial/industrial loan markets. On the other hand, females and especially young good-looking females have an advantage in mortgage loan markets. Although the disadvantage of bearing and raising children cannot be easily disentangled from discrimination in labor markets, it does not pose an issue in mortgage loan markets. We interpret these different patterns of favoritism as a result of differential risk levels associated with the two types of loans.

2.1 Introduction

Access to credit from institutional sources, such as small business loans and mortgage loans, represents an important way to improve welfare of households. Therefore, it is a concern that a growing body of evidence suggests that owners of small businesses from some demographic groups, such as minorities and females, may have less access to institutional financing (Bates 1973, 1991; Cavalluzzo and Cavalluzzo 1998; Cavalluzzo et al., 2002). There are more successful male entrepreneurs than female entrepreneurs, therefore, in small business loan markets loan officers may think male entrepreneurs have a better repayment ability and see gender as a signal regarding

[1] I benefit very much from constant discussions with Jason Abrevaya and Daniel Hamermesh. I also thank Yan Dong and Xue Li for providing part of the data used in this study.

creditworthiness, but does it really signal quality or is it just a prejudice? Although the literature of labor economics usually find females receive lower wages than males, the disadvantage of bearing and raising children could be associated with real productivity, but such a disadvantage should not pose an issue in small business loan markets. Moreover, mortgage loans are very safe, it may be not necessary for loan officers consider gender as a signal regarding creditworthiness. Then given most loan officers are males, will females, especially good-looking females, be treated better than males?

Our paper sheds light on particular factors that influence observed differences in the credit market. We do so by using a market structure-based method founded on Becker's (1957) costly discrimination theory. That is, in a concentrated market, banks have large market power, and consequently their loan officers can discriminate against certain groups of borrowers without worrying about being driven out of the market. On the other hand, discriminating loan officers are more likely to be driven out of a competitive market. We analyze costly discrimination in China's bank loan markets using several unique datasets and online maps. China provides an excellent case for this kind of research. Although studies about the United States find that Dun \& Bradstreet credit scores and FICO scores provide cost effective methods for lenders to evaluate loan applications and monitor borrowers (e.g. Frame et al, 2001; Akhavein et al. 2005; Berger et al. 2005; Berger and Frame, 2007), there is not such information available in China. Since 2000, China's bank industry has experienced large-scale deregulation, with many markets witnessing an explosive growth in the number of different banks and the number of bank branches. Many new loan officers have very limited experience in dealing with borrowers, and hence they probably choose borrowers based on some simple demographic characteristics. Moreover, China has experienced a housing boom since

2000, and thus home as collateral is very safe. Therefore, it could be easier to detect discrimination in this market.

We examine two types of possible discrimination related to household heads' physical attractiveness (Hamermesh and Biddle,1994) and gender, and the two types of markets under consideration are the commercial/industrial loan (small business loans in the U.S.) markets and the mortgage loan markets. Physical attractiveness or beauty is rated by the student surveyors of the household finance data we use, with rankings between 1 and 10. To follow the usual practice and to accommodate the distribution of beauty ratings, we classify those with a rating of 8-10 as good-looking people, and those with a rating of 1-2 as bad-looking people, although different classifications yield qualitatively identical results. Our complementary evidence shows that the beauty rating is highly positively correlated with height and negatively correlated with weight. Our prediction is that costly discrimination will tend to decline in a more competitive bank loan market. That is, if less attractive individuals or those of a certain gender have higher default rates and hence are less likely to obtain a loan or are forced to pay higher interest rates, more market competition should not reduce these productive lending practices (in that case they are no longer prejudice).

For commercial/industrial loans, we use a novel identifying technique based on both the community identifier and information collected from online maps. As documented in the literature, commercial/industrial loans for small businesses are usually relationship-based (e.g., Peterson and Rajan, 1994, 2002), and for this reason, we use community-level market concentration. As opposed to borrowers of mortgages, entrepreneurs' collateral is generally much less liquid and has greater volatility in value, and they usually need to borrow from the same bank many times. This means that monitoring is paramount and therefore, the distance between a bank and a small business

should be relatively short. Realizing this fact, we find the number of different banks within two kilometers of the community office where a household is located[2]. In China, each community has an official identifier which can be found at the National Bureau of Statistics website[3]. Actually, we also find that market concentration in this circle and that of larger/smaller circles are highly correlated. Gan (2016) notes that this community identifier contains information about whether the community is located in an urban or a rural area, and he uses this information to measure China's urbanization. He also remarks that very few papers make use of the information from this community identifier, not to mention the information collected from online maps based on the community identifier. This is not particularly surprising, as the usual publicly available datasets do not contain the community identifier. Even if some administrative datasets do include it, the statistical information regarding economic development is not available at the community level, and for this reason the usual research cannot be improved with the community identifier. However, we find that the community-level market concentration has larger variation than the prefecture-level market concentration, can mitigate the impacts of other prefecture-level confounding factors, and hence can provide larger identification power for our work.

Because households often move out of their original community after they purchase a new home, and because borrowing in each of these instances is a one-time transaction, the prefecture-level market concentration is more appropriate for mortgage loans. A prefecture in China is a level of jurisdiction between the provincial level and the county level, similar in size to a metropolitan statistical area (MSA) in the United States. In the following sections of this paper, community-level market structure refers to the

[2] A community office is the smallest level government unit in China.
[3] http://www.stats.gov.cn/tjsj/tjbz/tjyqhdmhcxhfdm/2013/index.html

market structure within the 2-kilometer circle of the community office in which a household is located, and prefecture-level market structure relates to market structure in the prefecture where a household is located.

Our principal findings are summarized as follows. First, generally speaking, we find that in a more concentrated commercial/industrial loan market, i.e., those with a higher Herfindahl index (HHI), good-looking people are more likely to obtain loans than average-looking people, and when they do, those loans tend to have lower interest rates, while the converse is true for bad-looking people. For example, with a one-standard-deviation increase in the community-level HHI, the chance that a good-looking male will obtain a loan is 20 percentage points higher compared with an average-looking male. The magnitude is similar for good-looking females compared with average-looking females. Moreover, our results show that males have an advantage over females. Second, in contrast to most findings in labor markets, we detect that females have a strong advantage in a more concentrated mortgage loan market, and this is especially the case for younger, good-looking females. Although the disadvantage of bearing and raising children cannot be easily disentangled from discrimination in labor markets, it does not pose an issue in mortgage loan markets, and hence this explains such findings. Third, both the descriptive statistics and regression estimates evaluated at the mean HHI indicate the existence of an advantage associated with good-looking people in the two types of markets, and an advantage associated with females in mortgage loan markets. We think that this fact is also of some importance. Loan officers can obtain almost the same hard information, such as education, family income, home ownership, retirement status, and household register (``Hukou") as researchers, and it is costly to collect further information from these small borrowers. Therefore, conditioning on these pieces of hard information, the observed premium or penalty probably reflects discrimination related to physical

attractiveness and/or gender. Although some regressions do not produce significant results for the variables of major interest, we are encouraged by the fact that only the results in the expected direction are significant. Moreover, it is probably unnecessary for bank loan officers to discriminate against the same person in more than one way. They can reject the application, require a higher interest rate or a larger share of down payment, but not necessarily use all of them together. In summary, the consistent pattern shown in various regressions suggests the existence of costly discrimination in Becker's sense in bank loan markets.

Our findings also shed light on the importance of analyzing different loan markets separately. Commercial/industrial loans are usually riskier than mortgage loans, and hence bank loan officers probably want to take borrowers' physical attractiveness or gender as a sign of creditworthiness, even if the signal is not really associated with better quality. Indeed, we find some evidence that good-looking people might be more willing or able to communicate verbally, which signals a better-quality borrower. Because there are more successful male entrepreneurs than female entrepreneurs, gender can be seen as a signal in commercial/industrial loan markets. Therefore, both the findings related to physical attractiveness and gender support the interpretation of the role of gender or physical attractiveness as a signal. However, in a more competitive market, it is less likely for loan officers to use this signal. This implies that this signal is not effective in revealing the real credentials of borrowers, and hence is in line with Cavalluzzo et al. (2002) and other papers on U.S. small business loan markets. On the other hand, mortgage loans are pretty safe, and it is thus more likely for loan officers to enjoy visual pleasure. Notice that both of these are consistent with Becker's costly discrimination, but are different from statistical discrimination. Statistical discrimination is toward less

creditworthy groups of borrowers, and hence this kind of discrimination will not decline in a more competitive market.

Together, our paper makes three major contributions. First, this is the first paper to relate a beauty premium in credit markets to market structure. Moreover, there are very few papers that discuss a gender premium in bank loan markets. Secondly, we analyze commercial/industrial loan markets and mortgage loan markets separately, and find very different patterns in loan pricing behavior. This strongly implies that, in future research, it is important to study different kinds of loan markets separately. Although some researchers have examined costly discrimination in small business loans using the market structure-based method, there are few studies on mortgage loans. Thirdly, this is the first study to connect a community identifier and bank branch information collected from online maps. Although this paper studies China in empirical work, our methods can be generalized to the research on other countries with an identifier on small geographical areas available. In other words, we collect new data, analyze them with new methods, deliver bring new findings.

The field of discrimination in bank loan markets is much less developed than it is in labor markets, partly due to limited data availability. Our research aims to elevate the discussions in this field by using new technique and unique datasets. Bank loan terms are usually set by regional offices and probably the headquarters, and hence are usually considered much more standard than labor contracts, especially within the same bank in a certain province. Moreover, the conditions or requirements can usually be found in brochures at bank branches or online and are therefore are quite transparent. However, our findings imply that loan officers still have great freedom in choosing borrowers. Our explanation is that there are severe asymmetries of information in bank loan markets (Stiglitz and Weiss, 1981), and thus it is difficult for banks to set a rigorous standard for

their loan officers. Therefore, bank loan officers are granted great autonomy in selecting qualified borrowers and setting corresponding credit terms. Conversations with several bank managers support this possibility. On the other hand, many borrowers might not understand complex financial products very well, and may therefore rely on the explanations provided by bank loan officers.

The structure of the paper is as follows. Section 2 provides an introduction to Becker's theory on costly discrimination and the institutional background. Section 3 gives a review of the related literature; Section 4 presents the empirical strategy; Section 5 describes the dataset; Section 6 and 7 demonstrate the results and robustness check for the two kinds of bank loan markets; Section 8 is a discussion of our findings. Finally, Section 9 concludes.

2.2 Theory and Background

2.2.1 Theory

In his seminal work, *The Economics of Discrimination*, Becker (1957) models discrimination as a personal prejudice against a particular group. In his model, discrimination is costly. Competition should mitigate the presence of this type of discrimination over time.

But more concentrated markets do not exert the same pressure for cost minimization. Thus, in the absence of competition, it may be possible to sustain noneconomic discrimination. For example, in labor markets, a discriminating employer foregoes the opportunity to hire cheaper labor and thus achieves a lower profit, which leaves a competitive advantage for nondiscriminating employers. In competitive markets,

the nondiscriminating employers drive out discriminating employers and no wage gap will exist if there are enough nondiscriminating employers.

There are actually two types of costly discrimination in Becker's spirit. Consider bank loan markets: loan officers might simply dislike a certain group and be willing to pay to avoid such a group. However, loan officers might be more likely to decline loan applications from a certain group because they think these borrowers are more likely to default, though after controlling for differences in the verifiable credentials, they are not more likely to underperform other groups. In this sense, group attributes serve as a signal or ``soft information''. In a competitive bank loan market, there is less space for loan officers to discriminate against a certain group of borrowers in either way. Costly discrimination is different from the statistical discrimination (Phelps, 1972; Arrow, 1973). According to the theory of statistical discrimination, borrowers who are discriminated against are more likely to underperform other groups, and hence this kind of discrimination would not disappear in a competitive market.

Discrimination toward a certain demographic group in the bank loan markets can be carried out in two ways, a lower approval rate, or worse credit terms (e.g., a higher interest rate). A financial institution that would normally loan funds at rate r, could require $r+t$, where t is the discrimination coefficient, or interest premium that must be charged in order to compensate for having to deal with the group toward which the lender has a prejudice. However, because of the presence of asymmetric information in credit markets, the extent to which lenders vary interest rates depending on the attributes of borrowers is unclear. Interest rates may therefore be not always a desirable place to look for evidence of discrimination (Petersen, 1981; Duca and Rosenthal, 1994). If lenders act on their prejudices by turning down certain groups at disproportionate rates, then denial rates would exceed expected levels after controlling for the creditworthiness of these

borrowers. Stiglitz and Weiss (1981) show that in equilibrium both credit rationing and limited rate flexibility can occur.

Most of the credit market literature does not consider the relationship between competition and discrimination, and instead estimates some variant of the following econometric model:

$$Y = \alpha + \beta D + X'\gamma + \varepsilon, \quad (1)$$

where Y represents either approval rates or interest rates charged, X is a vector of demographic and risk (and any other relevant) characteristics, and D represents an indicator variable for demographic groups of major interest. Then β captures differences in Y because of all of the characteristics associated with D that are not captured in X. These differences may include statistical and prejudicial discrimination as well as economic differentials not properly accounted for by X. In this paper, we will exploit variation in concentration across bank loan markets and estimate equations in the following form:

$$Y = \alpha + \beta_1 D * Market + \beta_2 D + X'\gamma + \varepsilon, \quad (2)$$

Under this specification, β_2 continues to reflect across-group differentials that can arise from a variety of sources that we expect to be invariant with respect to market structure, including statistical discrimination, omitted variables, and possibly prejudicial discrimination. In contrast, β_1 reflects differentials associated with lender market power in households' local area, proxied here by the HHI or other measures of lender market concentration. Wider differentials in less competitive lending markets are consistent with Becker's costly discrimination.

2.2.2 Background: China's Banking Reform

Prior to 1978, the Chinese financial system followed a mono-bank model (People's Bank of China) whereby all the bank branches were part of one administrative hierarchy. In 1978, a banking reform was put on the agenda and various banking functions were devolved from the People's Bank of China (PBOC), the central bank of China. Four specialized state-owned banks, the Bank of China (BOC), the Agriculture Bank of China (ABC), the Construction Bank of China (CBC), and the Industrial and Commercial Bank of China (ICBC), the so-called ``Big Four'', were established. In 1985, additional changes were implemented that were designed to give these institutions greater scope in raising and allocating capital. The four banks are now national commercial banks that compete with each other (Lin and Zhang, 2009).

In the middle and late 1980s, banking reform turned to bank ownership; during this period, the existing banking system structure was held constant. Ownership reform was introduced incrementally. The first Chinese-foreign joint-equity bank, China and South Sea Bank Ltd., was formed in 1984. Two years later the Bank of Communications, the first domestic joint-equity bank, was established. In 1991, Shenzhen Development Bank, also a domestic joint-equity bank, was successfully listed on the Shenzhen Stock Exchange, becoming the first partially public-owned bank in China.

In 1995, the Central Bank Law and the Commercial Bank Law were promulgated. With the implementation of the Commercial Bank Law, urban and rural credit cooperatives started to merge and form city-level commercial banks, which were owned by the state, state-owned enterprises, or private capital. Compared with the ``Big Four'', joint-equity banks, urban and rural commercial banks and credit unions witnessed a larger expansion over the last two decades. In 2006, the urban commercial banks were allowed to establish branches beyond their home province. Although before then, urban

commercial banks were usually very small and focused on their home city, starting then their expansion has been accelerating. Till now some of them have become Fortune 500 companies.

Before 1993, the government allowed foreign banks to establish branches in certain cities to conduct foreign-currency business with foreign firms and citizens only. Starting in 1993, the banking sector started lifting various geographic and client restrictions on foreign bank lending. The government allowed foreign banks in China to conduct both foreign- and local-currency business with foreign firms and citizens, and to conduct foreign-currency business with domestic firms. Under the WTO agreements, restrictions on the operations of foreign financial institutions in the Chinese financial sector were relaxed in stages (Lin, 2011). In the banking sector, foreign banks were scheduled to receive treatment identical to that of national institutions and to provide Rmb (China's currency) business to Chinese firms and individuals by December 2006. From 2001 to 2011, the number of foreign bank branches in China soared from 200 to 800. However, the market share of foreign banks is still much smaller than that of native banks.

Overall, these bank deregulation policies led to more competitiveness in China's bank loan markets, and they can provide plausibly exogenous temporal variation to our study. China's bank deregulation is comparable to that happened in the U.S. from the 1970s to the 1990s, though because of lack of comprehensive bank-level data as the Call reports in the U.S., the former is still underexplored in the literature.

Figure 1 plots the mean and standard deviation of prefecture-level HHI by year, using the bank branch data obtained from China Banking Regulatory Commission (CBRC), the bank regulatory agency in this country. As we can see, the average HHI declined from 0.24 in 1995 to 0.13 in 2013, coinciding with the establishment and

expansion of various types of banks induced by the bank deregulation. Although the standard deviation of HHI also decreased, the ratio of standard deviation and mean actually increased from 0.5 to 0.7. These facts imply there is large variation in bank market concentration across time and areas. A market of great economic importance is usually more attractive to firms, meaning that market concentration is usually correlated with the economic importance of a market, such as GDP and population size. For this reason, we also plot the mean and standard deviation of prefecture-level logged GDP (those of logged population are very stable across year and hence are not plotted here). Although there is a negative correlation between average HHI and average logged GDP as expected, we notice that the standard deviations seem uncorrelated and hence much variations in HHI is probably not explained by the economic level of a prefecture. In empirical parts, we will also control the measures of economic level, and the results are intact.

2.2.3 Variation in Market Concentration across Areas

There are three main sources of variation in market concentration across areas, which shows that the observed differences in the treatment of different demographic groups should not result from unobserved variables or reverse causality. First, this variation can be traced to historical differences. During the era of the planned economy (the 1950s to the mid-1990s), financial institutions belonged to the government and channeled funds to local governments and state-owned enterprises, and it is rare for households to obtain credit from banks. The ``Big Four'' banks, along with many urban commercial banks and credit unions have a history dating back to the planned economy era, and hence the current market structure in a given area is heavily influenced by the historical existence of the branches of these banks. In areas where the central government

put on its list of priorities, there would be more bank branches, especially branches belonging to the ``Big Four'' banks. In addition, joint-equity banks were usually established before the planned economy era, but they were closed in the planned economy era. After the country returned to a market economy, these banks expanded in their original places quickly in their respective regions.

Secondly, the central bank of China has 9 regional bureaus as well as a bureau in every prefecture. According to the 1995 Commercial Bank Law and the 2002 Guidelines for Commercial Banks to Establish New Branches[4], establishing a new bank branch needs to be approved by the corresponding prefecture bureau of the central bank. Therefore, an important source of variation in market concentration across areas comes from the different policy preferences of regulators. We also realize that, in a more concentrated market, dominant players probably have a larger influence on the local regulator's policy, and as a consequence the current market structure tends to persist. Similarly, in a more competitive market, players have limited influence on the local regulator's policy, and the market will still be competitive.

Thirdly, a market of great economic importance is usually more attractive to firms, and hence there should be more applications for establishing new branches. These differences in economic levels can bring differences in approval rates and credit terms across the country. For example, an area with a higher credit risk would be compensated by a lower approval rate and a higher interest rate. However, differences in economic levels should not lead to large differences in approval rates and credit terms among different demographic groups in the same area except via correlation with the market

[4] See http://news.xinhuanet.com/zhengfu/2002-02/22/content 285872.htm

concentration. This is verified by the fact that our results are intact after purging the impact of economic level from market concentration.

