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Three Essays on the Empirical Analysis of An Authoritarian Political Regime

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Abstract

This dissertation consists of three essays on the origins and the functioning of the authoritarian political regime in China.

The first essay "Historical Roots of Political Stability" seeks to understand the historical determinants of political stability by investigating the role of deeply-rooted centralized bureaucracies and the unified political system in ancient China in shaping interactions between citizens and the state. To avoid the possibility that the negative relationship between historical centralization and contemporary events reflecting political instability may be spurious, we control for a rich set of covariates and employ an instrumental variable approach. The results show that past exposure to centralized empires significantly improves present-day political stability: one additional century in the timing of exposure leads to a 3.4% decrease in anti-government attacks and reduces anti-government protests by 6.6%. We find that the persistence of local institutions with their well-respected administration cannot fully explain the results, while nationalistic culture represents the main channel through which the impact of a long-gone institution persists.

The second chapter "Political Tournament and Political Outcomes" analyzes how the political competition in an authoritarian regime affects the level and the composition of local public expenditures. In a performance-based promotion mechanism that rewards short-term investments, we show that Chinese prefecture leaders make different policy decisions based on the local competition level within a career-concerns model. Where there is a trade-off between two kinds of public input, these leaders choose the input which maximizes their own career prospects. After exploring various mechanisms and examining variation in the sudden death of competitors as an instrumental variable used for identification, the evidence gathered suggests that

local officials spend more and prioritize short-term over long-term investments when they have fewer potential competitors, translating to a higher probability of being promoted. We find robust support for the model's predictions using various sources of data and several outcome variables.

The third chapter "Political Competition, Economic Spillovers, and Uneven Spatial Development" extends the discussion in the second essay and examines how political competition, along with the positive economic spillovers of public provisions, affect the spatial distribution of public inputs and economic outputs within jurisdictions. Using annual data from prefectures in China, we find evidence of an increased border effect on the nighttime luminosity, which approximates increasing economic disparities between center and border regions within a prefecture in response to an additional effective political competitor in an adjacent jurisdiction. This occurs through politicians' strategic allocation of public resources which are distributed away from the cross-jurisdictional boundaries when the concerns regarding spillovers raise. The findings are consistent if we instrument endogenous political replacements with politician sudden deaths. These effects are confined to the provincial borders; contestants from neighboring provinces do not lead to such spatial patterns. Moreover, the border effects are amplified when the competing neighbors are closer in political and economic ranking. These pieces of evidence suggest that relative performance evaluation (RPE) is an essential mechanism for achieving policy goals in China.

Keywords. Persistence; Centralization; Historical empires; Culture; Political stability; Political competition; Tournament; Public expenditures; Spillovers; Spatial distribution; Border effect; China; Chinese economy.

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Chapter 1

Historical Roots of Political Stability

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1.1 Introduction

Growing pieces of evidence indicate that history generates long-lasting effects on modern economic growth either through its impact on formal institutions, including financial, legal institutions, etc. (e.g., North, 1990; La Porta et al., 1997, 1998; Acemoglu, Johnson, and Robinson, 2001), or on beliefs, social values, and cultural norms (e.g., Putnam, 1993; Alesina and Fuchs-Schündeln, 2007; Nunn and Wantchekon, 2011; Guiso, Sapienza and Zingales, 2016). There is an increasing number of research papers in the field, with some placing greater emphasis on institutions, and others focusing more on culture. Nevertheless, all those works attempt to link the negative consequences of depraved institutions or cultural norms to economic

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underdevelopment in a long run.

On the contrary, some topics, such as the endogenous interactions between culture and institutions and the way in which institutions lead to negative consequences through an unwittingly created culture, have not yet been thoroughly investigated (Alesina and Giuliano, 2015).

This paper exploits China's millennium-long centralized authoritarian monarchy (in Chinese, *zhuanzhizhuyi zhongyangjiquan*) to analyzes the effect of a past institution. It was not only the most enduring political regime across the history of China, but also the most far-reaching one, as it enlightened the authoritarian rule of the Chinese Communist Party (CCP) in modern China.

The monarchical centralism which starts with the Qin dynasty (221 BC) and ends with the Qing dynasty (1911), lasting for more than 2,000 years, was designed to concentrate the state power in the hands of the emperor and the central government. It ended up the period of frequent conflicts and wars among several powerful feudal states (i.e., Warring States Period) and ensured a better administration of the local authorities and people at the grass-root level; as such, it historically assured political stability. Meanwhile, one can observe a change in the locus of allegiance and loyalty, which shifted to the states and their emperors after Qin (221 BC), when the first centralized state was founded. Ordinary people in the centralized states developed a deep sense of attachment to their states, and of trust and obedience towards the rules of the emperor and the central authorities. This was not only because, under this new system, the people believed the emperor to be the only one with divine rights, but also because a centralized regime was better at helping the population organize small-scale production. When such a culture was formed and transmitted from generation to generation, contemporary obedience to the state and a sense of nationalism are maintained. These "cultural" variables that could be correlated with the historical experience of centralized states, intrinsically suppresses the potential instability and revolts against the central authority. Therefore, this paper seeks to understand the influence of deeply-rooted centralized autocratic monarchy in ancient China on contemporary outcomes, and whether the persistence occurs through an intergenerational transmission of pro-national attitudes.

A series of studies has investigated the long-term consequences of centralized

statehood on modern economic development. Michalopoulos and Papaioannou (2013, 2015) examine how the pre-colonial political centralization, defined by the number of jurisdictional hierarchies, conditioned the long-run development in Africa. Angeles and Elizalde (2017) report a strong positive correlation between pre-colonial statehood and sub-national economic outcomes for Latin America. Meanwhile, Wahl (2017) attributes the roots of European development to the centralized Roman empire, using evidence from the German Limes. Besides the focal point on sub-national development, another strand of literature focuses on the cultural outcomes of political centralization. Becker et al. (2014) suggest that a historical Habsburg affiliation increased current societal trust, affecting the interactions between citizens and the authorities. Lowes et al. (2017) compare respondents from the former Kuba Kingdom with those from just outside the Kingdom, showing that centralized formal institutions are linked with weaker rule-following norms and a higher propensity for cheating. Buonanno et al. (2018) document that tax compliance is higher in Italian municipalities that belonged to medieval republics. In line with the previous works, our paper contributes to the literature by examining the consequences on the institutional side, namely sub-national political stability.

Political stability symbolizes the integrity and durability of a regime. A regime is considered stable if the ruling government and its agencies are supported by the population and do not experience strong indicators of social upheavals. In contrast, revolutions, terrorist attacks, as well as public protests, demonstrations, and violence are associated with political instability. It is worthwhile to study the levels of stability of a current institution for the following reasons. First, as Alesina et al. (1996) suggest, political instability reduces investments and the speed of economic development, which in turn can cause more severe instability. To avoid stepping into such a vicious cycle of underdevelopment, the exploration of the roots of political instability is necessary. Secondly, studies in political science have argued that social instability accelerates the process of democratization (Hollyer, Rosendorff, and Vreeland, 2015). However, China's regime shows no sign of collapsing anytime soon. This paper provides an explanation for the solid authoritarian resilience in China. Last but not least, the ruling party's suppression of dissent incurs substantial economic, political, and moral costs. Our study of this particular outcome thus has some prac-

tical implications in better allocating public resources in preventing social unrests. In the aspect of outcome variables, We contribute to the measurement of political instability at small local units (i.e., counties), by counting the occurrences of specific events, such as anti-government armed attacks and protest, within the county-level administrative boundaries. The information used comes from some novel data sets.

To examine the historical roots of political stability or instability, we draw upon cross-sectional data on regional variation in the past exposure to centralized statehood. In 221 BC the first emperor Qin Shihuang, established the first centralized and unified state in China's history. The Central Plains, inhabited by the Han majority, were transformed from a loose confederation of feudal states to an authoritarian empire. From 221 BC to 1911 AD, a series of imperial dynasties emerged, expanded, and then disappeared with their irregular cycles in the Central Plains region, which represents China proper. To the north of China proper were the nomadic regions of Inner Asia, inhabited by nomads who relied on growing forage. The nomadic confederations, whose form of government was strictly different from that of the Han centralized states, were characterized by their decentralized power divided over several tribal leaders, and by loose alliances, having a separated military and taxation system. During the imperial period, the area of contemporary China was divided into the aforementioned two regions. In between themselves, there was always a moving boundary; as one fell, the other one rose; therefore, the coverages of the two regimes were changing together and over time. This allows us to investigate the georeferenced position and coverage of the centralized empires, more specifically their commandery and county system across history, and systematically build a yearly graphic panel collecting information of political entities ruling over the period. We sum up the years of exposure to obtain regional variation in historical centralization experience, measured by the number of centuries.

The baseline model uses the within-province identification to solve the most severe issues driven by unobserved heterogeneity. The ordinary least squares (OLS) result shows that one century of exposure to centralized statehood is associated with a 0.8% decrease in anti-government attacks and a 3.1% decrease in anti-government protests. The finding does not alter after the inclusion of several socio-demographic

characteristics,[2] geographical covariates,[3] and contemporary economic development indices, such as 2010 luminosity-related data and agricultural feasibility index, policy triggers,[4] cultural factors,[5] and historical traits[6]. Importantly, our result remains robust to different sub-samples and weighted historical exposure.

The statehood experience of a county correlates with a complicated series of factors. We can control for many confounding variables, especially for the historical settlement patterns and pre-221 BC feudal states that determined the initial state of the regimes. However, the endogeneity problem occurs when the factors that moved the boundary between centralized empires and nomadic confederations in the first place are also simultaneously associated with the political stability. Endogenous culture is one possible candidate for the omission, which may upward bias the results. We use weather shocks, that could change the regime boundary exogenously, as a plausible instrumental variable (IV). In line with Bai and Kung (2011), who conclude that nomadic incursions into centralized statehood regions were positively associated with less rainfall while negatively correlated with more rainfall, our first-stage estimation suggests that the southward shift of the boundary is positively associated with drought. The underlying logic is that, since nomads chose between production (herding) and looting (from their sedentary counterparts) based on the returns and costs of each activity, climate shocks could exogenously affect the returns and costs of the two options to a different extent. Herding suffered more with droughts. Water shortages lead to a lack of fodder and shortage in meat as the herding output was null; in such case, the nomads inclined to invade the empires for survival, driving the regime boundary southwards. The covariates in both stages take into account the contemporary climate shocks and the smooth change in production patterns due to past climate changes, to ensure that the historical climate shocks affect present-

[2]These are logged population, logged immigrants, sex ratio, ethnicity, average years of schooling, urban residency, agricultural and industrial employment, Party and state institutions employment, unemployment status.

[3]These are elevation, terrain ruggedness, precipitation, distance to the national boundaries, distance to the coast, and distance to the capital.

[4]As defined by land revenue, and pollution levels.

[5]As defined by language groups and number of Confucian temples.

[6]As defined by shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and number of historical commercial centers.

day conflicts through and only through the change in the historical centralization experience. The instrumented results show that historical exposure to centralization significantly and positively explains contemporary political stability: an additional century of exposure leads to a 3.4% decrease in the number of attacks against the government and a reduced number of anti-government protests by 6.6%; we thus claim the correlation could be in fact, causal.

In the last section, we examine the underlying mechanism of this persistence. The inclusion of variables that approximate the accountability and the loyalty of current local institutions in the regression does not absorb the effect of the past institution on political instability, indicating that the persistence of local institutions cannot fully explain the results; it accounts for solely 4-16% of the total effects. Therefore, we explore a culture channel, which is defined as by breeding particular types of culture, a past institution may impact upon the behavior of individuals over an extended period of time (Grosjean, 2011; Becker et al., 2014), and sequentially the fostered beliefs and social norms would affect recent institutions or economic growth in a long run.

We use data from an existing survey to capture how culture evolves, namely the Chinese Political Compass of the year 2009. First we regress the nationalism indicator on the historical exposure to centralized empires and find out that the long-gone institution, through the formation and transmission of a culture of obedience to the state and a sense of nationalism, influenced the nationalistic thoughts and beliefs of citizens today. After our exploration of a positive association between experience of centralization and reported sentiments of nationalism, we check if citizens' higher level of nationalism is the mediator in between a longer historical exposure and lower occurrences of anti-state attacks or protests. We then include both the county-level nationalism indicator and exposure to past centralization as regressors. The results suggest that citizens' better psychological support for the maintenance of state power driven from regional exposure suppresses their participation in rebellion, while the direct effect of past regimes on political instability becomes insignificantly different from zero. The cultural channel, whose mediation effect accounts for 40-65% of the total effect, is therefore attested: when controlling for the competence of the local government and bureaucracies, as well as the seriousness of policy-driven social

problems, citizens in regions with a longer experience of centralization are less likely to perform armed attacks or protests against the government, since they believe in the state and government more.

The cultural channel is further confirmed by using individual-level data from CGSS of the years 2006 and 2010. The results suggest that past experience can significantly improve the interaction between citizens and states today, resulting in a higher level of reported confidence in the government and its policies.

The rest of our paper is structured as follows. In section 1.2 we document the historical background in the context of imperial China. Section 1.3 introduces the variables and examines the long-term consequences of centralization on present-day political instability, whereas section 1.4 determines whether the correlations uncovered could be causal, using an instrumental variable approach. Section 1.5 identifies the two main mechanisms responsible for the persistence. Section 1.6 concludes this paper.

1.2 Historical Background

After the slave society of 1045-256 BC, the Zhou dynasty ruled over China, using a form of government called feudalism to consolidate its control. Western historians describe this Zhou period as "feudal," because the power was decentralized and belonged to aristocratic families which ruled as lords of their principalities.[7] There were many similarities between the decentralized system of the Zhou kingdom and medieval rule in Europe, such that when a dynasty was established, the conquered land was divided into hereditary fiefs.

For over 300 years, feudalism kept China stable. However, the increasing power of the lords broke this system down. As the king sold more of his land, the stronger feudal states were able to swallow up their weaker neighbors, some lords became

[7]It is important to mention that feudalism as theorized by Marxist historians is a completely different concept. Marxist historians in China have described ancient Chinese society as largely feudal, since in their opinion a feudal society refers to a social form in which landlords own land and exploit peasants or serfs. In contrast, feudalism as theorized by non-Marxists refers to a particular kind of state institutions and form of government. In this paper, we use the later meaning of feudal and feudalism.

wealthier and more powerful, forming several huge city-states or feudal states, and fighting each other for more power, which resulted in the Warring States Period. As a consequence of the great societal division during this period, philosophers began to think that feudalism, more specifically the way it decentralized power, had caused more instability than it had helped in consolidation of the regime, and they started to influence their rulers against it. The theory of constructing a unified and centralized authoritarian empire was formed and developed.

In 221 BC the first emperor, Qin Shihuang established the first centralized and unified empire in China's history. The Central Plains, inhabited by the Han majority, were transformed from a loose confederation of six feudal states to an authoritarian empire. From 221 BC to 1911 AD, which is defined as the imperial China period, a series of imperial dynasties which emerged on the territory of the Central Plains, developed, and then disappeared over this period, such as the dynasty of Han, Tang, etc. In these empires, the emperor would be treated with increasing reverence and would come to be worshipped as a god. The emperor ruled with the Mandate of Heaven, the belief that he was only emperor because the gods chose him to be. The power was concentrated in this unique "god" and his central government, with multi-level subordinated administrations and hierarchical organizations. This kind of institution is called an autocratic centralization system (or centralized authoritarian monarchy/monarchical centralism), and it lasted for more than 2,000 years until the last empire of the Qing dynasty.

The centralization of bureaucracy in the hands of the emperor was achieved through a unique organizational form called "the county system (in Chinese, *junxian zhi*)",[8] which replaced the feudal organization of the Zhou kingdom based on kinship and land grants. With a line management model from the central to the local, the local authorities had no independence on politics, economic and military nor real power in dealing with important governance affairs and local officials, who were directly assigned by the emperor, were forced to go along with the emperor and central authority.

On the territory of present-day China, around the monarchical states and par-

[8]The full name of the county system in ancient China is the commandery-county system. We use the county system throughout the paper for simplicity.

ticularly to the north and to the west of China proper, were the nomadic regions. During the imperial era, those regions were inhabited by nomads, who relied on pastures and constant plunder invasions into the neighboring Han empires for sustenance. The best known examples of nomadic groups in ancient China were the Huns, the Siberians, the Tungguts, the Turks, and the Khitans. The communities formed various tribal chiefdoms and confederations as their form of governance. The alliances were characterized by a separation of governmental powers, military, and taxation. Their power was decentralized and split over several tribal leaders.

In 1911, the fall of the last empire of China, the Qing dynasty, put utterly an end to the 2,000 years of imperial rule in entire China and the centralized autocratic bureaucracies aforementioned. The Republic of China (ROC) was formally established on January 1, 1912, following the Xinhai Revolution which successfully overthrew the last imperial dynasty.[9] In 1949, the CCP took control of mainland China and founded the People's Republic of China (PRC).

1.3 Empirical Design

1.3.1 Baseline Model

To examine whether the monarchical centralism has had a long-term consequences on contemporary political stability, we begin with our baseline estimate of the following specification:

$$Y_{c,p} = \beta Exposure_c + \psi X_{c,p} + \delta_p + u_{c,p} \tag{1}$$

where c indexes a contemporary county in p province. The dependent variable $Y_{c,p}$ is an index of the present-day county-level political stability (or instability) as illustrated in section 1.3.3. $X_{c,p}$ stands for a rich series of covariates, as introduced

[9]Therefore, the regional variation in past exposure to centralized empires is only originated from the period of 221 BC-1911 AD. Some may raise the concerns that whether the whole contemporary Chinese territory belongs to the ROC after the year 1912. It is confirmed by the Provisional Constitutional Law of the ROC of which Sun Yat-sen presided over the formulation and promulgation in 1912; it states "The territory of the Republic of China contains 22 provinces, Inner Mongolia, Tibet, and Qinghai."

in section 1.3.4; δ_p approximates province fixed effects. As the highest layer of local government, provinces in China are large units across which there is great heterogeneity. Within-province identification solves the most severe issues related to unobserved heterogeneity and allows us to compare counties led by the same provincial government. These counties are therefore exposed to identical macro- and socio-economic policies, have similar geographical features, and are in a similar developmental stage.

The key explanatory variable of interest is $Exposure_c$, which measures the length and intensity of exposure to centralized authorities during 221 BC-1911.

1.3.2 Explanatory Variable

We combine information on the yearly spatial distribution of statehood status during 221 BC-1911 AD to obtain the regional variation in exposure to the rule of centralized bureaucracy states in imperial China. Centralization is essentially a political power system and a way of organization. To identify the levels of centralization objectively, we thus check through the power structure and organizational form of the regimes. The autocratic system of centralized authority firmly required multi-level administrative divisions[10] similar to contemporary China from central to local, where all local units were strictly subordinated to the central one; with this governmental form, the power was highly centralized. If a region applied this commandery-county system, we regard it as having been exposed to centralization. This system is completely distinct from the decentralized and loose confederations: on the one hand, under such a system the officials are directly appointed by the emperor, without being given real power in military and taxation (power structure), and on the other hand, this system captures enough political complexity, implying that the political area consists of at least two layers of local government (organizational form).

The boundary between empires with a high level of centralization and nomadic confederations constantly changed across imperial history, depending on the intrinsic power of the Han empires in defending their land and on the external forces from the

[10]The total number and name of layers of local governments vary under the county system over the imperial history. For instance, there could be two layers of local governments such as commandery (*jun*) and county (*xian*), or three layers such as province (*sheng*), circuit (*dao*), and county (*xian*).

nomadic territories in initiating the invasion:[11] as one fell, another one rose. When the empire conquered a small tribe and acquired back its territory, the new piece of territory would be organized into a county under the direct rule of the emperor (Zhou, 2018). This means that the change in regional coverage of the commandery-county system coincides with the changing spatial distribution of the centralized regimes. Therefore, we explore the annual information on the regional experience of the county system to capture the variation in political centralization.

The source of geo-information on the county system comes from the *China Historical Geographic Information System* (CHGIS V6). The project was launched in January 2001 by Fudan and Harvard University to establish a database of the historically populated places and past administrative units over the period of imperial China. Version 6 provides a time-series geo-referencing dataset of all counties that have ever been built in ancient China, by offering more than 6,000 polygons of counties with information on their spatial coverage, name, establishment year, and end year of all the units during our time span of interest.

Firstly, we restructure these polygons into annual maps with a dummy variable. In each map, we follow the strategy of Buonanno et al. (2018) and assign a value of one to regions covered by any county polygon existing in that certain year, and a value of zero to regions belonging to nomadic tribes (i.e., not covered by any of the former county in that year). This dummy variable could be interpreted as one year of exposure to centralization; therefore we overlap the maps and sum up the dummies, to get a raster graphic with continuous values indicating the total number of years of exposure for all regions. Next, we add the contemporary administrative boundaries (i.e., county boundaries)[12] to calculate the average value of past exposure, rescaled to a number of centuries, at each current county level. Figure 1.1 plots the average

[11] Despite being much more numerous than the nomadic populations, it was always the Han Chinese to defend themselves from others, rather than the contrary. Given that Han culture has always been a culture based on agriculture, men worked on land and women made fabrics, with a self-sufficient and stable economic structure; while the slow expansions of Han empires were usually through the penetration of culture.

[12] We would like to address that this paper contains two concepts of "county": past counties (the commandery and county system) and nowadays counties (the administrative level below than prefecture). We explore past counties only to identify centralization, while exploit contemporary counties as study units, all variables are thus aggregated to current counties.

value of past exposure in all counties, while Table 1.1 reports its mean and standard deviation.

We cross-validate the CHGIS's data by comparing it to other sources and to the official historical maps. We first digitalize the annual maps from the Historical Atlas of China and depict all states (including centralized empires, nomadic or Han feudal states, vassal states, etc.). We assign a dummy variable to each state, which takes the value of one when the state has a centralized political system; the index equals zero if it does not. Then, we checked the lifespan and geo-referenced spatial coverage of these states and built a yearly panel. By overlaying the maps and summing up the dummies, we obtain an alternative measurement of exposure. The strong correlation between these two measurements (around 0.81) suggests that the shapefile data from CHGIS is in accordance with works describing the degree and extent of centralization in ancient China.

1.3.3 County-level Outcome Variables

There is no standardized way to measure the degree of political stability or instability. Political instability can be measured through either perceptions indices or objective indices. Perceptions indices contain expert opinions or survey results, presenting assessments and insights from specific groups on the degree of political stability in a particular country. These types of indices are usually at the country level, for example the World Bank governance indicators and ICRG indices. Objective indices count data on the incidence of certain phenomena, such as demonstrations, protests, and assassinations. Examples come from Easterly and Levine (1997) and Annett (2001), who use conflict-containing events to approximate political instability. The advantage of the objective method is that, if it is possible to identify the location of the event, then it is certainly possible to obtain an index (e.g., total count, or frequency) within a small unit such as a county, a town, or even a smaller cell. Therefore, we measure county-level instability by counting events sourced from two new datasets within each county.

Number of Anti-government Armed Attacks The *Global Terrorism Database* (GTD)[13] records violent events that have taken place in China between 1989 and 2016. These records include the dates and the geographical coordinates of the attacks, the attack types, the target types, and the identity of attackers. In order to understand instability from a political perspective, we select the attacks aimed at separating the country or destabilizing the government and governmental agencies (i.e., governmental bureaucracies and state-owned enterprises). These attacks include attacks on a government building, on the head of state, on politicians, government employees, civil servants, judges, courts, on the army, and on the state militias, which add up to the 678 attacks used in our analysis. Information on latitude and longitude helps us match the events to the counties where these attacks took place. We aggregate each event to the county where it happened, counted the total number of occurrences between 1989 and 2016 in each county and use a natural log to avoid the influence of extreme values. The county-level number of anti-government armed attacks is depicted in Figure 1.2. From the figure, it is visualized that the northwestern part of China is strongly more unstable than the southeast based on the raw correlation.[14] Its mean, standard deviation, minimum and maximum values are presented in Table 1.1.

We admit that in order to have more variations, we have taken an expended time-span of focus (1989-2016); many time-variant changes (i.e., policies, shocks) that may occur in each county, correlates with their number of anti-government. We then divide the chosen events into two sets: those happened in between 1989 and 2000 and those happened between 2000 and 2016, generating two corresponding measures of instability (i.e., $Y^{1989-2000}$ and $Y^{2000-2016}$) instead of the previous one $Y^{1989-2016}$. We run regression on both variables and discuss the result in Table A.1.

To test the validity of the variable, we then collapse the objective indicators to country-level time-series and check whether objective measurements coincide with

[13] GTD is the most comprehensive public database with information on terrorist behaviors around the world that took place during the period from 1970 to 2016. The data are available for download at *www.start.umd.edu/gtd/*

[14] It could be driven by many factors, geographic variables for instance, which we explicitly control for in section 1.3.4.

the time-series trends of perception indices of China's politics from the World Bank.[15] For that indicator, the World Bank provides information for China between 1996 and 2015. The mean value for China during that period was -0.47 points with a minimum of -0.66 points in 2010 and a maximum of -0.17 points in 1996. Our aggregated time-series from the selected events in the GTD coincides with the time-series pattern of World Bank indicators; the year 1996 had nine attacks, so the least number of attacks, while the year 2010 had 156 events. The validity of this variable is thus confirmed.

Number of Anti-government Protests From 2012, *Not the News* systematically documented daily protests throughout China by gathering information from online sources and reporting the data on YouTube, Twitter, and other social media channels until June 13, 2016.[16] This included information on dates, locations, online discussion archives, the cause of a protest, the form of a protest, the identity of protesters, and whether a protest was repressed. We captured 50,141 protests in total from 2014 to 2015 and match each protest to its location (county).[17]

In the next steps, we are going to do a text analysis in order to classify protests based on their motives: aggrieved citizens may protest against the government because of land acquisition, environmental pollution, or dissatisfaction with the government and the state-owned enterprises; while others may protest against non-governmental entities, such as private firms. We include only the 6,882 events from the first category in our analysis. Among the protests aimed at expressing people's resentment towards the government, we further categorize their causes into policy-related causes and policy-unrelated motives. Policy-related protests are mainly land-related protests and environmental protests, the proportions of which are 73% and 16%, respectively. Policy-unrelated protests refer to complaints against urban management officers (accounting for 5% in the dataset), against the regional governments or the communist party (<1%). The summary statistics of this variable are presented

[15]The index of political stability from *www.theglobaleconomy.com* is an average of several indicators from the Economist Intelligence Unit, the Political Risk Services, and the World Economic Forum. These indexes reflect the perceptive likelihood of social unrest, violent demonstrations, armed conflicts, terrorism, as well as ethnic and religious conflicts.

[16]The police arrested the founders for "picking quarrels and provoking trouble" on June 15, 2016.

[17]see *newsworthknowingcn.blogspot.tw* for example

in Table 1.1.

We admit that the news concerning anti-government attacks and protests may be underreported due to a series of factors, such as the media exposure of each county. However, since the counties that were historically more exposed to centralization tend to be more developed, thus more well-connected to media; and their news are less likely to be underreported, we believe the failure to capture all events would only underestimate our final results.

1.3.4 Covariates

To avoid the possibility that the negative relationship between historical centralization and the contemporary political instability is spurious, we control for a series of covariates denoted by the vector $X_{c,p}$ in the equation (1):

Socio-demographic Characteristics. Terrorist attacks and protests are collective actions. Collective behaviors could be highly related to local demographic characteristics, which may be a function of historical socio-economic factors, ethnic conflicts as well as ethnic integrations. We include the following characteristics in our study: the logged population, logged number of immigrants[18], sex ratio, average years of schooling, proportion of ethnic minorities, ratio of urban to overall residents, the unemployment rates, the percentage of agricultural, manufacturing, service-providing industrial population, and Party and state institutions employees[19] to the total employed population in 2010. All variables are taken from the 2010 *County Population Census Data*.

Contemporary Economic Outcomes. As differences in historical prosperity may

[18]There are several concerns regarding migration we need to address. Firstly, migration in ancient time was very unlikely. The Great Wall which was at the center of the boundaries between the nomadic and centralized regions made across-border migration impossible. Secondly, migration at current time can be brief captured by the covariate: the number of immigrants in each county. We argue that contemporary migrations can hardly lead to selection bias, since the main determinant of internal migration in China is income gap (Hare, 2002), while preferences towards Party/state play trivial roles in migration decisions.

[19]This includes employees in party-state organs, state-own enterprises and public institutes.

persist and impact upon political stability today, we control for two contemporary economic outcomes. First, we use data from satellite images on the average nighttime luminosity for the year 2010, as provided by the National Oceanic and Atmospheric Administration (NOAA); this serves as a proxy for the degree of local economic activities (Chen and Nordhaus, 2011; Henderson, Storeygard, and Weil, 2012). Another variable included is the agricultural feasibility index which approximates local land suitability for agricultural uses; since agriculture still represents as the base industry of national productivity in modern-day China. Data is computed from the dataset of Zabel et al. (2014), which presents the gridded suitability for the cultivation of main crops.

Climate and Geography. Climate and geography can have a profound and lasting effect on long-run economic development either through its direct influence or by means of its interaction with historical events. Therefore, we control for average annual precipitation, average altitude, terrain ruggedness, distance (in kilometers) from the centroid to the nearest national boundaries, distance (in kilometers) to the nearest coastline, and distance (in kilometers) to the capital, Beijing. Data on rainfall is computed from the *WorldClim-Global Climate Data*. Data on topographic factors is taken from the *Global Digital Elevation Model* (DEM v2). Average elevation and terrain ruggedness is calculated from the mean and standard deviation of elevation at the county level, respectively. The shapefile data on administrative boundaries derived from the National Geomatics Center of China enables the calculation of multiple distances.

Policy Triggers. The analysis should fix the policy-driven social issues and grievances across the counties. The main policy-related triggers of protests are land acquisition and pollutant emissions, which together account for 90% of the anti-government protests as documented in section 1.3.3, and should be explicitly controlled for.[20] Information on land acquisition can be inferred from the land rev-

[20]The terrorism attacks in China, on the other hand, is generally about ideological and religious issues, whose policies remain mostly unchanged over time and are not set up by the local government. Meanwhile, the variables related to ethnicity and religion in the social-demographic characteristics

enue of county governments, the data of which is taken from the *Financial Statistics of Cities and Counties* by averaging the land revenue from 2003 to 2005. For pollutants, we look at air pollution, and use data from the *Global Annual Average PM2.5 Grids* of 2010, as released by MODIS and MISR Aerosol Optical Depth (AOD).

Regional Culture in a State of Nature. The cultural characteristics of one's ethnicity or race should also be excluded. We employ the language group fixed effects, as sourced from the *Language Atlas of China*, to control for unobservable factors and obtain a within-culture estimation.[21] Besides, since Confucianism is the mainstream philosophic tradition in the Central Plains culture, its distribution may be closely related to the distribution of the historical empires. We further control for the number of Confucian temples[22] to rule out the possibility that Confucianism itself, rather than the institution, affects the results.

Historical Traits. We take into considerations the potential issue of a biased selection into treatment. First, local settlement patterns are strongly associated with treatment condition: pastoralists (nomads) are generally mobile, diffused, and decentralized, and therefore built up decentralized regimes; while for sedentary agricultural communities, farming equipment and production facilities, such as irrigation systems, are required to be provided and protected by a solid state. Therefore, we control for observed historical settlement patterns by calculating the share of agricultural activities and herding across the imperial period in each current county. This information comes from the *Chinese Historical Geography Tutorials*. We calculate the proportions of years during which counties were part of agricultural zones. Second, the pre-221 BC feudal states status (i.e., feudalism) provides an initial state of treatment; as the first emperor, Qin Shihuang unified other six feudal states to build the first empire, therefore, the initial state of centralization coincides with the feudalism in 221 BC. Data is obtained from the *Historical Maps of the Warring States Period* produced by the Center for Humanities and Social Sciences from Academia

can fully capture these issues; thus we do not further control for any trigger for terrorism attacks.

[21] The underlying assumption is that the groups or communities that share the same language, are very likely to have common culture.

[22] Information from the website *www.chinakongmiao.org*

Sinica. We assign a value of one to areas belonging to pre-221 BC feudal states, and a value of zero to the remaining ones. Likewise, covariates which serve as a proxy for the historical economic prosperity, urbanization rate (i.e., the density of cities, pre-221 BC and in 1800),[23] and historical commercial centers[24] are included.

The mean, standard deviation, minimum and maximum values of all county-level variables are shown in Table 1.1.

1.3.5 Baseline Results

The baseline results are reported in Tables 1.2 and 1.3. We begin by using the logged attacks value as the first key dependent variable in Table 1.2. To provide a benchmark, we show the raw correlation in column (1) and include province fixed effects in column (2). In both cases, exposure to centralized political authority has a negative and highly significant (at the 1% level) effect on the terrorist attacks targeting government-related buildings or agencies. When we gradually control for the baseline covariates in columns (3)-(8), we can observe a diminishing effect size, indicating that the raw correlation causes a downward bias of the estimation. The estimate, conditional on historical traits, reaches its minimum value in column (8), indicating that historical agricultural patterns are positively correlated with centralization statehood and negatively correlated with instability. This is consistent with the literature reporting that sedentary agriculture generated more compliant and stable lifestyles (Edgerton, 1971; Goldschmidt and Kunkel, 1971). The estimate of the full specification described in column (8) suggests that one additional century of exposure corresponds to a decrease of 0.8% in armed attacks, accounting for 5% of the outcome mean.

Another measurement of political instability shows a similar pattern. Table 1.3 uses the log of protests as the dependent variable. The raw correlation between the two variables is statistically significant with a small size, as reported in column (1). When province fixed effects are included in the regression, the estimate clearly reveals that historical statehood experience has a highly significant and negative effect on

[23] Data is from CHGIS v6
[24] Data is from Cao (2015)

present-day protests. As the vector of covariates is gradually included starting from column (2), the magnitudes of the effect increases, suggesting an upwards bias of the raw correlation. This means that there are omitted variables that correlate positively with both the exposure variable and the number of protests. This finding implies that protests and terrorist attacks are different in their area of effect: in areas that are more developed, civilized and democratic, citizens tend to choose protests, demonstrations, and strikes to express their dissatisfaction, instead of selecting an extreme and destructive terrorist behaviors. The full specification in column (8) reports that an additional century of exposure to political centralization significantly and negatively affects the rate of protests, decreasing it by 3.1%, which accounts for 3% of the mean of logged protests.

1.3.6 Robustness of *Exposure* Measurement

The estimates above can generate some concerns, such as whether the county system is an appropriate measurement of centralization. To test this and check our results' robustness, in addition to the CHGIS data file, we also use the exposure index obtained from the self-digitalized maps of the Historical Atlas of China.[25] The main advantage of such digitalized data is that it allows us to include the vassal states belonging to centralized empires; these territories are dependent on a particular sovereign dynasty, but are not exposed to the county system. By including these dependent states into the alternative measurement of exposure, as shown in columns (1) and (2) of Table 1.4, the robustness of the results can be attested. The magnitude of the estimates is slightly higher than the one obtained with CHGIS data.

The second concern is that the observed persistence may be driven by the inclusion of places such as Xinjiang, Tibet, Qinghai, and Inner Mongolia, which are extremely politically unstable. Excluding those provinces does not alter the results, as suggested in columns (3) and (4). This process equals to keeping only the former Central Plain areas, as a way to explore the variation on one side of the boundary. As expected, the size of the inter-correlation decreases but remains significant, further

[25] We do not use this as our main explanatory variable because it contains our subjective classification of regimes.

suggesting that even small variations in centralization can lead to different intensities of societal unrest.

Most of the comparisons above are between exposure to centralized empires and that to decentralized confederations; in such case, the stateless status of some regions in the early imperial period may confound the interpretation. Therefore, we firstly exclude the Tibet area, which was only later discovered by the Chinese civilization, and sum the exposure starting from the Dong Han dynasty (25-220 AD), when there were no other unexplored areas except for Tibet in contemporary Chinese territory. The results are shown in columns (5) and (6) of Table 1.4. The magnitude becomes smaller, indicating that the inclusion of stateless and unexplored regions overestimates the effect of centralization compared to decentralized confederations on political stability.

Proximate empires, such as Ming and Qing, should have a greater influence on contemporary outcomes than remote empires such as Qin and Han, we thus weight the *Exposure* variable according to the closeness in time. The exposure dummy in the year 1911 is given a weight of one, while the annual exposure before Christ all given a weight of zero;[26] other years in between 1 BC and 1911 AD are weighted by the ratios of the year over 1911.[27] Table 1.5 presents the results of the regressions where the weighted *Exposure* is the explanatory variable. All estimates remain significant.

1.4 Causal Identification

A county's historical experience within a centralized regime was possibly linked with a complex myriad of elements. Though we have controlled for lots of confounding ones, such as the production patterns and initial state of the regimes that determined the initial prosperity, there are still omitted variables which are simultaneously correlated with past centralization intensity, as well as its moving boundary, and stability today. It would be problematic if the omissions that drive the boundary away from the initial state correlate with the outcome variables of our study. For in-

[26]The results do not alter when the years of 221 BC-1 BC are given positive weights.
[27]For instance, the map of 1000 AD weights 1000/1911.

stance, less exposed counties may be associated with certain unobserved endogenous culture: it is possible that some docile communities where people were less conflictual and more easily satisfied were not able to defend themselves against nomads in the imperial time. If so, we expect an upward bias in the OLS estimation. This may also be driven by the persistence of other historical traits, such as army forces and informational networks, although in that regard the direction of the bias is unknown.

To deal with this concern, we employ an instrumental variable approach and investigate whether and how the regime boundary could change exogenously and move away from the initial state.

1.4.1 Instrumental Variables

Climate shocks are one source of the exogenous influence on regime boundary. Bai and Kung (2011) inspire the selection of our instrument by concluding that nomadic incursions into Han centralized regions (i.e., southward moves of the boundary) were positively correlated with droughts and negatively correlated with floods. Their incursions moved the boundary and resulted in a contraction of the Central Plains empires. We attempt to prove in this paper that extreme precipitation can alter present-day stability only through its effects on regional exposure to centralized bureaucracies.

Nomads made decisions between self-sustaining activities (herding) and looting from their sedentary counterparts based on the returns and costs of each activity. When they produced their own goods, the returns were an increasing function of their herding output; in contrast, if they looted, the returns were an increasing function of others' agricultural output. Drought and flood exogenously affected the nomadic choices by altering the returns and costs of the two options to a different extent.

Nomadic production suffered more with droughts, resulting in incursions into the Han empires which were necessary for survival. Water shortages led to a shortage of fodder and disruption in meat production, making the herding output decrease to as low as zero. In this case, areas specialized in crop farming could effectively diversify the risks, producing positive output. Therefore, in the event of drought, nomads invaded neighboring areas and shifted the boundary southwards.

Nomadic herding suffered less with floods. Since there were few branches of the great rivers passing through the nomadic pasture lands, herding was almost unaffected when the river burst its banks. However, agricultural regions, with their well-developed river system, were struck during floods. The net returns of looting thus dropped, since agricultural output decreased and the use of horses in agricultural regions became ineffective. In such cases, no further incursions occurred. However, the literature findings in terms of the effects of floods on boundaries are mixed. Chen (2014) finds out an effect of floods on the northwards shifting of the boundary, indicating that nomads may have decided to give up some of their occupied territories when the cost of managing the flooded territories increased.

In what follows, we illustrate how the above-mentioned climate shocks interact with the initial state of a territory in determining its exposure to centralized bureaucracy. As mentioned in section 1.3.4, the spatial coverage of the Qin Empire and nomadic confederations in 221 BC is defined as the initial state of the territory. We further note that the binary variable C_c equals one for each county c being inside the Qin Empire in 221 BC, and equals zero if not; while the dummy N_c equals one for each county c being as part of the nomadic confederations, and equals zero if opposite. The variable $InvDis_c$ represents the inverse distance of the centroid of each county to the boundary between two regimes in the initial state.

After setting up those variables in the initial state (i.e., in 221BC), we include the aforementioned exogenous shocks during the imperial period (221 BC-1911 AD). The sources for the frequency and the spatial information on droughts and floods in the entire imperial era are the *Atlas of Drought and Flood Distribution in China in the Past Five Hundred Years*, and the *Hydrological and Climate Dataset of Drought and Flood Disasters in the Yellow River Basin in the Last 2,000 Years*, both edited by the National Earth System Science Data Sharing Infrastructure.[28] We use $Drought_c$ to capture the frequency of droughts on county c's nearest boundary, and $Flood_c$ to capture the number of floods on c's nearest boundary.

[28] Acknowledgement for the data support from "National Earth System Science Data Sharing Infrastructure, National Science & Technology Infrastructure of China. (*http://www.geodata.cn*).

The first-stage regression is illustrated as follows:

$$Exposure_{c,p} = \alpha_1 Drought_c \times InvDis_c \times C_c + \alpha_2 Drought_c \times InvDis_c \times N_c +$$

$$\alpha_3 Flood_c \times InvDis_c \times C_c + \alpha_4 Flood_c \times InvDis_c \times N_c + Z_{c,p}\eta + v_{c,p} \quad (2)$$

where $Z_{c,p}$ contains all covariates in the baseline model and all the components of the interaction terms. Each interaction in the first-stage equation corresponds to one case illustrated as follow.

In the case that the nearest boundary suffered a drought, the nomadic invasions incentivized by a sudden drop of herding output, drove the boundary from the blue line to the red one. For the counties located within the empire (i.e., C_c equals one), as depicted by points A and B in Figure 1.3a, their regime has the possibility to be affected and to be altered from centralized empire to a loose confederation, such as the point A in Figure 1.3b; point B is less likely to be affected since it had been further away from the boundary. Therefore, an increased first interaction term leads to a lower value of *Exposure*: α_1 is expected to be negative and significant; while the counties initially situated within the nomadic region (i.e., N_c equals zero) as exampled by point C in Figures 1.3a and 1.3b can never be affected in the event of drought, given that the boundary moves southwards. Hence, we expect α_2 to be non-significant.

If the nearest boundary suffered a flood, as shown in Figures 1.3c and 1.3d, no further invasion occurred according to Bai and Kung (2011) and Chen (2014). Nomads may either keep what they have or return some territories if they failed in managing them. Suppose that they give up the occupied land and retreat, the regime boundary moves from the red line back to the blue one. For the counties located near the boundary and within the empire in the initial state (i.e., C_c equals one), as represented by point A in Figures 1.3c and 1.3d, flood may help the empire to re-gain its control over these areas; therefore, α_3 is expected to be positive, either significant or non-significant conditional on nomadic decisions between retreat or else. For the counties located within the nomadic region (i.e., N_c equals zero) as represented by point C in Figures 1.3c and 1.3d, they may or may not be affected by nomadic retreat and would never be affected in the case of stay. Hence, we expect α_4 to be

positive but non-significant.

We examine the importance of the four interaction terms for regional exposure in Table 1.6. We explore the first-stage by regressing *Exposure* on the four interactions, and find that the direction of effects and the significance levels of the four estimates fully meet our expectations: The estimate of α_1 is negative and statistically highly significant (at the 1% level), regardless of whether we include all the controls from the baseline model or not. As shown in column (2), an increase of one standard deviation (1.151) in the value of the first interaction, results in 440 additional years of exposure. As expected, α_2 and α_4 are both insignificant. The estimate of α_3 in column (1) suggests that an increase in the value of the third interaction is correlated with an expansion in the coverage of centralized regimes (i.e., higher *Exposure*) through the empires' regained control over some territories. However, when the covariates are included in column (2), the relationship becomes non-significant. The weak effect or non-significance of this coefficient confirms the findings in the literature that floods could not fully explain the expansion of the Han empire; however, drought contributed extensively to the incursion to the Central Plains of nomadic groups. When we restrict the bandwidth to 300 kilometers and then to 200 kilometers, all results remain robust. By excluding counties positioned farther away from the boundary, the effect is strengthened and amplified, as reported in columns (3)-(4) of Table 1.6. The F-statistics indicate that our instrumental variables are by no means weak instruments.

A key concern raised throughout the literature relates to the validity of the instruments. The relevance assumption is attested through the results of the first stage, that α_1 is highly related to (at the 1% level) the endogenous variable and the four interactions have expected effects on the intensity of exposure. In order for our instruments to be valid, they must also satisfy the exclusion restriction assumption related to the effect of droughts and flood on the instability today. Particularly, there is an important strand of literature (Burke and Leigh, 2010; Bruckner and Ciccone, 2011; Dell, Jones, and Olken, 2012), showing that weather shocks also plausibly impact political stability (e.g., democratization and the probability of irregular leader transitions, etc.) through an exogenous change of national income. Thus the effects of historical drought and flood may work through other variables, most notably

current weather shocks and economic outcomes, rather through the past institutions.

However, what we explore is the droughts and floods in each county's nearest boundary rather than the weather shocks occurred within the county; this helps us to resolve most of the threats to the exclusion restriction assumption. For instance, the economic development of the county throughout the history is less like to be directly affected by the extreme rainfalls of farther places, in particular the nearest boundary may be several hundred kilometers away from the county. For violations that may occur to places near the boundary, we further include current weather shocks, i.e., the frequency of droughts and floods from 1990 to 2000 in both stages, sources from the *Atlas of Natural Disaster System of China*. The inclusion of annual precipitation and county-level frequency of climate shocks during the period of 1990-2000 in the set of climatic and geographic covariates allows the exclusion of this channel. To consider the income effect of weather shocks as suggested by the literature, we run regression of economic prosperity proxies (the density of populated places and commercial centers, population size both during and after the imperial period) on the four interactions; the correlations among which could be rejected at a 10% significance level. Meanwhile in the stability-focused equation, we always include variables that act as confounding factors and are affected by weather shocks while having a direct effect on political stability. To sum up, the concern that our interactions in the first-stage estimation may be correlated with current weather shocks or income is unsupported.

1.4.2 Instrumented Results

We report the 2SLS estimates in the following two tables. The second-stage IV estimates are significant, suggesting that the correlations uncovered could represent causal relationships. The instrumented results strongly support the causal effect of historical exposure to political centralization on present-day political stability. Table 1.7 reports the IV results on the number of attacks against the government. The coefficient of instrumented exposure (around 3.4-4.3% in absolute values) is somewhat larger than the OLS estimate (around 0.8-2%), suggesting that the endogenous *Exposure* measure underestimates the long-run consequence of historical empires on contemporary political outcomes. The full specification of our instrumented result

suggests that an additional century of exposure leads to a 3.4% decrease in armed attacks against the government in the full specification model, as shown in column (8) of Table 1.7.

Table 1.8 reports the IV results on the number of protests against the government. The full specification in column (8) reveals that one additional century of centralized empire experience reduces the anti-government protests by 6.6%, and the size and magnitude of the effects are stable regardless of the set of covariates we include.