Figure 2 plots the prefecture-level average HHI during 2009-2013 for the 31 provinces or province-level jurisdictions in mainland China. The darker color stands for a higher market concentration level, whereas the lighter color stands for a lower market concentration level. As can be seen in this graph, the northeastern and western parts, which are relatively poor compared to other parts of the country, have a higher market concentration level on average, whereas the northern and southeastern parts, which are relatively wealthy, have a lower market concentration level on average. However, we can find large variation in a relatively small region, which implies that our measure of market concentration is not very likely to reflect factors specific to a certain region.

2.3 Related Literature

2.3.1 Product Market Structure and Discrimination

The relationship between discrimination and product market structure in labor markets has attracted economists' attention for a long time. Milgrom and Oster (1987) propose the invisibility hypothesis that job skills of disadvantaged workers are not easily discovered by potential new employers, but that promotion enhances visibility and alleviates this problem. Then, in a competitive labor market equilibrium, firms profit by hiding talented disadvantaged workers in low-level jobs. As a result of the inefficient and discriminatory wage and promotion policies, disadvantaged workers experience lower returns to investments in human capital than other workers. Ashenfelter and Hannan (1986) examine the relationship between product market competition and employment by linking data on female employment with measures of market concentration in the banking

industry. Their results provide strong support for a negative relationship between market concentration and the relative employment of women. This relationship is primarily due to differences across markets rather than individual firms. A more recent and influential paper about discrimination and market structure in labor markets, Black and Strahan (2001), documents that male bank employees' wages fell much more than women's after deregulation. This suggests that rents in a more concentrated market were shared mainly with men, while women's share of employment in managerial positions also increased following deregulation. Our results do not present a consistent disadvantage of females in bank loan markets, and we find that females actually have an advantage in mortgage loan markets. The banking industry is an ideal place to test discrimination using a market structure-based method. Many industries, such as wholesale and retail industries, are contestable markets with few entry costs, and for this reason the market concentration level may not reflect real market power. On the other hand, for utilities and other ``natural monopoly'' markets, there is no variation in market concentration. The banking industry is regulated by the government and has large variation in market concentration, which makes it easier to test discrimination based on market structure.

Cavalluzzo et al. (2002) examine the small business loan markets and find substantial differences in denial rates between firms owned by African Americans and white males using the 1993 Survey of Small Business Finances. Consistent with Becker's (1957) theory, they also find increases in competition in the firm’s local banking market reduces these differences. They also find female borrowers are less likely to obtain a loan in a more concentrated market. Similar to them, we find a male premium in a more concentrated commercial/industrial loan markets; however, we find that women are treated better in a more concentrated mortgage loan market. Moreover, Mitchell and Pearce (2009) also test the discrimination toward minorities using the market structure

method and find similar evidence. Other research also discuss the impacts of market structure on small business loans using the Surveys of Small Business Finances, such as Berger et al. (1998) and Cavalluzzo and Cavalluzzo (1998).

Overall, in contrast to the large volume of empirical literature on labor markets, the discussions on discrimination in loan markets especially bank loan markets are still very scarce. This is perhaps not surprising. Although the Federal Reserve's Survey of Consumer Finances contains abundant information on household asset and income, it does not have enough geographic identifiers (MSA or county) to link with market structure data, not to mention measures on beauty and many other individual characteristics. In addition, the most recent Small Business Survey is the 2003 version, and we do not realize a paper testing discrimination in mortgage loan markets related to market structure. Our paper will provide a test of Becker (1957)'s theory in a case study of bank loan markets. Because we obtain prefecture and community identifiers for our sampled households, we can link the prefecture-level and community-level bank concentration information with households' borrowing history. Our results therefore provides a stronger identification than using province-level data.

2.3.2 Physical Attractiveness

Our interest in physical attractiveness is inspired by the influential work by Hamermesh and Biddle (1994). They develop a theory of sorting across occupations based on looks and derive its implications for testing for the source of earnings differentials related to looks. Holding constant demographic and labor-market characteristics, they find that plain people earn less than people of average looks, who earn less than the good-looking, and the effects are slightly larger for men than for women. Later papers, such as Hamermesh and Abrevaya (2013), find that such a beauty

premium exists in many western countries and is related to better life satisfaction. They also discuss the measurement error issue in beauty resulting from different practices in recording individuals' beauty. Hamermesh (2011) reviews the literature on beauty economics. However, the surveys on such a beauty premium in developing countries such as China are still very limited. Compared to the western countries, anti-discrimination laws are non-existent or weakly enforced in these countries. Moreover, China is much more racially homogeneous than most western countries, with the ethnic Han group taking up a share of 91.5% (2010 Population census) in the national population, and most other ethnic groups are physically indistinguishable from the ethnic Han group. This implies that the beauty ratings given by different raters are more likely to be inherently consistent and hence better for us to examine the beauty premium.

Three papers discuss discrimination related to beauty in peer-to-peer lending markets, using data from Prosper.com. Duarte et al. (2012) find that borrowers who appear more trustworthy have higher probabilities of having their loans funded, while borrowers who appear more trustworthy indeed have better credit scores and default less often. Overall, their findings suggest that impressions of trustworthiness matter in financial transactions as they predict investors' as well as borrowers' behavior. On the other hand, a further examination by Ravina (2012) confirms the existence of beauty premium but finds that beautiful borrowers turn out to be as likely to default as average-looking borrowers with similar credentials, who are on average less likely to obtain funds and are charged higher rates. Her finding is consistent with the experiment-based results by Mobius and Rosenblatt (2006), Andreoni and Petrie (2008), Olivola and Todorov (2010) and others, who find that the beautiful are treated better, are perceived as more productive and are more confident, but that their actual productivity is not higher than that less attractive individuals. Finally, Pope and Sydnor (2011) find evidence of

significant racial disparities in this market. Although interesting, peer-to-peer lending markets are much smaller and less important than bank loan markets. Moreover, the borrowers on Prosper.com post their pictures voluntarily, which makes the selection issue hard to tackle. Therefore, Hamermesh (2011) comments on the area:

This discussion of credit markets illustrates yet another area where a person's beauty modifies an economic exchange. Research in this area is just beginning, and the evidence is very far from conclusive. It does seem, though, that lenders are willing to exchange more generous terms on loans for the pleasure of dealing with good-looking borrowers. They do this not because good looks predict that the loan will perform better, but because they are prejudiced against bad-looking applicants.

Compared with these papers, our market structure based method also makes it more straightforward to distinguish discrimination from unobservable credentials that impact loan offers' decisions. For example, since we find that on average good-looking people are treated better, we may conjecture that this is partly because good-looking people have some unobservable creditworthy attributes. However, the market will compensate for this difference in profit resulting from the difference in these attributes, either when the market is more concentrated or more competitive. That is, with a changing degree of market concentration, the differences in profit resulting from the difference in these attributes are pretty much the same, and hence should have few impacts on the estimate for the interaction term.

2.4 Empirical Strategy

2.4.1 Regression Specification

We will estimate the role of market competition in mitigating discrimination in bank loan markets. Based on data availability, we will analyze bank loan approval (whether the loan application was approved or rejected if a household once submitted a loan application) and the annualized interest rate of the loan of the largest amount for commercial/industrial loan markets. We will also analyze loan approval, the annualized interest rate, and the down payment ratio (down payment divided by the sum of down payment and the amount of the loan) of the loan of the largest amount for mortgage loan markets.

For bank loan approval, either in commercial/industrial loan markets or mortgage loan markets, we include the households who once applied a loan, and estimate the following regression equation:

$$Approve_{isp} = \beta_1 + \beta_2 Feature_{isp} Market_{isp} + \beta_3 Feature_{isp} + \beta_4 Market_{isp} + \beta_5 X_{isp} + \lambda_s + \varepsilon_{isp}, \quad (3)$$

where *i, s, p* represents household *i* in community or prefecture *p* of province *s*. Approve is a dummy variable indicating whether the household's loan application was accepted or rejected. *Feature* can be dummy variables for good-looking people, bad-looking people, or gender (male equal to 1). *Market* represents measures of market concentration such as HHI, C5, or C3. For commercial/industrial loan markets, we use community-level measures of market concentration, and the residual from a regression of market concentration on the community type (rural area, small town, small city, median city and big city). On the other hand, because a household probably moves out of its original community after buying a new house, we use prefecture-level measures of

market concentration for mortgage loan markets, and the residual from a regression of market concentration on logged GDP and population size.

The variables of major interest are the interaction terms $Feature_{isp}Market_{isp}$. Taking *Good looks*HHI* as an example, we expect a positive sign for the estimated coefficient in the regressions with the possibility that the loan application was approved as the dependent variable. *X* are a set of controls including an indicator for agricultural Hukou, rural status, household head's age, ethnic Han indicator, educational attainment, marital status, health status, communist party member status, and their interaction terms with market concentration. λ_s are province fixed effects. We do not use prefecture fixed effects to avoid having too many parameters for a relatively small sample size of commercial/industrial loans (the much larger R-squared than the adjusted R-squared implies possible overfitting). Another subtle issue is that the equilibrium combination of loan approval and interest rate has less within-prefecture variation for arbitrage reasons, especially for mortgage loans. However, we notice that the results are qualitatively identical and usually still significant with prefecture fixed effects.

For commercial/industrial loan markets, we will also control for home ownership to further account for the impact of family wealth, though we do not try to control for family income because it is probably impacted by the credit support from banks. For mortgage loan markets, we will also control for logged family income and retirement status. Since the majority of borrowers in this dataset report being granted a loan between 2009 and 2013, we use the measures of community-level market concentration in 2011 for commercial/industrial loans (to save labor cost) and the average measures of prefecture-level market concentration across these five years for mortgage loans. Using

alternative average measures[5] does not change our results because market concentration is highly persistent in the same market across time.

An older borrower probably possesses better working skills, has accumulated more wealth and hence has a greater ability to pay back a loan. Education increases income potential, and loan officers might also see better-educated people as having greater creditworthiness. A married couple would lose more if they defaulted, while health can enhance productivity and bring confidence (Ravina, 2012). Indicators for Hukou, rural status, party member status, home ownership, family income, and retirement status can further serve as proxies for the repayment willingness and ability. Our household finance dataset does not contain a direct variable for total family income, and hence we define family income as the sum of wage income, agricultural income and business income. We do not include government subsidies here because they cannot signal borrowers' repayment ability in the same way as other income sources, though the results with government subsidies included are almost the same.

Furthermore, we include the households whose loan application was approved, and estimate interest rate in both markets and down payment ratio in mortgage loan markets using the following regression equations:

$$Credit_{ispt} = \beta_1 + \beta_2 Feature_{ispt} Market_{ispt} + \beta_3 Feature_{ispt} + \beta_4 Market_{ispt} + \beta_5 X_{ispt} + \lambda_s + \lambda_t + \varepsilon_{ispt}, \quad (4)$$

where *Credit* refers to the credit terms of the loan of the largest amount a household borrowed, such as the interest rate (winsorized at 20 percent) in both markets and down payment ratio (winsorized at 0.99) in mortgage loan markets, both of which

[5] For example, we consider using the average measures of 2007-2011 or 2008-2012 for households whose loan application were rejected. We do not think measures with very different periods should be used for the accepted and rejected groups. Market competition becomes much fiercer over time, and hence a rejected household can probably reapply a loan several years later.

refer to the loan of the largest amount in corresponding markets. Although we may also be interested in the amount of the loan, current data available do not allow us to distinguish between the demand and supply sides. For example, if we observe that a beautiful borrower received a smaller loan amount than a less attractive borrower, we cannot say whether the good-looking borrower requested a smaller amount or the lender only guaranteed part of the requested loan. For this reason, we do not analyze the amount of the loan.

Taking *Good looks*HHI* as an example, we expect a negative sign for the estimated coefficient in the regressions with interest rate as the dependent variable. China has experienced a housing boom since 2000, and hence a lower down payment ratio might be preferred. However, a larger mortgage payment associated with a lower down payment ratio might drive away borrowers. Besides the variables mentioned above, for the regressions of the interest rate of commercial/industrial loans, we also control for an indicator variable for a loan with collateral, an indicator variable for whether the interest rate is adjustable (an adjustable loan affords the bank more flexibility to adjust the loan interest rate, such as in times of a high deposit interest rate), and their interaction terms with market concentration. For mortgage loans, we also control for an indicator variable for public housing fund loans (gongjijin) and its interaction term with market concentration. Here *Market* represents measures of market concentration such as HHI, C5, or C3 in the year the loan was granted (rather than the average measures in the regressions of loan approval), and λ_t are loan granted year fixed effects.

2.4.2 Measures of Market Concentration

We construct HHI, C5 (the market share of the largest five banks), and C3 (the market share of the largest three banks), the regular measures of market concentration.

Following Dong (2016)'s and Chong et al (2013)'s practice, we calculate these measures based on bank branch presence. That is, we calculate the number of the branches belonging to a certain bank and divide it by the total number of branches in a community or prefecture, and use this as the market share of this bank. Then we calculate HHI as usual. We keep all the commercial banks and credit unions in China. For household borrowers, credit unions are quite similar to other banks and are very important in small towns and rural areas, though excluding them does not change our results.

Unlike FDIC's Summary of Deposits, our dataset does not contain prefecture-level total deposits for a bank, and hence we cannot construct measures of market concentration based on deposits. Although many studies on the U.S. construct HHI based on deposits following the practice of U.S. Department of Justice, bank regulators consider branch presence as a very important measure of market power, as the intrastate and interstate branching restrictions show; indeed, the Summary of Deposits reports state-level and MSA-level total deposit and the number of branches together. As widely documented in the literature (i.e. Rose and Hudgins), the existence of a bank branch boosts deposits' confidence, and hence more branches can attract more depositors. In addition, it is easier for borrowers to find or visit a bank with more branches, and as a consequence after considering search cost or transportation cost, a bank with more branches should have larger market power. A big bank with many branches and hence large market power can also press small banks to follow its agenda. As to China, we usually see different banks are more likely to have a similar number of branches in eastern provinces than in western provinces, where we usually see several big banks staying with many small banks with only one branch, and banks usually consider the former markets as more competitive.

Furthermore, we consider the following checks. First, using the 2013 annual reports for the publicly traded banks in China, we find that the correlation between the number of branches and the amount of deposits (or loans) is 0.7 and significant under the1 percent level. Secondly, using the 2013 China City Statistical Yearbooks, we find that the correlation between the number of branches and the amount of deposits (or loans) for prefectures is 0.8 and significant under the1 percent level. This would not happen if banks with a larger number of branches had much smaller deposits (or loans) per branch in a prefecture, or if banks with a larger number of branches had much larger deposits (or loans) per branch in a prefecture. Thirdly, using FDIC's 2013 Summary of Deposits, we find that the correlation between state-level (or MSA-level) total deposits and the number of branches for a bank is 0.7 and significant under the 1 percent level. Therefore, the HHI constructed based on the number of branches should be similar to the HHI based on total deposits or total loans.

We will always report the results using HHI. Although not reported in the main analysis for brevity, regressions using C5 and C3 always give qualitatively identical results. This is because the three measures are highly positively correlated. We use prefecture-level market concentration for mortgage loans. Although households can probably move out of their original community after buying a new house, it is not very likely that they move out of their original prefecture. It is not uncommon for an individual living in a certain county to work in another county in the same prefecture, and therefore is reasonable for him/her to borrow from a bank branch along this route.

2.4.3 Community-level Market Concentration from Online Maps

In this paper, community-level market structure refers to market structure within the 2-kilometer circle around the community office where a household is located.

Commercial/industrial loans for small businesses are usually relationship-based as the literature of relationship banking documents (e.g., Peterson and Rajan, 1994, 2002), and for this reason we use community-level market concentration for this market. As opposed to borrowers of mortgages, entrepreneurs' collateral is less liquid and has greater volatility in value, and they usually need to borrow from the same bank many times. This means that monitoring is very important (Diamond, 1991; Berger and Udell, 1995) and the distance between a bank branch and a small business cannot be long. Peterson and Rajan (2002) find that a usual borrower is less than 5 miles from its lenders in the U.S. using the Survey of Small Business Finances. Brevoort and Hannan (2006) suggest that distance could have an increasing importance in US commercial lending (lender's decisions). Therefore, since the key advantage of our dataset is that we can obtain the community identifier, for commercial/industrial loans, we will find the number of different banks within 2 kilometers around the community office where a household was located. Not surprisingly, community-level market concentration has larger variation than prefecture-level market concentration, can mitigate the impacts of other prefecture-level confounding factors, and hence can provide large identifying power for us.

The choice of 2 kilometers is due to the labor intensive hand-collecting work of bank branches to a large extent, and we think it is reasonable for China. Compared with the U.S., China's population and thus bank branches are more concentrated (for many urban areas the number of branches is beyond 100 and they belong to more than 20 banks). Moreover, cars were not very common for almost all the possible borrowing years in our sample. The 2-kilometer circle has an area of 12.6 square kilometers, about one half of the East district (25 square kilometers with 0.92 million people) or the West district (32 square kilometers with 1.24 million people), two central county-level districts in Beijing, and therefore is large and contains a substantial number of bank branches for

many urban areas. When we search the bank branches using the Baidu Maps, we find that a bank with more branches in a smaller circle is almost always has more branches in the 2-kilometer circle. We also search bank branches beyond the 2-kilometer circle for randomly chosen communities and find that a bank with more branches in the 2-kilometer circle always has more branches in a larger circle. Indeed, the level of market concentration in a smaller circle is highly correlated with that of a larger circle.

Importantly, a community is small enough so that it can measure the approximate location of a sampled household accurately for our purpose. For example, we find that the East district and West district of Beijing include 187 communities and 255 communities respectively, which means that the community size is about 0.13 square kilometers in these districts, around one percent of a 2-kilometer circle (12.6 square kilometers). Overall, the community size is approximately comparable across the country.

Specifically, we use the Baidu Maps (http://map.baidu.com/), an online map search engine like Google Maps but having a higher precision for China's locations, for this purpose. The procedure for constructing the community-level market concentration is the following: we enter the address of a community office on Baidu Maps, then search ``Yinhang (bank in Chinese)'' in the ``Locations Nearby'' and can find the names of bank branches within 2 kilometers around the community office as shown on the left-hand side of Figure 3. Although the search results also include ATMs, we do not keep them because they cannot grant a loan.

A tricky part is that the bank branches found online are those existing currently, rather than those existing in the loan granted years. Some of the current bank branches might not exist several years ago, and some branches existing years ago might have already closed. We can solve this issue by matching the branches sought online with the branch file obtained from the China Banking Regulatory Commission (CBRC), which

contains the establishment year and closing year of a branch. Noticing that the name sought from the online maps does not always coincide with the name in the branch file perfectly, it is necessary to make sure the match is correct using the address information from the branch file in these cases.