The strategy of Altonji, Elder, and Taber (2005) uses selection on observables to assess the potential bias from unobservables. Denote the estimated coefficient for *Exposure* from the regression with a restricted set of control variables (e.g., province fixed effects only) β^R (i.e., we use the coefficients in column (2) of Tables 1.7 and 1.8) and the estimated coefficient from the regression with a full specification β^F (i.e., in column (8) of Tables 7 and 1.8). Then, the ratio can be calculated as $|\beta^F/(\beta^R - \beta^F)|$. The larger the ratio the better due to two following intuitions: the smaller is the difference between β^R and β^F, the less the estimate is affected by selection on observables, and the stronger selection on unobservables requires to be (relative to observables) to explain away the entire effect; and the larger β^F, the greater is the effect that needs to be explained away by selection on unobservables.

The influence of the remaining unobservable factors would have to be 5 times greater than that of the observable factors in determining terrorism attacks, and 32 times larger relative to observables in deciding protests against government in order to completely explain away the negative relationship between the exposure and both variables of instability; this is reasonably unlikely.

When apply this strategy to OLS estimates in Tables 1.2 and 1.3, the remaining unobservables in the error term only have to be 1-3 times larger than the observable elements in order to explain away the persistent effect; this is much more likely. Therefore, by exploiting the instrumental variable approach, the identification problem driven from variable omissions is released to a large extent.

1.5 Channels of Persistence

In this section, we explore the two possible channels through which autocratic centralization may have persisted. The first candidate pertains to the persistence of local institution transmitted across time. In addition, a society's believes and views represent the other possible channel. We quantify these possible channels by including each of our two potential mediators into the equations:

$$Med_{c,p} = \gamma Exposure_c + \phi X_{c,p} + \delta_p + \epsilon_{c,p} \tag{3.1}$$

$$Y_{c,p} = \beta' Exposure_c + \rho Med_{c,p} + \psi' X_{c,p} + \delta_p + e_{c,p} \tag{3.2}$$

All the settings are the same as those in equation (1). $Med_{c,p}$ proxies each candidate of mediators, and γ should be statistically significant. Following the literature (Cutler and Lleras-Muney, 2010), we exploit the change in the magnitude of the coefficient on $Exposure$ estimated from equations (1) and (3.2) as the part explained by Med. The explained proportion equals $1 - |\beta'/\beta|$, and the larger this proportion is, the larger the mediate power of each channel of persistence.

1.5.1 Persistence of Local Institutions

The monarchical centralism generated well-functioning and loyal local governments through the overwhelming power of the emperor and his central government over local authorities during the imperial time; those local governments had no independence in politics, economy, and military and local officials in the government were appointed and dispatched directly by the emperor and were strictly required to obey the orders of the emperor and the central government due to their extreme dependence for resources. As a result, a new central-local relation was thus established and developed, and the large-scale of local separatism which had led to the Warring States Period was driven to its minimum. While in decentralized nomadic areas, local authorities had real power, particularly in taxation and military, and did not respond to the needs of the whole confederation; this generated many conflicts among nomadic tribes as well as non-responsive local institutions in nomadic regions. It is possible that the effect of centralization on contemporary outcomes

works through the performance, both their accountability and loyalty, of the local authorities, which endures the passage of time.

Accountability to Citizens The prefectures and counties are administrative units with a certain degree of fiscal autonomy. Although a general direction for policies is decided by the provincial or prefectural government, the implementation of these policies and the formulation of local public expenditure vary across the counties. The local accountability to communities, which was formed through various historical experience, could generate or mitigate anti-government collective behaviors. Proxies for local accountability include densities of public provisions: roads, schools, and hospitals of each county; those variables are calculated from the GIS maps depicted by the National Administration of Surveying, Mapping and Geo-information of China for the year 2012, capturing the amount and the distribution of main local provisions.

To examine whether the accountability of local institution is transmitted, we run regressions on the three proxies in columns (1)-(3) of Table 1.9, and find a longer historical exposure leads to a higher local accountability. In columns (4)-(7), the OLS results suggest long-term pro-social provision (i.e., density of schools and hospitals) mitigates the dissatisfaction towards the local authorities. However, conditioning on each proxy, the magnitude of *Exposure* effects changes slightly and remains highly significant; this suggests that the percentage of effect through the public provisions over total effect is extremely trivial, and equals around 1-6%. When IV is applied, the ratio is even smaller.

Loyalty of Local Institutions On the other hand, due to the bureaucratization and politicization of local institutions and the imposition of various programs on them by the central authority, the loyalty of local institutions to central government may not be sufficient for, may even be antithetical to, their response to the local needs; thus the central-local relations, particularly the loyalty of locals, should be explicitly considered. In all sides of loyalty, anti-corruption is probably the most important one (Hollyer and Wantchekon, 2015). We explore a prefectural-level government-business relation innocence index to approximate local levels of anti-corruption.

The data is from 2017 *City Ranking by Government-Business Relations*, released by the National Academy of Development and Strategy (NADS), Renmin University of China. The ranking's research team has taken two approaches to evaluate the local levels of "innocence" - government honesty and transparency. We focus only the index of government honesty, which consists of two sub-indicators: the ratio of the total number of officials inspected over the total number of officials and the ratio of the number of bribery news over total number of news. The indicator ranges from 0 to 100, and its spatial distribution is illustrated by Figure A.1. We take the natural log for running regression.

We add the measure of corruption in columns (3) and (5) of Table 1.10; both are negative and highly significant, lending firm credence to an institutional channel. In terms of magnitude, a 1% increase in innocence index (i.e., a higher loyalty of local institution to the central government) is associated with a decrease in the terrorism attacks of 3% and in the protests of 6%. However, the coefficients of *Exposure* remain significant even after controlling for this local authority measure, and the mediation effect only accounts for 4-16% of the total effect. Both OLS and IV estimation yield similar results. The facts in both Tables 1.9 and 1.10 suggest that local institution cannot account for the entire observed persistence.

1.5.2 Cultural Persistence

Culture may also serve as a mediator through which this effect persists. The existence of a possible culture channel means that, by creating and fostering a particular culture, institutions may impact upon the behavior of individuals over a long period of time (Grosjean, 2011; Becker et al., 2015). From the historical background of authoritarianism, we know that centralization can foster a cult of personality characterized by the worship of the state's leader and main organs, and it can influence people's trust, making them obey the institution holding the general and centralized power. We expect that these cultural propensities can be transmitted from generation to generation and thus suppress revolts and instability at their very roots.

As Fernández (2008) documents it, economists have measured culture in three ways: by using survey data; by looking at second-generation immigrants to isolate

the impact of culture, holding constant the economic and institutional environment; and by collecting experimental evidence. To examine whether culture represents the channel, we look at two sources of attitudinal surveys as follows, focusing on nationalism, trust and obedience towards the government, respectively.

Nationalism Index Following Lan and Li (2015), we employ information from the 2009 *Chinese Political Compass*, a survey which asks participants to appraise 50 statements on a four-point scale, then groups their responses together and evaluates a participant's political stance relative to all other participants. Among the 50 statements, four are concerned with attitudes towards national stability, as suggested by Lan and Li (2015). The investigated attitudes and their corresponding statements are:

- Assertion of national unity (Gellner, 2009), as measured by the statement: "National unity and territorial integrity are the interests of paramount priority for a society."
- Emphasis on protecting national interests from other countries (Hobsbawm, 1990), as measured by the statement: "Given sufficient comprehensive national power, China has the right to take any measure to protect its interests."
- Militarism (Posen, 1993), as measured by the statement: "All students, regardless of whether they are in college, high school, or elementary school, should attend the military training arranged by the government."
- Anti-foreign sentiments (Gries, 2005), as measured by the statement: "Western countries, headed by the United States, will not really allow China to become a world-class powerful nation."

For each participant, we average their four ratings into one nationalism index. Then, all personal indexes are aggregated at the county level based on the IP address of the participants, in order to have a county-level measurement of nationalistic culture. The spatial distribution of the variable is shown in Figure A.2.

Both OLS and IV results support a strong positive correlation between the years of exposure to centralized monarchy and the indicator of nationalism, as shown in column (1) of Table 1.11. By including the county-level nationalism index in the previous regression as a regressor in columns (3) and (5), we observe that higher nationalistic beliefs of the residents in the county can generate fewer occurrences of attacks and protests against the government; meanwhile, the direct effect of *Exposure* decreases almost to zero, and more importantly, becomes insignificant. The mediation effects of nationalism index range from 40-60%, indicating that nationalism could well-explain the impact of the historical institutions on political unrests, thus confirming that culture is indeed an important element in our story.

Trust in Government We use information from the 2006 and 2010 *China General Social Survey* (CGSS) to explore individual-level cultural traits and more culture variables. CGSS aims to systematically monitor the changing relationship between social structure and quality of life in both urban and rural China. Subjective aspects of the people's well-being, their attitudes towards those around them, and social phenomena both at the individual and aggregate levels are found in the dataset. The sets of questions related to personal attitudes towards state-entities are:

- "To what extent do you trust the central/local government in China?" We define two ordinal variables named *Trust_CentralGov* and *Trust_LocalGov*, which take the value of two if the respondent reports trusting the central/local government, one if the individual has a neutral feeling between trust and no trust, and zero if the individual does not trust the government.

- Trust in governmental agencies and their policies: "Do you think government agencies are able to solve these problems: rich-poor gap; judgment on social security; corruption?" Three dummies *Trust_PolicyPoor*, *Trust_PolicySecurity* and *Trust_PolicyCorr* correspond to each answers, where the value of one represents trust, and the value of zero represents lack of trust.

- "Do you agree it is always correct to obey the central government?" The binary variable *Obedience_Gov* directly captures individual obedience and sentimental

attachment to the central government, coded as one for agree, and zero for disagree.

- "Do you agree that the most serious social conflict is between cadres and common people?" The answer to this question is denoted *Dissention_Gov*, coded as one for agree, and zero for disagree.

Besides the county-level control variables X_c above, we further add a rich set of control variables at the individual level. The individual-level controls include variables that are arguably exogenous, such as age and gender, as well as variables whose effect we would like to separate from any possible effect of the ancient centralized administrative experience, for example ethnic minority status, and *Hukou* register status. The controls further contain variables that may be viewed as endogenous, such as individual working status, education, religious beliefs, and whether one is a member of the CCP. The summary statistics for these variables are reported in Table A.2.

The results consistently show that *Exposure* has a significant positive effect on the relationship between a citizen and the government even up to the present day, when this relationship is defined by a higher level of trust. As shown in the upper panel of Table 1.12, respondents from counties historically more exposed are more likely to trust the central government. Their correlation conditional on a series of county- and individual-level is around 0.7%, as reported by column (3). Columns (4)-(6) report the 2SLS estimates, and show that instrumented *Exposure* increases contemporary trust in the central government by 2.1% (column (6)). As reported in the lower panel of Table 1.12, though the regressions on trust in local government consistently yield similar estimates in the beginning, the effect disappears when county-level characteristics are included. Particularly, the inclusion of local nighttime luminosity absorbs entirely the effect on trust in local government, implying whether a respondent reports trusting the local government depends little on the attitudes transmitted by older generations, but on current local economic development. However, this is not a threat to our conclusions, since the persistence of centralized monarchy only requires a strengthened interactions between individuals and the central authorities.

It is thus not surprising that these respondents believe not only in the government, but also in its agencies and public policies. Table A.3 reports the corresponding results, indicating that, in regions that were historically more exposed to centralization, the citizens tend to agree more that the government's agencies are able to solve the existing social issues. Likewise, the more exposed they were, the more likely the interviewees obey the government and the less likely they are to show dissent, as shown in the lower panel of Table A.3.

We address an important issue here, namely the possibility that the results above are driven by an increased social capital, not by a change in interpersonal interactions rather than person-state interactions. If this is the case, then the underlying mechanism may be more closely related to the diffusion of Confucianism, rather than to the influence of historical institutions on culture. By using variables regarding general trust as dependent variables, we find no significant evidence that *Exposure* would change general trust towards other people, such as the relatives, colleagues, people in the same town, and old classmate. Table A.4 presents the OLS results, and applying the IV leads to consistent results.

1.6 Conclusion

This paper exploits novel measurements of county-level political instability to examine the persistence of centralized empires in China from 221 BC to 1911. The results suggest that past institutions do influence present-day outcomes from a political perspective: the effect of political centralization in ancient China persists and explains the regional variation in political instability. The longer a county was historically exposed to centralized statehood, the less likely it was that anti-government armed attacks and protests would occur within the county. The correlations estimated by OLS account for 3%-5% of the outcome mean. To avoid the possibility of endogeneity and claim that the correlation could reflect a causal relationship, we control for a rich set of covariates and employ an instrumental variable approach. The instrumented results reveal that one additional century of centralized empire experience reduces anti-government attacks by 3.4% and decreases anti-government protests by 6.6%. All findings remain consistent to using different sub-samples and

a time-weighted explanatory variable.

In the last part, we explore the channels through which the effect persists. Historical experience of centralization on the one hand, generated well-functioning and loyal local authorities; on the other hand, fostered the general worship of the emperor, and influence people's nationalistic sense, and attitudes towards institutions holding the centralized power. We find that the latter channel (i.e., deeply-rooted culture) could account for the majority of the estimated persistence: nationalism, trust and obedience towards the government which persist to this day, evidenced by their positive and strong correlation with the intensity of exposure, well-mediate the effect of the long-gone historical institution on political instability; this contributes to the literature that past institutions lead to certain current consequences through an unwittingly created culture.

Bibliography

[1] Acemoglu, D., S. Johnson, and J. A. Robinson, (2001). The colonial origins of comparative development: An empirical investigation. American Economic Review, 91: 1369-1401.

[2] Alesina, A., and N. Fuchs-Schündeln, (2007). Good-Bye Lenin (or Not?): The Effect of Communism on People's Preferences. American Economic Review, 97(4): 1507-28.

[3] Alesina, A., and P. Giuliano, (2015). Culture and Institutions. Journal of Economic Literature, 53 (4): 898-944.

[4] Alesina, A., S. Özler, N. Roubini, and P. Swagel, (1996). Political instability and economic growth. Journal of Economic Growth, 1: 189-211.

[5] Altonji, J. G., E.E. Todd, and C.R. Taber, (2005). Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools. Journal of Political Economy, 113 (1): 151-184.

[6] Angeles, L., and A. Elizalde, (2017). Pre-colonial institutions and socioeconomic development: The case of Latin America. Journal of Development Economics, 124 (1): 22-40.

[7] Annett, A., (2001). Social Fractionalization, Political Instability, and the Size of Government. IMF Staff Papers, 48 (3): 561-592

[8] Bai, Y., and J. Kung, (2011). Climate Shocks and Sino-nomadic Conflict. Review of Economic Statistics, 93 (3): 970-981.

[9] Becker, S.O., K. Boeckh, C. Hainz, and L. Woessmann, (2014). The Empire Is Dead, Long Live the Empire! Long-Run Persistence of Trust and Corruption in the Bureaucracy. Economic Journal, 126 (3): 40-74.

[10] Bruckner, M., and A. Ciccone, (2011). Rain and the Democratic Window of Opportunity. Econometrica, 79 (3): 923-47.

[11] Buonanno, P., M. Cervellati, S. Lazzaroni, and G. Prarolo, (2018). The Legacy of Political History 1000-1800 for Attitudes Towards the State: Disaggregated Analysis for Italy. Working paper.

[12] Burke, P.J., and A. Leigh, (2010). Do Output Contractions Trigger Democratic Change? American Economic Journal: Macroeconomics, 2 (4): 124-57.

[13] Cao, S.J. (2015). Zhongguo renkoushi, Mingshiqi (History of Population in China, the Ming Period). Manuscript.

[14] Chen, Q. (2015). Climate Shocks, Dynastic Cycles and Nomadic Conquests: Evidence from Historical China. Oxford Economic Papers, 67 (2): 185-204.

[15] Chen, Q. (2015). Climate Shocks, State Capacity and Peasant Uprisings in North China during 25-1911 CE. Economica, 82: 295-318.

[16] Chen, X. and W.D. Nordhaus, (2011). Using luminosity data as a proxy for economic statistics. Proceedings of the National Academy of Sciences. 108 (21): 8589-8594.

[17] Cutler, D. M. and A. Lleras-Muney, (2010). Understanding differences in health behaviors by education. Journal of Health Economics, 29 (1): 1-28.

[18] Dell, M., (2010). The Persistent Effects of Peru's Mining Mita. Econometrica, 78 (6): 1863-1903.

[19] Dell, M., B.F. Jones, and B.A. Olken, (2012). Temperature Shocks and Economic Growth: Evidence from the Last Half Century. American Economic Journal: Macroeconomics, 4 (3): 66-95.

[20] Dell, M., N. Lane, and P. Querubin, (2018). The Historical State, Local Collective Action, and Economic Development in Vietnam. Econometrica (Forthcoming).

[21] Easterly, W. and R. Levine, (1997). Africa's Growth Tragedy: Policies and Ethnic Divisions. Quarterly Journal of Economics, 112 (4): 1203-1250.

[22] Edgerton, R.B., (1971). The individual in cultural adaptation: a study of four East African peoples. University of California Press.

[23] Fernández, R. (2008). Culture and Economics New Palgrave Dictionary of Economics, 2nd edition, 2008

[24] Gellner, E. (2009). Nations and Nationalism. 2nd ed. Oxford: Cornell University Press.

[25] Gries, P.H., (2005). Chinas New Nationalism: Pride, Politics, and Diplomacy. Berkeley: University of California Press.

[26] Goldschmidt, W. and E.J. Kunkel, (1971). The Structure of the Peasant Family. American Anthropologist, 73 (5): 1958-1971

[27] Grosjean, P. (2011). The Weight of History on European Cultural Integration: A Gravity Approach. American Economic Review 101 (3): 504-508.

[28] Guiso, L., P. Sapienza, and L. Zingales, (2016). Long-term Persistence. Journal of European Economic Association, 14 (6): 1401-1436.

[29] Hare, Denise, (2002). The Determinants of Job Location and Its Effect on Migrants' Wages: Evidence from Rural China, 50(3): 557-579.

[30] Henderson, J. V., A. Storeygard, and D.N. Weil, (2012). Measuring Economic Growth from Outer Space. American Economic Review, 102 (2): 994-1028.

[31] Hobsbawm, E. J. (1990). Nations and Nationalism since 1780: Programme, Myth, Reality. Cambridge: Cambridge University Press.

[32] Hollyer, J.R., B.P. Rosendorff, and J.R. Vreeland, (2015). Transparency, Protest, and Autocratic Instability. American Political Science Association, 109 (4): 764-784.

[33] Hollyer, J.R. and L. Wantchekon, (2015). Corruption and Ideology in Autocracies. Journal of Law, Economics, and Organization, 31 (3): 499-533

[34] La Porta, R., F. Lopez-de-Silanes F, A. Shleifer, R.W. Vishny, (1997). Legal determinants of external finance. Journal of Finance, 52: 1131-50

[35] La Porta, R., F. Lopez-de-Silanes, A. Shleifer, R.W. Vishny, (1998). Law and Finance. Journal of Political Economy, 106 (6): 1113-1155.

[36] Lan, X.H, and B.G. Li. (2015). The Economics of Nationalism. American Economic Journal: Economic Policy, 7 (2): 294-325.

[37] Lowes, S., N. Nunn, J. A. Robinson, and J. Weigel, (2017). The Evolution of Culture and Institutions: Evidence from the Kuba Kingdom. Econometrica, 85 (4): 1065-1091.

[38] Michalopoulos, S., and Papaioannou E. (2013). Pre-Colonial Ethnic Institutions and Contemporary African Development. Econometrica, 81 (1): 113-152.

[39] North, D.C. (1990). Institutions, Institutional Change and Economic Performance, Cambridge:Cambridge University Press.

[40] Nunn, N. and L. Wantchekon, (2011). The Slave Trade and the Origins of Mistrust in Africa. American Economic Review, 101 (7): 3221-52.

[41] Posen, B.R., (1993). Nationalism, the Mass Army, and Military Power. International Security, 18 (2): 80-124.

[42] Putnam, R., R. Leonardi, and R. Nanetti, (1993). Making Democracy Work: Civic Traditions in Modern Italy, Princeton, NJ: Princeton University Press.

[43] Wahl, F. (2017). Does European development have Roman roots? Evidence from the German Limes. Journal of Economic Growth, 22 (3): 313-349.

[44] Zabel F., B. Putzenlechner, W. Mauser, (2014). Global Agricultural Land Resources - A High Resolution Suitability Evaluation and Its Perspectives until 2100 under Climate Change Conditions. PLoS ONE. 9 (9): e107522.

[45] Zhou H.W. (2018). A Model of Institutional Complementarities in Ancient China. Eastern Economic Journal, 44 (2): 286-304.

Table 1.1: Summary Statistics

Variables	Obs.	Mean	S.D	Min	Max
Outcome Variables					
Attacks (log)	2306	0.152	0.378	0	2.708
Protests (log)	2306	0.900	0.897	0	3.638
Main explanatory variables					
Exposure (centuries)	2306	9.426	7.157	0	21.32
Socio-demographic characteristics					
Population (log)	2301	12.93	1.160	8.837	16.92
Immigration (log)	2301	5.055	1.710	1.414	6.942
Sex ratio (%)	2300	105.81	5.663	72.77	160.43
Avg years of schooling	2300	8.257	1.182	2	12.56
Ethnic minority (%)	2301	19.311	31.526	0	99.78
Urban (%)	2301	79.40	13.79	6.340	98.42
Unemployed (%)	2299	0.281	0.073	0.065	0.722
Empl. in agriculture (%)	2301	0.451	0.173	0.003	0.904
Empl. in manufacturing industry (%)	2297	0.120	0.083	0.001	0.542
Empl. in service-providing industry (%)	2300	0.083	0.040	0.005	0.336
Empl. in Party and state institutions (%)	2300	0.018	0.008	0.001	0.031
Autonomous regions	2301	0.276	0.447	0	1
Contemporary economic outcomes					
Nightlight density	2306	9.917	9.401	0	63
Agricultural feasibility	2306	183.78	42.97	63.36	255
Climate and Geography					
Precipitation	2283	903.77	471.06	32	2399
Altitude	2306	876.45	1113.39	0.223	5150.48
Ruggedness	2306	1066.41	991.84	3	6696
Distance to national boundary	2306	610.67	370.77	0	1430.97
Distance to coastline	2306	708.74	745.73	0	4132.03
Distance to Beijing	2306	621.92	684.64	0	3826.90
Policy triggers					
Land revenue (log)	2306	4.338	3.004	0	12.26
Pm 2.5 pollutant	2306	33.83	18.91	1.868	77.30
Cultural variables					
Language	2306	7.449	2.251	1	14
Confucius Temples	2306	0.291	0.656	0	6
Historical variables					
Share of agriculture	2306	0.713	0.452	0	1
Animal husbandry	2306	0.204	0.403	0	1
Feudalism	2306	0.253	0.435	0	1
Pre-221 BC density of cities	2285	5.80	26.43	0	94
1800 density of cities	2285	15.70	39.87	1	788
Historical commercial center	2306	0.165	0.372	0	1

Table 1.2: Anti-government Attacks

	Log(#attacks+1)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exposure	-0.020***	-0.019***	-0.015***	-0.011***	-0.010***	-0.009***	-0.010***	-0.008***
	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Province FE	N	Y	Y	Y	Y	Y	Y	Y
Demography	N	N	Y	Y	Y	Y	Y	Y
Development	N	N	N	Y	Y	Y	Y	Y
Geography	N	N	N	N	Y	Y	Y	Y
Policy	N	N	N	N	N	Y	Y	Y
Culture	N	N	N	N	N	N	Y	Y
History	N	N	N	N	N	N	N	Y
N	2306	2306	2294	2294	2272	2262	2262	2252

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.3: Anti-government Protests

	Log(#protests+1)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exposure	-0.009***	-0.024***	-0.033***	-0.031***	-0.030***	-0.032***	-0.032***	-0.031***
	(0.003)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Province FE	N	Y	Y	Y	Y	Y	Y	Y
Demography	N	N	Y	Y	Y	Y	Y	Y
Development	N	N	N	Y	Y	Y	Y	Y
Geography	N	N	N	N	Y	Y	Y	Y
Policy	N	N	N	N	N	Y	Y	Y
Culture	N	N	N	N	N	N	Y	Y
History	N	N	N	N	N	N	N	Y
N	2306	2306	2294	2273	2259	2252	2252	2252

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.4: Robustness of the *Exposure* Measurement

	(1)	(2)	(3)	(4)	(5)	(6)
	Alternative measurements of exposure Including vassal states		Excluding Xinjiang, Tibet, Qinghai, Inner Mongolia		Excluding stateless regions in the first two centuries	
	Anti-gov attacks	Anti-gov protests	Anti-gov attacks	Anti-gov protests	Anti-gov attacks	Anti-gov protests
Exposure	-0.010**	-0.032***	-0.005**	-0.025***	-0.005**	-0.026***
	(0.005)	(0.008)	(0.002)	(0.008)	(0.002)	(0.007)
Full Controls	Y	Y	Y	Y	Y	Y
N	2252	2252	1931	1931	2065	2065

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.5: Weighted *Exposure*

	Anti-gov attacks		Anti-gov protests	
	(1)	(2)	(3)	(4)
Weighted Exposure	-0.010***	-0.004*	-0.007*	-0.015***
	(0.002)	(0.002)	(0.004)	(0.005)
Full Controls	N	Y	N	Y
N	2306	2252	2306	2252

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.6: First-stage Results

			Exposure			
			All		300km bw	200km bw
	Mean	S.D	(1)	(2)	(3)	(4)
$InvDis \times Drought \times C$	0.892	1.151	-5.215***	-4.401***	-9.369***	-14.91*
			(-4.804)	(-3.923)	(-3.208)	(-1.887)
$InvDis \times Drought \times N$	0.926	2.416	-0.431	-0.019	0.352	0.192
			(-0.866)	(-0.040)	(0.423)	(0.129)
$InvDis \times Flood \times C$	1.070	1.271	2.419*	1.521	4.751	6.937
			(1.791)	(1.142)	(1.451)	(0.784)
$InvDis \times Flood \times N$	0.837	2.143	0.212	-0.429	-0.576	-1.001
			(0.785)	(0.490)	(-1.148)	(-1.434)
Additional Controls	-	-	N	Y	Y	Y
N	-	-	2147	2147	692	428
F-statistics	-	-	27.17	38.69	45.13	18.04

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.
[2] Every components of these four interactions are controlled in both stages.
[3] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.7: IV Results: Anti-government Armed Attacks

	Log(#attacks+1)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exposure	-0.010***	-0.043**	-0.037*	-0.032*	-0.041**	-0.036*	-0.035**	-0.034**
	(0.002)	(0.020)	(0.020)	(0.019)	(0.019)	(0.019)	(0.017)	(0.016)
Province FE	N	Y	Y	Y	Y	Y	Y	Y
Geography	N	N	Y	Y	Y	Y	Y	Y
Development	N	N	N	Y	Y	Y	Y	Y
Demography	N	N	N	N	Y	Y	Y	Y
Policy	N	N	N	N	N	Y	Y	Y
Culture	N	N	N	N	N	N	Y	Y
History	N	N	N	N	N	N	N	Y
N	2305	2305	2293	2293	2271	2251	2247	2247

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; current weather shocks, precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.8: IV Results: Anti-government Protests

	Log(#protests+1)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exposure	-0.011**	-0.064**	-0.055*	-0.063*	-0.064*	-0.065*	-0.071*	-0.066*
	(0.005)	(0.025)	(0.034)	(0.033)	(0.038)	(0.039)	(0.037)	(0.040)
Province FE	N	Y	Y	Y	Y	Y	Y	Y
Geography	N	N	Y	Y	Y	Y	Y	Y
Development	N	N	N	Y	Y	Y	Y	Y
Demography	N	N	N	N	Y	Y	Y	Y
Policy	N	N	N	N	N	Y	Y	Y
Culture	N	N	N	N	N	N	Y	Y
History	N	N	N	N	N	N	N	Y
N	2305	2305	2278	2272	2258	2251	2247	2247

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; current weather shocks, precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.9: Institution Channel: Public Provision

	Road	School	Hospital	Attacks			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: OLS							
Exposure	0.0049	0.0169***	0.0143***	-0.0075***	-0.0074***	-0.0070***	-0.0072***
	(0.0032)	(0.0051)	(0.0052)	(0.0026)	(0.0026)	(0.0026)	(0.0026)
Road					-0.0337		
					(0.0251)		
School						-0.0539***	
						(0.0165)	
Hospital							-0.0500***
							(0.0170)
Panel B: IV							
Exposure	0.0382***	0.0705***	0.0536***	-0.0337*	-0.0334*	-0.0321*	-0.0329*
	(0.0121)	(0.0159)	(0.0156)	(0.0195)	(0.0195)	(0.0195)	(0.0195)
Road					-0.0263		
					(0.0289)		
School						-0.0332	
						(0.0202)	
Hospital							-0.0295
							(0.0212)
Full Specification	Y	Y	Y	Y	Y	Y	Y
N	2257	2257	2257	2257	2257	2257	2257
Dep.Var. Mean	3.290	1.684	1.359		0.152		
Dep.Var. S.D	0.725	0.849	0.735		0.376		

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; current weather shocks, precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.10: Institutional Channel: Corruption

	Innocence index	Attacks		Protests	
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS					
Exposure	0.0153**	-0.0075***	-0.0063**	-0.0305***	-0.0294***
	(0.0075)	(0.0026)	(0.0025)	(0.0073)	(0.0073)
Innocence index			-0.0271**		-0.0647***
			(0.0106)		(0.0227)
Panel B: IV					
Exposure	0.0710*	-0.0333**	-0.0326*	-0.0664*	-0.0622**
	(0.0394)	(0.0160)	(0.0198)	(0.0401)	(0.0300)
Innocence index			-0.0175*		-0.0547**
			(0.0106)		(0.0245)
Full Specification	Y	Y	Y	Y	Y
N	2258	2258	2258	2258	2258
Dep.Var. Mean	3.684	0.152		0.900	
Dep.Var. S.D	0.825	0.376		0.896	

[2] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.

[3] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; current weather shocks, precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.11: Culture Channel: CPoC Nationalism Index

	CPoC nationalism index	Attacks		Protests	
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS					
Exposure	0.0466***	-0.0055**	-0.0033	-0.0226***	-0.0097
	(0.0102)	(0.0025)	(0.0025)	(0.0086)	(0.0085)
Nationalism index			-0.0454***		-0.3246***
			(0.0071)		(0.0210)
Panel B: IV					
Exposure	0.0997***	-0.0193*	-0.0132	-0.0595*	-0.0287
	(0.0374)	(0.0116)	(0.0118)	(0.0341)	(0.0328)
Nationalism index			-0.0389***		-0.3141***
			(0.0080)		(0.0232)
Full Specification	Y	Y	Y	Y	Y
N	1642	1642	1642	1642	1642
Dep.Var. Mean	2.380	0.084		1.082	
Dep.Var. S.D	0.977	0.284		0.940	

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.
[2] Covariates include logged population, logged immigrants, sex ratio, ethnic minorities, average years of schooling, urban residents, agricultural, industrial and Party/state institutions employment, unemployment, and affiliation with autonomous regions; current weather shocks, precipitation, elevation, terrain ruggedness, distance to the national boundaries, distance to the coast, distance to the capital; luminosity in 2010, agricultural suitability index; land revenue, pollution levels; language groups, number of Confucian temples; shares of agriculture, herding, feudalism, pre-221 BC and 1800 density of cities, and historical commercial centers.

Table 1.12: CGSS: Trust in Government

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
	Trust_CentralGov					
Exposure	0.009***	0.008**	0.007*	0.020**	0.015*	0.021*
	(0.003)	(0.003)	(0.004)	(0.009)	(0.009)	(0.010)
	Trust_LocalGov					
Exposure	0.016***	0.013**	-0.000	0.033**	0.028**	0.009
	(0.005)	(0.005)	(0.007)	(0.014)	(0.013)	(0.023)
Province FE	Y	Y	Y	Y	Y	Y
Wave FE	Y	Y	Y	Y	Y	Y
Individual Charac.	N	Y	Y	N	Y	Y
County Charac.	N	N	Y	N	N	Y
N	11785	11303	11102	11785	11303	11102

[1] Robust standard errors clustered at county level in parentheses. Significant at * 10%, ** 5%, *** 1%.
[2] The county-level covariates include all variables introduced in section 1.3.4. The individual-level covariates include the respondent's age, gender, ethnicity, religious beliefs, marital status, years of school, employment status, CCP membership, parental years of schooling and parental CCP membership.

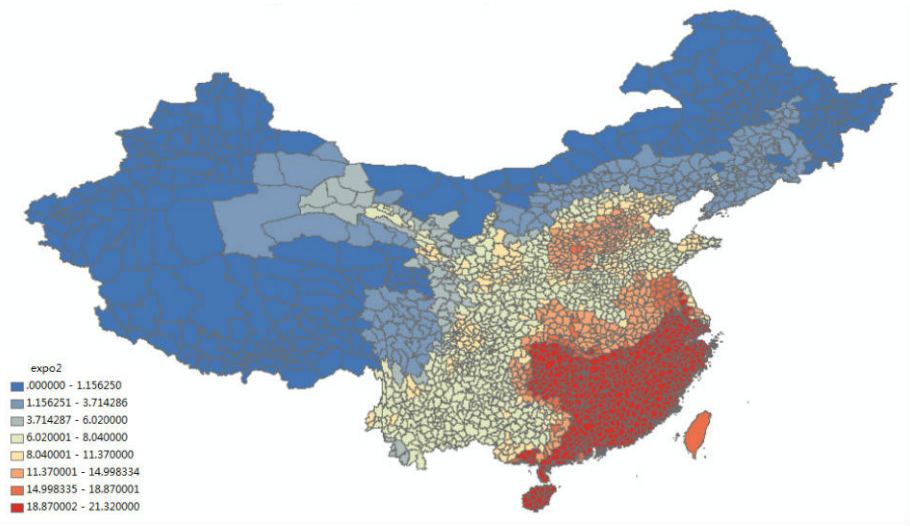


Figure 1.1: Historical Exposure (in Centuries) to Centralized Statehood

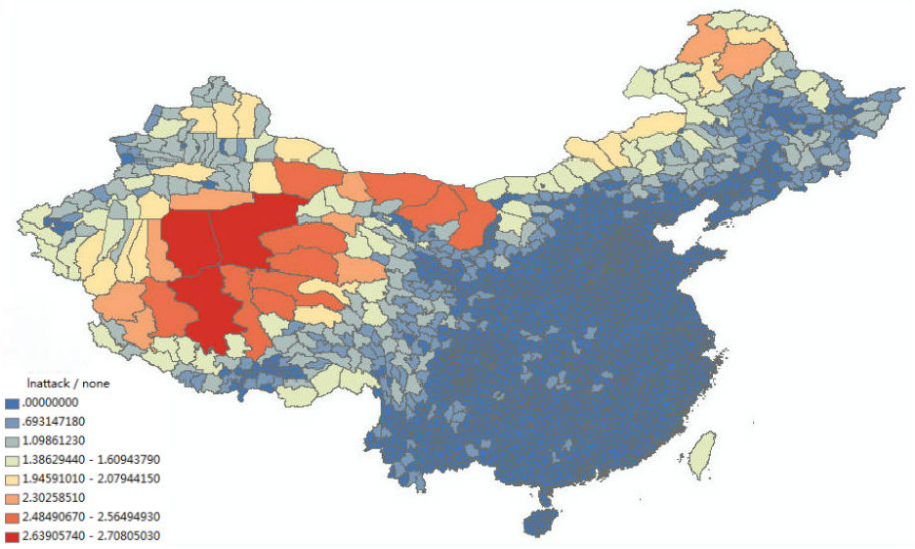


Figure 1.2: County-level Number of Anti-government Armed Attacks

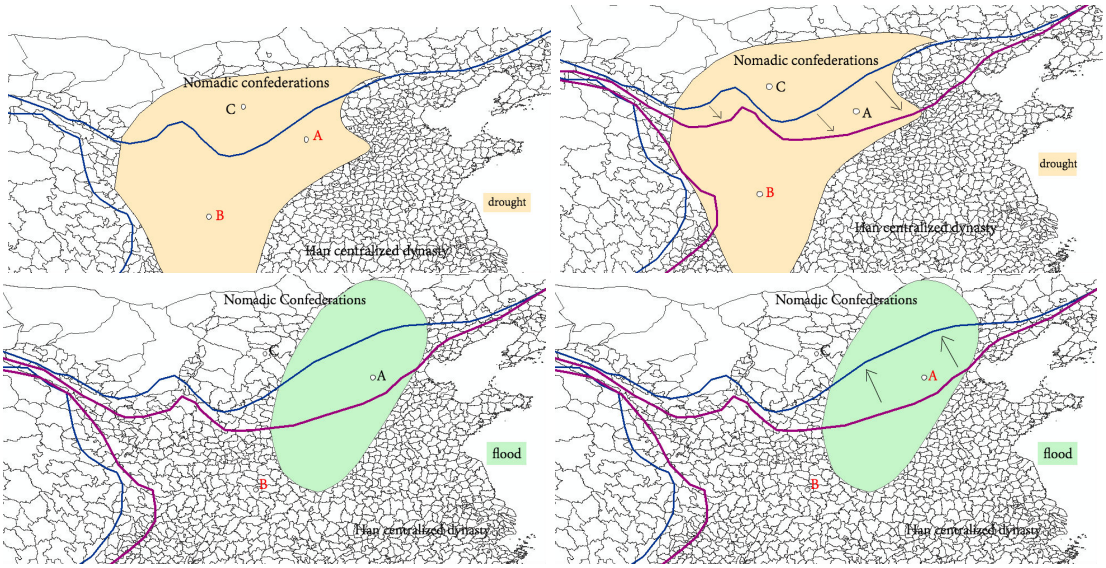


Figure 1.3: How *Exposure* Changed Based on a Combination of *Initial Regime States*, *Initial Distance to the Border* and *Droughts and Floods on the Boundary*

Table A.1: Different Set of Events

	Log(#attacks+1)			Log(#protests+1)		
	$Attacks^{1989-2000}$	$Attacks^{2001-2016}$		$Protests^{2014}$	$Protests^{2015}$	
Exposure	-0.005***	-0.004**	-0.002	-0.020***	-0.021***	-0.003
	(0.002)	(0.002)	(0.001)	(0.007)	(0.007)	(0.005)
$Attacks^{1989-2000}$			0.491***			
			(0.045)			
$Protests^{2014}$						0.901***
						(0.021)
N	2259	2259	2259	2259	2259	2259
Province FE	Y	Y	Y	Y	Y	Y
Covariates	Y	Y	Y	Y	Y	Y

[1] Robust standard errors clustered at province level in parentheses. Significant at * 10%, ** 5%, *** 1%.
[2] The county-level covariates include all variables introduced in section 1.3.4.

Table A.2: Summary Statistics Individual-level Data (CGSS)

Variables	Obs.	Mean	S.D	Min	Max
Outcome Variables					
Trust_CentralGov	11785	1.850	0.450	0	2
Trust_LocalGov	11785	1.479	0.763	0	2
Trust_PolicyPoor	10103	0.377	0.485	0	1
Trust_PolicySecurity	10088	0.335	0.472	0	1
Trust_PolicyCorr	10085	0.390	0.488	0	1
Dissention_Gov	21936	0.362	0.481	0	1
Obedience_Gov	21159	0.689	0.463	0	1
Main explanatory variables					
Exposure (per hundred year)	30034	10.805	6.915	0	21.32
Individual Characteristics					
Age	30034	43.468	14.752	13	94
Male	30034	0.470	0.499	0	1
Ethnic minority	30034	0.074	0.261	0	1
Religious	30034	0.106	0.308	0	1
Married	30034	0.892	0.310	0	1
Years of schooling	30034	8.348	4.460	0	22
Employed	30034	0.682	0.466	0	1
CPC member	30034	0.108	0.310	0	1
Father's years of schooling	30034	4.949	4.454	0	18
Mother's years of schooling	30034	3.134	4.099	0	18
Father is CPC member	30034	0.134	0.340	0	1
Mother is CPC member	30034	0.027	0.161	0	1

Number of counties = 204

Table A.3: CGSS: Trust Government Agencies & Policies

	Trust_PolicyPoor		Trust_PolicySecurity		Trust_PolicyCorr	
	OLS	IV	OLS	IV	OLS	IV
Exposure	0.011***	0.027**	0.007**	0.024*	0.013***	0.028
	(0.003)	(0.013)	(0.003)	(0.012)	(0.004)	(0.030)
N	8607	8607	8598	8753	8604	8753
	Dissention_Gov		Obidience_Gov			
	OLS	IV	OLS	IV		
Exposure	-0.003***	-0.008*	0.008**	0.018**		
	(0.001)	(0.004)	(0.002)	(0.007)		
N	21736	21736	19552	19552		
Province FE	Y	Y	Y	Y	Y	Y
Wave FE	Y	Y	Y	Y	Y	Y
Individual Charac.	Y	Y	Y	Y	Y	Y
County Charac.	Y	Y	Y	Y	Y	Y

[1] Robust standard errors clustered at county level in parentheses. Significant at * 10%, ** 5%, *** 1%.
[2] The county-level covariates include all variables introduced in section 1.3.4. The individual-level covariates include the respondent's age, gender, ethnicity, religious beliefs, marital status, years of school, employment status, CCP membership, parental years of schooling and parental CCP membership.

Table A.4: CGSS: General Trust

	(1) General trust	(2) trust relatives	(3) trust colleagues	(4) trust people in the same town	(5) trust old classmates
Exposure	-0.002	-0.000	0.001	-0.002	-0.002
	(0.008)	(0.002)	(0.002)	(0.002)	(0.002)
Province FE	Y	Y	Y	Y	Y
Wave FE	Y	Y	Y	Y	Y
Individual Charac.	Y	Y	Y	Y	Y
County Charac.	Y	Y	Y	Y	Y
N	3674	21041	19426	20226	19932

[1] Robust standard errors clustered at county level in parentheses. Significant at * 10%, ** 5%, *** 1%.
[2] The county-level covariates include all variables introduced in section 1.3.4. The individual-level covariates include the respondent's age, gender, ethnicity, religious beliefs, marital status, years of school, employment status, CCP membership, parental years of schooling and parental CCP membership.

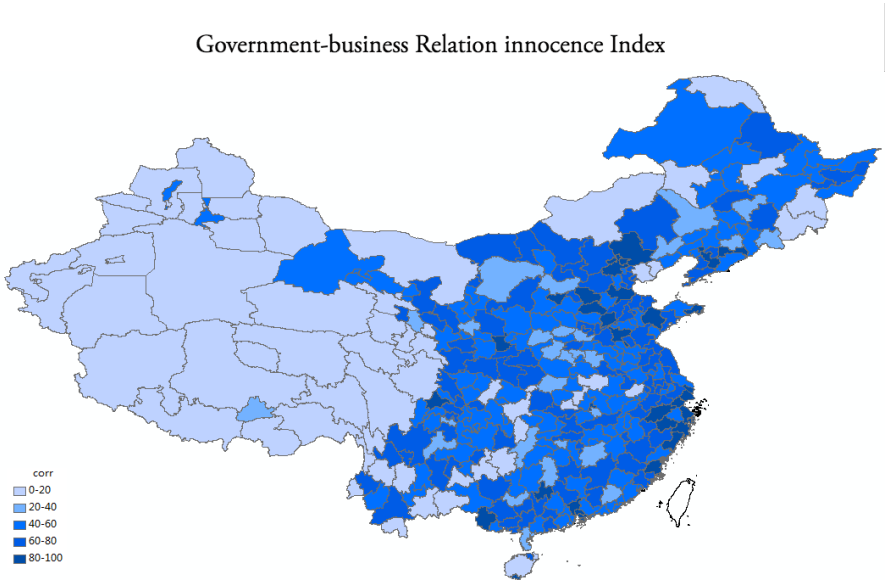


Figure A.1: Government-Business Innocence Index

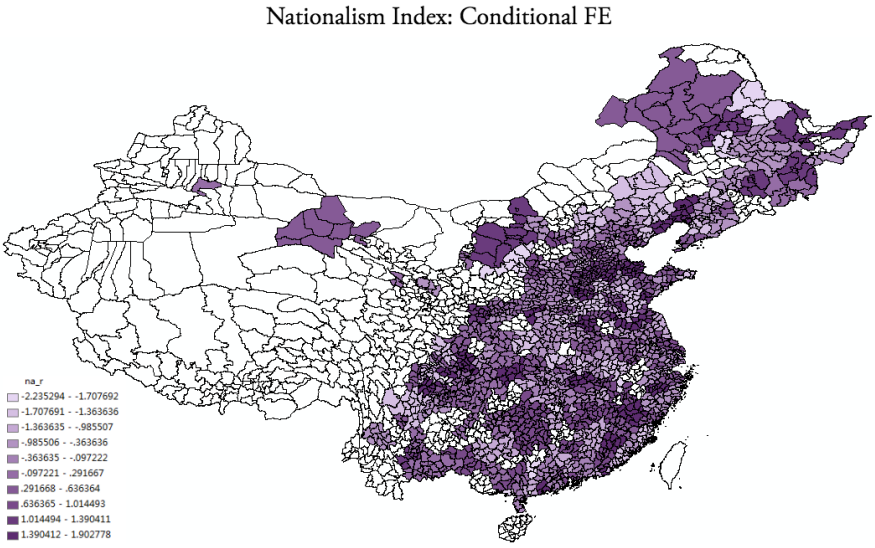


Figure A.2: CPoC Nationalism Index

Chapter 2

Political Tournament and Political Outcomes

[*]

2.1 Introduction

What is the inter-correlation between local political tournament and local government performance? Theories of democracy suggest that electoral activities promote both responsiveness and accountability. Increasing empirical evidence shows that in developed democracies greater political competition generally results in lower levels of corruption, better incentives for incumbents in office (Besley and Burgess, 2002; Besley, Persson and Sturm, 2010), and a higher provision of public goods. However, the evidence does not indicate that increases in competition are always beneficial, or that they would function in all political systems. For example, in autocracies like China, where local politicians are selected and promoted by the autocrat rather than

[*]I am indebted to my supervisor Paolo Masella for his guidance. I am grateful to Giovanni Prarolo, Giulio Zanella, Paolo Vanin, Paolo Roberti, Matteo Cervellati, Margherita Fort, Gaetano Minerva, Pierre Landry, Qi Gao, Xiaobo He for constructive suggestions and the seminar participants at University of Bologna, The Chinese University of Hong Kong, Shanghai University of Finance and Economics for their comments. Thanks to CSC (China Scholarship Council) for financial support. All remaining errors are my own.

the voters, promotion tournaments may lead to a different relationship between the levels of political competition and policy outcomes.