2.4.4 Measure of Physical Attractiveness

The beauty ratings are given by student surveyors of CHFS, ranging from 1 to 10, with a lower rating representing a a worse-looking individual. To accommodate the distributions of beauty ratings in our samples as shown in Figure 4 and to follow the practice in this literature, we classify a rating of 1-2 as bad-looking, since there is a natural cutoff between a rating of 2 and above. To balance the concerns about sample size and the danger of classifying plain-looking people as good-looking ones, we classify a rating of 8 to 10 as good-looking. Classifying a rating of 9-10 as good-looking increases the magnitude of the impact of the interaction term of good-looking indicator and HHI and the impact of good-looking at the mean HHI generally, whereas classifying a rating of 7-10 as good looking reduces the magnitude of these impacts. These findings suggest that the ratings are indeed statistically effective. Moreover, using the 2012 China Labor-force Dynamics Survey carried out by Sun Yat-Sen University, which also contains beauty ratings given by college student surveyors ranging from 1-10 like our dataset, we find that each additional centimeter of height is associated with a 0.05 higher beauty rating for females and a 0.06 higher rating for males, and the beauty rating is also significantly negatively correlated with weight for females but not for males. This is consistent with the importance of slimness in judging women's beauty rather than men's

in this country. Actually, using a matched sample based on individual characteristics, we observe such patterns as well[6].

Indeed, although there is some concern about the subjective nature of measures on physical attractiveness, it is easy to adjust statistically for biases in drawing conclusions about the relationship between differences in beauty and any outcome. The real question is whether people agree on the beauty of a particular individual, and the extent of that agreement, if any. Although in our study and most other papers, the beauty of an individual was rated by a single surveyor, Hamermesh (2011, pages 24-28) provides rich evidence for the high correlation between ratings given by different people. Hamermesh and Biddle (1998) find a Cronbach's alpha of 0.75, while Andreoni and Petrie (2008) find an alpha of 0.86 and an intra-class correlation coefficient of 0.76. Ravina (2012) find 0.77 and 0.76 for these two commonly used measures of reliability[7]. Moreover, when classifying people into three beauty groups, which is the usual practice, the misclassification error should be small.

The peak of the distribution at ratings 5-7 is similar as findings in many surveys conducted in Western countries. However, a special phenomenon in our data is the right skewness of the distribution, which deserves an explanation. One possible reason is that Western countries usually have many means-tested welfare programs and hence inequality is relatively low in these countries; however, there are very few such programs in China. The 2011 CHFS has been shown to have an income distribution that is similar to that of other well-known surveys in China (Zhang et al., 2014). Comparing the distributions of family income in the 2011 Current Population Survey March supplement

[6] Specifically, we combine the two surveys, and run a regression with an indicator for one survey as the dependent variable and individual characteristics as independent variables and obtain a matched sample.}.

[7] There has not been a study documenting a weak or no correlation between the beauty ratings given by different people till now, which is probably not due to the ``significance bias'' in usual studies. It should be interesting to document such a deviation in beauty ratings as well.

and the 2011 CHFS and adjusting the sampling weights, we find that only 5 percent of the population has family income lower than 10 thousand U.S. dollars and the density declines to 0 as the family income nears 0, as shown in Figure 5. On the other hand, we find a much larger share of households with family income close to 0 in CHFS (government subsidies are included here to make this measure comparable to CPS family income[8]. We remind the readers that the two samples are not perfectly comparable because of differences in sampling methods; however, the differences in the distributions are intriguing and should not be fully driven by the sampling methods. Not surprisingly, the distribution of physical attractiveness partly reflects the long-term accumulation of these kinds of inequality, though we can control for economic factors in regressions to obtain a direct effect of beauty. Moreover, we also notice that our sample is nationwide, with most households either living in underdeveloped provinces, small towns and rural areas, or being migrants in developed areas. When just looking at the local citizens in developed areas, we find a less skewed distribution of beauty ratings.

2.5 Data and Descriptive Statistics

We construct the measures of market concentration, using an administrative dataset obtained from the China Banking Regulatory Commission (CBRC) and online maps (for community-level market concentration). The CBRC dataset provides information about the address, establishment year and closing year of each bank branch in this country, which allows us to construct measures of market concentration in each

[8] Not including government subsidies give an almost identical distribution.

prefecture/circle for each year, based on the number of branches a bank has in that prefecture/circle and that year[9].

The information about households' bank loans is obtained from the confidential 2013 China Household Finance Survey (CHFS) dataset, conducted by the Southwestern University of Finance and Economics in China. This survey employs a stratified three-stage random sample design based on probability proportional to size, interviewing 28,228 households across 29 provinces, 262 counties, and 1,048 communities. This survey is the only nationally representative survey in China that has detailed information about household finance and assets, including housing, business assets, financial assets, and other household assets. In this paper, we focus on two types of bank loans: commercial/industrial loans, and mortgage loans for the first home. Although this dataset also contains information about agricultural and educational loans, the government intervenes heavily in these two types of loan markets, and for this reason they are not analyzed here. Mortgage loans for a second home have also been highly regulated by the government since 2007, as part of the policies that are in place to curb the housing bubble. This survey was also conducted in 2011 and contains 8438 households. However, we do not use it because it does not contain community or prefecture identifiers, nor does it distinguish agricultural loans from commercial/industrial loans.

For our purposes, we use the household heads in the CHFS, and the gender and most other individual characteristics hence refer to those household heads. For beauty, the choice of household heads is not important, because a good-looking male tends to marry a good-looking female, as suggested by the assortative mating theory (e.g. Pencavel, 1998). The choice of household heads is probably important for our discussions

[9] Each bank branch has a branch code given by the central bank, which contains the code of the prefecture where this branch is located. Therefore, branch codes can be used to construct the prefecture-level measures. For the 2-kilometer circles, we use the online maps as discussed in the previous section.

on gender because most households contain both males and females. Although the survey asks the interviewees to name the head directly, we use a more delicate algorithm to determine the household heads for the main analysis. First, we retain an interviewee and his/her spouse, because the interviewee probably knows much better about the household's financial position if the household head is his/her spouse rather than his/her parents or children. Second, we sort educational attainment within a household and consider the individual with the higher level of education to be the household head. This is because the individual with more education should have a higher ability to understand loan conditions and search for better loan terms. Third, if the educational attainment is the same for both family members, we choose the one with a higher wage level as the head. This is because the individual with more income should be more likely to influence the borrowing decision and to repay the loan. Finally, if they have the same wage level, we keep the one named by the interviewee as the head. Alternatively, we also consider the case in which we simply keep the individual named by the interviewee as the head, and the results are very similar. This is not surprising, because the named head has 0.8 years extra educational attainment (about 10 percent of the mean educational attainment) and 2000 yuan extra wage income (about 25 percent of the mean wage income) on average, and these differences are highly significant. Actually, CHFS tends to select the one more familiar with household financial position if there were more than one family members present, and hence the interviewee is more likely to be the named head.

It should be noted that, in China, females' labor force participation is as high as that of males on average, and hence the gender of a household head is usually determined by the employment status or income of individuals in this household. Indeed, the marriage rate for female-headed families is close to that for male-headed families, and we do not find an obvious disadvantage in socioeconomic status for the former.

In addition, to complement prefecture-level variables such as log GDP and population size, we obtain relevant data from the 1995-2013 China City Statistical Yearbooks.

In columns (1) to (4) of Table 1, we compare the chance that a loan application was approved (or rejected) and annualized interest rate in commercial/industrial loan markets, for different beauty groups and gender groups. We ignore average-looking males and females in this comparison for clarity, and in this way we can obtain a ``sharper'' comparison. On average, the chance of good-looking males' applications being approved is almost the same as their bad-looking counterparts, while there is a statistically significant gap of 13 percentage points for good-looking and bad-looking females. The gaps in interest rates are 3 and 3.3 percentage points respectively and are highly significant. These gaps are large since the one-year benchmark loan interest rate set by China's central bank was 6 percent in 2013. These facts imply the possible existence of favoritism toward good-looking borrowers and discrimination against bad-looking ones. Moreover, we notice that good-looking females are less likely to have collateral and that the interest rate is more likely to be adjustable for them.

Switching to individual characteristics, good-looking men and women are, on average, 3 and 4 years younger than bad-looking men and women respectively, which confirms the validity of our beauty measure. A younger individual perhaps has a lower ability to repay a loan, especially for commercial/industrial loans. We do not find statistically significant or economically large differences in most other attributes, implying that our measure of physical attractiveness is not very likely to reflect the confounding impacts of these attributes. Good-looking people have one extra year of educational attainment and are less likely to live in rural areas, which could be associated with a higher repayment ability. Moreover, good-looking men are more likely to be

married and own a home, and are less likely to have an agricultural Hukou than bad-looking men, while the converse is true for women. Overall, good-looking people have a higher socioeconomic status than bad-looking people, but the differences are small.

Columns (5) and (6) focus on the comparison between the two genders. Males and females have similar approval rates and interest rates, and the differences in collateral and interest rate adjustability are also trivial. Furthermore, males are older, more likely to be married or be party members, and own a home, but are also more likely to live in rural areas and have an agricultural Hukou. Overall, it is hard to say which gender group is more creditworthy based on these characteristics.

Columns (1) to (4) of Table 2 report the major variables used in analyzing mortgage loan markets for different sets of groups. The chances of good-looking males and females' applications being approved are 6 and 7 percentage points significantly higher than their bad-looking counterparts respectively, while the gaps in a interest rates are 1.3 and 0.2 percentage points respectively, and the gaps in down payment ratio are trivial. Moreover, the chance that a loan application was approved is much larger than that for commercial/industrial loan markets, reflecting the safety of mortgage loans, since a house or apartment as collateral has a pretty stable value.

Again, good-looking men and women are 3 and 5 years younger than bad-looking men and women, which confirms the validity of our beauty measure. Good-looking people are better educated and more healthy, are more likely to be communist party members, have a higher family income, are less likely to live in rural areas, and are less likely to have an agricultural Hukou, which are probably related to better credentials. However, good-looking people are younger and are less likely to be married, which are probably related to worse credentials. Again, good-looking people have a higher socioeconomic status than bad-looking people, but the differences are not large.

Columns (5) and (6) show the differences between the two gender groups. We notice that males are less likely to be granted a loan and face a higher interest rate than females. Furthermore, males are older, more likely to be married or be party members, and are less likely to be retired, but are less educated, have a lower family income, are more likely to live in rural areas and have an agricultural Hukou. Overall, it is hard to determine which gender group is more creditworthy based on these characteristics.

2.6 Results: Commercial/industrial loans

2.6.1 Main Results

As a reminder, our prediction is that costly discrimination resulting from loan officers' prejudice will tend to decline in a more competitive bank loan market. Indeed, if the group of less attractive people or a certain gender has a higher default rate on average and hence is less likely to obtain a loan or faces a higher interest rate, more market competition would probably not reduce these productive lending practices (in that case they are no longer prejudice). This is in the same spirit as the studies on labor markets, such as Ashenfelter and Hannan (1986) and Black and Strahan (2001). The prejudice might be related to visual pleasure, but it can also be related to the willingness to extract a signal or ``soft information." For example, in labor markets an employer may see a certain racial group as being less productive and hence pays these workers a lower wage than others. If this group of workers actually has a similar productivity to other groups', the employer's decision leads to costly discrimination. Therefore, we consider these kinds of signals or ``soft information" to be results of prejudice. This is in line with Cavalluzzo et al. (2002) and Ravina (2012).

For commercial/industrial loans, we report results using the community-level HHI or the HHI residual from a regression of HHI on the community type (rural area, small town, small city, median city and big city). In columns (1) to (4) of Table 3, we find that there probably exists favoritism toward good-looking people in loan approval decisions. Specifically, in a more concentrated market, i.e., those with a higher HHI, good-looking people are significantly more likely to obtain a loan. For example, with a one-standard-deviation increase in community-level HHI (about 0.3), the chance that a good-looking male will obtain a loan is 20 percentage points higher compared with an average-looking male. The magnitude of this difference is very similar among females.

Columns (5) and (6) show that males are more likely to obtain a loan in a more concentrated market. One possible explanation is that women are probably considered to have weaker business skills than males, perhaps because there are many more successful male entrepreneurs. When setting HHI equal to its mean value of 0.4, we find that good-looking females are significantly more likely to obtain a loan, though neither the differences between good-looking males, bad-looking males, and average-looking males, nor the difference between the two gender groups is significant.

The upper part of Table 4 shows that bad-looking females pay a significantly higher interest rate in a more concentrated market. For example, with a one-standard-deviation increase in HHI, the interest rate faced by a bad-looking woman is 5 percentage points higher than that faced by an average-looking woman. The differences between other groups are relatively small and insignificant. This suggests that favoritism or discrimination in commercial/industrial loans is mainly through approval/reject decisions and, to a lesser extent, the interest rate. This fact is consistent with Cavalluzzo et al. (2002), who find that African Americans and women are less likely to obtain a loan but are not charged a significantly higher interest rate in a more concentrated

commercial/industrial loan market. They notice that Stiglitz and Weiss's adverse selection hypothesis can explain this. That is, in relatively risky commercial/industrial loan markets, the approval decision is probably a better screening mechanism. A high interest rate may encourage risk-taking behavior, and hence is not always in lenders' interests. Moreover, our conversations with loan officers suggest the following practice: interest rates are usually set by the provincial offices and probably the headquarters, which makes it relatively harder to adjust the interest rate than to make approval/rejection decisions.

Setting HHI equal to its mean, we find that bad-looking males and females pay 3 and 4 percentage points lower interest rates respectively, compared to average-looking males and females, and these differences are highly significant. Males also pay a lower interest rate than females, though this difference is not significant.

In the lower part of Table 4, we further separate the samples based on whether or not collateral was required. As we find in the websites of several banks, the types of collateral are various and can be any valuable assets, such as machines and inventories. These assets usually are not very liquid, and they are also more volatile in value than homes. It is possible that more favoritism or discrimination exists for loans without collateral because, in these cases, it is harder to verify the credentials of borrowers. We find that this is, indeed, true. For example, for loans without collateral, good-looking males pay a significantly lower interest rate compared to average-looking males in a more concentrated market, whereas for loans with collateral, we do not observe such a differential. Indeed, in the case without collateral, a loan officer may try to obtain a signal on borrowers' credentials, though the signal is not actually related to a higher quality, since such a practice declines in a more competitive market. Because the size of the female subsample is small, we do not conduct this exercise for it.

Overall, using the HHI or HHI residual as the measure of market concentration gives very similar results. This is perhaps not surprising. Indeed, a market of great economic importance is usually more attractive to firms, and hence there should be more applications for establishing new branches. These differences in economic levels can result in the differences in approval rates and credit terms across the country. For example, an area with a higher credit risk would be compensated by a lower approval rate and a higher interest rate. However, differences in economic levels should not lead to large differences in approval rates and credit terms among different demographic groups in the same area, except via the correlation with market concentration.

2.6.2 Interpretation and Subsample Analysis

Here we provide further interpretations of our findings through subsample analysis. The literature on beauty usually discusses three channels unrelated to real productivity: visual pleasure, the confidence channel, and verbal communication channels (Mobius and Rosenblat, 2006; Gallego, 2015). That is, not only can good-looking people bring visual pleasure, but they can also be more confident, and be more willing or able to communicate verbally. In other words, bank loan officers probably see confidence or communication skills as a signal of better quality, though these features are not necessarily related to higher productivity. In this sense, we can say the beauty premium or gender premium is a kind of prejudice. As opposed to borrowers of mortgages, entrepreneurs' collateral is usually much less liquid and has greater volatility in value. Therefore, it is necessary for bank loan officers to learn more about the borrowers.

Although the 2013 CHFS does not contain questions directly related to confidence or oral communication, we can elicit the possible channels in an indirect way.

We divide samples based on age 35, which is a typical cutoff for visual pleasure, though using 40 as the cutoff age gives similar results. If we document that bias toward good-looking people is concentrated among the age group younger than 35, this beauty premium probably mainly results from visual pleasure, and from confidence to a lesser extent. However, if bias is concentrated among the age group older than 35, it is probably more likely to result from enhanced willingness or skills in verbal communication. We run the subsample regressions with the approval decision as the dependent variable, because the sample size for interest rate is smaller.

Table 5 presents the results. We find that significant favoritism toward good-looking males is concentrated among the age group older than 35. The situation is similar for good-looking females, though this is insignificant partly due to a smaller sample size. Our explanation is that commercial/industrial loans are risky, and hence loan officers give less weight to visual pleasure, but more weight to the perceived higher quality based on better verbal communication. Of course, we acknowledge the limitation of this judgment. This result is in stark contrast to that for mortgage loans, as we will discuss later.

Similarly, we also find that the favoritism toward males relative to females is concentrated in the age group older than 35. This is also consistent with the explanation of a signal regarding borrowers' quality. There are many more successful older male entrepreneurs than older female entrepreneurs, and therefore it is possible for loan officers to see older male entrepreneurs as being more reliable. On the other hand, it is rare to see either successful young male entrepreneurs or young female entrepreneurs, and hence a young male entrepreneur is not more trustable than young female entrepreneurs.

Therefore, both the findings regarding physical attractiveness and gender support the interpretation of a signal. However, in a more competitive market, it is less likely for loan officers to use this signal. This implies that the signal is not effective in revealing the real credentials of borrowers. This is consistent with Becker's costly discrimination. It should be noted that this is different from statistical discrimination. Statistical discrimination is toward less creditworthy groups of borrowers, and hence will not decline in a more competitive market.

Starting in 2000, China's bank industry has experienced large-scale deregulation, with many markets witnessing an explosive growth in the number of different banks and the number of bank branches. Many new loan officers have very limited experience in dealing with borrowers, and they do not have Dun \& Bradstreet credit scores or FICO scores to check. Therefore, they probably choose borrowers based on some simple demographic characteristics. Although our dataset does not contain information on the characteristics of loan officers, future studies with suitable data can test whether experienced loan officers perform differently from new loan officers.

2.7 Results: Mortgage loans

2.7.1 Main Results

In mortgage loan markets, home as the collateral is very safe, it should be less likely for loan officers to see physical attractiveness and gender as a signal for quality, whereas visual pleasure should be more likely to affect lenders' decisions. If this is the case, we should observe the favoritism is concentrated in younger groups, such as the age group younger than 35. Given that most loan officers are male, we probably observe that

females, especially young good-looking females, are preferred in a more concentrated market. Our empirical findings confirm this prediction.

As shown in Table 6 and 7, we cannot find favoritism toward good-looking males. This is reasonable, since to male loan officers, a good-looking male borrower should not bring more visual pleasure than a plain male borrower. Although we do not find a beauty premium for the whole female sample, this is not surprising because the female sample contains both old and young females, and hence the results for the whole sample mask the pattern for the younger sample. A subsample analysis in Table 8 shows that young good-looking females are significantly more likely to obtain a loan in more concentrated markets, and young bad-looking females are less likely to obtain a loan and pay a much higher interest rate in more concentrated markets compared to average-looking females. This suggests the importance of visual pleasure in these markets as we expect.

The most striking findings involve gender discrimination. In stark contrast to most findings in labor markets, we find that women are much more likely to obtain a loan and pay a significantly lower interest rate in a more concentrated market. For example, as shown in Table 6 and 7, with a one-standard-deviation increase in HHI (0.04), females are 0.5 percentage points more likely to obtain a loan, and pay 0.3 percentage points lower interest rate. These gaps are large since the mean differences between males and females are 3 and 0.4 percentage points respectively.

Furthermore, we set HHI to its mean (0.12 for loan approval and 0.14 for the interest rate and down payment ratio). We find that good-looking males and females are 4 and 0.2 percentage points more likely to obtain a loan respectively, while men are 1.4 percentage points less likely to obtain a loan compared to women. Moreover, bad-looking

males face a significantly higher interest rate, and males pay a higher interest rate at the mean HHI.