The political hierarchical system in China is characterized by two key components: economic decentralization and strong political centralization (Xu, 2011; Yu, Zhou and Zhu, 2015; Persson and Zhuravskaya, 2016). On the one hand, economic decentralization offers local leaders a great deal of freedom to implement local economic policies and to decide whether to provide public goods and services. On the other hand, political centralization allows higher hierarchically-situated politicians to provide their subordinates with incentives to adhere to their proclaimed goals, through their control over the promotion tournament.

The Chinese political tournament, one of the most important parts of the hierarchical system, refers to intra-party competition where local politicians on the same administrative level compete with one other for positions within higher-level authorities. The decision to promote local officials in China is made not by the citizens, but entirely by the higher-level authority who chooses a winner from the pool of officials based on candidates' performance, their competence, and their loyalty. Neither competence nor loyalty is easy to observe practically: upper-level governments usually look for observable and substantive indicators. The candidates face anecdotally well-defined promotion criteria that are closely associated with their local economic performance, mainly measured by local GDP growth rate over their tenure (Chen, Li and Zhou, 2005; Li and Zhou, 2005). More specifically, relative performance is assessed by comparing a candidate's GDP growth with the growth of areas under the administration of competitors.[2] The great economic performance of the Chinese economy in the last decades suggests that the officials chosen should have been conducive to growth, or at least not detrimental to local development.

The growth-based promotion mechanism has its advantages and disadvantages. The career-maximizing behaviors of officials due to their career concerns are one of the key drivers of economic growth in China over the last few decades (Maskin,

[2]This promotion rule stems from historical reasons. Firstly, China has experienced a long period of poverty, economic growth is a common aspiration of people across the country in a given period. Secondly, giving priority to efficiency rather to fairness has been a long-term guidance of central and local government, that the goal of the autocrat is to make the size of the cake larger, to feed better our 1.3 billion people.

Qian and Xu, 2000), given the facts that promotion and local economic development are strongly linked together. A career-focused candidate is motivated to execute the policies that maximize their career prospects, and strives to boost economic growth. However, the growth-related career concerns model will inevitably turn local governments into "production-oriented governments," leading to rising local fiscal deficit. Statistics evidence shows that at the end of 2016 the debt ratio of local governments had reached 36%. The negative impact of promotion tournament not only appears at this level, but also in the composition of public expenditure: problems such as excessive investment in infrastructure construction and insufficient local inputs in education, health care, and other public services are increasingly prominent. The reasoning behind the unbalanced distribution of public expenditure is that the promotion process in China rewards investments in construction and infrastructure, which favor local production directly and immediately. In contrast, investments in education, health care, and welfare, which have long-term effects on growth and stability, have been underfunded relative to construction in China, because they cannot boost economic growth in the short run (Luo, Zhang, Huang and Rozelle, 2010).

We divide the public input into short-term and long-term investment based on whether they could increase the productivity of capital in each unit immediately or not and link them to politicians' career concerns. For instance, the building of local infrastructure can be regarded as a short-term investment, because it is able to motivate local businesses and attract foreign capital, which can raise local productivity and boost economic growth rapidly; enhanced growth sequentially benefits politicians in their competition with one other, within one's career term, and is a more reliable signal of a candidate's competence. Meanwhile, the returns on educational and social welfare spending, contributing to long-term public goods and services for local residents, need time to be materialized and are less advantageous to a politician's career.

In this paper, we consider the time-dependent competition level as the source of variations in career concerns. Using the characteristics of the Chinese political tournament, we measure the level of competition by counting the potential competitors for promotion in the candidate pool at time t, and by subtracting the prefectures

whose leader just left the office from the total number of prefectures in each province.

We investigate the intercorrelation between political competition and public policies by analyzing whether and why political competition affects the overall level and composition of public investments. Specifically, we formalize this research as a simple career-concerns model with two choices for public input. Following theoretical predictions, having fewer actual competitors indicates better odds of being promoted, which work to increase the marginal return on effort. Effort refers not only to more financial input, but also to the strategic allocation of different contributions: more investment into short-term projects and less spending on long-term enterprises. In contrast, more contestants decrease the probability of promotion, which lowers the spending level and renders long-term pro-social spending more attractive than short-term investment.

Our paper tests the model by exploring administrative units at the prefecture level. We combine information on party secretaries with official data on prefecture-level expenditures, by collecting panel data from a sample of 280 prefectures from 23 province-level units[3] between 2003 and 2015. The number of potential competitors comes from the curricula vitae of around 1,000 politicians that worked as prefecture leaders during the time span of interest; these documents record when a politician was appointed as well as when and why this politician left his function. An exogenous case of politicians' turnover allows us to address the empirical challenge that the number of competitors is likely to be endogenous. Our estimates explore competitors' sudden deaths as an instrument: some candidates left the office because they died from a sudden accident or a sudden illness. Moreover, we employ data from various sources, including prefecture-level outcomes from official yearbooks from different statistics bureaus. In this way we explore the effects of career concerns as seen through different lenses and check the consistency of the results across various sources as a way of avoiding data inaccuracy stemming from politically-motivated interferences.

Our findings suggest that a politician's motivation to pursue growth rises with decreasing competitors. With fewer potential candidates, more public expenditure

[3]Except Tibet, Xinjiang, Qinghai where promotion may focus on securing political stability instead of growth; Four province-level municipalities are excluded because they are under the direct control of the state council; The islands Taiwan and Hainan are also excluded.

is going to be realized. As far as the composition of contributions is concerned, spending in education and social welfare is shifted to short-term investment, which immediately leads to more roads and construction projects. When there are too many contestants for a position, the marginal returns on effort decrease; this is characterized by decreased expenditures in infrastructure and higher pro-social long-term spending. In addition, we conduct robustness checks for our main findings, firstly by allowing for a more flexible estimation of the dynamics of the impact, which turn out to be discontinuous at the time competitors in the pool suffered sudden death. We also explore another explanatory source as a proxy for the competition level, namely the number of vacancies in upper-level governments.

Our paper is related to two strands of literature. The first strand studies a critical issue for political economy - the link between levels of political competition and public expenditures. On the one hand, a bunch of studies claims that the inter-correlation is positive. Besley and Burgess (2002) show that higher levels of competition lead to greater calamity expenditures. Moreover, Besley et al. (2010) apply to the United States to show empirically political competition has important positive impacts on the state-level public welfare, claiming that political competition results in lower levels of corruption and therefore, greater provision of public goods. On the other hand, the findings are sometimes inconsistent, which depend on certain institutional conditions. Acemoglu and Robinson (2006) suggest that for countries not fully democratic, the association between political competition and growth-enhancing policies should be non-monotonic: competition moving from a low to an intermediate level might results in growth-inhibiting behaviors. Boulding and Brown (2012) and Nye and Vasilyeva (2015) focus on the impacts of political competition on local provisions in weak democracies and observe the abovementioned evidence of a non-monotonic (inverted U-shaped) relationship.

Another strand of literature discusses China's political tournament, focusing on the career concerns among officials at the same administrative level through promotions and demotions. The papers published earlier discuss the positive relationship between the promotion of local politicians and the growth of areas under their administration (Li and Zhou, 2005; Chen et al., 2005). As extensions, scholars start to look at politicians' policy choices and behaviors in the performance-based pro-

motion scheme. Wu, Deng, Huang, Morck and Yeung (2013) provide evidence that investments on transportation are associated with an immediate increase of GDP growth, which then is translated to a better odd for promotion. Yu et al. (2015) analyze the strategic response of local politicians to the behavior of their competitors, showing that Chinese leaders, make public choices depending on their own career backgrounds through different career concerns. Persson and Zhuravskaya (2016) find that "local" leaders who have been working within their province spend a greater amount of budget on education and healthcare than "outsiders." Jia (2017) shows that good connections for provincial officials lead to more pollutant as a by-product of their incentives to promote growth.

This paper sheds light on the debate on the relationship between political tournament and political outcomes in authoritarian countries. We try to answer the debate in the context of a very different regime, by investigating how the level and composition of expenditures can vary with the change in the intensity of political competition. Most related studies demonstrate that the promotion of local officials in China is performance-based, and that their professional background relates to their political behavior through career concerns. This study diverges from the Chinese political tournament literature by exploring how the environment that politicians compete in affects their choice of public policy; it argues that the intensity of political competition is also an important determinant of regional variation in the promotion of economic growth and in policy-making decisions. Moreover, we introduce a unique exogenous shock that can affect the competition intensity, namely the competitors' sudden deaths, to see how this factor changes the outcome of interests.

The rest of the paper is structured as follows. Section 2.2 introduces briefly the institutional background and discusses the theoretical intuitions linking the intensity of political tournament and the level as well as composition of public expenditures. Section 2.3 introduces the variables and their data sources, while section 2.4 presents the identification strategy and the baseline results. Section 2.5 further includes robustness checks. Section 2.6 concludes the paper.

2.2 Institutional Background

The political tournament in China takes place within a pyramidal administrative structure defined by dictatorship, which contains five hierarchical levels: the central government, the provincial level, the prefecture level, the county level, and the township governments. Within a single hierarchical level, a fixed pool of candidates competes for positions in the upper-level authority. The party secretaries, possessing the ultimate authority and substantial discretion over budgetary policies, are the top executives and direct candidates in the tournament. Usually the chief and deputy leaders have to be first promoted to party chiefs and then into the upper-level.[4] Our analysis is limited to the province-prefecture level. The party secretaries at the prefecture level are appointed for five-year terms, but can be promoted at any time as long as there are positions available.

It is worth comparing the political tournament among the local officials in China with the Western-style competition as portrayed by Besley and Case (1995) and other existing literature. Both cases involve assessment of relative performance, but the ways in which this is done differ. The performance of candidates in a Western competition is assessed by the voters, reflecting the bottom-up power structure; while the power structure of competition in China is top-down where a high-level authority picks winners from a given set of candidates.[5] Different power structure influences the constraints that the candidates face. Compared to politicians in democracy, who have limited freedom in the policy decision-making due to the checks and balances imposed by the legislature, the officials in China have greater capacities in influencing the local economy and taking strategic actions. Another important difference, as well as a main explanation for the strategic behaviors of local officials, is that, in a political tournament, only the performances of candidates within the tournament

[4]The governor/mayor/county magistrate/town chief is the second highest and is subordinated to the secretary of the communist party along with other chief and deputy leaders including also Chairman of the Standing Committee of the local People's Congress, CPPCC Director; Deputy leaders include vice party secretaries/governors/mayors/county magistrates/town chiefs, and other members in the standing committee, the total number of seats usually ranges from 11-15.

[5]Some selected villages in China have undergone transitions to democracy. Martinez-Bravo et al. (2011, 2012) study the effect of such democratization and find that the village-level elections, as a direct accountability mechanism, could increase local provision.

(i.e., prefectures in the same province) but not the performances of contestants outside the tournament (i.e., prefectures across different provinces) will be evaluated and compared.

To have some brief intuitions linking the intensity of the aforementioned tournament and the local public expenditures, we start with a principal-agent framework: the agents are represented by local politicians; the principals in our case are committees of upper-level government and they have the power to appoint and promote local officials. Local officials' efforts depends on expected probability of being promoted $E(p) = k/n$, which is decided by the number of positions for promotion (k) as well as the number of competing politicians (n). Promotion tournament implies that a local politician's promotion depends not only on his or her effort but also competitors' effort.

We first argue that local contestants exert zero effort when $E(p) = 0$ or $E(p) = 1$ (i.e., either everyone or no-one is promoted), because in both cases promotion is not based on their efforts, which indicates that the marginal probability of efforts (MPE) is zero. As $E(p)$ deviates from the two extreme cases, contestants monotonically increase their levels of efforts. Along the continuum of $E(p)$ between zero and one, contestants exert the greatest effort at a promotion rate $p* = 1/2$, where effort yields the highest marginal returns. In the case where the actual $E(p)$ is lower than $p*$, officials place less effort since efforts are costly with lower marginal returns, and intangible factors (such as good political connections and luck) turn out to be critical for a potential promotion. While given that the actual $E(p)$ exceeds $p*$ (i.e., probability of promotion is high), officials also put less effort, since marginal costs of efforts are rising and only intangible elements (such as poor political connections and bad luck) stand in their way of getting promotion. If k is fixed, then the promotion rate solely depends on the number of officials competing in the pool (n), and there should thus be an inverse U relationship between the number of officials and their efforts. For the case that there is only a small part of politician could get promoted (i.e., $E(p) < 1/2$),[6] with an additional contestant (n to $n + 1$), the MPE decreases.[7]

The fundamental assumptions of this tournament is that performance is mea-

[6]This assumption is reasonable given that the mean promotion rate is 9% in our data.

[7]See Appendix B.1 for a complete model and formula derivations.

sured and evaluated based on economic outputs (Li and Zhou, 2005), and politicians welcome more expenditures, particularly constructive inputs in their regions when they have incentive to promote growth. In this setting, efforts are strongly related to behaviors that boost local economy and are therefore, approximated by both the total budget and the re-allocation of resources from long-run input to short-run input. When the MPE decreases, the marginal returns of both two aspects of efforts drop.[8] Therefore, a larger pool of competitors reduces the total expenditures as well as the investment. Politicians with more rivals would implement policies that, intuitively, mixed with policies desired by the prefecture inhabitants, since lower odds of promotion strengthens their attachment to their current position. While a smaller set of competitors, i.e., any exogenous event that decreases the size of pool (i.e., an increased MPE) makes local officials' efforts more profitable. With higher expected chance of getting promoted, prefecture leaders have excessive need to signal their competence and to ascertain their loyalty toward higher-level authority aiming to exceed growth.

2.3 Variables and Data

2.3.1 Competition Level

Spatial and temporal heterogeneity in candidate pools allows us to measure the competition level by using the actual number of competitors of the leader in prefecture i. We look at the effective number of competitors for provincial Politburo at the beginning of time t, depicted as $Comp_{it}$ in the model.

The intensity of political competition is primarily defined by the number of contestants in the pool, which depends on the number of prefectures in province p, denoted as $M_{p,t}$, where one prefecture has one party secretary. Regarding variations across time,[9] if a politician does not serve as a party secretary anymore and decides to leave the prefectural office, we consider that there is a turnover in this

[8] See Appendix B.1 for a complete model and formula derivations.

[9] It is important to note that the number of prefectures may change due to the foundation of new prefectures, a decision which is made by the central government; however, variations are generally very small.

position (i.e., the dummy T is given the value of one). The reason for their leaving can vary, from accidental death, to retirement, promotion or demotion, being caught doing illegal activities, resignation etc. Importantly, when this position is occupied by another politician, a turnover of that prefecture occurs. Given that newcomers are usually unable to get promoted in their first year of taking office,[10] we do not consider newcomers to be viable candidates for promotion at time t. Therefore, we can subtract the prefectures whose leaders left their office at time $t-1$ from the whole pool $M_{p,t}$, as a way of creating variations in competition levels across time.

It is worth emphasizing that, since we are studying how competitiveness affects an individual's choice, we are interested in how many actual competitors the leader of prefecture i is faced with. Thus the measurement of the competition level experienced by the leader of prefecture i should contain the total turnover rate $\sum_j \mathrm{T}_{j\neq ip,t-1}$ at the end of $t-1$, (i.e., in the beginning of t) of all his competitors, where subscript j refers to any other prefecture in province p besides i. The actual number of competitors in prefecture i at the beginning of time t equals: $Comp_{ip,t} = \mathrm{M}_{p,t} - \sum_j \mathrm{T}_{j\neq ip,t-1}$

The competition level is not only time-variant within prefectures but also time-variant for each politician. It allows the estimation conditional on politician fixed effects to deal with a concern regarding endogenous appointments of officials is that aggressive politicians are likely assigned to provinces with high or low competition levels.

2.3.2 Instrumental Variable

Instead of summing up all the turnovers of contestants, we pick and sum up the cases where competing politicians left because they died, as a way of creating our instrumental variable. To make sure that the events are entirely exogenous and unforeseeable, we take into account only accidental deaths and sudden illnesses. Accidental deaths include death in a car accident, in an earthquake, drowning, and any other kinds of accidents. We further include sudden illnesses such as experiencing a heart attack, having cardiovascular disease, and other acute

[10]It is possible for the mayor to be temporarily as secretary after secretary's leave, and then to get promoted in the same year to provincial Politburo, but such case happens no more than 10 in our dataset.

diseases. The mathematical expression of the exogenous variable can be written as $CompDeath_{ip,t} = \sum_j \text{Death}_{j \neq ip,t-1}$, which only includes the turnover rate of the previous year driven by a rival's sudden death. An example is shown in the Appendix Figure B.2.

This exogenous shock is still under-researched in the literature. Jone and Olken (2009) report that the outcome of an assassination attempt, regardless of whether it is successful or not, can influence political institutions. Gao, Gilbert and Sylwester (2013) confirm that the findings of Jone and Olken (2009) are robust. However, since assassinations of prefecture leaders are rare and attempts are generally unobservable, we are only investigating the deaths caused by unpredictable factors. With these unique variations we aim to capture the exogenous changes in the number of competitors, in order to solve a potential endogeneity problem, as we explain later on.

2.3.3 Politician Data

We combine information on party secretaries and official data on prefecture-level expenditures by collecting panel data from a sample of 280 prefectures from 23 province-level units over the course of 13 years, from 2003 to 2015; this results in 3,614 prefecture-year observations.

With regard to the politician data, we focus on prefecture-level party secretaries, who are in charge of most economic activities and have the greatest power.[11] We collect information on the lives of party secretaries between 2003 and 2015. This information contains biographical data on Chinese leaders at the prefecture level, including detailed information about their year of birth, place of birth, gender, ethnicity, education history, and job history, as well as the list of past positions held in the government, along with the period during which each position was held. From this job history, we are informed about when they leave an office and about their further career path. This dataset is created by digitalizing the prefecture-level party secretaries' curricula vitae published on Baidu Wikipedia[12] and Local Leadership

[11] The results for mayors are upon request.

[12] *https://baike.baidu.com/*

Database[13].

The dataset tells us how many prefecture leaders remain employed in each year, how many leave, and why some leave. From this, we generate data for our explanatory variable of interests $Comp_{ip,t}$. Its mean, standard deviation, minimum and maximum values are shown in Table 2.1. Although in our dataset there are only 42 cases of politicians dying while in office, since we are investigating other's death and if one politician died, all of the rivals of a deceased politician get a one as their value for this variable.[14] The mean of $CompDeath_{ip,t}$ is 0.15, with 534 non-zero cells. This means that we are actually not too worried about the variations in the instrumental variable. From the descriptive statistics we know that the average size of a candidate pool is around 11 contestants, that on average 23% of party secretaries leave the office after a year (i.e., the turnover rate), and that 6% of this turnover rate can be explained by accidental deaths. Politicians' personal characteristics are used as control variables; these include age, gender, ethnicity, education level, working year, and whether they are originally from the province governed (i.e., local), information of which is also presented in Table 2.1.

2.3.4 Official Data

We are interested in both the level and the composition of public spending allocated to each kind of provision in each prefecture. We aim to capture the trade-off in public spending: whether a marginal unit of Yuan from the budgetary funding is spent on infrastructure investments or on public provisions such as education and healthcare. In particular, we define the expenditures on construction of roads, railroads, bridges, and real estates, agriculture, forestry, and water affairs as infrastructure investments, and the expenditures on education, scientific research, and social welfare as public goods spending. We check these four large categories of expenditures in each prefecture i and year t.[15]

The sources used for these data are the Financial Yearbooks of each prefecture, available between 2004 and 2016. The data presented in the yearbooks are the

[13] *http://ldzl.people.com.cn/dfzlk/front/firstPage.htm*

[14] In the Appendix B.2, we will show an example of how these variables are computed.

[15] The expenditure data are available only for large categories.

amount of expenses (in 10,000 Yuan) from the balance sheets of the prefectures. After converting the measurements to Yuan, we focus on the logs of the outcome variables as a way of reducing the influence of large values. The mean and standard deviation for the log of total expenditures are 13.84 and 0.97, respectively, whereas those for the log of infrastructure, log of education, and log of social security are 11.77 and 1.19, 11.94 and 1.15, and 11.04 and 1.39, respectively. Summary statistics are presented in Table 2.1.

Besides the expenditure, there are other variables of interest such as the established road and construction areas, and the number of teachers, schools, and hospital beds in each prefecture between the years 2003 and 2015, which are also gathered from the China City Yearbook, and are used as outcome variables. To control for a variety of socio-economic factors, we use official information on the local tax revenue, the GDP growth rate, the log of GDP per capita, the log of the population, the unemployment rate, and the log of wage per capita. These lagged variables are gathered from the China City Yearbook for the years between 2004 and 2016. This yearbook is sponsored and edited by the National Bureau of Statistics, which confirms that the data is fully reliable, and even if measurement errors might exist, these should be biased towards the same direction. The mean and standard deviation of the covariates are shown in Table 2.1.

2.3.5 Empirical Support for the Assumptions

Our hypotheses have several implications and are testable by computing intercorrelations between variables. A key assumption for our model specification is that the competitor level, measured by $Comp$ should systematically change the probability of promotion. Anecdotal evidence suggests that more viable competitors lead to a lower likelihood of promotion, as the assumption (b) in Appendix B.1 suggested. To formally test such anecdotal evidence, we regress a dummy variable for promotion on the number of competitors. The definitions of promotion vary across studies (Tao, Su, Xi and Zhu, 2010). In our setting, promotion for the secretarial position refers

to becoming a provincial Politburo member.[16]

Table 2.2 presents the results on promotion using party secretaries data between the years 2003 and 2015. We use politician-year observations, in order to capture the correlation between immediate competition level and promotion outcome when the final decision to the officials is going to be made.[17] Columns (1) and (2) of Table 2.2 shows that the number of contestants negatively correlates with a promotion decision. While the estimate is not very precise, the size of inter-correlation is large: one more competitor corresponds to the probability for promotion by around 2% whereas the rate of promotion over all decisions is around 30%[18] and the average number of competitors is ten. Second, our instrumental variable, sudden deaths of competitors, should also have effects on promotion only through the changes in the number of competitors. Columns (3) and (4) report the results of IV specification, that one more competitor drops the odds of promotion by around 7.5-9%. Columns (5) and (6) show the reduced-forms that one competitor death raises the probability for promotion by around 7-8.5%, with very similar magnitude but different sign comparing with columns (3) and (4), since one competitor death would cause the number of competitors decreases by one. Given the mean of *CompDeath* is around 0.15, the size of the effect becomes precise, reasonable and interpretable. Controlling for politician's characteristics and political performance, which is approximated by mean GDP growth rate across tenure, does not alter the impacts.

Another issue to be addressed is whether the focus on growth can translate into a potential promotion. Table 2.3 examines how the promotion decision is affected by growth and public inputs, as well as the interactions of the levels of competition and these factors. Column (1) of Table 2.3 tests assumption (a) in Appendix B.1 and shows that mean GDP growth across tenure is correlated positively with the promotion probability - one percentage point increase in average GDP growth increases the promotion rate by about 0.5%. This finding is in line with the argument of Li and Zhou (2005) and Jia (2014). It remains consistent when we use GDP growth of

[16]When we change the definition of promotion, by including the promotion to vice-chairmen of the Provincial People's Congress and vice-chairmen of the Provincial Committee of the People's Political Consultative Conference, the results remain robust.

[17]Hence each politician appears only once in politician-year observations

[18]The mean of promotion in prefecture-year observations is 0.09 instead.

previous year or conditional on competition level and other politician-level controls. Column (2) reports the regression with the interaction term and presents that the interaction effect is significantly negative. It fits the assumption (c). This finding suggests that a higher level of competition (i.e., a more crowded candidate pool) dilutes the marginal benefits of economic performance (i.e., efforts) on promotion decision.

To further explore how the different policies involve in the career-maximizing choice, we examine how promotion rate depends on the policy outcomes to test the assumptions (d) and (e) in Appendix B.1. We provide evidence in column (3) that politicians' spending on infrastructure since assuming office strongly correlates with a higher probability for promotion, through an increased GDP growth rate driven by those short-term projects; while other kinds of spending do not show this pattern. The level of significance of the interaction term in column (4) indicates when n is higher, inputting in infrastructure has a smaller marginal benefit. Consistent with Persson and Zhuravskaya (2016), columns (5)-(8) generally indicate the promotion mechanism does not reward consumption of education and healthcare, which translates into economic growth only in long run, therefore unrelated to promotion. These findings are consistent with promotion based on the economic performance across the tenure of the secretaries, and reveal what performance matters for the future career.

2.4 Empirical Results

2.4.1 Identification Strategy

Our main task is to estimate the effect of the competition level, as measured by the effective number of competitors, on policy outcomes. We estimate the fixed effects model based on a panel data as follows:

$$Y_{ip,t} = \beta Comp_{ip,t} + X_{it}\gamma + \delta_i + \lambda_t + R_i\lambda_t + \epsilon_{ip,t}$$

where $Y_{ip,t}$ represents the budgetary outcome in prefecture i of province p during year t. Furthermore, δ_i represents the prefecture fixed effects; λ_t stands for year fixed

effects; $Comp_{ip,t}$ represents the competition level exposed by prefecture i, approximated by the actual number of competitors faced by politicians in prefecture i at the beginning of year t; X_{it} is a rich set of control variables, which include the lagged prefectural socio-economic characteristics (i.e., the log of the fiscal revenue, the log of the population, the GDP growth rate, the GDP log, the unemployment rate, the log of wage per capita, and politician's characteristics such as age, gender, ethnicity, educational level, working experience in years, and whether they are originally from the province governed.) Meanwhile, the regional-specific trends are controlled for by adding region $\times$ year fixed effects, where regions are divided into Eastern, Western, and Central region. Controlling for region $\times$ year fixed effects is a flexible way of considering the implementation of macro policies during our time horizon. The standard errors are clustered at the prefecture level.[19]

Some identification issues need to be addressed here. The first challenge is endogeneity, which arises when there are omitted, time-variant variables that are simultaneously associated with both the number of turnovers and the expenditure level, even though we have already controlled for a number of possible confounding factors. It is worthwhile to address that the direction of the bias is not obvious, and it depends on the correlation between outcome variable Y and the probability of politicians remaining in their position as prefecture leaders (i.e., 1 - probability of promotion - probability of demotion). Similarly, endogeneity also arises when policy outcomes affect the switches between low and high competition levels. Besides this, the prediction on endogenous turnover rates and manipulated competition levels may lead to biased results.

To deal with these concerns, we employ an instrumental variable approach. In the first stage, we regress the number of competitor deaths on the effective number of competitors. The effect should theoretically be -1, meaning that one competitor death results in a unitary increase in the turnover rate, and hence one less competitor. A key identification assumption is that the instrument determines policies only by means of changing the number of rivals. The main challenge to the exclusion restriction assumption is that an increased turnover rate in the leadership of an area i may by itself directly change the governance, in addition to changes in others' com-

[19]The results remain robust when clustering the standard errors at the politician level.

petition level. Besides, the prefecture with turnover is not affected by the change in competitors. Hence, we exclude from our analysis the prefecture-year observations where the turnover T is one. Finally, our sample consists of 2,946 observations instead of 3,614.[20]

A remaining challenge is that politicians with certain characteristics, such as aggressive or well-connected politicians, may be preferentially appointed to certain regions, namely to the provinces where the competition level is higher or lower. With a focus on within-politician variation, this concern is relieved. We use the following two-stage least squares (2SLS) to estimate the unbiased effect of competition level on policy outcomes:

$$Comp_{ip,t} = \alpha CompDeath_{ip,t} + X_{it}\eta + \delta_i + \lambda_t + R_i\lambda_t + \mu_k + \nu_{ip,t}$$

$$Y_{ikp,t} = \beta \widehat{Comp_{ip,t}} + X_{it}\gamma + \delta_i + \lambda_t + R_i\lambda_t + \mu_k + \epsilon_{ikp,t}$$

The subscript i, k indicates prefecture i under the administration of party secretary k. Time-invariant politician features are redundant after the inclusion of politician fixed effects. We input age squared and tenure squared as a non-linear variable to avoid such co-linearities.

2.4.2 Baseline Results

Table 2.4 presents the results of the regressions, where the total expenditure is the outcome variable. Column (1) shows the estimates controlled for prefecture and year fixed effects. Column (2) includes other covariates. Column (3) further adds regional trends. The within-prefecture estimates indicate that the number of competitors has a negative impact on the total expenditure level. All estimates are statistically significant, indicating that more competitors lower the MPE, hence dropping the marginal returns on expenditure. Column (4) presents the corresponding results for the within-party secretary estimation. The magnitudes are close to those of within-prefecture estimates, and still significant. Slightly higher magnitude for the within-politician estimates suggest that aggressive officials are more possibly to be

[20]Full sample is applied for robustness, but the main findings do not change.

appointed to more competitive provinces. The results do not change after using competitor sudden deaths as an instrument in columns (5)-(8), indicating that the total level of spending decreases by 2-3% when the competition level increases by one competitor. The increased size suggests that higher local investments lead to a higher rate of remaining in power (i.e., a lower rate of demotion): OLS estimates are understated, and IV estimates are around two to three times higher in absolute value. The results in the first stage are not surprising.

Table 2.5 reports the estimates of the regressions, where the infrastructure expenditure is our dependent variable. We investigate both log and percentage increases in infrastructure spending to check how they are affected by increased competition levels. The within-prefecture estimates show that one competitor increase results in around 1.5% decrease in public investments and a 3-4% additional increase rate. Coefficients obtained by IV have a larger magnitude compared to the OLS estimates, dropping infrastructure spending by 4-5%, an effect which is not trivial.

Besides the local government's investment efforts, we also look at the actual outcomes (i.e., realizations) of the spending. Table 2.6 shows the results, with the variables for the logged length of newly built road and logged new constructions surface (per 10,000 m^2) as the dependent variables. From IV estimates and after clustering the standard errors, it can be concluded that one more competitor decreases the length of new roads built by about 3-5% and decreases the surface taken by new constructions by around 6%.

In Table 2.7, different effects are shown with the growth percentage and the log of education spending as the dependent variables. This category of variables is a measurement of long-term human capital investment and cannot promote growth immediately according to our assumptions. In terms of OLS estimates, growth percentage of education expenditures are positively correlated with an increase in *Comp* by 2-3%, while no significant correlation is found with the logged educational spending.[21] The IV results in Table 2.7 reinforce our OLS finding that an increase in the competition level does have a significant positive impact both on the level and

[21]It is biased by an anticipated endogenous turnover rate. For instance, politicians' predictions that in the following period there will be an increased rate of retirement may lead to a decrease in educational spending even though the competition level remains high.

the percentage increase of education expenditure. In Table 2.8, similar patterns are shown with other long-term growth variables, such as the logged difference of schools and the logged difference of teachers.

Table 2.9 reports the impact on spending on well-being and redistribution, by using the variables of social security spending and logged difference of hospital beds. The results are similar to those for the educational expenditure: when there is more competition, politicians will remain for longer in their current position, within which long-term investments can be materialized and the marginal benefits of benevolent behaviors are higher.

2.5 Robustness Checks

2.5.1 Dynamic Impact of Deaths

In this section we verify the robustness of the results shown in the previous tables. First, to deal with the concerns of potential anticipation of the events or confounding institutional cycles, we follow Jia (2017) and allow for dynamic specifications to analyze the impacts of competitor deaths.

The reduced form of the equations above captures the average effect of competitor deaths over time. Instead of general average effect, we utilize a more flexible specification to explore how the outcomes alter in the year, or the years after an exogenous event. We limit our data to observations that have ever exposed to rivals deaths within our given period (2003-2015), the number of which now is restricted to around 1,500. The effect of competitor deaths is estimated by the following regression:

$$Y_{ip,t} = \sum \beta_{\tau=-2}^{\tau=3} CompDeath_{ip,(t_0+\tau)} + \delta_i + \lambda_t + R_i\lambda_t + \epsilon_{ip,t}$$

where t_0 presents the year that politician died in the pool and τ stands for the number of years before and after t_0. Estimating a shorter horizon dynamics window, we use two years before death as default period and check the outcomes in one year before death, the year of death, the first, second, third year after deaths. To avoid

the potential cyclic effect due to the party congress, which takes place every five years, we further control for this political cycles.

The results are reported in columns (1)-(3) of Table 2.10. The impact of competitor deaths is observed only in the year that competitor died. The estimate β_{-1} is not significantly different from zero indicates that anticipating of the accidental deaths and taking action in advance is not feasible. After deaths happen in the year t_0, no substantial lasting impact takes place in periods after, measured by β_1, β_2, β_3, which are insignificantly different from zero. These results fit our expectations, that the effect of competitor's death on outcomes works only in short-term. The died competitor will be replaced by another politician soon, who in the next periods, is able to compete in the pool. This finding suggests that politicians would adjust their spending quickly, given their average length of tenure is only around three to four years.[22]

2.5.2 Another Measurement of Competition Level

In this part we present another measurement of competition level, namely the number of vacancies. As the theoretical intuitions suggest, when we keep n fixed, raising the number of vacancies k increases the likelihood of being promoted, therefore, encourages the politicians to reallocate in investment. This variable is also endogenous, and can be instrumented by politicians' deaths in the provincial Politburo. In the first stage, the sudden death of provincial-level Politburo members would result in one additional vacancy for promotion.[23] This would increase the probability of being promoted, MPE increases. Hence local officials switch resources from long-term to short-term.

Instead of using the number of competitors, Table 2.11 presents the results using the number of vacancies as our endogenous variable, which is instrumented by sudden deaths of provincial Politburo members. They also show a significant impact of the competition level on main outcomes. Columns (1) and (2) support that a re-

[22]The results in Table 2.10 are visualized in Figure 2.1. The dots indicate the coefficients relative to β_{-2} and the lines present the 90% confidence intervals.

[23]As defined previously, this paper considers a promotion occurs if the prefecture leaders are promoted as Politburo members in provincial government.

duced competition level would lead to an increase in terms of short-term investment, measured by government's infrastructure expenditure and length of the newly-built roads. On the contrary, from columns (3) to (6), the IV estimates represent a significant drop of the long-term expenditures, including educational spending, science spending, social welfare spending and logged difference of hospital beds, when the number of vacancies increases.

2.6 Conclusion

This paper sheds light on the question of the inter-correlation between political competition and political outcomes in an authoritarian regime and analyzes whether and why the competition levels among local leaders affect policy decisions in China. We employ an administrative feature of the intra-party competition to define the levels of competition, namely we use the number of effective competitors within the same province to measure competition. Through career incentives, the intensity of competition plays an important role in local party secretaries' governance policies. They reallocate resources from much required public provisions, such as education, redistribution, and healthcare, towards infrastructure and constructions when the number of their rivals is small, in order to seize the chance to get promoted. This is because the promotion welcomes investments in short-term project, but not inputs in education and healthcare. When exploring variations in competitor sudden death to obtain unbiased estimates, the evidence does not change.

However, we are aware that some characteristics of the Chinese regime may be not generalizable to all autocracies. Compared to other countries, the one-party rule of China facilitates the monitoring of local agents, making officials more accountable to the autocrat's needs. Regimes that lack a supervisory authority may struggle to build a link between economic growth and the careers of local agents. The administrative structure in China is organized in such a way as to have an impact on the policy decision of local officials, and this is in contrast to the organization of democracies where greater political competition increases outcomes which favor one's career.

Bibliography

[1] Acemoglu, Daron and James A Robinson (2006). Economic Backwardness in Political Perspective. American Political Science Review 100(1): 115-131.

[2] Benjamin, Jones, and Benjamin A. Olken (2009). Hit or Miss? The Effect of Assassinations on Institutions and War. American Economic Journal: Macroeconomics, 1(2):55-87.

[3] Besley, Timothy and Anne Case (1995). Does Electoral Accountability Affect Economic Policy Choices? Evidence from Gubernatorial Term Limits, Quarterly Journal of Economics 110: 769-98.

[4] Besley, Timothy and Robin Burgess (2002). The Political Economy of Government Responsiveness: Theory and Evidence from India, Quarterly Journal of Economics, 117(4), 1415-1451.

[5] Besley, Timothy, Torsten Persson, Daniel M. Sturm (2010). Political Competition, Policy and Growth: Theory and Evidence from the US, Review of Economic Studies (2010) 77, 1329-1352.

[6] Boulding, Carew, David S. Brown (2014). Political Competition and Local Social Spending: Evidence from Brazil, Studies in Comparative International Development, 49: 197-216.

[7] Cai, Hongbin and Daniel Treisman (2005). Does Competition for Capital Discipline Governments? Decentralization, Globalization, and Public Policy. American Economic Review, 95(3): 817-830.

[8] Chen, Ye, Hongbin Li, Li-An Zhou (2005). Relative performance evaluation and the turnover of provincial leaders in China, Economics Letters 88: 421-425.

[9] Gao, Wei, Scott Gilbert and Kevin Sylwester (2013). The effect of assassinations on political institutions: Are the Jones-Olken findings robust? Applied Economics Letters, 20(7): 673-676.

[10] Gibbs, M. (1995), Incentive Compensation in a Corporate Hierarchy, Journal of Accounting and Economics, 19: 247-277.

[11] Jia, Ruixue (2017). Pollution for Promotion, mimeo IIES.

[12] Jia, Ruixue, Masayuki Kudamatsu and David Seim (2015). Political Selection In China: The Complementary Roles Of Connections And Performance, Journal of the European Economic Association, European Economic Association, 13(4): 631-668.

[13] Karachiwalla, Naureen and Albert, Park (2017). Promotion incentives in the public sector: Evidence from Chinese schools. Journal of Public Economics, 146: 109-128.

[14] Lazear, E., Rosen, S., 1981. Rank-ordered tournaments as optimal labor contracts. Journal of Political Economy 89: 841-864.

[15] Li, Hongbin and Li-An Zhou (2005). Political Turnover and Economic Performance: the Incentive Role of Personnel Control in China, Journal of Public Economics 89: 1743-62.

[16] Luo, Renfu, Linxiu Zhang, Jikun Huang, and Scott Rozelle (2010). Village Elections, Public Goods Investments and Pork Barrel Politics, Chinese-Style. Journal of Development Studies, 46, 662-684.

[17] Martinez-Bravo, Monica, Gerard Padro i Miquel, Nancy Qian, and Yang Yao (2011). Do Local Elections in Non-Democracies Increase Accountability? Evidence from Rural China. NBER Working Paper No. 16948.

[18] Martinez-Bravo, Monica, Gerard Padro i Miquel, Nancy Qian, and Yang Yao (2012). The Effects of Democratization on Pubic Goods and Redistribution: Evidence from China. Working paper, Yale University.

[19] Maskin, Eric, Yingyi Qian, and Chenggang Xu (2000). Incentives, information, and organizational form. The Review of Economic Studies, 67(2): 359-378.

[20] Nye, John V.C. and Olga Vasilyeva (2015). When does local political competition lead to more public goods? Evidence from Russian regions. Journal of Comparative Economics, 43: 650-676.

[21] Persson, Petra and Ekaterina Zhuravskaya (2016). The Limits of Career Concerns in Federalism: Evidence from China. Journal of the European Economic Association, 14(2): 338-374.

[22] Tao, Ran, Fubing Su, Lu Xi and Yuming Zhu (2010). Jingjizengzhang nenggoudailai shengqian ma? dui jinshengjinbiaojingsaililun de luojitiaozhan yu shengjishizheng- chonggu (Does Economic Growth Lead to Promotion? A Challenge of the Logic of Tournaments and A Reevaluation of the Provincial-level Data). Guanlishijie (Management World), 12: 13-26.

[23] Wu, J., Deng, Y., Huang, J., Morck, R., Yeung, B., 2013. Incentives and outcomes: China's environmental policy.

[24] Xu, Chenggang (2011). The fundamental institutions of China-s reforms and development. Journal of Economic Literature, 49(4): 1076-1151.

[25] Yu, Jihai, Li-An Zhou, Guozhong Zhu (2016). Strategic Interaction in Political Competition: Evidence from Spatial Effects across Chinese Cities. Regional Science and Urban Economics, 57: 23-37.

Table 2.1: Summary Statistics

Variables	Obs.	Mean	S.D	Min	Max
Outcome Variables					
log(Expenditure)	3614	13.84	0.97	10.57	17.38
log(Infrastructure)	3614	11.77	1.19	4.19	14.64
log(Education)	3614	11.94	1.15	4.89	15.02
log(Social Security)	3614	11.04	1.39	5.85	14.55
Main explanatory variables					
Num. of competitors	3614	10.86	3.95	0	21
=Num. of prefectures-competitor turnovers					
Competitor deaths	3614	0.15	0.37	0	2
(i.e., 534 cells has a non-zero value)					
Competitor turnovers	3614	2.50	1.94	0	9
Prefecture-level control variables					
log(Revenue)	3614	12.81	1.36	7.85	17.08
log(Population)	3614	5.84	0.66	2.77	7.12
GDP growth rate(%)	3614	12.52	4.70	-19.38	29.94
log(GDP)	3614	15.74	1.05	12.39	19.01
Unemployment rate(%)	3614	0.62	0.53	0.04	11.54
log(Wage per capita)	3614	10.02	0.61	2.28	12.67
Politician's characteristics					
Age	3614	52.401	3.658	39	72
Tenure	3614	3.186	1.753	0	9
Experience	3614	32.932	5.006	15	59
Education	3614	18.261	2.037	12	24
Male (Yes=1, No=0)	3614	0.959	0.199	0	1
Minority (Yes=1, No=0)	3614	0.066	0.249	0	1
Local (Yes=1, No=0)	3614	0.043	0.202	0	1
Performance (average GDP growth rate)	3614	14.36	7.53	-11.5	29.94

Table 2.2: Empirical Support for the Model Assumptions I

	Promotion (1=Yes, 0=No)					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS		IV		Reduced-form	
Competitor	-0.017*	-0.022**	-0.090**	-0.075*		
	(0.010)	(0.011)	(0.045)	(0.044)		
Competitor Death					0.084**	0.069*
					(0.035)	(0.036)
First Stage						
Competitor Death			-0.916***	-0.948***		
			(0.129)	(0.136)		
Prefecture and Year FE	Y	Y	Y	Y	Y	Y
Controls		Y		Y		Y
#clusters	279	279	279	279	279	279
#observations	957	888	953	874	957	888

[1] Promotion is a dummy indicating that a secretary becomes a provincial Politburo member. Controls include his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs, and political performance (measured by average GDP growth rate since assuming office).

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 2.3: Empirical Support for the Model Assumptions II

	Promotion (1=Yes, 0=No)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP Growth	0.005***	0.010***						
	(0.001)	(0.004)						
Competitor×GDP Growth		-0.001*						
		(0.000)						
Infra Growth			0.032**	0.062**				
			(0.013)	(0.029)				
Competitor×Infra Growth				-0.004*				
				(0.002)				
Edu Growth					-0.004	-0.004		
					(0.002)	(0.008)		
Competitor×Edu Growth						0.000		
						(0.001)		
Soc Growth							-0.024	-0.031
							(0.017)	(0.044)
Competitor×Soc Growth								0.000
								(0.004)
Competitor		-0.045***		-0.016***		-0.053***		-0.053***
		(0.005)		(0.002)		(0.003)		(0.003)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y
#clusters	279	279	279	279	279	279	279	279
#observations	3643	3570	3377	3412	3435	3435	3442	3442

[1] Promotion is a dummy indicating that a party secretary becomes a provincial Politburo member. *Mean GDP Growth* indicates average of annual growth since assuming office. *Mean Infra. Growth Mean Edu. Growth* and *Mean Soc. Growth* measure the average annual growth of infrastructure investment, educational investment and social welfare spending during tenure. Controls include his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 2.4: Impact of Competition on Total Expenditures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
Competitor	-0.010**	-0.010**	-0.009	-0.015*	-0.022*	-0.023*	-0.031**	-0.035**
	(0.003)	(0.004)	(0.007)	(0.007)	(0.011)	(0.011)	(0.013)	(0.015)
First Stage								
Competitor Death					-0.965***	-0.945***	-0.881***	-0.755***
					(0.065)	(0.066)	(0.060)	(0.099)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y	Y	Y		Y	Y	Y
Regional Trends			Y	Y			Y	Y
Politician FE				Y				Y
#clusters	279	279	279	279	279	279	279	279
#observations	2897	2684	2684	2684	2897	2684	2684	2684

[1] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 2.5: Impact of Competition on Infrastructure Expenditures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Infrastructure Expenditure (log)							
Competitor	-0.013**	-0.017***	-0.011**	-0.015**	-0.041*	-0.048**	-0.010	-0.043**
	(0.006)	(0.006)	(0.005)	(0.008)	(0.024)	(0.023)	(0.025)	(0.022)
	Infrastructure Expenditure (% growth)							
Competitor	-0.033***	-0.032***	-0.030***	-0.045**	-0.137***	-0.147***	0.147***	-0.150**
	(0.006)	(0.007)	(0.007)	(0.020)	(0.022)	(0.023)	(0.026)	(0.052)
First Stage								
Competitor Death					-0.965***	-0.945***	-0.881***	-0.755***
					(0.065)	(0.066)	(0.060)	(0.099)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y	Y	Y		Y	Y	Y
Regional Trends			Y	Y			Y	Y
Politician FE				Y				Y
#clusters	279	279	279	279	279	279	279	279
#observations	2883	2656	2656	2656	2883	2656	2656	2656

[1] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 2.6: Impact of Competition on Other Short-term Pro-growth Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Road							
Competitor	-0.013***	-0.013***	-0.010***	-0.019**	-0.039**	-0.041**	-0.030	-0.049*
	(0.004)	(0.004)	(0.004)	(0.010)	(0.019)	(0.020)	(0.025)	(0.026)
	Construction							
Competitor	-0.011**	-0.012**	-0.014***	-0.025**	-0.041	-0.050*	-0.069**	-0.058*
	(0.005)	(0.005)	(0.005)	(0.011)	(0.025)	(0.026)	(0.029)	(0.030)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y	Y	Y		Y	Y	Y
Regional Trends			Y	Y			Y	Y
Politician FE				Y				Y
#clusters	279	279	279	279	279	279	279	279
#observations	2567	2409	2409	2733	2567	2408	2408	2733

[1] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the party secretary level. Significant at * 10%, ** 5%, *** 1%.

Table 2.7: Impact of Competition on Education Expenditures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Education Expenditure (% growth)							
Competitor	0.026**	0.028**	0.021*	0.018*	0.066***	0.077***	0.069*	0.067
	(0.010)	(0.012)	(0.012)	(0.010)	(0.026)	(0.029)	(0.040)	(0.020)
	Education Expenditure (log)							
Competitor	-0.001	-0.001	-0.001	0.000	0.009***	0.011***	0.017***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.004)	(0.002)
First Stage								
Competitor Death					-0.950***	-0.929***	-0.865***	-0.755***
					(0.066)	(0.066)	(0.060)	(0.099)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y	Y	Y		Y	Y	Y
Regional Trends			Y	Y			Y	Y
Politician FE				Y				Y
#clusters	279	279	279	279	279	279	279	279
#observations	2885	2735	2735	2735	2882	2734	2734	2734

[1] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the party secretary level. Significant at * 10%, ** 5%, *** 1%.