To explain these findings, we note that there is no inherent disadvantage for female borrowers in mortgage loan markets. Given the relative majority of male bank loan officers, the preference for females is not that surprising. By contrast, one major concern for employers considering a female job-seeker is that women usually spend plenty of time in bearing and raising children, which might reduce their productivity. This does not pose a problem in bank loan markets. In commercial/industrial loan markets, women are probably considered to have weaker business skills than males, perhaps because there are many more successful male entrepreneurs. However, this is not a problem in mortgage loan markets as well.

This fact is also inconsistent with Cavalluzzo et al.'s (2002) finding on the female disadvantage using the Survey of Small Business finances in the United States. Because the studies on costly discrimination based on market structure usually use the Surveys of Small Business finances, and for this reason analyze only commercial/industrial loans, our findings on a female premium in mortgage loan markets provide a whole picture on this topic.

2.7.2 Interpretation and Subsample Analysis

Similar to the previous section, we also divide the samples based on the cutoff of age 35 in Table 8. Interestingly the results are in stark contrast to those for commercial/industrial loans. Young good-looking females are significantly more likely to obtain a loan in more concentrated markets, and young bad-looking females are less likely to obtain a loan and face a much higher interest rate in more concentrated markets compared to average-looking females. This suggests that visual pleasure could explain

the favoritism toward good-looking females. On the other hand, visual pleasure does not seem to be important for loan officers when dealing with either old or young male applicants. This result is also reasonable because most loan officers are male.

In columns (5) and (6), we find that the discrimination against males is concentrated in the age group younger than 35. This also suggests that young females are more likely to induce visual pleasure experience than young males.

Compared with commercial/industrial loan markets, in a period with soaring housing prices, home as collateral is very safe. Therefore, loan officers might give less weight to verbal communication or other attributes serving as a signal and enjoy more from visual pleasure.

To this point, we notice that women usually spend more time on searching, so a natural question is whether the observed advantage of women in mortgage loans should be attributed to more intensive search. We argue that this is not possible in this study. Search intensity is related to its opportunity costs, which is controlled when including education, income and other hard qualities. Moreover, although it is possible that women derive additional utility from shopping clothes, it is hard to believe that they also enjoy spending more time in a bank. The explanation of opportunity costs is also not compatible with the advantage of men in commercial/industrial loans.

2.8 Discussion

Bank loan terms are usually set by provincial offices and probably the headquarters, and hence are usually considered much more standard than labor contracts, especially within the same bank in a certain province. Moreover, the conditions or requirements can usually be found in the brochures at bank branches or online and are

therefore quite transparent. However, our findings imply that bank loan officers still have great freedom in choosing borrowers.

Our explanation is that there are severe asymmetries of information in bank loan markets (Stiglitz and Weiss, 1981), and thus it is difficult for banks to set a rigorous standard for their loan officers. Therefore, loan officers are granted great autonomy in selecting qualified borrowers and setting corresponding credit terms. By dealing with preferred but not more creditworthy groups, loan officers can probably receive private benefits while impose a higher cost on their banks. On the other hand, many borrowers might not understand complex financial products very well, and may therefore rely on the explanations provided by bank loan officers.

Our findings also suggest the importance to analyze different loan markets separately. Commercial/industrial loans are usually riskier than mortgage loans, and hence bank loan officers probably want to extract a signal regarding borrowers' credentials from their physical attractiveness or gender, even if the signal is not really associated with better quality. On the other hand, mortgage loans are pretty safe, and hence it is more likely for loan officers to enjoy visual pleasure.

Our paper is designed to elevate the understanding of costly discrimination in bank loan markets, an underexplored field. Therefore, our theoretical framework, regression results, and explanations generally achieve this purpose.

2.9 Conclusion

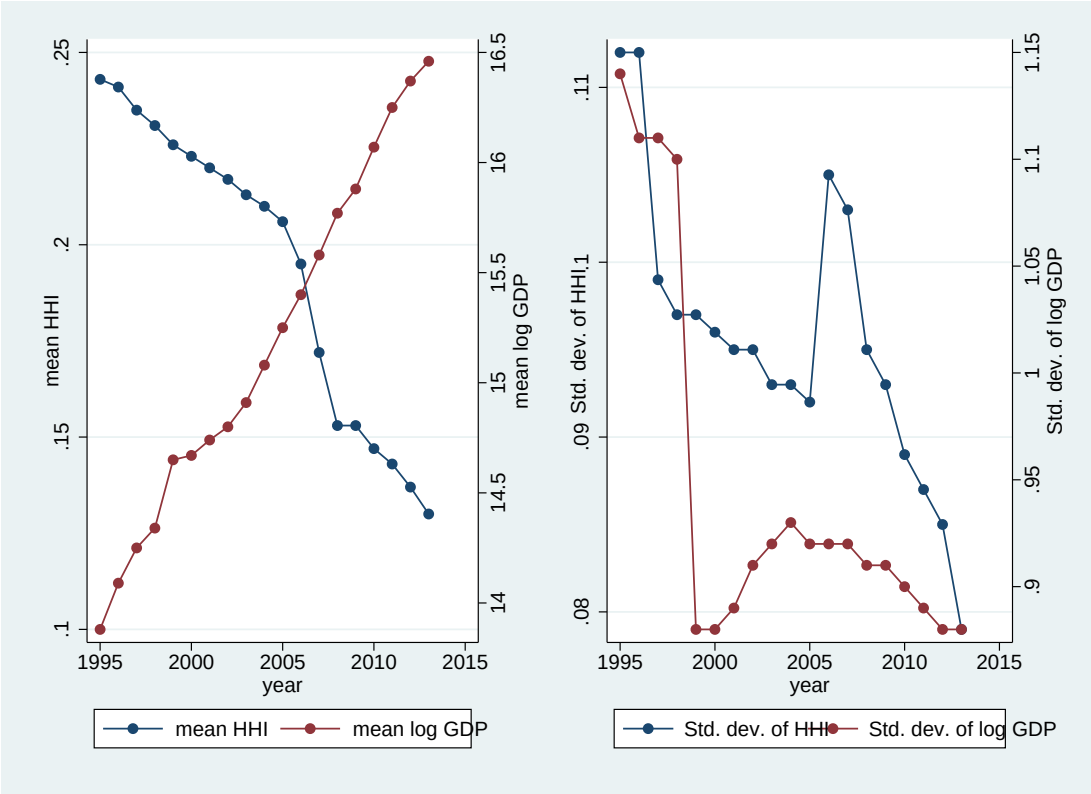
This paper analyzes costly discrimination related to physical attractiveness and gender in bank loan markets using a market structure-based method. The rationale is that high market concentration increases the degree of favoritism or discrimination, which is

confirmed by empirical evidence based on several unique datasets and online maps containing information about market structure and household borrowing. We document evidence that in a more concentrated commercial/industrial loan market, compared with average-looking people, good-looking people are more likely to obtain loans, and face lower interest rates, while the converse is true for bad-looking people. Moreover, our results show that males have an advantage over females.. On the other hand, in contrast to most findings in labor markets, we find that females have a strong advantage in a more concentrated mortgage loan market. Although the disadvantage of bearing and raising children cannot be easily disentangled from discrimination in labor markets, it does not pose an issue in mortgage loan markets and hence explains such findings. The consistent pattern shown in various regressions suggests the existence of taste-based discrimination in bank loan markets.

Discrimination in bank loan markets is not widely discussed by economists, perhaps due to limited data access. Compared to Western countries, anti-discrimination laws are either nonexistent or weakly enforced in many developing countries including China. Our paper therefore contributes to the understanding of discrimination in bank loan markets, and can potentially lead to better policies in combating such discrimination.

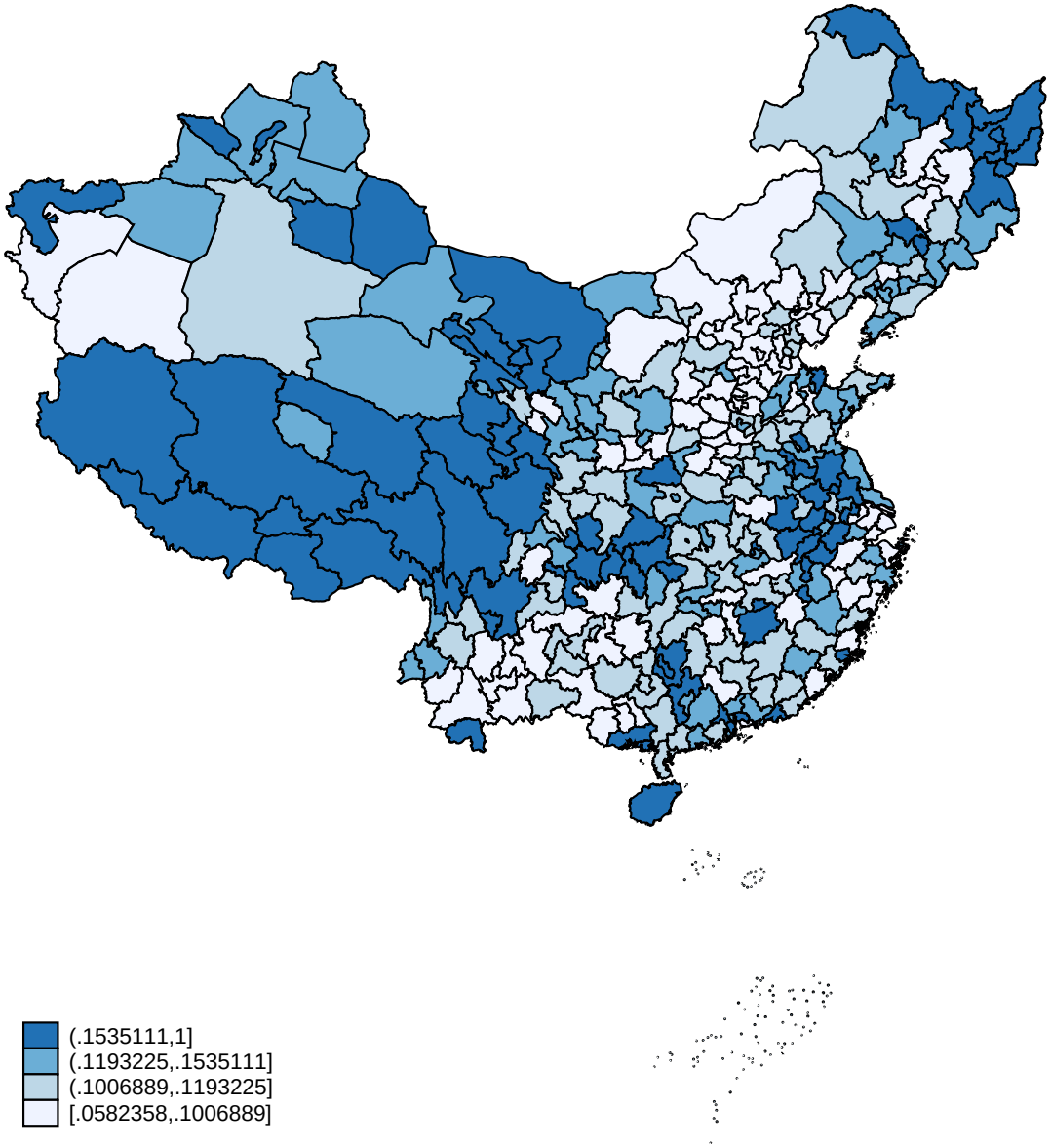
2.10.1 Figures

Figure 2.1: Mean and standard deviation of prefecture-level Herfindahl index (HHI) and logged GDP by year



Note: the left graph plots the mean of prefecture-level HHI and logged GDP by year, and the right graph plots the standard deviation of prefecture-level HHI and logged GDP by year. When calculating HHI, we use the number of branches belonging to a bank dividing by the total number of branches in this area as the market share of this bank, and obtain the sum of the squared shares of these banks. Data source: China Banking Regulatory Commission (CBRC) and China City Statistical Yearbooks.

Figure 2.2: Prefecture-level average HHI during 2009-2013 in mainland China

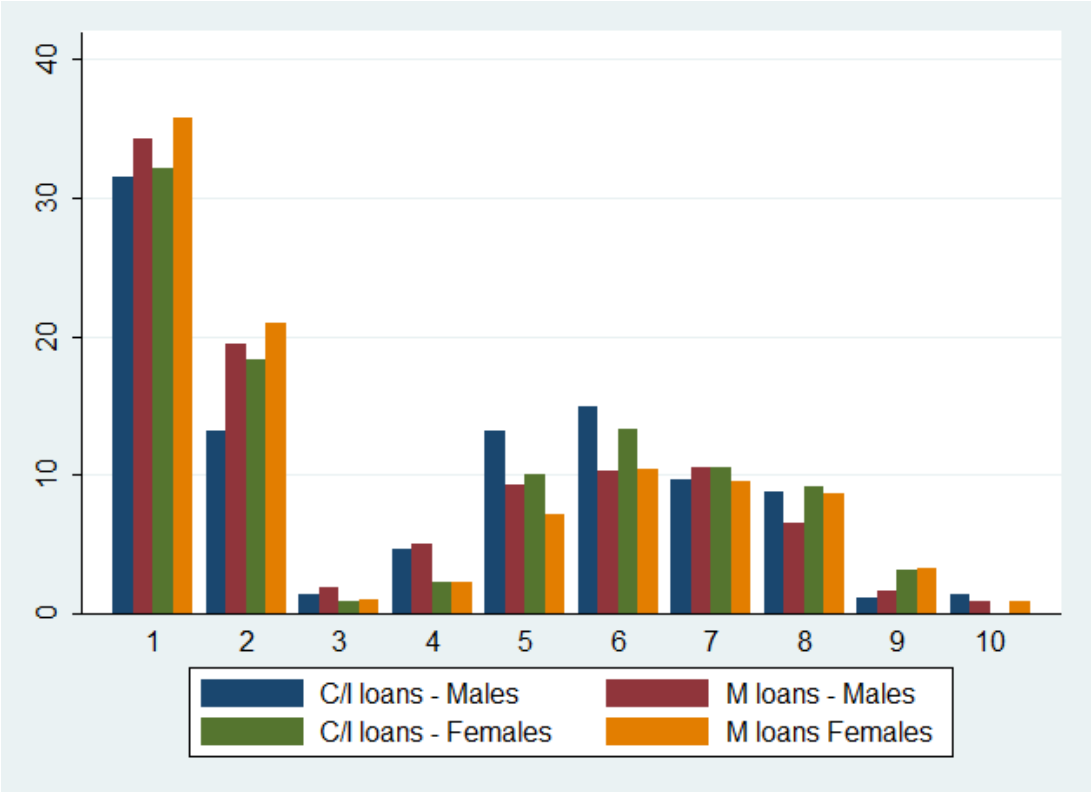


Note: the northeastern and western parts have a higher market concentration level on average, whereas the northern and southeastern parts have a lower market concentration level on average. However, we can find large variation in a relatively small region. When calculating HHI, we use the number of branches belonging to a bank dividing by the total number of branches in this area as the market share of this bank, and obtain the sum of the squared shares of these banks. Data source: China Banking Regulatory Commission (CBRC).

Figure 2.3: Example: the map of Shaoyaojusi community, Beijing and bank branches nearby

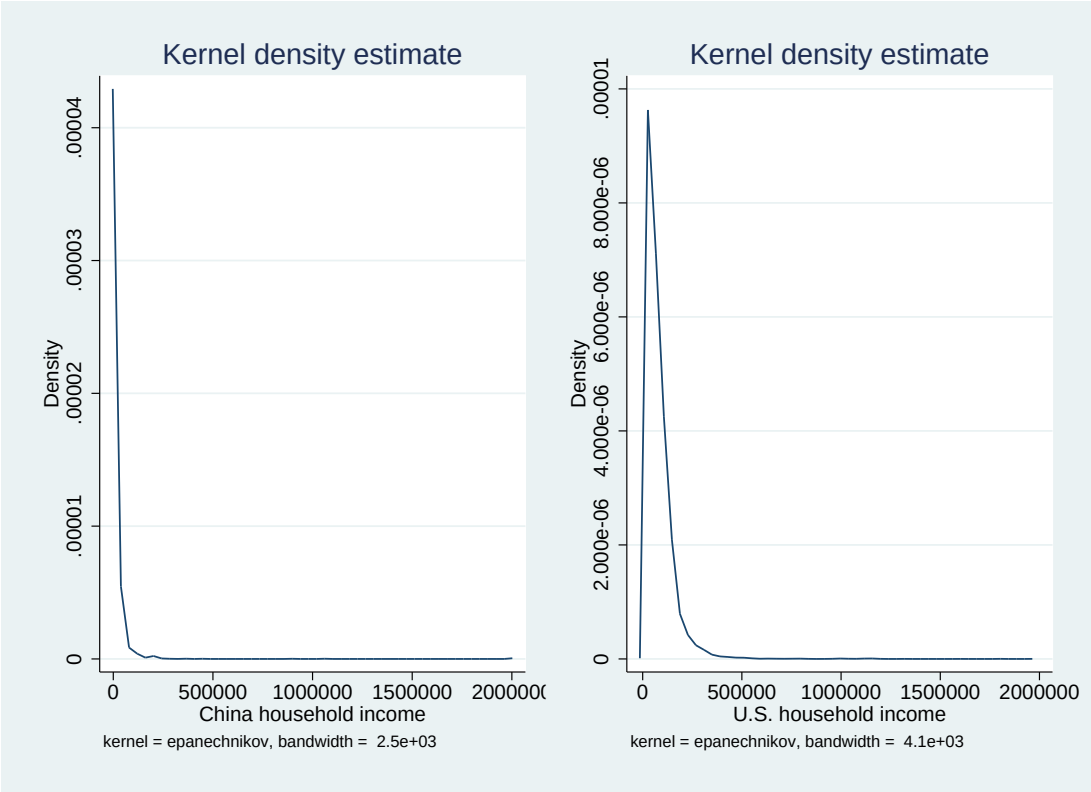
Note: in this example, we use the Baidu Maps (http://map.baidu.com/), an online map search engine like Google Maps but which has a higher precision for China's locations, to search for the bank branches around the community office of Shaoyaojusi community in Beijing. The procedure for constructing the community-level market concentration is the following: we enter the address of a community office on Baidu Maps, then search "Yinhang (bank in Chinese)" in the "Locations Nearby" and can find the names of bank branches within 2 kilometers around the community office. Although the search results also include ATMs, we do not keep them because they cannot grant a loan.

Figure 2.4: Beauty ratings by gender and market



Note: The distributions of beauty ratings. The unit of the vertical axis is the share of the sampled individuals with each rating in percentage points. The ratings range from 1 to 10 with a lower rating representing a worse-looking individual. C/I loans and M loans indicate the two major samples we use to analyze commercial/industrial loan markets and mortgage loan markets, respectively. Data source: 2013 China Household Finance Survey.

Figure 2.5: A comparison of income distributions in China and the U.S.



Note: The left graph is the income distribution for China, from 2011 China Household Finance Survey; The right graph is the income distribution for the United States, from 2011 Current Population Survey March supplement. The large right skewness is visible for China's income distribution, while the density declines to 0 as the family income is close to 0 for the U.S. income distribution.