Table 2.8: Impact of Competition on Other Long-term Pro-growth Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Schools							
Competitor	0.008	0.010	0.009	0.020	0.033*	0.041**	0.042	0.054
	(0.005)	(0.009)	(0.006)	(0.014)	(0.019)	(0.023)	(0.029)	(0.112)
	Teachers							
Competitor	0.014**	0.016**	0.013*	0.020**	0.044***	0.051***	0.046**	-0.050**
	(0.007)	(0.007)	(0.008)	(0.008)	(0.016)	(0.017)	(0.021)	(0.022)
First Stage								
Competitor Death					-0.950***	-0.929***	-0.865***	-0.755***
					(0.066)	(0.066)	(0.060)	(0.099)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y	Y	Y		Y	Y	Y
Regional Trends			Y	Y			Y	Y
Politician FE				Y				Y
#clusters	279	279	279	279	279	279	279	279
#observations	2884	2766	2766	2766	2884	2766	2766	2766

[1] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the party secretary level. Significant at * 10%, ** 5%, *** 1%.

Table 2.9: Impact of Competition on Well-being

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Social Security Expenditures							
Competitor	0.008*	0.010**	0.002	0.012*	0.028*	0.037*	0.023	0.035*
	(0.004)	(0.005)	(0.005)	(0.007)	(0.019)	(0.021)	(0.027)	(0.023)
	Hospitals							
Competitor	0.007**	0.006**	0.004	0.012**	0.018*	0.024**	0.022	0.028**
	(0.003)	(0.003)	(0.003)	(0.005)	(0.010)	(0.011)	(0.014)	(0.013)
First Stage								
Competitor Death					-0.950***	-0.929***	-0.865***	-0.755***
					(0.066)	(0.066)	(0.060)	(0.099)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls		Y	Y	Y		Y	Y	Y
Regional Trends			Y	Y			Y	Y
Politician FE				Y				Y
#clusters	279	279	279	279	279	279	279	279
#observations	2881	2675	2675	2804	2878	2675	2675	2804

[1] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the party secretary level. Significant at * 10%, ** 5%, *** 1%.

Table 2.10: Robustness Checks: Dynamic Impact of Competitor Deaths

	(1) Infrastructure	(2) Education	(3) Social security
1 year before *CompDeath*	0.008	0.006	-0.002
	(0.007)	(0.006)	(0.004)
The year of *CompDeath*	0.014**	-0.008*	-0.007**
	(0.007)	(0.004)	(0.004)
1 year after *CompDeath*	-0.002	0.002	-0.002
	(0.007)	(0.005)	(0.004)
2 year after *CompDeath*	-0.004	-0.003	-0.004
	(0.010)	(0.005)	(0.005)
3+ year after *CompDeath*	-0.007	-0.014	0.003
	(0.010)	(0.010)	(0.006)
Prefecture and Year FE	Y	Y	Y
Controls and Regional Trends	Y	Y	Y
#clusters	253	253	253
#observations	1572	1572	1572

[1] The outcomes are the share of infrastructure/education/social security expenditures over total expenditures.

[2] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[3] Reported in parentheses are standard errors clustered at the party secretary level. Significant at * 10%, ** 5%, *** 1%.

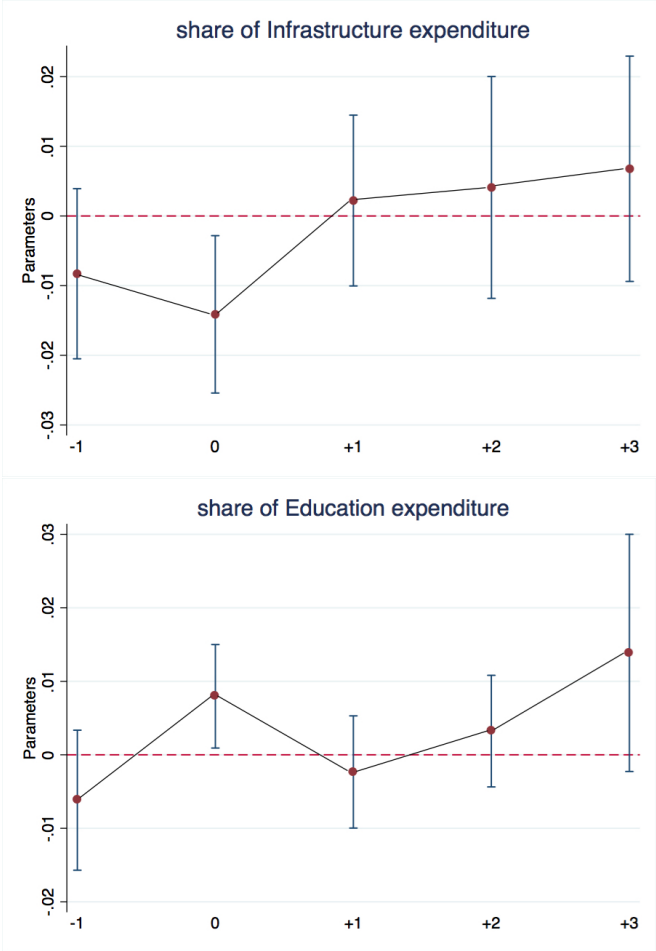
Table 2.11: Robustness Checks: Alternative Measurement of Competition Level

	IV					
	short-term		long-term			
	Infra. Spend.	Roads	Edu. Spend.	Science Spend.	Social Welfare	Hospital beds
	(1)	(2)	(3)	(4)	(5)	(6)
# of Vacancies	0.040**	0.061***	-0.021*	-0.042**	-0.039**	-0.012*
	(0.018)	(0.016)	(0.012)	(0.021)	(0.018)	(0.007)
First Stage						
Polit. Mem. Death	0.985***	0.988***	0.985***	0.987***	0.985***	0.986***
	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)
Prefecture and Year FE	Y	Y	Y	Y	Y	Y
Controls and Regional Trends	Y	Y	Y	Y	Y	Y
#clusters	279	279	279	279	279	279
N	3321	3263	3319	3318	3325	3318

[1] Controls include lagged prefecture's socio-economic characteristics: log revenue, log population, GDP growth rate, log GDP, unemployment rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the party secretary level. Significant at * 10%, ** 5%, *** 1%.

Figure 2.1: Dynamic Impact of Competitor Deaths on Outcomes



Appendix B.1: Theoretical Framework

This part describes a theoretical framework of competition level and policy choices, which guides the empirical specifications. We set up a contest model which is characterized by the inclusion of two public inputs and examine the response of a politician in making two choices: one is on total budget, while another is on the allocation of resources between short-run input and long-run input; the variation in career concerns is considered and modeled by the different size of candidate pool.

Promotion Incentives The model consists of n candidates competing for k positions. From Lazear and Rosen (1981), Gibbs (1995) and Karachiwalla and Park (2017), to be selected a politician must place k^{th} or higher, namely beating at least $n-k$ politicians in pair-wise comparisons. The performance q consists of real output y and luck ϵ. The probability that leader of the prefecture i beats leader of the prefecture j equals:

$$\begin{aligned} pr(q_i > q_j) &= pr(y_j + \epsilon_j < y_i + \epsilon_i) \\ &= G(y_i + \epsilon_i) \end{aligned}$$

To placing exactly g^{th} from the top out of a pool of n contestants, one must beat $n-g$ opponents and lose to $g-1$ opponents. The probability of promotion conditional on i's luck ϵ_i is the sum of the conditional probabilities of being first through k^{th}. Integrating out ϵ_i shows the following unconditional probability of promotion:

$$p(y, y^*) = \sum_{g=1}^{k} \binom{n-1}{n-g} \int G(y_i + \epsilon_i)^{n-g} (1 - G(y_i + \epsilon_i))^{g-1} g(\epsilon) d\epsilon$$

When $p = 0$ or 1 ($k = 0$ or n) (i.e., either everyone or no-one is promoted) p is constant and the marginal probability of effort (MPE, hereafter) is zero. Nobody has an incentive to compete. To solve for the MPE we define $\Psi = G(y + \epsilon)$ and differentiate with respect to y, and get the following:

$$\frac{\partial p}{\partial y} = \int (n-k) \binom{n-1}{n-k} \Psi^{n-k-1} (1 - \Psi)^{k-1} f(G^{-1}(\Psi) - y) d\Psi$$

Optimal y is determined by the Nash equilibrium in which each politician exerts output anticipating the output of his or her competitors (which affects G). Consider the case in which competitors' output is fixed and when the variation in optimal output is relative to the variation in luck ϵ. The MPE is a weighted sum of the Beta

density values. If the promotion rates are less than 1/2, $\beta(k, n-k)$ is skewed to the left, a candidate would need a high draw of luck in order to be promoted; when n increases, fewer politicians will be promoted and high draws of luck are less likely, i.e., $f(G^{-1}(\Psi))$ decreases. Therefore, with an additional contestant (n to $n+1$), while holding the number of vacancies fixed (k), the MPE decreases for $p < 1/2$, and vice versa. We have:

(a) $\partial p/\partial y > 0$ (promotion positively correlates to the output);
(b) $\partial p/\partial n < 0$ (promotion negatively associates with the number of competitors);
(c) $\partial^2 p/\partial y \partial n < 0$ (MPE decreases with more competitors) when $p < 1/2$.

These assumptions will be tested empirically in section 2.3.5.

Input and Output Following Cai and Treisman (2005), we define I_i as government i's short-term infrastructure investments. Infrastructure is interpreted broadly, that it represents spending aimed at raising the productivity of capital in the units, and contains transportation, telecommunications, etc. For simplicity, we assume the immediate output is only a function of short-term investments and define it as $y_i = f(I_i)$ ($f'(I) > 0$, $f''(I) < 0$). Therefore among the different types of expenditure, only current infrastructure spending but not the educational expenditure correlates with the promotion odds through immediate economic growth:

(d) $\partial p/\partial I = \partial p/\partial y \cdot \partial y/\partial I > 0$ (defined as MPI: marginal probability of infrastructure investment);
(e) $\partial^2 p/\partial I \partial n < 0$ (MPI decreases with more competitors) when $p < 1/2$.

These assumptions will be tested empirically in section 2.3.5. Another input c_i is interpreted in either of these two ways, one as a share of budgetary funding on incumbent officials' consumption, and another one as expenditures on public goods and services. Officials obtain extra utility from their consumption or behavior of benevolence. The utility function $v(\cdot)$ is strictly increasing and concave.

Solution The local officials maximize the expected benefits minus the cost of budget as follows:

$$p + v(c) - C(e)$$

where $p = G(y_i + \epsilon_i)$ is the probability of being promoted, and the benefit from promotion is normalized to one. $C(\cdot)$ is convex cost functions. The government's

budget has been spent in two inputs $e_i = I_i + c_i$.

Inserting the budget constraint into the maximization equation, the first-order conditions are written:

$$MR_I = \frac{\partial p}{\partial y_i} \cdot \frac{\partial y_i}{\partial I_i} = C'(e) = MC_I \tag{1}$$

$$MR_c = v'(c) = C'(e) = MC_c \tag{2}$$

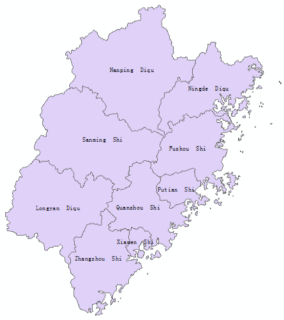
From (1) and (2):

$$v'(c) = \frac{\partial p}{\partial y} \cdot f'(I) \tag{3}$$

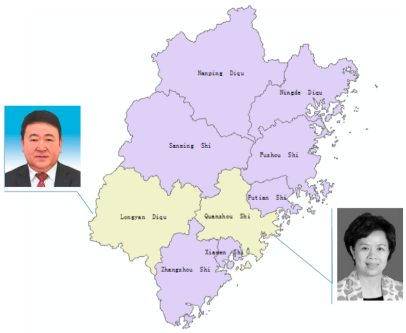
Given that the promotion probability is less than 1/2, the MPE decreases with raising n, from equation (3) either $v'(c)$ decreases or $f'(I)$ increases or both (i.e., an increased c and/or a decreased I). Similarly, from equation (1) $C'(e)$ will reduce or $f'(I)$ raises or both happen (i.e., e and/or I drops). While equation (2), c and e either both remain fixed, or both change.

Suppose e stays fixed, from equation (1) I has to decrease. Then c has to increase to maintain the same e. However, from equation (2) change in c would translate to a change in e. This solution fails to be reached. Therefore, the unique solution in the model predicts a decrease in e, and a shift from I to c when the MPE decreases by an exogenous change of n.

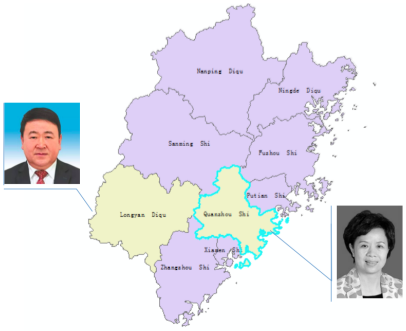
Appendix B.2: Example in Defining Explanatory Variable and Instrument Variable



- Number of prefectures=9



- Two turnovers occur, one because of sudden death



- For regions in purple (i.e., without turnovers)
  # Effective competitors=6
  # Competitor deaths=1

Chapter 3

Political Competition, Economic Spillovers, and Uneven Spatial Development

*

3.1 Introduction

Economic spillovers are a common feature of the public goods and services. For instance, firms and citizens may make use of the public transportation (i.e., roads, railroads, bridges, etc.), facilities and services in their neighboring jurisdictions; educational expenditures and job training provisions can result in productivity gains outside the unit. However, local jurisdictional boundaries often do not coincide with the locus of the effects of local economic activities. Because of this, the horizontal separation of authorities over local public decisions reveals discontinuities, raising concerns that the spending of one jurisdiction can affect the growth in other jurisdictions, and thus extend its effects beyond jurisdictional boundaries. Therefore these spillovers, particularly the spillovers in local provisions, have played an important role in political economy literature on local governments.

*I am indebted to my supervisor Paolo Masella for his guidance. I am grateful to Ming-Jen Lin, Kevin Milligan, Tzu-Ting Yang for constructive suggestions and the seminar participants at Academia Sinica for their comments. Thanks to CSC (China Scholarship Council) for financial support. All remaining errors are my own.

The related literature focuses on spillovers from decentralized local expenditures and discusses how governments can theoretically change the overall provision of public goods in the presence of spillover (Bergstrom, Blume and Varian, 1986; 1992; Bloch and Zenginobuz, 2006). The theory indicates that, in the case of symmetric spillovers, an increase in spillovers reduces the total provision of public goods.

However, the spatial interdependence of local provision can be empirically explained by various effects stemming from non-cooperative behaviors such as spillovers, tax competition, and yardstick competition/mimicking. The pure spillover effects in a yardstick competition can hardly be disentangled (Case, Rosen and Hines, 1993; Bordignon, Cerniglia and Revelli, 2003; Ollé, 2005). Abundant evidence suggests that, in the presence of competition among local governments, the observed positive spatial dependence between the level of spending and taxation decisions is unlikely to be driven by spillover; rather, it seems to be consistent with the yardstick competition hypothesis and with strategic considerations.

However, quite little literature pays attention to the border effects of politics, i.e., how local governments geographically allocate public resources in response to spillovers, and the corresponding consequences which affect the border regions. Lipscomb and Mobarak (2017) examine the border effects of pollution and find that the amount of pollutant raises as a river approaches the downstream exit boundary. The reason for this is that the local authorities are well aware of the negative spillover effects of pollution, and thus allow more settlements to develop close to the downstream boundaries of their counties.

Following Lipscomb and Mobarak (2017), instead of looking at the level of inputs, this paper focuses on local politicians' response to spillovers, by examining the border effects on local inputs (i.e., public goods) and outputs (i.e., economic growth). This paper also aims to depict the features of the distribution of public goods and those of the economic development within each jurisdiction that is in a yardstick competition.

In the context of an authoritarian political system, which is based on yardstick competition and relative performance evaluations (RPE), as studied by Lazear and Rosen (1981) and Shleifer (1985), local officials are incentivized to engage in a growth-enhancing policy experimentation (Maskin, Qian and Xu, 2000; Callander and Harstad, 2015). The tournament is essentially an analogical zero-sum game where only a limited number of local politicians can get promoted, and the promotion of an official directly reduces the chances of others being promoted (i.e., the gain of one politician constitutes the loss of another). The decision is made by the upper-level authorities who follow their own anecdotal principles in evaluating the performance of the candidates in the pool. Among those there is the "comparable areas principle"; according to this, comparing local officials of regions with similar re-

sources makes it easier to distinguish the candidates' effort and their ability to boost growth from original local endowments. Neighboring units are therefore considered a perfect example of comparable areas, since adjacent zones usually have a similar potential for promoting growth, which at the same time makes cross-jurisdictional spillovers crucial for competition.

Spillovers lead to insufficient incentives for local leaders to make investment decisions that generate considerable positive consequences for neighboring jurisdictions; an example of such investment decisions are cross-border provisions. Since the career of local leaders is positively related to the economic growth they bring relative to their competitors, cross-border provisions raise the probability of promotion not only for the provider, but also for the provider's geographical competitors (i.e., free-riders). The net political benefit from providing public goods and services around and across the cross-jurisdictional boundary is offset by this undesirable, even negative effect. Therefore, local decision makers minimize the spillovers into neighboring jurisdictions by changing the spatial distribution of public inputs.[2] Decision makers thus end up spending more in the geographical center of their jurisdiction while investing less in its borders, since the spillovers at the border are substantially larger than those in the center. A shrinking locus of policy effect and an increased border effect are expected to be observed.

This paper examines how the border effects are consequences driven by political competition. Its goal is to present evidence that in China local officials engage in the political tournament by strategically changing the distribution of public inputs in a way which minimizes the spillover effects and therefore maximizes their career perspectives. The identification strategies used allow for variations in competition level across time. We model this feature by counting the number of neighboring prefectures that are effective competitors, a value which is defined as the number of actual rivals competing for promotion in each specific year. This quantitatively equals the number of neighboring jurisdictions minus the political replacements occurring in adjacent jurisdictions during that year.

We use prefecture-year panel data, and the study units are 280 prefectures in China. The baseline findings indicate that, in a given year, if a prefecture neighbors more jurisdictions governed by potential candidates for promotion, the cross-jurisdictional borders will be less developed relative to the center. The logic behind this is that the more competing neighbors there are around the border, the more likely it is that the overall spillover effect from investments and economic developments results in an increased influence on the political ranking of local leaders,

[2]Though the level of public inputs may also change, this paper controls for the overall local government provision, and checks how this distribution alters.

results in a further decrease in the radius of policy effect, and sequentially in a more impoverished border. The findings are consistent if we instrument the endogenous political replacements with politicians' sudden deaths. Sudden deaths of local officials in neighboring regions, lead to transitions of neighboring officials and make direct competition in that year less likely. This leads to less competition and more projects with cross-boundary spillovers.

We further test whether the border effects can be adequately explained by a unique feature of the political tournament among candidates at the prefecture level. The results suggest that this pattern occurs only for neighboring prefectures within the same province, but not for those across provinces. Moreover, if the neighboring jurisdictions have similar economic performances, the corresponding border effect is even amplified.

A growing line of literature shows that potential competition from candidates or political neighbors incentivizes the local governments to strategically increase their efforts to promote GDP growth (Lyu and Landry, 2014; Yao and Zhang, 2015; Yu, Zhou and Zhu, 2016). However, the impact of the competition on the geographic distribution of public resources, on the subsequent economic development in the cross-jurisdictional border is mainly unexplored. This paper attempts to fill these gaps.

It sheds light on the two following prominent features of the Chinese economy. The first is that, although China's economy is growing at a rapid rate, the spatial inequalities have been continuously expanding. From the geographical distribution of China's poverty-stricken areas shown in Figure 3.1, we observe that the poor counties are usually located at the cross-jurisdictional boundaries.[3] Some of these cross-border regions have a high potential for engineering projects, mining, or tourism, yet it seems that, for some reasons, they have been economically under-exploited for a long time. The second feature is the considerable heterogeneity in public goods and service provision within administrative units. Actions taken within a jurisdiction increase the likelihood that decentralization without inter-jurisdictional coordination would lead to misallocation of capital and resources across districts (Besley and Coate, 2003; Hsieh and Klenow, 2009).

The remaining part of the paper is structured as follows. Section 3.2 brings a sketch of the institutional background on Chinese political system and local leader's career concerns. This part also discusses the theoretical intuitions linking promotion tournament to border effects on public inputs and economic outputs. Section 3.3 introduces the variables and data sources. Section 3.4 reports the identification

[3]Geographical determinism does not fully explain the problem of poverty at the borders, since poverty can still occur on a large scale even when the geographical environment is superior.

strategy, while section 3.5 presents the empirical results. Section 3.6 concludes the paper.

3.2 Institutional Background

We first introduce the implications of RPEs for the incentive of local leaders. Then we present the theories linking promotion tournaments to spatial disparities of public inputs and economic outputs.

3.2.1 Career Incentives of Local Leaders

The Chinese political tournament follows a five-level pyramidal administrative structure of a dictatorship.[4] We limit our analysis to the province-prefecture level. Within the prefecture level, a fixed pool of party secretaries, the top executives and direct candidates in the tournament, competes for positions in the provincial level authority. The promotion may occur at any time as soon as there are positions available.

Empirical evidence supports the importance of economic performance as an essential requirement for promotion, and attributes the remarkable economic growth of Chinese economy in the past decades to RPE (Li and Zhou, 2005; Chen, Li and Zhou, 2005; Xu, 2011; Yao and Zhang, 2015).

However, rather than the absolute term of performance, the ranking of comparable candidates (such as neighbors) plays a more important role in promotion. RPE applies to the neighboring competitors within the tournament (i.e., prefectures in the same province), whose performance as measured by GDP is compared.[5] How to interact with these comparable competitors can be another source of incentive for local leaders.

Politicians are first incentivized to enhance growth, as this is a measurement of their performance. Overlooking the interactions between politicians in the political tournament misses their second important incentive, namely avoiding decisions that are consciously or unconsciously beneficial to their competitors by minimizing positive spillovers.

[4]The central government, the provincial level, the prefecture level, the county level, and the township governments.

[5]In contrast, it does not apply to neighbors outside the tournament (i.e., prefectures across different provinces), whose performance will not be compared.

3.2.2 Promotion, Spillovers, and Border Effects

The local policymaker in a decentralized decision-making model accounts for the externalities onto neighboring jurisdictions in a yardstick competition model. In the yardstick competition with two competitors, the probability of promotion alters, when the politician takes external effects into account, written as

$$Pr(y_i + \delta_j y_j + \epsilon_i > y_j + \delta_i y_i + \epsilon_j)$$

It is observed from the equation that a positive economic spillover can turn into a negative "political spillover" for the politician. If δ is large enough, it may change the political ranking of local leaders. Therefore, politicians are incentivized to minimize economic spillovers δ by strategically distributing the public inputs.

Since the spillover effect (δ) is larger at cross-jurisdictional borders than in the center, local decision-maker with career-concerns favors a concentrated allocation of public resources and narrows down the radius of policy effects. We make two following predictions.