2.10.2 Tables

Table 2.1: Descriptive statistics: commercial/industrial loan markets

	GL Male	BL Male	t	GL Female	BL Female	t	Male	Female	t
Approved	0.84	0.85	-0.2	0.96	0.83	1.8	0.83	0.85	-0.8
Interest rate (percentage)	4.25	7.29	-3.5	3.66	6.96	-2.3	6.35	6.27	0.2
With collateral	0.29	0.29	0.0	0.11	0.29	-1.9	0.26	0.25	0.2
Interest rate adjustable	0.34	0.34	0.1	0.4	0.25	1.2	0.34	0.30	0.7
HHI (community)	0.35	0.41	-1.1	0.32	0.35	-0.4	0.42	0.37	2.1
Age	40.9	43.9	-1.7	36	39.8	-1.8	44.7	40.9	4.4
Ethnic Han	0.98	0.87	2.2	1	0.9	1.7	0.92	0.94	-0.5
Educational attainment	11.9	10.9	1.7	12.3	11.2	1.4	10.8	11.3	-1.9
Marital status	0.92	0.89	0.6	0.78	0.86	-1.1	0.91	0.87	1.8
Healthy	0.94	0.92	0.5	0.89	0.93	-0.7	0.91	0.90	0.4
Party member	0.23	0.18	0.8	0.04	0.05	-0.4	0.18	0.08	3.5
Home ownership	0.81	0.76	0.7	0.70	0.73	-0.2	0.81	0.74	1.9
Rural status	0.27	0.36	-1.2	0.19	0.21	-0.3	0.39	0.24	3.8
Agri Hukou	0.44	0.61	-2.2	0.67	0.51	1.5	0.61	0.51	2.4
N	48	189		27	110		426	220	
M	29	107		13	48		230	96	

Note: Descriptive statistics for the mean values of different beauty and gender groups in commercial/industrial loan markets. N is the number of observations for regressions with bank loan approval as the dependent variable, and M is the number of observations for regressions with credit terms such as interest rate as the dependent variable. t is the t statistic for the hypothesis that the mean difference is equal to 0. HHI is the average community-level Herfindahl index during 2009-2013. Data source: 2013 China Household Finance Survey and China Banking Regulatory Commission (CBRC).

Table 2.2: Descriptive statistics: mortgage loan markets

	GL Male	BL Male	t	GL Female	BL Female	t	Male	Female	t
Approved	0.96	0.90	2.6	0.99	0.92	3.0	0.90	0.93	-2.8
Interest rate (percentage)	4.87	6.18	-3.5	5.21	5.45	-0.7	5.72	5.30	2.3
Down payment ratio	0.41	0.42	-0.5	0.42	0.42	0.0	0.42	0.42	0.2
Public housing fund loan	0.62	0.74	-3.4	0.57	0.66	-1.9	0.73	0.65	5.0
HHI (prefecture)	0.12	0.11	4.4	0.13	0.11	4.4	0.12	0.12	0.9
Age	42.2	45.6	-3.6	38.6	43.6	-4.0	45.8	43.1	5.8
Ethnic Han	0.98	0.90	3.7	0.96	0.93	1.5	0.91	0.93	-1.6
Educational attainment	13.4	12.1	4.0	14.5	12.2	5.7	11.7	12.3	-3.7
Marital status	0.90	0.92	-1.2	0.76	0.84	-2.0	0.93	0.82	9.3
Healthy	0.93	0.88	1.9	0.92	0.87	1.7	0.87	0.86	1.0
Party member	0.35	0.26	2.7	0.18	0.13	1.6	0.26	0.15	6.9
Log family income	8.44	6.96	3.5	8.96	6.71	4.3	6.91	7.01	-0.4
Retired	0.08	0.08	0.2	0.10	0.14	-1.2	0.07	0.13	-5.3
Rural status	0.16	0.31	-4.3	0.05	0.21	-4.3	0.34	0.19	8.4
Agri Hukou	0.29	0.42	-3.4	0.23	0.34	-2.4	0.46	0.33	6.8
N	197	1168		129	565		2185	1007	
M	95	424		63	211		822	381	

Note: Descriptive statistics for the mean values of different beauty and gender groups in mortgage loan markets. N is the number of observations for regressions with bank loan approval as the dependent variable, and M is the number of observations for regressions with credit terms such as interest rate and down payment ratio as the dependent variables. t is the t statistic for the hypothesis that the mean difference is equal to 0. HHI is the average prefecture-level Herfindahl index during 2009-2013. Data source: 2013 China Household Finance Survey and China Banking Regulatory Commission (CBRC).

Table 2.3: Competition and commercial/industrial loan approval

Dep. variable:	Male		Female		Male & Female	
Application was approved	(1)	(2)	(3)	(4)	(5)	(6)
Good looks*HHI	0.0357	0.668**	0.596**	0.646**		
	(0.153)	(0.323)	(0.267)	(0.362)		
Bad looks*HHI	-0.110	-0.241	0.160	0.219		
	(0.111)	(0.184)	(0.259)	(0.292)		
Male*HHI					0.232**	0.338**
					(0.101)	(0.137)
Good looks (at mean HHI)	0.022	0.046	0.247***	0.211**		
	(0.058)	(0.053)	(0.086)	(0.088)		
Bad looks (at mean HHI)	0.070	0.077	-0.033	-0.032		
	(0.044)	(0.046)	(0.068)	(0.066)		
Male (at mean HHI)					-0.012	-0.014
					(0.030)	(0.029)
N	423	420	218	215	646	640
Adj R-sq	0.072	0.071	0.052	0.036	0.080	0.068

Note: HHI is the average community-level Herfindahl index in 2011 (odd columns), and the HHI residual from a regression of HHI on the community type (rural area, small town, small city, median city and big city) (even columns); mean HHI=0.4, and mean HHI residual=0. Other covariates include an indicator for agricultural Hukou, rural status, home ownership, household head's age, ethnic Han indicator, educational attainment, marital status, health status, communist party member status, their interaction terms with HHI, HHI (main effect), and province fixed effects. Good look and bad look indicators are included in the regressions for column (1) to (4); male indicator is included in the regressions for column (5) to (6). Standard errors are clustered at prefecture,* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 2.4: Competition and commercial/industrial loan interest rate

Dep. variable:	Male		Female		Male & Female	
Interest rate	(1)	(2)	(3)	(4)	(5)	(6)
Good looks*HHI	-3.941	-3.222	-1.368	21.63		
	(2.691)	(4.692)	(7.108)	(13.40)		
Bad looks*HHI	-0.256	-1.687	11.29***	16.56**		
	(1.751)	(2.206)	(3.722)	(7.316)		
Male*HHI					1.840	2.556
					(1.590)	(1.611)
Good looks (at mean HHI)	-0.695	-0.349	0.786	-0.397		
	(0.836)	(0.844)	(2.481)	(1.663)		
Bad looks (at mean HHI)	3.197***	3.108***	4.130***	3.645***		
	(1.017)	(0.957)	(1.427)	(1.195)		
Male (at mean HHI)					-0.428	-0.602
					(0.687)	(0.734)
N	225	223	95	93	321	317
Adj R-sq	0.141	0.143	0.238	0.243	0.103	0.092
Dep. variable:	Male		Male & Female			
	Collateral	No Collateral	Collateral	No Collateral		
Interest rate	(1)	(2)	(3)	(4)		
Good looks*HHI	-1.122	-10.730*				
	11.570	(5.723)				
Bad looks*HHI	3.254	-3.164				
	6.461)	(2.366)				
Male*HHI			-5.525	3.362		
			(4.586)	(2.673)		

Note: HHI is the community-level Herfindahl index in the year the loan of the largest amount was granted (odd columns of the upper part), and the HHI residual from a regression of HHI on the community type (rural area, small town, small city, median city and big city) (even columns of the upper part); mean HHI=0.4, and mean HHI residual=0. Other covariates include an indicator for agricultural Hukou, rural status, home ownership, household head's age, ethnic Han indicator, educational attainment, marital status, health status, communist party member status, an indicator for a loan with collateral, an indicator for whether the interest rate is adjustable, their interaction terms with HHI, HHI (main effect), province fixed effects and loan granted year fixed effects. Good look and bad look indicators are included in the regressions for column (1) to (4); male indicator is included in the regressions for column (5) to (6). Standard errors are clustered at prefecture,* $p<0.10$, ** $p<0.05$, *** $p<0.01$. The lower part divides the samples into loans with collateral or not, where HHI always stands for the HHI residual.

Table 2.5: Subsample analysis: competition and commercial/industrial loan approval

Dep. variable:	Male		Female		Male & Female	
	age $\leq$ 35	age>35	age $\leq$ 35	age>35	age $\leq$ 35	age>35
Application was approved	(1)	(2)	(3)	(4)	(5)	(6)
Good looks*HHI	-0.233	0.781**	-0.558	0.509		
	(0.573)	(0.359)	(2.419)	(0.517)		
Bad looks*HHI	-0.029	-0.183	-0.112	0.413		
	(0.856)	(0.199)	(1.224)	(0.364)		
Male*HHI					-0.476	0.379**
					(0.324)	(0.157)

Note: HHI is the HHI residual from a regression of average community-level Herfindahl index on the community type (rural area, small town, small city, median city and big city). Other covariates include an indicator for agricultural Hukou, rural status, home ownership, household head's age, ethnic Han indicator, educational attainment, marital status, health status, communist party member status, their interaction terms with HHI, HHI (main effect), and province fixed effects. Good look and bad look indicators are included in the regressions for column (1) to (4); male indicator is included in the regressions for column (5) to (6). Standard errors are clustered at prefecture,* p<0.10, ** p<0.05, *** p<0.01.

Table 2.6: Competition and mortgage loan approval

Dep. variable:	Male		Female		Male & Female	
Application was approved	(1)	(2)	(3)	(4)	(5)	(6)
Good looks*HHI	-0.090	-0.118	0.183	-0.470		
	(0.285)	(0.342)	(0.189)	(0.415)		
Bad looks*HHI	-0.334	0.471	-0.109	-0.576		
	(0.549)	(0.608)	(0.442)	(0.585)		
Male*HHI					-0.233	-0.115
					(0.165)	(0.246)
Good looks (at mean HHI)	0.037	0.043*	0.002	0.002		
	(0.023)	(0.023)	(0.021)	(0.021)		
Bad looks (at mean HHI)	0.008	0.009	0.040	0.040		
	(0.025)	(0.026)	(0.026)	(0.026)		
Male (at mean HHI)					-0.014	-0.014
					(0.011)	(0.011)
N	1720	1574	797	750	2533	2339
Adj R-sq	0.098	0.093	0.082	0.098	0.097	0.090

Note: HHI is the average prefecture-level Herfindahl index during 2009-2013 (odd columns) and the HHI residual from a regression of HHI on the logged prefecture GDP and logged prefecture population (even columns); mean HHI=0.12 and mean HHI residual=0. Other covariates include an indicator for agricultural Hukou, rural status, logged family income, household head's age, ethnic Han indicator, educational attainment, marital status, health status, communist party member status, retirement status, their interaction terms with HHI, HHI (main effect), and province fixed effects. Good look and bad look indicators are included in the regressions for column (1) to (4); male indicator is included in the regressions for column (5) to (6). Standard errors are clustered at prefecture,* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 2.7: Competition and mortgage loan interest rate

Dep. variable:	Male		Female		Male & Female	
Interest rate	(1)	(2)	(3)	(4)	(5)	(6)
Good looks*HHI	-1.164	2.481	1.675	11.56		
	(5.484)	(7.009)	(11.68)	(12.48)		
Bad looks*HHI	5.788	0.918	4.380	15.07		
	(5.853)	(8.006)	(10.13)	(10.96)		
Male*HHI					8.445**	8.962**
					(3.704)	(4.452)
Good looks (at mean HHI)	-0.009	0.177	-0.260	-0.257		
	(0.312)	(0.290)	(0.492)	(0.492)		
Bad looks (at mean HHI)	1.037***	1.017***	-0.479	-0.556		
	(0.334)	(0.340)	(0.513)	(0.522)		
Male (at mean HHI)					0.225	0.135
					(0.182)	(0.209)
N	609	560	297	283	1145	852
Adj R-sq	0.079	0.066	0.029	0.060	0.047	0.045

Note: HHI is the prefecture-level Herfindahl index in the year the loan of the largest amount was granted (odd columns) and the HHI residual from a regression of HHI on the logged prefecture GDP and logged prefecture population (even columns); mean HHI=0.14 and mean HHI residual=0. Other covariates include an indicator for agricultural Hukou, rural status, logged family income, household head's age, ethnic Han indicator, educational attainment, marital status, health status, communist party member status, retirement status, an indicator for public housing fund loan (gongjijin), their interaction terms with HHI, HHI (main effect), province fixed effects and loan granted year fixed effects. Good look and bad look indicators are included in the regressions for column (1) to (4); male indicator is included in the regressions for column (5) to (6). Standard errors are clustered at prefecture,* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 2.8: Subsample analysis: competition and mortgage loan approval/interest rate

Dep. variable:	Male		Female		Male & Female	
	age $\leq$ 35	age>35	age $\leq$ 35	age>35	age $\leq$ 35	age>35
Application was approved	(1)	(2)	(3)	(4)	(5)	(6)
Good looks*HHI	-0.509	0.174	0.635**	-0.562		
	(0.489)	(0.535)	(0.306)	(0.675)		
Bad looks*HHI	0.300	0.595	-0.814	-0.528		
	(0.634)	(0.723)	(0.901)	(0.673)		
Male*HHI					0.534	-0.252
					(0.395)	(0.322)
Interest rate	(1)	(2)	(3)	(4)	(5)	(6)
Good looks*HHI	4.475	0.542	12.555	17.623		
	(12.562)	(8.829)	(31.290)	(17.561)		
Bad looks*HHI	-7.855	-0.485	25.695	4.498		
	(11.932)	(9.320)	(23.996)	(14.504)		
Male*HHI					17.72***	4.573
					(6.372)	(4.378)

Note: HHI is the HHI residual from a regression of prefecture-level Herfindahl index on the logged prefecture GDP and logged prefecture population. Other covariates include an indicator for agricultural Hukou, rural status, logged family income, household head's age, ethnic Han indicator, educational attainment, marital status, health status, communist party member status, retirement status, their interaction terms with HHI, HHI (main effect), and province fixed effects (for approval), and in addition an indicator for public housing fund loan (gongjijin), its interaction term with HHI, and loan granted year fixed effects (for interest rate). Good look and bad look indicators are included in the regressions for column (1) to (4); male indicator is included in the regressions for column (5) to (6). Standard errors are clustered at prefecture,* p<0.10, ** p<0.05, *** p<0.01.

Chapter 3

Economic Policy Uncertainty, Political Capital and Bank Risk-taking

The existing literature has conflicting findings regarding whether protection from the government induces firms to take on more risk or enjoy the quiet life. We address this issue by studying how political connections and their interaction with economic policy uncertainty affect banks' risk-taking behavior. Our hypothesis is that policy uncertainty increases the option value of waiting but political connections can reduce such option value. Our findings support the existence of two types of moral hazards, but they exist at different periods. When policy uncertainty is low, managers in politically connected banks have a less tendency to take on risk than those without political connections and enjoy the quiet life. However, when policy uncertainty is high, politically connected banks have much larger loan amounts, but smaller amounts of loss provision than those without political connections. These facts hold for both large and small banks, and suggest that maintaining lower policy uncertainty is vital in restricting the rent from political connections. Moreover, after bank deregulation, the benefit of political connections declines.

3.1 Introduction

How do political connections affect financial institutions' risk-taking behavior? At first sight, political connections might encourage risk-taking behavior of financial institutions if they are more likely to be bailed out by the government. Government bailouts are discretionary and, like other government decisions, they can be influenced by political considerations and political connections. Consequently, a moral hazard-based

theory would predict that firms with better political connections should take on more risk if it would bring more profits to them. For example, Kostovetsky (2015) find that the presence of a senator in the influential United States Senate Committee on Banking, Housing, and Urban Affairs (Senate Banking Committee) is associated with a 10\% increase in leverage and a 5% to 8% increase in stock volatility for financial institutions headquartered in his/her state, and the risk-taking behavior for politically connected financial institutions was more pronounced during the recent financial crisis.

However, financial institutions may limit their risk-taking in order to protect the quasi-monopoly rents granted by their government charters (Marcus, 1984; Furlong and Keeley; Keeley, 1990), and political connections will tend to increase the quasi-monopoly rents since the threat from competitors is alleviated. Moreover, in the United States, managers own very little of the firms they manage. For this reason, another moral hazard-based theory would predict that managers have little incentive to maximize shareholder wealth at the expense of their position. Using the enforcement of state takeover laws as the measure for the threat of takeover, Bertrand and Mullainathan (2003) document that when managers are insulated from takeovers, worker wages (especially those of white-collar workers) rise, the destruction of old plants falls, but the creation of new plants also falls. Similarly, with more protection granted by political connections and hence a weaker threat from potential competitors, bank managers may limit their risk-taking and ``enjoy the quiet life".

It is important to learn how to reconcile the two competing corporate governance literatures regarding protection from the government and firms' risk-taking. Especially, it is of vital policy concern to learn which type of moral hazard is closer to the real behavior of banks, and whether the existence of each type of moral hazard depends on policy uncertainty. To the best of our knowledge, this is the first paper to answer this

question. Banks have a unique advantage in reducing information asymmetry in credit supply (Diamond, 1984; Gande and Saunders, 2012), and are the main channel of obtaining external funds, especially for small and median firms. Further, government bailouts of banks are costly, as the 2008 Troubled Asset Relief Program (TARP) shows (Blau et al., 2013). The TARP program originally authorized expenditures of $700 billion, though the Dodd-Frank Wall Street Reform and Consumer Protection Act, signed into law in 2010, reduced the amount authorized to $475 billion.

To answer this question, we construct a sample using the Federal Deposit Insurance Corporation (FDIC)'s quarterly Call & Thrift Financial Reports and Summary of Deposits, including all the commercial banks and savings associations in the U.S. (hereafter referred as ``banks"). Similar to Kostovetsky (2015), we also use the Senate Banking Committee representation as the measure of political connections, since it is more likely to be exogenous than several other measures such as lobbying expenses. Compared to his paper, an additional advantage is that we can use a geographic discontinuity design to further mitigate the endogeneity concern regarding Senate Banking Committee representation. Moreover, to examine whether political connections pay off when government policies are more uncertain, we use the economic policy uncertainty (EPU) index from Baker, Bloom and Davis (2016). Our hypothesis is based on the option value of waiting in high EPU periods and the role of political connections in reducing such option value. When there is little uncertainty around government policies, political connections may not bring more competitive advantages to connected banks. When such uncertainty increases, the risk associated with the introduction of unfavorable policies increases for unconnected banks, and therefore the values of real option of delaying increases. On the other hand, for politically connected banks, such risk regarding unfavorable policies is lower. Moreover, even if the government implements

similar unfavorable policies for all banks, it is more likely for politically connected banks to be bailed out. Therefore, unconnected banks should reduce risk exposure during periods with more policy uncertainty, and hence leave extra market shares to politically connected banks.

Our empirical findings support this hypothesis. When policy uncertainty is low, politically connected banks have a significantly smaller credit supply than those without political connections, and the loss provision is similar for the two types of banks. This suggests the mangers in the former have less risk-taking behavior under protection. Moreover, when the EPU level is high, politically connected banks have much larger loan amounts, but smaller amounts of loss provision than those without political connections. Quantitatively, with one standard deviation increase in the EPU index, banks with Senate Banking Committee representation have 0.9 percentage points (controlling state fixed effects) or 0.6 percentage points (controlling bank fixed effects) higher loan-asset ratio than those without, equivalent to 7 percent or 4 percent of the standard deviation of loan-asset ratios in our sample. On the other hand, the loss provision ratios of the connected banks decline relative to unconnected banks when policy uncertainty is high. This is economically important for investor wealth due to the inherent leverage - gross loans are generally around 80\% of total assets. Especially, although the loan amounts for connected banks are much smaller than unconnected banks in the periods with the lowest quartile of the EPU index, this relationship reverses in the periods with the highest quartile of the EPU index (Figure 3). In addition, unconnected banks have similar amounts of loss provision to connected banks during periods with the lowest quartile of the EPU index, but much larger amounts of loss provision during periods with the highest quartile of the EPU index. This fact means that not only do connected banks take on more risk during high EPU periods relative to unconnected banks, but they also increase the

absolute amounts of credit supply without commensurate increases in loss provision. In other words, connected banks grab the market shares left by unconnected banks during high EPU periods.

Although Kostovetsky (2015) uses a sample of listed financial institutions and hence large ones, we use a full sample consisting of both large and small banks, and consequently we can check whether Senate Banking Committee representation and policy uncertainty have differential impacts by bank size. Big banks can spend more resources in lobbying senators or assisting their elections. However, they may exert influence over senators beyond their home state, and therefore, it may not be very important whether senators in their home state are in the Banking Committee. Our findings show that compared to small banks with political connections, big banks with political connections are more likely to enjoy the quiet life during low EPU periods and take more risk during high EPU periods, though the differences are not large. In addition, since Kostovetsky (2015)'s sample consists of large financial institutions including both banks and non-bank institutions, he focuses on book leverage rather than loans and loss provision. However, the majority of banks in our sample are financed by deposits, which are not easily manipulated. Therefore, following Bordo et al. (2016)'s practice, we see lending as the most appropriate measure of banks' investments and risk-taking. We also analyze loss provision to provide a whole picture of their risk-taking, since banks regularly adjust the level of loss provision when the risk of their asset portfolios changes. In another analysis, we separate the sample into two subsamples by period: 1985-2000 and 2001-2013. Banks in the former period were more heavily regulated than in the latter period. The results suggest that after bank deregulation, the benefit of political connection declines.

Finally, we investigate whether housing bubbles and business cycles drive the impacts of policy uncertainty. When adding the housing price growth, the recession

indicator and their interaction terms with Senate Banking Committee representation, our previous results are intact. Moreover, we find that in Metropolitan Statistical Areas (MSAs) with a higher housing price growth rate, politically connected banks have significantly less credit supply but a similar level of loss provision. An explanation is that unconnected banks might face large earnings growth pressure from investors (Chen, McInnis and Yust, 2014) during housing bubbles. On the other hand, connected banks have relatively stable profits and hence are less aggressive in extending credit. Interestingly, although Kostovetsky (2015) finds that politically connected financial institutions took on more risk during the recent recession, our results show that connected banks reduce credit supply and increase loss provision during recessions on average. This could be reasonable if political connections can give them early warnings on bad economic conditions. For example, Jagolinzer et al. (2016) find that political connected banks engaged in significant trading thirty days in advance of the announcement of the TARP program, suggesting political connections provided these banks with private information related to government intervention. Overall, the evidence regarding housing bubbles and recessions verifies the mechanism related to the option value of waiting.

Our paper is related to the literature on the relationship between political connections and rent-seeking, especially corporate risk-taking and corporate governance. In her seminal work, Krueger (1974) describes how economic agents can secure an advantage over their competitors through government means. Value to firms from rent seeking can come in the form of tax benefits, government contracts, fewer regulations, favorable trade restrictions (Stigler, 1971), or bailouts. The empirical literature usually verifies benefits from political connections. Faccio et al. (2006) analyze the likelihood of government bailouts of 450 politically connected firms from 35 countries during 1997-2002. They find that politically connected firms are significantly more likely to be bailed

out than similar unconnected firms. Faccio (2006) examines firms in 47 countries and finds that the announcement of a new political connection results in a significant increase in value, particularly in countries with higher levels of corruption, with barriers to foreign investment, and with more transparent systems. However, these papers neither address the differential impacts of political connections on corporate behavior during volatile and peaceful environments, nor separate benefits from enjoying the quiet life and value from risk-taking.

Further, our findings on the lower risk-taking made by politically connected banks extend the literature on active empire building. The seminal paper by Bertrand and Mullainathan (2002) find that under more protection from the government, active empire building may not be the norm and that managers may instead prefer to enjoy the quiet life. Cohen and Malloy (2014) find that government-dependent firms (who are likely to be politically connected) have lower investment, lower R&D spending, and lower sales growth than non-government-dependent firms. Relatedly, Kim (2015) finds that firms with strong political connections have lower investment, lower R&D spending, and lower patent citations (but higher government sales) relative to firms with weak political connections. A close paper to us is Akey and Lewellen (2015), who find that political connected firms take on risk, and policy-sensitive firms' investment, leverage, operating performance, Tobin's Q, option-implied volatility, and CDS spreads respond more sharply to the resolution of uncertainty after close elections than policy-neutral firms. On the other hand, our paper investigates a full universe of banks and considers the differences in political capital across all the banks in all the years. Moreover, we find both politically connected and unconnected banks are sensitive to policy uncertainty. Finally, our paper is also related to Koetter et al. (2012), who find that U.S. banks with

large market power tend to enjoy the quiet life. However, it is not directly related to political connections.

In his presidential address, Zingales (2015) encourages the finance profession to develop a deeper understanding of the rent-seeking dimension of finance. Our paper analyzes these areas and has important implications for understanding the complex pattern of corporate rent-seeking behavior. Especially, our results strongly suggest that maintaining lower policy uncertainty is vital in restricting the rent from political connections.

The rest of the paper is as follows. Section 2 gives more details on the background, and describes the datasets and methodology. Section 3 presents the main results for the relationship between economic policy uncertainty, Senate Banking Committee representation, and loan and loss provision. Section 4 looks at empirical findings for different subsamples. Section 5 discusses alternative explanations. In Section 6, we provide further evidence in supporting the exogeneity of Senate Banking Committee representation using a geographic discontinuity design. Finally, Section 7 concludes.

3.2 Background, Data and Methodology

3.2.1 Senate Banking Committee representation

Historical membership of the Senate Banking Committee is drawn from annual volumes of the Official Congressional Directory. For each bank and year/quarter, we define the dummy variable Committee Senator as equaling one if the bank is headquartered in a state with a senator on the Banking Committee in that quarter and zero

otherwise. As shown in Table 1, 44 percent of banks have Senate Banking Committee representation on average.

We follow Kostovetsky (2015) in introducing the Senate Banking Committee representation but provide more details. At the beginning of each Congress, senators and representatives are given committee assignments based on their seniority, preferences, and prior committee assignments. The committee's areas of jurisdiction include banking, insurance, financial markets, securities, international trade and finance, and economic policy. Members of the committee write legislation in these areas and oversee (and vote to confirm the heads of) executive departments and other government agencies regulating the financial industry including the Treasury Department, the Federal Reserve, and the Securities and Exchange Commission (SEC). These oversight powers provide committee members with a great deal of leverage to influence government decisions that affect the financial industry, including bailout decisions.

Several reasons support the use of Senate Banking Committee representation as the measure of political connections. First, senators have extra leverage over government officials that oversee the banking industry, because of their advise and consent power to confirm these officials. The committee's legislative record includes the major acts forming the banking industry. For example, the 1980 Depository Institutions Deregulation and Monetary Control Act phased out interest rate ceilings on deposits, expanded thrift powers, and raised deposit insurance coverage to $100,000; the 1994 Riegle-Neal Interstate Banking and Branching Efficiency Act permitted interstate expansion; the 1999 Gramm-Leach-Biley Act allowed financial holding companies to offer banking, securities, and insurance products under one corporate roof and established sweeping consumer privacy protections; and the 2002 Sarbanes-Oxley Act that includes far-reaching changes in federal securities regulation. Second, most banks operate within

state boundaries (and often have the name of the state in their names; e.g., First Texas Bank). For this reason, it is appropriate to look at senators who represent individual states. Finally, congressional boundaries change every ten years during redistricting, and banks often move their headquarters to different buildings in the same city but in a different congressional district. Therefore, the relationship between a bank and a district's representative is much weaker than that between a bank and a state's two US senators.

Importantly, having a connection to the Banking Committee is (mostly) not a choice variable of the bank. In addition, because committee membership changes over time, we can use bank fixed effects to test whether a bank changes its risk-taking behavior in response to changes in its political connections. A high-risk bank could move from a state without a committee senator to another state with a committee senator to enjoy that senator's protection. However, this seems unlikely, because the cost of moving bank branches from state to state is high, and senators in the Banking Committee may decide to retire or lose bids for reelection. And similar to Kostovetsky (2015), we find little evidence that banks move their headquarters across stateliness examining the National Information Center website, which has a history of FDIC-registered banks, including the current and former addresses of their headquarters.

A concern is that new senators base their choice of committee assignments on the type of banks in their home states. This would create a spurious correlation between committee senators and risk-taking behavior. However, the banking industry is dispersed across the country; consequently the Banking committee is different from the Agriculture Committee in which the committee members are mostly from Midwest farm states. According to the Congressional Research Service (CRS) Report for Congress[1] that

[1] The CRS report for Congress is available at http://assets.opencrs.com/rpts.

explains the committee choice process, senators usually try to obtain a seat on one of the big-four committees (Appropriations, Armed Services, Finance, and Foreign Relations), which have the most power and exposure. For the other committees (such as Banking), senators are assigned to committees to ``match the legislator's skills, expertise, and policy concerns".

Finally, because we have a large sample of banks rather than only listed financial institutions, we provide further evidence in supporting the exogeneity of Senate Banking Committee representation using a geographic discontinuity design, similar to Holmes (1998), Black (1999), Mian, Sufi, and Trebbi (2015). The rationale is that the counties close to state borders are generally more similar, and hence when we compare the banks located in these counties, it is less likely that Senate Banking Committee representation capture the impact of other differences across states. We obtain counties' shortest distance to a state border from Holmes (1998), and keep the samples of banks in 50 miles or 20 miles from a state border. In Section 6, we find the results are similar to those when using the full sample.

3.2.2 **Economic Policy Uncertainty**

Concerns about policy uncertainty have a direct impact on activities by market participants. A well-researched mechanism among them is that uncertainty increases the values of real options of waiting (Dixit and Pindyck, 1994). As a result, investment, hiring and consumption decline as the level of uncertainty rises. Studies related to the real options effects of uncertainty on corporate investment include Bernanke (1983), Leahy and Whited (1996), Guiso and Parigi (1999), Bloom, Bond, and Van Reenen (2007), Bloom (2009), Julio and Yook (2012), Gulen and Ion (2016), and others. Especially, Bordo et al. (2016) find that policy uncertainty has a significant negative effect on bank

credit growth. Therefore, the Federal Open Market Committee (2009) and the International Monetary Fund (IMF) (2012, 2013) suggest that uncertainty about U.S. and European fiscal, regulatory, and monetary policies contributed to a steep economic decline in 2008-2009 and slow recoveries afterward.

Importantly, political connections could have an interaction effect with policy uncertainty. When there is little uncertainty around government policies, connected banks do not have a sharp advantage in expanding their market shares. When such uncertainty increases, the risk associated with the introduction of unfavorable policies increases for unconnected banks, and consequently they could reduce credit supply and increase loss provision. On the other hand, for politically connected banks, such risk regarding unfavorable policies is lower. Moreover, even if the government implements the similar unfavorable policies for all banks, it is more likely for politically connected banks to be bailed out. Therefore, unconnected banks could leave extra market shares to politically connected banks. Indeed, the empirical results show that unconnected banks reduce their credit supply in absolute term during the periods with high policy uncertainty, whereas connected banks increase their credit supply in absolute term in these periods.

To measure policy uncertainty, we use the Economic Policy Uncertainty (EPU) US Monthly Index proposed and constructed by Baker, Bloom and Davis (2016)[2]. This index consists of three components: (i) news on policy-related economic uncertainty, (ii) federal tax code provisions set to expire in the near future, and (iii) forecaster disagreement on macro variables. To guarantee the quality of the index, the authors conducted an extensive audit to show that the indexes generated by computer algorithms are highly correlated with those generated by human auditors. Furthermore, the EPU

[2] The EPU index is downloaded from the Economic Policy Uncertainty website. For more details regarding the EPU index, please refer to http://www.policyuncertainty.com/.

index has been used in several recent finance studies to measure economic policy uncertainty (e.g., Pastor and Veronesi, 2013; Brogaard and Detzel, 2015; Akey and Lewellen, 2015; Starks and Sun, 2016), and it is carried by major commercial data providers to meet customers' demands.

The EPU index is particularly attractive for testing our hypothesis for the following reasons. First, it is reasonable that uncertainty related to government policies, rather than general economic uncertainty, has a direct impact on the role of political connections. Secondly, the EPU index measures uncertainty using sources that are readily accessible to all of the banks (either large or small) by reading major newspapers. The news component, which is given the highest weight in the index, is able to proxy for the level of uncertainty as perceived by these banks. Thirdly, the EPU index captures both financial and policy uncertainty and is plausibly exogenous to the activities of these banks.

Since the EPU index starts in 1985, we focus on the 1985-2013 sample period. Following Starks and Sun (2016), we calculate the quarterly EPU index by averaging the monthly EPU index in a quarter, then normalize it by subtracting the mean time-series EPU index and dividing the standard deviation of the time-series EPU index. In Figure 2, we plot the time trend of the normalized EPU index. In the following part of this paper, we always use this normalized EPU index (and the dummy variables for the quartiles of the EPU index), therefore our results can be explained in terms of one standard deviation change in the EPU index.

3.2.3 **Regression Specification**

In most of our analysis, we estimate the following regression equation:

$$y_{ist} = \beta_1 + \beta_2 EPU_t * CommSenator_{st} + \beta_3 EPU_t + \beta_4 CommSenator_{st} + \beta_5 X_{ist} + \lambda_t + \lambda_i + \varepsilon_{ist}, \quad (1)$$

where *i, s, t* represents bank *i* in state *s* and year-quarter *t*. *y* equals the amounts of total loans or loss provision scaled by total assets, expressed in percentage points for the ease of reading. *EPU* is the normalized EPU index, a continuous measure. *Comm Senator* is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that quarter and zero otherwise. λ_t are year fixed effects and quarter fixed effects; λ_i are bank fixed effects. We also try settings with state fixed effects rather than bank fixed effects. We choose the specification with year and quarter fixed effects rather than year by quarter fixed effects and hence include EPU_t in regressions. This gives us a chance to see the dynamics of loan and loss provision ratios in absolute term conditional on other covariates for connected and unconnected banks, and hence facilitate our understandings on the aggressiveness of connected banks in periods with different levels of policy uncertainty. For example, we define the quarter dummy for June to 1 for the same quarter in every year. Therefore, the average loan ratios (or loss provision ratios) conditional on other covariates for connected banks and unconnected banks are $\beta_1 + \beta_2 EPU_t + \beta_3 EPU_t + \beta_4$ and $\beta_1 + \beta_3 EPU_t$ respectively. We also run regressions using year by quarter fixed effects (different for the same quarter in different years), or regressions with different kinds of clustering[3], and the results are very similar.

Concerning the potentially nonlinear impact of the EPU index, we also estimate a variant of Equation (1), where we replace the continuous EPU measure with the dummy variables for the four quartiles of the EPU index:

$$y_{ist} = \delta_1 + \sum_j \delta_{2j} EPU_{jt} * CommSenator_{st} + \sum_j \delta_{3j} EPU_{jt} + \delta_4 X_{ist} + \lambda_t + \lambda_i + \varepsilon_{ist}, \quad (2)$$

[3] We tried the regressions by clustering at MSA, or clustering at both bank and year by quarter.

where j stands for the quartiles of the EPU index. Here we do not include $CommSenator_{st}$ and the dummy variable for the lowest quartile of the EPU index to avoid perfect collinearity. Again, here we can obtain loan ratio and loss provision ratio in absolute term for connected and unconnected banks in the periods with different EPU levels, after controlling log total assets, ROA, ROA volatility, dividend ratio, cash ratio, year, quarter, and state fixed effects. That is, we calculate the estimated $\delta_1 + \delta_{3j}$ (unconnected banks) and $\delta_1 + \delta_{2j} + \delta_{3j}$ (connected banks) for each j, as shown in Figure 3.

Following the regular practice, we include covariates X such as log total assets, ROA (net income divided by total assets), ROA volatility (standard deviation of current ROA and the last seven quarters' ROA), dividend ratio (dividends scaled by total assets), and cash ratio (cash holdings scaled by assets). Banks with a higher level of total assets usually have a higher ability to diversify their risk, and hence can supply more credit and maintain a low level of loss provision. ROA may have a positive impact on credit supply and a negative impact on loss provision, whereas the converse could be true for the volatility of ROA. In addition, dividend-paying banks may have a higher level of loss provision, which could be attributed to having more resources, and they may also be more conservative in lending. In addition, to maintain more cash reserve, banks may reduce both credit supply and loss provision. These variables are expressed in percentage points as well.

We obtain the financial statement information from FDIC's quarterly Call & Thrift Financial Reports. We use one quarter lag for these variables to mitigate the simultaneity issue, though using the current quarter values gives identical results. We convert the amounts of total assets to constant dollar values of the fourth quarter of 2013,

using the quarterly Consumer Price Index (CPI) from Social Security Administration[4], which is in turn constructed from the monthly CPI calculated by the Census Bureau.

3.2.4 Descriptive Statistics

In the major regressions, we keep observations from March 1985 to December 2013, measured at the bank-year-quarter level, because the EPU index starts in 1985. The original number of observations is 1,183,016. We drop the observations missing the major variables in our regressions: loan ratio, loss provision ratio, log total assets, ROA, ROA volatility, dividend ratio, and cash ratio, and keep observations with loan ratio and loss provision ratio larger than 0. The number of observations in the remaining sample is 877,448.

We report the descriptive statistics in Table 1. Total assets are measured in thousand dollars (constant dollar values of the fourth quarter of 2013). We find that the mean of total assets is much larger than the median of total assets, because most of the banks in the U.S. focus only on a small area and hence have a small size. Indeed, there are only 5 percent of the bank-year-quarter observations representing banks operating in multiple states. Moreover, we obtain quarterly MSA-level median housing price growth rates constructed from data collected by the Federal Housing Finance Agency, which have mean and median of 0.7 and 0.8 percentage points, though the housing price growth varies a lot across the country, reflecting the possible impacts of land supply elasticities and households' expectations (i.e. Saiz, 2010; Gao, Sockin, Xiong, 2015).

[4] These data can be downloaded from https://www.ssa.gov/oact/STATS/avgcpi.html.

3.3 Main Results

3.3.1 Continuous Measure of the EPU Index

In Table 2, we report the main results with loan ratio and loss provision ratio as dependent variables. In Columns 1 and 4, we ignore the EPU index and check if banks located in a state with a senator on the Banking Committee behave differently from those without connections. We find that the former supply slightly more loans than the latter given total assets, but their loss provision ratios are 0.01 percentage points lower on average or 3 percent of the average loss provision ratio, which is significant under the 5 percent level. This result is in line with Kostovetsky's (2015) findings on the financial leverage of listed financial institutions and implies more risk-taking behavior by politically connected banks on average. Notice these estimates reflect the average impact of political connections during low EPU periods and high EPU periods. If during most of the time connected banks take on less risk and during very high EPU periods they take on much more risk than unconnected banks, we could still find this average impact. However, it masks the complex pattern regarding political connections.

Columns 2 and 5 report the results in the regressions with the EPU index and its interaction term with the Senate Banking Committee representation. Since we use a standardized measure of the EPU index, the magnitude of these two terms can be explained in terms of one standard deviation change in the EPU index. We find that when policy uncertainty increases, politically connected banks have a much higher level of credit supply, significant under the 1 percent level. Quantitatively, with one standard deviation increase in the EPU index, banks with Senate Banking Committee representation have 0.9 percentage points (controlling state fixed effects) or 0.6 percentage points (controlling bank fixed effects) higher loan-asset ratio than those without, equivalent to 7 percent or 4 percent of the standard deviation of loan-asset ratios

in our sample. Due to their inherent leverage, banks' loan portfolios are several orders of magnitude greater than shareholders' equity - gross loans are generally around 80\% of total assets. Therefore, this is an economically large impact related to investor wealth.

On the other hand, the loss provision ratios of the connected banks decline relative to unconnected banks when policy uncertainty is high. With one standard deviation increase in the EPU index, banks with Senate Banking Committee representation have 0.008 percentage points (controlling state fixed effects) or 0.007 percentage points (controlling bank fixed effects) lower loss provision-asset ratio than those without, equivalent to 1 percent of the standard deviation of loss provision-asset ratios in our sample. This implies relatively more risk-taking behavior for politically connected banks during periods with more policy uncertainty. In addition, we find a significantly negative estimate on the EPU index in the regressions with loan ratio as the dependent variable, implying that banks are more prudent during periods with more policy uncertainty on average. The decline in loss provision is possibly a byproduct of the decline in credit supply.

Our setting also allows us to detect the change in loan and loss provision ratio in both absolute term or relative term. The average loan ratio (or loss provision ratio) conditional on other covariates for connected banks and unconnected banks are $\beta_1 + \beta_2 EPU_t + \beta_3 EPU_t + \beta_4$ and $\beta_1 + \beta_3 EPU_t$ respectively. Therefore, for example, when the EPU index changes from -1 to 1, connected banks increase their credit supply in absolute term without commensurate increases in loss provision, whereas unconnected banks reduce their credit supply in absolute term. This pattern will be more clear when we use a discrete measure of the EPU index, as shown in Figure 3.

In Columns 3 and 6, we replace state fixed effects with a full set of bank fixed effects; therefore, we can account for all the time-invariant bank-level factors. Because

committee membership changes over time, using bank fixed effects gives us a unique chance to test whether a bank changes its risk-taking behavior in response to changes in its political connections. Although the estimate on the interaction term declines by one third, it is still significant under the 1 percent level. Moreover, politically connected banks still have a slight net decline in loss provision ratio during periods with more policy uncertainty relative to unconnected banks.

Overall, we find that during periods with low policy uncertainty, politically connected banks have a significantly lower level of credit supply, and the level of loss provision is even lower. This result verifies our hypothesis: when there is little uncertainty around government policies, connected banks do not have an advantage in expanding their market shares. Therefore, this kind of enjoying the quiet life under more protection during normal periods is in line with Bertrand and Mullainathan (2003) and Koetter et al.'s (2012) findings, but in stark contrast with Kostovetsky's (2015) findings. Only when policy uncertainty is high and the unconnected banks become more prudent, connected banks increase their risk-taking.

Turning to other covariates, we find banks with a higher level of total assets supply more credit and have more loss provision, while the converse is true for cash ratio. ROA has a negative impact on loss provision, but the impact on loans is not robust. The volatility of ROA has a positive impact on loss provision, but the impact on loans is again not robust. In addition, dividend-paying banks have a higher level of loss provision, which could be attributed to more resources they have, and they supply less credit since they should be less aggressive. These results are consistent with the usual findings in the literature, such as Kostovetsky (2015), Bordo et al. (2016) and others. In the latter tables, we do not report the estimates for the covariates because they are very similar to here.

3.3.2 Quartile Dummies of the EPU Index

A continuous measure of economic policy uncertainty masks the potential nonlinearity in the effects of policy uncertainty. Therefore, in Table 3, we replace the continuous measure of the EPU index with the dummy variables for its four quartiles, where EPU(Q1) represents the lowest quartile of the EPU index and EPU(Q4) represents the highest quartile of the EPU index. We find significantly lower loan ratio and similar loss provision ratio for banks with Senate Banking Committee representation when the EPU level is low, either when adding state fixed effects or bank fixed effects. Again, this pattern is perfectly consistent with Bertrand and Mullainathan (2003) and Koetter et al.'s (2012) findings. When there is little uncertainty around government policies, unconnected banks do not face an obvious disadvantage and maintain a high level of credit supply. Consequently, it is not attractive for connected banks to expand in this case.

Moreover, we find an increasing pattern in the estimates of the interaction terms in the regressions with loan ratio as the dependent variable, whereas these estimates are more negative in the highest quartiles in the regressions with loss provision ratio as the dependent variable. Therefore, when policy uncertainty increases, politically connected banks increase credit supply monotonically relative to unconnected banks, but their loss provision ratios increase less or decline more than unconnected banks.

To see this pattern more clearly, we plot the ratio and loss provision ratio for connected and unconnected banks in the periods with different EPU levels after controlling log total assets, ROA, ROA volatility, dividend ratio, cash ratio, year, quarter, and state fixed effects. That is, we calculate the estimated $\delta_1 + \delta_{3j}$ (unconnected banks) and $\delta_1 + \delta_{2j} + \delta_{3j}$ (connected banks) for each j in Equation (2). We can see that during the periods with the lowest quartile of the EPU index, connected banks have much less

credit supply than unconnected banks and the same level of loss provision; however, during the periods with the highest two quartiles of the EPU index, they extend more loans but have much less loss provision. Actually, compared to loss provision ratios in the lowest quartile of the EPU index, loss provision ratios are lower for connected banks and higher for unconnected banks in the highest quartile of the EPU index on average.

This pattern is important, which suggests that not only do connected banks take on more risk during high EPU periods relative to unconnected banks, but also they increase the absolute amounts of credit supply without commensurate increases in loss provision. In other words, connected banks grab the market shares left by unconnected banks during high EPU periods. Therefore, the findings using the quartiles of the EPU index provide more evidence supporting our hypothesis.

3.4 Subsample Analysis

3.4.1 By Bank Size

Big banks could spend more resources in lobbying senators or assisting their elections. However, they may exert influence over senators beyond their home state, and then it may be not very important whether the senators in their home state are in the Banking Committee. Kostovetsky (2015) uses the sample of listed banks and thus large banks. Will smaller banks show the similar pattern as big banks? In this paper, we have a sample consisting of both large and small banks, and consequently we can examine whether Senate Banking Committee representation and EPU have differential impacts in the different size groups.

We divide the sample based on the percentile of total assets by year/quarter, and consider banks with total assets larger than 75 percentile within each year/quarter group

as large banks, and the remaining banks as small banks. Columns 1 and 2 of Table 4 shows that during low EPU periods, both big banks and small banks with Senate Banking Committee representation have significantly smaller loan amounts than those without, which suggests that both of them may enjoy the quiet life. In addition, the impact of Senate Banking Committee representation is slightly larger among big banks. Moreover, politically connected banks' (either large or small) credit supply is significantly higher than those without Senate Banking Committee representation when policy uncertainty is high, suggesting relatively less risk aversion during periods with more policy uncertainty.

Turning to loss provision in Columns 4 and 5, we find political connections have a positive but weaker impact among big banks, and a significantly negative impact among small banks. Overall, compared to small banks with political connections, big banks with political connections are more likely to enjoy the quiet life during low EPU periods and take more risk during high EPU periods, though the differences are not large.

In addition, we divide the sample into 10 groups based on the deciles of total assets and report the estimates for the interaction terms in Figure 4. We do not find a monotonic pattern in regressions with either loan ratio or loss provision ratio as dependent variables.

Next, we divide the sample into banks with existence in a single state or multiple states, based on the presence of branches. Unlike the main sample, this sample starts in 1994. The results for banks with existence in multiple states, as shown in Columns 3 and 6, are similar to those for the full sample, though these estimates are less precise because of a smaller sample.

3.4.2 By Period

The Riegle-Neal Interstate Banking Act eliminated all the restrictions on interstate banking by 1995 and branching by 1997. Because of such bank deregulation, the banking market was less regulated and more volatile during the post-2000 period than the pre-2000 period. For example, the early 2000s experienced a credit boom and then the recent financial crisis. Therefore, a natural question is that whether political connections have a larger or weaker role in the later period. To answer this question, in Table 5, we divide the sample into two periods: 1985-2000 and 2001-2013.

In the later period, banks with Senate Banking Committee representation have smaller loan ratios and higher loss provision ratios when policy uncertainty is low. Moreover, although loan ratios increase more with the EPU index in the later period, loss provision ratios also increase more with the EPU index. This is in stark contrast with the earlier period, since at that time loss provision ratios decline significantly with the EPU index. Overall, these results suggest that after bank deregulation, the benefit of political connections declines.

3.5 Alternative Explanations

3.5.1 ``Too Big to Fail''

Regulators have a main concern regarding the ``too big to fail'' (TBTF) banks, because of their systemic importance. These banks are likely to incur risks, believing that the authorities will assist them if any problems should occur (Mishkin et al., 2006). Not only does this thinking create instability in the banking market, but the TBTF banks are also too costly to save (Demirguc-Kunt and Huizinga, 2010). Therefore, there is a possibility that our estimates might reflect the impact of bank size, rather than political

connections, if these two things are highly correlated. Although we already find evidence consistent with our main results when dividing the sample by bank size, here we directly control the interaction term of EPU and log total assets to purge the impact of bank size.

As shown in Columns 1 and 2 of Table 6, we find that both the impacts of Senate Banking Committee representation and its interaction term with the EPU index have very similar magnitude to those in Columns 3 and 6 of Table 2, and they are still highly significant. These results imply that our main results are not likely to be driven by the impact of banks size. Indeed, although larger banks have larger amounts of loans during high EPU periods, they have larger amounts of loss provision.

3.5.2 Housing Bubbles

Kostovetsky (2015) finds that politically connected financial institutions have higher leverage during housing bubbles in response to local growth in median housing prices. Therefore, it is possible our results relating to policy uncertainty reflect the impact of housing bubbles. We use the quarterly MSA-level median housing price growth rates constructed from data calculated by the Federal Housing Finance Agency, and add this growth rate and its interaction term with Senate Banking Committee representation in our main regressions.

As shown in Column 3, the estimate of the interaction term of EPU and Senate Banking Committee representation declines but is still large and significant. Moreover, we find that in MSAs with higher housing price growth rates, politically connected banks have significantly less credit supply but a similar level of loss provision, which suggests they take on less risk during housing bubbles. An explanation is that unconnected banks might face large earnings growth pressure from investors (Chen, McInnis and Yust,

2014) during housing bubbles. On the other hand, connected banks have relatively stable profits and hence are less aggressive in extending credit.

3.5.3 Business Cycles

In addition, the macroeconomic literature documents a strong negative correlation between uncertainty and business cycles (e.g., Bloom, 2014). Figure 2 shows that this is true as well. Therefore, it is possible our results related to EPU reflect the impacts of recession. We control for possible alternatives related to business cycles by including an interaction term between a dummy variable for NBER-defined recessions and Senate Banking Committee representation. Since the recession variable is binary, in order to allow better comparison with the coefficient on the policy uncertainty variable, we construct a binary policy uncertainty variable that takes the value of one when the EPU index is above its time-series median, and zero otherwise.

Although Kostovetsky (2015) finds that politically connected financial institutions took on more risk during the recent recession, our results show that risk-taking behavior by these banks declines during recessions on average, as shown in Columns 3 and 4 of Table 6. This could be because political connections can give connected banks early warnings on bad economic conditions, and lead them to reduce risk exposure before the storm. For example, Jagolinzer et al. (2016) find that connected banks engaged in significant trading thirty days in advance of the announcement of the Troubled Asset Relief Program (TARP) program, suggesting political connections provided these banks with private information related to government intervention. On the other hand, we find that the impacts regarding Senate Banking Committee representation and its interaction term with the EPU index are intact.

Overall, the evidence regarding housing bubbles and recessions verifies the mechanism related to the option value of waiting. That is, in high EPU periods, the option value of waiting increases more for unconnected banks, and consequently they reduce credit supply and increase loss provision relative to connected banks.

3.6 A Geographic Discontinuity Design

To further address the endogeneity concern regarding Senate Banking Committee representation, we use a geographic discontinuity design, similar to Holmes (1998), Black (1999), Mian, Sufi, and Trebbi (2015). The rationale is that the counties close to state borders are generally more similar, and hence when we compare the banks located in these counties, it is less likely that Senate Banking Committee representation captures the impact of other differences across states.

We obtain counties' shortest distance to a state border from Holmes (1998), and keep the samples of banks in 50 miles or 20 miles from a state border. Table 7 reports the results. For both samples, we find connected banks have significantly less credit supply and slightly less loss provision, and both of them increase with the EPU index. These results are quite similar to Table 2. In addition, we repeat the aforementioned full-sample or subsample analysis using the border sample, and the results are generally quite similar, and hence the endogeneity concern is further mitigated.

3.7 Conclusion

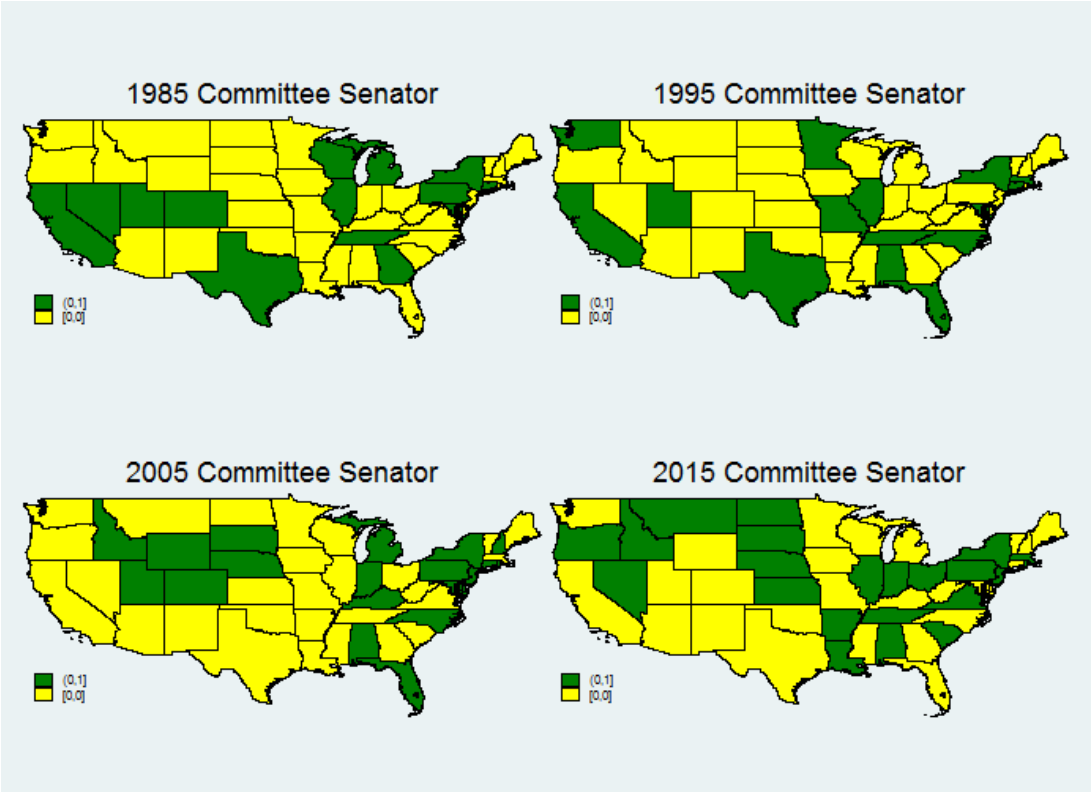
Our paper connects the two important corporate governance literatures related to bank risk-taking and enjoying the quiet life, by studying how political connections and their interaction with economic policy uncertainty affect banks' risk-taking behavior. Our

findings support the existence of two types of moral hazard, but they exist at different periods. When police uncertainty is low, politically connected banks have a weaker tendency to take on more risk than those without political connections and enjoy the quiet life. However, when police uncertainty is high, politically connected banks have much larger credit supply, but smaller loss provision ratios than those without political connections. These facts hold for both large and small banks; moreover, after bank deregulation, the benefit of political connection declines.

These findings support our hypothesis related the option value of waiting in high EPU periods and the role of political connections in reducing such option value. When there is little uncertainty around government policies, political connections may not bring many additional benefits to connected banks. When such uncertainty increases, the risk associated with the introduction of unfavorable policies increases for unconnected banks. On the other hand, for politically connected banks, such risk regarding unfavorable policies is lower. Moreover, even if the government implements the similar unfavorable policies for all banks, it is more likely for politically connected banks to be bailed out. Therefore, unconnected banks should reduce risk exposure during periods with more policy uncertainty, and hence leave extra market shares to politically connected banks.

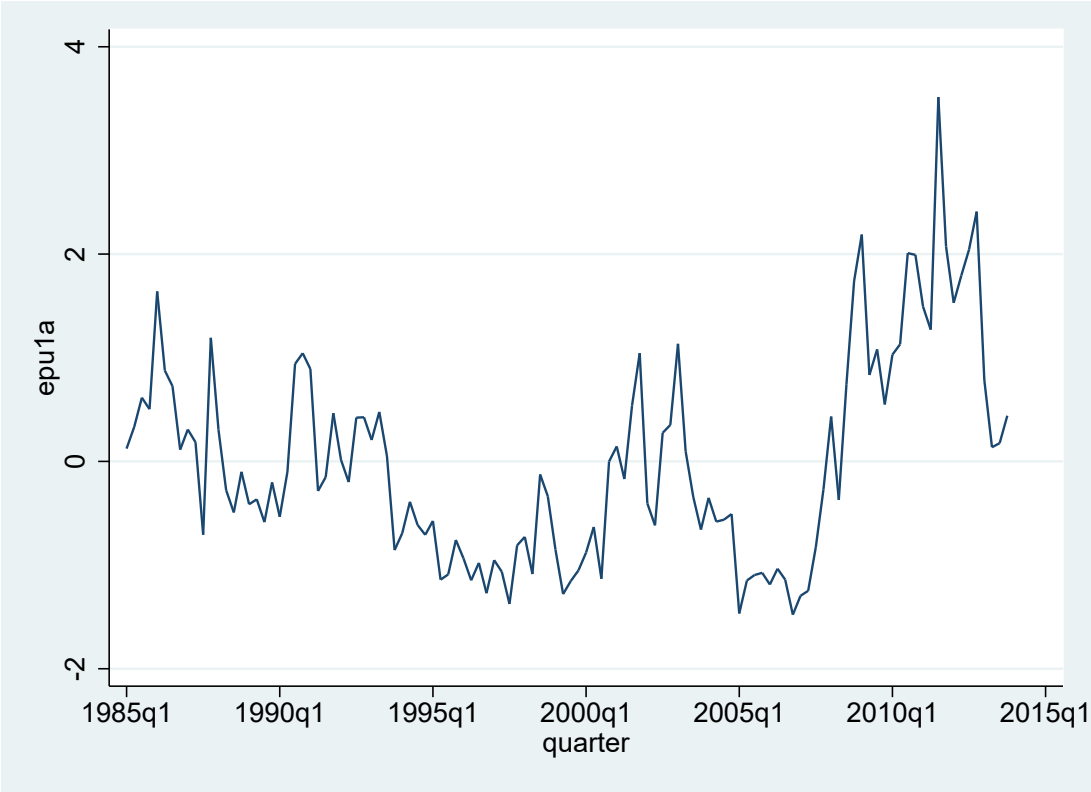
3.8.1 Figures

Figure 3.1: Senate Banking Committee representation



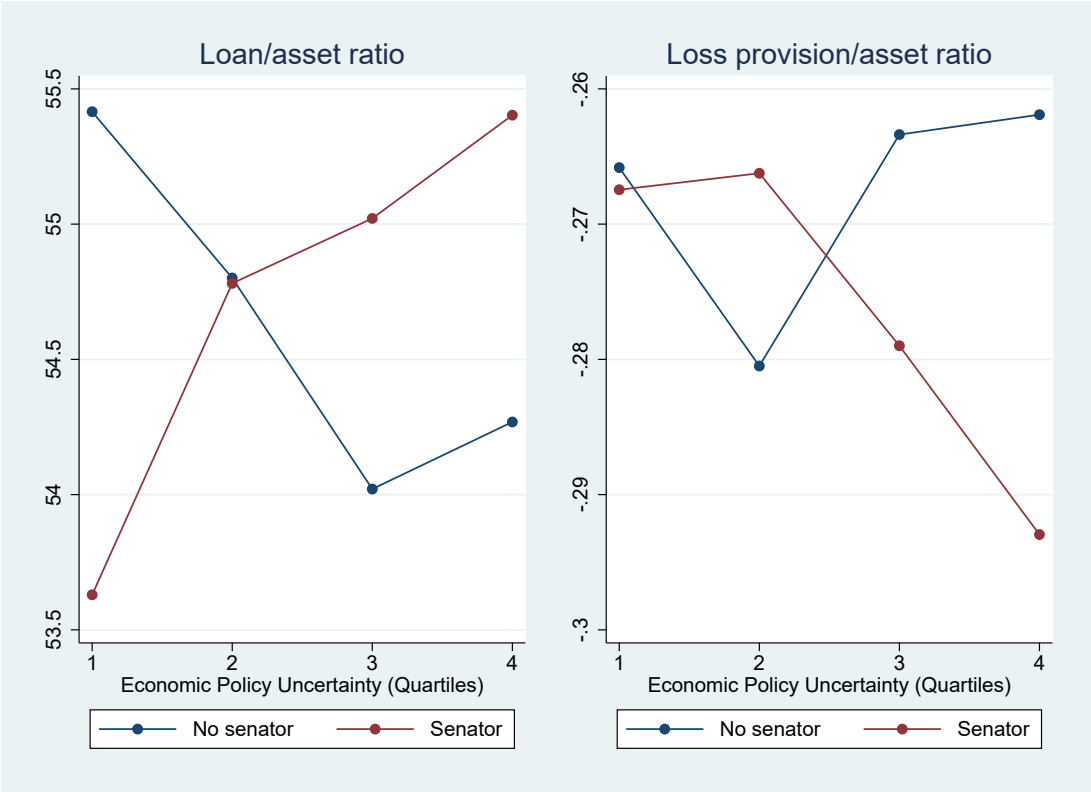
Note: this figure plots states with a senator in the Banking committee in 1985, 1995, 2005, and 2015. The green color stands for states with a senator in the Banking committee and the yellow color stands for those without. Data source: annual volumes of the Official Congressional Directory.

Figure 3.2: The time trend of the normalized Economic Policy Uncertainty (EPU) index



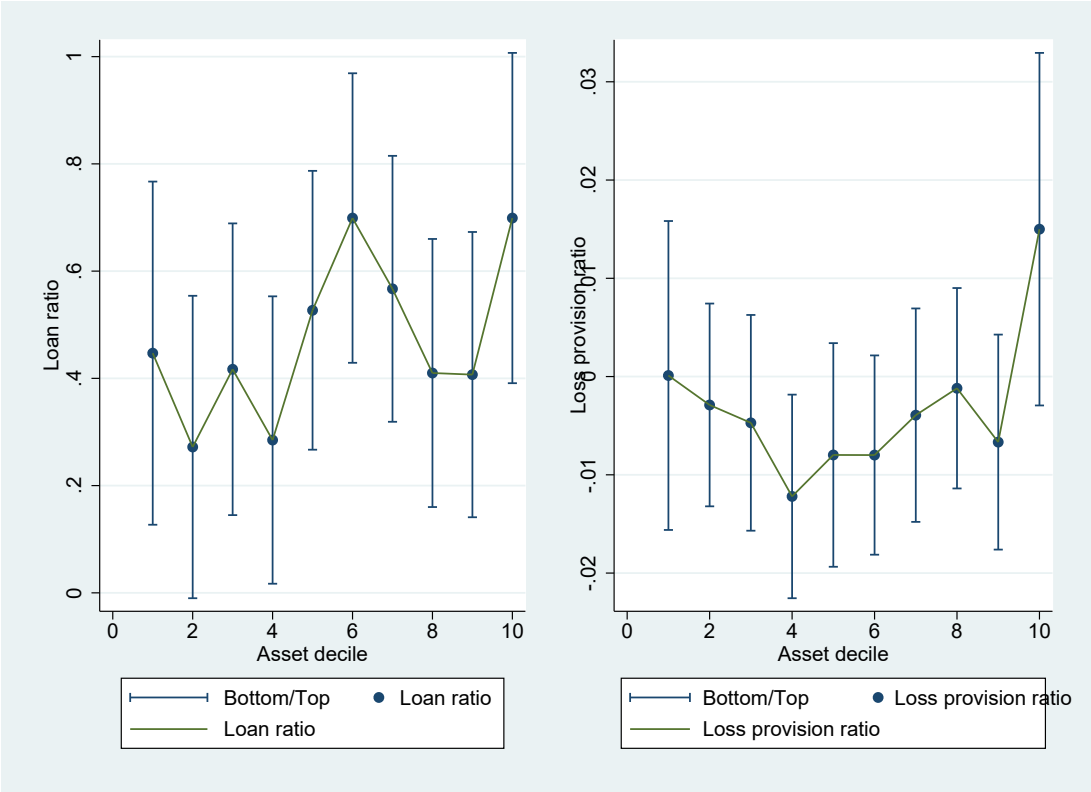
Note: this figure plots time trend of the normalized Economic Policy Uncertainty (EPU) index, which is obtained by subtracting the time-series mean EPU index and dividing the standard deviation of the time-series EPU index. Data source: the Economic Policy Uncertainty website (http://www.policyuncertainty.com/).

Figure 3.3: Senate Banking Committee representation and Economic Policy Uncertainty (EPU) quartiles



Note: this figure plots the log amounts of loans (and loss provision) for banks with Senate Banking Committee representation or not, during periods with the four EPU quartiles, after controlling log total assets, ROA, ROA volatility, dividend ratio, cash ratio, year, quarter, and state fixed effects. That is, we calculate the estimated $\delta_1 + \delta_{3j}$ (unconnected banks) and $\delta_1 + \delta_{2j} + \delta_{3j}$ (connected banks) for each j in Equation (2). EPU=1 represents the lowest quartile of the EPU index and EPU=4 represents the highest quartile of the EPU index.

Figure 3.4: Senate Banking Committee representation and total assets (deciles)



Note: this figure plots the coefficient estimates and 95% confidence intervals for the interaction term of Senate Banking Committee representation and the EPU index (continuous measure) by the deciles of total assets, estimated using Equation (1).

3.8.2 Tables

Table 3.1: Descriptive statistics

(in percentage)	Mean	Std. Dev.	Median	P10	P90
Comm Senator	44				
Multiple states	5				
Loan	60.4	14.8	61.7	40.3	78.3
Loss provision	0.3	0.9	0.1	0.0	0.7
Total assets (thousand dollars)	1,048,788	19,100,000	120,835	33,405.57	671,586
ROA	0.5	1.3	0.5	0	1.2
ROA volatility	0.4	0.9	0.3	0.2	0.6
Dividend ratio	0.2	2.6	0	0	0.6
Cash ratio	6.5	5.6	4.9	2.2	12.4
Housing price growth	0.71	1.96	0.82	-1.42	2.60

Note: Comm Senator is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that year-quarter and zero otherwise. Multiple states is a dummy variable that equals one if the bank is operated in multiple states and zero otherwise. Loan stands for the total loans scaled by total assets, and Loss provision stands for loss provision scaled by total assets. ROA is net income divided by total assets. ROA volatility is the standard deviation of current ROA and the last seven quarters' ROA. Dividend ratio is dividends scaled by total assets, and Cash ratio is cash holdings scaled by total assets. Total assets are measured in thousand dollars (constant dollar values of the fourth quarter of 2013). Data source: FDIC's quarterly Call & Thrift Financial Reports (1985-2013), and Summary of Deposits (1994-2013).

Table 3.2: Economic policy uncertainty (continuous measure), Senate Banking Committee representation, and loan and loss provision

Dep. var.:	Loan	Loan	Loan	Loss provision	Loss provision	Loss provision
	(1)	(2)	(3)	(4)	(5)	(6)
EPU*Comm Senator		0.931***	0.647***		-0.00789***	-0.00695**
		(0.0655)	(0.0523)		(0.00295)	(0.00287)
Comm Senator	0.187	0.117	-0.184*	-0.00958**	-0.00898**	-0.0135***
	(0.115)	(0.115)	(0.100)	(0.00426)	(0.00419)	(0.00424)
EPU		-0.451***	-0.310***		-0.0110***	-0.0104***
		(0.0319)	(0.0255)		(0.00165)	(0.00165)
Log total assets	1.06***	1.06***	0.708***	0.0258***	0.0258***	0.101***
	(0.0758)	(0.0758)	(0.160)	(0.00576)	(0.00576)	(0.0185)
ROA	-0.635***	-0.637***	0.0804***	-0.204***	-0.204***	-0.171***
	(0.131)	(0.131)	(0.0279)	(0.0356)	(0.0356)	(0.0413)
ROA volatility	0.414**	0.416**	-0.411***	0.297***	0.297***	0.251**
	(0.171)	(0.172)	(0.117)	(0.101)	(0.101)	(0.102)
Dividend ratio	-0.00308	-0.00290	-0.0560**	0.0411**	0.0411**	0.0345*
	(0.0171)	(0.0170)	(0.0249)	(0.0195)	(0.0195)	(0.0195)
Cash ratio	-0.388***	-0.388***	-0.326***	-0.00439***	-0.00440***	-0.00377***
	(0.0132)	(0.0132)	(0.00976)	(0.000436)	(0.000437)	(0.000574)
Year & quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes		Yes	Yes	
Bank FE			Yes			Yes
N	877448	877448	877448	877448	877448	877448
Adj. R-square	0.225	0.225	0.695	0.203	0.203	0.315

Note: Loan stands for the total loans scaled by total assets, and Loss provision stands for loss provision scaled by total assets. EPU is the original economic policy uncertainty index minus its time-series mean and divided by its time-series standard deviation. Comm Senator is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that quarter and zero otherwise. Standard errors are clustered at bank, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 3.3: Economic policy uncertainty (quartile dummy), Senate Banking Committee representation, and loan and loss provision

Dep. var.:	Loan	Loan	Loss provision	Loss provision
	(1)	(2)	(3)	(4)
EPU(Q1)*Comm Senator	-1.79***	-1.47***	-0.00163	-0.00659
	(0.151)	(0.125)	(0.00535)	(0.00461)
EPU(Q2)*Comm Senator	-0.0199	-0.326***	0.0143***	0.00578
	(0.137)	(0.117)	(0.00440)	(0.00381)
EPU(Q3)*Comm Senator	1.00***	0.464***	-0.0156***	-0.0166***
	(0.135)	(0.116)	(0.00589)	(0.00636)
EPU(Q4)*Comm Senator	1.13***	0.568***	-0.0310***	-0.0352***
	(0.139)	(0.118)	(0.00713)	(0.00744)
EPU(Q2)	-0.615***	-0.403***	-0.0147***	-0.0145***
	(0.0632)	(0.0491)	(0.00498)	(0.00476)
EPU(Q3)	-1.40***	-1.01***	0.00245	0.00142
	(0.0749)	(0.0581)	(0.00413)	(0.00425)
EPU(Q4)	-1.15***	-0.758***	0.00391	0.00454
	(0.0854)	(0.0673)	(0.00445)	(0.00447)
Other covariates	Yes	Yes	Yes	Yes
Year & quarter FE	Yes	Yes	Yes	Yes
State FE	Yes		Yes	
Bank FE		Yes		Yes
N	877448	877448	877448	877448
Adj. R-square	0.226	0.695	0.203	0.315

Note: Loan stands for the total loans scaled by total assets, and Loss provision stands for loss provision scaled by total assets. EPU(Q1) to EPU(Q4) are four dummy variables for EPU quartiles, with EPU(Q1) representing the lowest quartile of EPU and EPU(Q4) representing the highest quartile of the EPU index. Comm Senator is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that quarter and zero otherwise. Other covariates include log total assets, ROA, ROA volatility, dividend ratio, and cash ratio. Standard errors are clustered at bank, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 3.4: Economic policy uncertainty (continuous measure), Senate Banking Committee representation, and loan and loss provision: by bank size

Dep. var.:	Loan	Loan	Loan	Loss provision	Loss provision	Loss provision
	$\geq$ 75 pt.	<75 pt.	Multiple state	$\geq$ 75 pt.	<75 pt.	Multiple state
	(1)	(2)	(3)	(4)	(5)	(6)
EPU*Comm Senator	0.630***	0.608***	0.346	0.00145	-0.0104***	-0.00319
	(0.0946)	(0.0604)	(0.220)	(0.00490)	(0.00243)	(0.0129)
Comm Senator	-0.712***	-0.0653	-0.810**	0.00781	-0.0188***	0.00951
	(0.196)	(0.114)	(0.394)	(0.00856)	(0.00344)	(0.0150)
EPU	-0.366***	-0.266***	-0.267**	0.00413	-0.0149***	-0.00193
	(0.0514)	(0.0287)	(0.114)	(0.00379)	(0.00175)	(0.00837)
Other covariates	Yes	Yes	Yes	Yes	Yes	Yes
Year & quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
N	219433	658015	25291	219433	658015	25291
Adj. R-square	0.731	0.706	0.803	0.242	0.467	0.527

Note: Loan stands for the total loans scaled by total assets, and Loss provision stands for loss provision scaled by total assets. EPU is the original economic policy uncertainty index minus its time-series mean and divided by its time-series standard deviation. Comm Senator is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that quarter and zero otherwise. Other covariates include log total assets, ROA, ROA volatility, dividend ratio, and cash ratio. Standard errors are clustered at bank, * p<0.10, ** p<0.05, *** p<0.01.

Table 3.5: Economic policy uncertainty (continuous measure), Senate Banking Committee representation, and loan and loss provision: by period

Dep. var.:	Loan 1985-2000 (1)	Loan 2001-2013 (2)	Loss provision 1985-2000 (3)	Loss provision 2001-2013 (4)
EPU*Comm Senator	1.48***	0.161***	-0.0146***	0.00399
	(0.0834)	(0.0625)	(0.00561)	(0.00292)
Comm Senator	0.115	0.0509	-0.0286***	-0.0156***
	(0.116)	(0.121)	(0.00727)	(0.00544)
EPU	-0.696***	-0.152***	-0.0138***	0.00448**
	(0.0451)	(0.0277)	(0.00323)	(0.00210)
Other covariates	Yes	Yes	Yes	Yes
Year & quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
N	571044	306404	571044	306404
Adj. R-square	0.731	0.805	0.301	0.461

Note: Loan stands for the total loans scaled by total assets, and Loss provision stands for loss provision scaled by total assets. EPU is the original economic policy uncertainty index minus its time-series mean and divided by its time-series standard deviation. Comm Senator is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that quarter and zero otherwise. Other covariates include log total assets, ROA, ROA volatility, dividend ratio, and cash ratio. Standard errors are clustered at bank, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 3.6: Alternative explanations related to bank size and recession

Dep. var.:	Loan	Loss provision	Loan	Loss provision	Loan	Loss provision
	(1)	(2)	(3)	(4)	(5)	(6)
EPU*Comm Senator	0.637***	-0.00898***	0.544***	-0.00583		
	(0.0523)	(0.00293)	(0.0777)	(0.00414)		
Comm Senator	-0.182*	-0.0132***	-0.102	-0.00788	-0.828***	-0.00146
	(0.100)	(0.00423)	(0.155)	(0.00591)	(0.108)	(0.00343)
EPU	-1.08***	-0.163***	-0.233***	0.00193		
	(0.297)	(0.0148)	(0.0396)	(0.00285)		
EPU*Log total assets	0.0648***	0.0129***				
	(0.0250)	(0.00127)				
Home price growth*Comm Senator			-0.0579**	0.000538		
			(0.0242)	(0.00192)		
Home price growth			-0.112***	-0.0202***		
			(0.0171)	(0.00234)		
EPU(upper)*Comm Senator					1.42***	-0.0320***
					(0.0857)	(0.00633)
EPU(upper)					-0.852***	0.0250***
					(0.0428)	(0.00387)
Recession*Comm Senator					-0.696***	0.0443***
					(0.0997)	(0.00801)
Recession					0.647***	-0.0971***
					(0.0533)	(0.00476)
Other covariates	Yes	Yes	Yes	Yes	Yes	Yes
Year & quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
N	877448	877448	350915	350915	877448	877448
Adj. R-square	0.695	0.315	0.706	0.416	0.695	0.315

Note: Loan stands for the total loans scaled by total assets, and Loss provision stands for loss provision scaled by total assets. EPU is the original economic policy uncertainty index minus its time-series mean and divided by its time-series standard deviation. EPU(upper) is a dummy variable whether the economic policy uncertainty index is larger than its median. Comm Senator is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that quarter and zero otherwise. Recession is a dummy variable for recession periods defined by the National Bureau of Economic Research (NBER). Other covariates include log total assets, ROA, ROA volatility, dividend ratio, and cash ratio. Standard errors are clustered at bank, * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 3.7: Economic policy uncertainty (continuous measure), Senate Banking Committee representation, and loan and loss provision: a geographic discontinuity design

Dep. var.:	Loan	Loan	Loss provision	Loss provision
	<50 miles	<20 miles	<50 miles	<20 miles
	(1)	(2)	(3)	(4)
EPU*Comm Senator	0.436***	0.519***	0.00457	0.00189
	(0.0666)	(0.0910)	(0.00331)	(0.00387)
Comm Senator	-0.451***	-0.588***	-0.00634	-0.00746
	(0.129)	(0.179)	(0.00500)	(0.00466)
EPU	-0.253***	-0.298***	-0.00600***	-0.00245
	(0.0314)	(0.0435)	(0.00186)	(0.00250)
Other covariates	Yes	Yes	Yes	Yes
Year & quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
N	526057	292351	526057	292351
Adj. R-square	0.698	0.698	0.279	0.460

Note: Loan stands for the total loans scaled by total assets, and Loss provision stands for loss provision scaled by total assets. <50 miles and <20 miles stand for the shortest distance to a state border. EPU is the original economic policy uncertainty index minus its time-series mean and divided by its time-series standard deviation. Comm Senator is a dummy variable that equals one if the bank is headquartered in a state that is represented on the Senate Banking Committee in that quarter and zero otherwise. Other covariates include log total assets, ROA, ROA volatility, dividend ratio, and cash ratio. Standard errors are clustered at bank, * p<0.10, ** p<0.05, *** p<0.01.

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