The more competitors there are around the border, the more likely it is that the spillovers would play a role in the political ranking within the tournament, and the incentives of the local officials to develop the cross-jurisdictional borders are even smaller, leading to an increased border effect.

Projects which produce spillovers benefiting neighboring districts (and therefore, neighboring competitors) are likely to be invested when (1) there are fewer effective competitors around the border; (2) the economic performances of the contiguous regions are substantially different, so that the spillovers are not crucial to the promotion outcomes.

3.3 Variables and Data

3.3.1 Explanatory Variable

Defining Neighbors One of the critical characteristics of the Chinese political tournament is that only the performance of neighbors within the tournament, and not the performance of competitors outside the tournament, will be compared. Since we focus on the contest among prefecture leaders (i.e., party secretaries) competing for positions in the province-level government, only prefecture leaders in the same province are considered competitors. Hence it is necessary to build a single spatial weights matrix for each province p.

We use a first-order contiguity spatial weights matrix to measure and count the neighbors who share the same border within a province. The pre-specified binary contiguity matrix, $\mathbf{W} = [w_{ij}]_{ij=1,p}^{n_p}$ is an $n_p \times n_p$ matrix that defines the spatial contiguity between prefecture i and prefecture j in province p, which consists of n_p prefectures. Only contiguous jurisdictions have positive weights in between themselves. We use the spatial matrix to define and count neighbors, so that we do not row-standardize the matrix to ease the interpretation of the results.[6] The number of contiguities is exogenous; therefore the spatial weights matrix is strictly exogenous.

An example of the Hebei Province is depicted in Figure 3.2. The jurisdictions connected with red lines are geographical neighbors whose economic development is affected by the positive spillovers from one another.

Political Competition The number of contiguities is exogenous but fixed across time, which prevents yearly variations of political competition. However, we create the variations by exploiting the political replacement and counting the number of contiguous prefectures with effective competitors at time t. If the politician in neighboring prefecture j does not serve as party secretaries anymore and leaves the prefectural office, we consider that a turnover (replacement) in prefecture j occurs. Given that newcomers are usually unable to get promoted in their first year of assuming in office, we do not consider newcomers to be viable candidates in the tournament at time t. Therefore, the replacement of leaders results in fewer effective competitors and therefore, a lower competition level in year t.[7] The adjacent viable competitors account only for those neighboring prefectures without leader's turnovers, namely $NoTurnover_{jt} = 1$.

Together with spatial weights, we define the political competition regressor as

$$\sum_{j \neq i}^{n_p} w_{ij,p} NoTurnover_{jt}$$

to calculate how many neighborhoods of prefecture i are led by potential competitors in time t. This explanatory variable proxies the competition around the leader of prefecture i at time t, denoted C. An example of how this variable is generated is

[6] The interpretation is straightforward: with an additional increase in contiguous neighbors, the outcomes change.

[7] Given a certain number of vacancies, a smaller number of effective candidates indicates a lower competition level in this province p at time t. Another possible explanation is that in the year when the replacement takes place, the local government with leader replacement implements less growth-enhancing policy, which contributes to a lower competition level in the pool.

shown in Appendix C.1.

3.3.2 Instrumental Variable

The reason of politician's leaving can vary, from accidental death, to retirement, promotion or demotion, being caught doing illegal activities, resignation etc. It is endogenous because omitted variables may correlate with both the outcome and the turnover rate of competitors. We pick the replacement originated from the sudden deaths of politicians in power to create our instrument variable. If the leader in prefecture j of the same province left the position at time t (i.e., $NoTurnover_{jt} = 0$) due to accidental death, the dummy $Death_{jt}$ is assigned a value one, otherwise zero.

This instrument variable should also be weighted by the spatial matrix $\mathbf{W}$ and written as:

$$\sum_{j \neq i}^{n_p} w_{ij,p} Death_{jt}$$

which counts the total number of neighboring competitor deaths, and may affect the concerns regarding spillovers of the leader of prefecture i. In Appendix C.1 we show an example on the construction of the instrument.

3.3.3 Outcome Variables

This paper focuses on the border effect on economic development and the radius of public inputs of each jurisdiction. Suppose the distribution of economic activities or public provisions is as depicted in Figure 3.3, where the zero on the x-axis is the centroid of the jurisdictions; thus the values on the horizontal axis represent the radius of the units, and the values on the vertical axis correspond to the provisions given at particular distances from the central point. To simplify the estimation, instead of placing the distribution into a regression, we use the *center-border* ratio which takes an average of the values in the center as the numerator, and an average of the values in the cross-jurisdictional borders as the denominator to approximate the distribution, as shown by the red line in Figure 3.3. All the outcome variables are written in the form of the following *center-border* ratio, indicating the distribution of the outcomes of interest in the jurisdiction i:

$$Y_i = \frac{\text{outcome in the center of jurisdiction } i}{\text{outcome in the border of jurisdiction } i}$$

Before taking the average in both center and border region, we need to define the coverage of each zone. *Buffer by Percentage* plugin iteratively finds the buffer length required for resizing polygons to a specified percentage. For baseline estimation, we take buffer polygon based on a certain percent of 25% as the border regions of each jurisdiction, as shown in Appendix C.2. To demonstrate the robustness of the results, we also estimate it for 35% 15% and 5% buffers as the border. These results are upon request.

Economic Development 2005-2013 satellite images of nighttime light from NOAA allows us to measure yearly border effects on economic development within each prefecture. We create the outcome variable which proxies the distribution of economic activities of jurisdiction i and is measured by mean luminosity in non-border regions over mean luminosity in cross-border regions, written as:

$$DevRatio_{it} = \frac{CenterNightlight_{it}}{BorderNightlight_{it}}$$

Larger the ratio indicates less developed the border zones compared to centers, i.e., larger border effects on economic outputs.

Public Provisions GIS maps from the National Administration of Surveying, Mapping and Geo-information of China in the years 2009, 2012 and 2015 make it possible to capture the distributions of major public inputs, such as roads, schools, and hospitals. After calculating the density of these inputs, we generate similar ratios that capture the distribution of inputs within jurisdiction i: density of provisions in non-border regions over density of provisions in border regions. Larger the ratio indicates more concentrated the public contributions, i.e. a smaller radius of policy effect and larger border effects on public inputs.

3.3.4 Dataset

We combine information on party secretaries, data on prefecture-level *center-border* ratio based on satellite data and official reported data, by collecting a panel for 280 prefectures from 23 province-level units[8] for ten years, from 2006 to 2015, resulting in 2,800 prefecture - year observations.

[8]Except Tibet, Xinjiang, Qinghai where promotion may focus on securing political stability instead of growth; Four province-level municipalities are excluded because they are under the direct control of the state council; The islands Taiwan and Hainan are also excluded

With regard to the politician data, we focus on prefectural party secretaries, because they are the officials in charge of most economic activities and with the greatest power.[9] We use a self-collected dataset based on the lives of party secretaries between 2006 and 2015. It contains biographical data on their year of birth, place of birth, gender, ethnicity, education history, and job history, as well as the list of positions held in the party or government in the past, along with the period during which each position was held. From this job history, we are informed about when they leave an office and about their further career path. This dataset is created by digitalizing the curricula vitae of prefectural party secretaries published on Baidu Wikipedia[10] and Local Leadership Database[11].

The dataset tells us how many prefecture leaders remain employed each year, how many leave, and why some leave. From this, we infer the replacement status of each local government every year. Together with the spatial weights matrix, our explanatory variable of interests - the level of competition (C) $\sum_{j\neq i}^{n_p} w_{ij,p} NoTurnover_{jt}$ is generated. Its mean, standard deviation, minimum and maximum values are reported in Table 3.1. From the summary statistics, the mean for contiguous competitor death (Dj) is nearly 0.05, with 170 non-zero cells. On average, local politicians have three effective geographical contestants. Politician's personal characteristics are considered as covariates, including age, gender and ethnicity, education and major, working experience, and whether they are originally from the province governed (i.e., local). The summary statistics of these controls are also presented in Table 3.1.

The economic prosperity outcome sources from satellite data. Night-time light density is reported by an integer scale ranging from 0 to 63, and is available from the National Geophysical Data Center of the National Oceanic and Atmospheric Administration (NOAA) of the US. The information comes from satellite images taken for the Defense Meteorological Satellite Program (DMSP) of the US Department of Defense. We use the latest version of the satellite data (i.e., Version 4.0) and collect the values between the years 2006 and 2013. The mean and standard deviation of the luminosity *center-border* ratio are listed in Table 3.1.

GIS maps from National Administration of Surveying, Mapping and Geo-information of China available for the year 2009, 2012 and 2015 allow us to capture the distribution of public provisions, such as roads, schools, and hospitals.

The series of lagged prefecture-level covariates are gathered from the China City Yearbook for the years between 2004 and 2016.[12] To control for all possible socioeco-

[9] The results for mayors are upon request.

[10] *https://baike.baidu.com/*

[11] *http://ldzl.people.com.cn/dfzlk/front/firstPage.htm*

[12] The Yearbook is sponsored and edited by the National Bureau of Statistics, which confirms

nomic factors, we select official information on the log of fiscal revenue, GDP growth rate, log of GDP per capita, log of population, unemployment rates, log of wage per capita. In Table 3.1, the mean and standard deviation of the controls are shown.

3.4 Identification Strategy

We estimate this first order contiguity SLX (spatial lag of X) model for the following baseline estimation:

$$Y_{it} = \rho \sum_{j \neq i}^{n_p} w_{ij,p} NoTurnover_{jt} + x'_{it}\beta + \eta_i + \alpha_t + \lambda_p \times \kappa_t + \epsilon_{it}$$

The first-order spatial model is specified as follows: Y_{it} denotes the distribution of the outcome variables, *center-border* ratios being its proxy. The main explanatory variable $w_{ij,p} NoTurnover_{jt}$, indicates the number of effective contiguous neighbors, representing the political competition. ρ captures the impact of the political competition on outcomes.

We control for a vector of prefecture-level variables, x_{it}, which vary across time. These are the turnover rate in jurisdiction i (i.e.,$T = NoTurnover_{it}$),[13] the lagged population, the fiscal revenue, the unemployment rate, the log of wage per capita, the logged GDP, the GDP growth rate, and a set of politician characteristics such as age, gender, ethnicity, educational level and major, working years, whether they are originally from the province governed (i.e., local versus outsider). Prefecture fixed effects, η_i, capture regional heterogeneities in resource endowment, cultural features, and other omitted time-invariant factors. Year fixed effects, α_t, capture both the macro-shocks and the policy effects for each period, the omission of which leads to a spurious effect. We also include regional trends in the model, by adding province $\times$ year fixed effects. The Inclusion of these variables in the regression accounts for the possibility of regional cooperation driven by policies initiated by the provincial-level government.

The SLX model is advantageous over other spatial econometrics models since it could include non-spatial econometric techniques, especially when we have an en-

that the data is fully reliable, and even if measurement errors might exist, these should be biased in the same direction.

[13]This term should be explicitly controlled for, not only because it is suggested by settings of the SLX model, but also as the turnover rate in jurisdiction i is correlated with both politician replacements in other jurisdictions and the dependent variable. Its coefficient approximates the direct effect of a local politician's replacement on their public policies.

dogenous variable to be instrumented (Vega and Elhorst, 2015).[14] To deal with concerns regarding endogeneity, we employ an instrumental variable approach, by instrumenting competitor turnover rate with the variable death of competing politicians, as indicated in section 3.3.2. However, variable $NoTurnover_{it}$ is also endogenous. Based on the assumption that $Cov(Death_{jt}, Death_{it}) = 0$, we employ the death of the leader of jurisdiction i to instrument its rate of political turnover. Both effects on the turnover rate should theoretically be close to -1, which intuitively means that one death of a leader results in one more increase in the turnover rate for the position. Therefore, we employ the following two-stage least squares (2SLS) regression to estimate the causal effect of competition on policy outcomes, controlling for the instrumented direct-replacement effect.

3.5 Empirical Results

3.5.1 Baseline Results

Table 3.2 presents the results of regressions, where the luminosity *center-border* ratio is the dependent variable. Column (1) shows the pooled OLS estimate, column (2) presents result controlled for prefecture fixed effects. To provide a benchmark we include prefecture and year fixed effect in column (3) before controlling for other baseline covariates in following columns. Column (4) adds controls while column (5) further includes regional-specific trends. Column (6) allows within-politician estimations.

In all cases besides simple pooled-OLS, competition levels, measured by the number of effective contiguous neighbors, correlate positively and significantly with the luminosity ratio, indicating an increased border effect on the economic outcome. As expected, competing with one additional neighboring competitor in certain year makes the leader more concerned about the economic spillovers, and to be less incentivized to develop cross-jurisdictional border. From columns (2)-(6) of Table 3.2, The ratio increases by 0.7%-0.8%. The politician replacement effects range from 0.9%-1.2%, suggesting that the border effects are higher when there is no bureaucratic replacement. This correlation is consistent with tournament theory that at the beginning or at the end of local leader's tenure (i.e., when the replacements in the position occur), politicians have the least incentive to promote solely growth for promotion, instead they focus more on social welfare and fairness.

[14]The SLX model allows the Hausman test for endogeneity as well as other tests for the validity of the instruments to evaluate if they satisfy the assumptions of exogeneity and relevance.

3.5.2 Instrumented Results

In this part, we instrument the number of effective contiguous competitors (C) with the number of contiguous competitor death (Dj), and the turnover rate of jurisdiction i (T) with leader death of that prefecture (Di), respectively. The results are shown in Table 3.3.

With regard to the political competition effects, the bias using OLS estimation goes downwards. The 2SLS estimates of ρ are 2-3 times larger than OLS estimates. Columns (2)-(6) shows that one additional effective competitor in contiguous prefectures leads to a 1.4%-2% increase in the ratio of economic activities. Politician replacement effects become statistically insignificant when the endogenous variable is instrumented.[15]

3.5.3 Public Inputs

Short-term Investments & Long-term Public Provisions We further check if the increased border effect on economic prosperity is driven by a strategic choice of public provisions distribution implemented by local leaders.

In Tables 3.4 and 3.5, we change the outcome variables in order to estimate the impact of competition on the radius of policy effect or the distribution of public expenditures, again controlling for instrumented replacement effects. The *center-border* ratio of road density calculated by ArcGIS indicates the distribution of short-term investments. While the ratios of schools and hospitals density represent the distribution of long-term public provisions.

The border effect on road distribution increases with the political competition. Given the fact that short-run pro-growth programs correlate immediately and strongly with local economic activities (i.e., proxied by the nighttime luminosity), the direction of the effect should be as the same as the effect on luminosity ratio shown in Tables 3.2 and 3.3. From the IV estimation shown in Table 3.4, one more effective contiguous competitor increases the ratio by 6%-7%, which represents the politician'

[15] A possible reason is that if a politician is waiting for retirement/ is informed about promotion or demotion decision, he has the least incentive to pursue solely growth; in this case we observe the results shown in baseline results, that the replacement is associated with a reduced border effect; However the instrument, accidental deaths, are unforeseeable. Before the occurrence of deaths, the local leader was actually competing for promotion and taking spillovers into account. In such case, the direct effect of turnover rate on policy drops to zero, as the instrumented results show. On the other hand, the neighboring competitors, who don't care how and why the replacement in other areas happens, perceive the competition levels by counting the number of prefectures with potential competitors, so the effect of competition keeps robust with IV estimation.

decision on constructing new roads in center instead of border in response to their greater concerns about spillovers.

However, when using the distribution of schools and hospitals as outcomes in the regressions, we find that the change of border effect on long-term public expenditure seems obscure with IV estimation. The competition does not alter the distribution of schools and hospitals, as suggested by columns (4)-(8) of Table 3.5. Since these long-term provisions could not affect relative ranking in the pool immediately, the politicians do not change the distribution of this type of expenditure.

Positive & Negative Externalities This part discusses the case where public input with negative externalities is the outcome variable, as sort of placebo test. According to the theory above, the border effect on provision with negative externalities should be stable or decrease. Pollution can be an example of negative spillovers. Air pollutant data is from Global Annual Average PM2.5 Grids from MODIS and MISR Aerosol Optical Depth (AOD), v1 (2005-2010). In Table 3.6, the effect of competition on *center-border* ratio of pollutants is negative, i.e., more pollutant in the border. This finding is in line with Lipscomb and Mobarak (2017).

3.5.4 Ranking Effect

A corollary of the political tournament theory is that, although cooperation among local officials is hard to achieve, it does not necessarily mean that economic cooperation is impossible in all regions. The key lies in whether economic spillovers will affect the relative ranking of local officials. Cooperation may be unlikely to be achieved among party secretaries with a similar political status, as measured by the GDP ranking of prefectures. Particularly, the more economically close regions are, the more uncertain the expected net political return from cooperation is. We classify three types of neighboring pairs: (1) *strong*, *strong*; (2) *strong*, *weak*; (3) *weak*, *weak*; this classification is made based on the GDP growth of prefectures within a province. The border effect should be the lowest for case (2) and relatively high for case (1) and case (3). *strong-weak* pairs are usually willing to cooperate because local officials do not have to worry that spillovers could change their relative political ranking, so they have much stronger incentives to jointly develop cross-border resources. However, for *strong-strong* or *weak-weak* pairs the incentive to cooperate is weak.

We define prefectures whose annual GDP is above that of the annual mean GDP of the province to which they are subordinated as *strong* regions, and the remaining ones as *weak* regions. Then we count the number of strong and weak adjacent competitors in each prefecture for each year. In Table 3.7, columns (1) and (2)

report the effect on the *strong-strong* and *strong-weak* borders. In the case of *strong* prefectures, a border effect is strengthened only if the number of *strong* contiguous competitors increases. The variation in *weak* contestants does not affect the policy distribution in *strong* regions. The results for the *weak* units are shown in columns (3) and (4), which illustrate the cooperative levels of *weak-strong* and *weak-weak* pairs. Only additional *weak* neighbors can force a politician in a *weak* area to alter their distribution. No effect is observed for the change in *strong* competitors in this case. Columns (4)-(8) report the same information, with the IV specifications included.

3.5.5 Robustness Checks

Within-Province Effect When looking at prefectures from more than one province, the pattern above should not exist, otherwise the pattern would be explained by other factors rather than by the tournament theory. Distinguishing between the two kinds of neighborhood disentangles the border effects driven by RPE from the effects of market interactions, exploiting the features that the RPE operates only within a province, while the market segmentation does not have such limits.

We select only prefectures that have neighbors from other provinces and create an across-province weights matrix. Technically, weights matrix identify prefectures that are geographically proximate, but from different provinces, as neighbors. We run the aforementioned regressions again. The results are reported in Table 3.8. The effect on luminosity *center-border* ratio is statistically non-significant when investigating across-province continuities. This finding does not suggest that border effect is zero at the across-province boundaries,[16] but the border effect does not alter in response to the promotion incentives.

Reduced Forms: Competitor Deaths on Boundary Segment In this part, the border effect is examined in another way. Instead of using the *center-border* ratio, we look at the outcome in a specific boundary segment; therefore, we do not consider the cross-jurisdiction border of a given prefecture as a whole. Rather, we divide it into several segments according to the different bordering jurisdictions of the prefecture. Then we look at what happens when a leader in a neighboring jurisdiction dies, namely at how the public inputs change in the specific boundary segment that connects these two prefectures.

We restrict the sample to the prefectures that have at some point experienced

[16] Border effect may also come from local protectionism and market segmentation.

the death of a neighboring competitor. The results in Table 3.9 indicate that, after controlling for prefecture fixed effects, one neighboring competitor's death leads to a 0.25-0.3 increase in the density of roads in the boundary segment neighboring with the prefecture whose leader has just died. From columns (4)-(6) we can observe that the increase of provisions in the entire boundary zones is mainly driven by the increase in those specific boundary segments. This finding supports the idea that, sudden deaths of local officials in neighboring regions, which lead to turnovers of neighboring officials and thus less competition, incentivized more projects with cross-border spillovers.

Alternative Explanation: Tax Competition One branch of literature links this unwillingness to cooperate with economic decentralization among regions, which gives local leaders plenty of leeways to enhance the local economy, causing local tax competition (Oi, 1992; Montinola, Qian and Weingast, 1995; Qian and Weingast, 1997; Jin, Qian and Barry, 2005). The tax competition eventually leads to local protectionism and market segmentation (Young, 2000; Bai, Du, Tao and Tong, 2004). The cross-jurisdictional borders are exactly the areas where local protectionism and market segmentation occur. The specialized division of labor and regional trade can be suppressed, resulting in disruption of the economic development at the border.

However, based on the empirical findings obtained so far, we confirm that tax competition is not the critical driving factor of the increased border effect. First, tax competition should be more intensive on cross-jurisdictional boundaries since it is easier for residents and firms to relocate within these borders. This conflicts with our intuition that the local government, as a way of being more competitive within the tax contest, would invest more resources into those areas, since indeed most of those areas are completely undeveloped and neglected. Second, the ranking effect findings reported in section 3.5.4, as well as the within-province effects reported in section 3.5.5 could hardly be explained by the hypothesis of tax competition.

3.6 Conclusion

The paper examines how political competition influences the border effects on the political outcomes, including public inputs as well as economic outputs. The underlying assumption is that economic spillovers play a role in the yardstick competition, where the relative performance of candidates is evaluated. Local leaders, who engage in the tournament, strategically minimize the spillover effects onto the neighboring competitors in order to maximize the probability of being promoted

through RPE, particularly when the competition levels of the geographical cluster are high. We quantify the competition levels by counting the number of effective contiguous competitors, which allow the variations in competition across time. We exploit the *center-border* ratio to proxy the distribution of outcomes within a jurisdiction.

The baseline results suggest that political competition leads to a decreased radius of policy effect and sequentially a more impoverished border. The findings are consistent if we instrument the endogenous political turnover rates with politicians' sudden deaths. We prove that the border effect is driven by the unique feature of Chinese political tournament, rather than market segmentation and tax competition, since the aforementioned pattern occurs only for contiguous prefectures within the same province, but not for those across provinces. Moreover, the border effects are amplified when the competing neighbors are closer in political and economic ranking. The findings of this paper suggest that RPE in China is an essential mechanism for achieving multiple policy goals.

Bibliography

[1] Bai, C.E., Y. J. Du, Z.G. Tao, and S.Y. Tong. Local Protectionism and Regional Specialization: Evidence from China's Industries. Journal of International Economics (2004), 63(2): 397-417.

[2] Bergstrom T, Blume L, Varian H. On the private provision of public goods. Journal of Public Economics (1986) 29(1):25-49

[3] Bergstrom T, Blume L, Varian H. Uniqueness of Nash equilibrium in private provision of public goods: an improved proof. Journal of Public Economics (1992) 49(3):391-392

[4] Besley, Timothy and Stephen Coate. Centralized versus decentralized provision of local public goods: a political economy approach. Journal of Public Economics (2003), 87, 2611-2637

[5] Besley, Timothy and Anne Case. Does Electoral Accountability Affect Economic Policy Choices? Evidence from Gubernatorial Term Limits, Quarterly Journal of Economics (1995), 110: 769-98.

[6] Besley, Timothy and Robin Burgess. The Political Economy of Government Responsiveness: Theory and Evidence from India, Quarterly Journal of Economics (2002), Vol. 117, No. 4 , 1415-1451

[7] Besley, Timothy, Torsten Persson, Daniel M. Sturm. Political Competition, Policy and Growth: Theory and Evidence from the US, Review of Economic Studies (2010) 77, 1329-1352

[8] Bloch F, Zenginobuz U. Tiebout equilibria in local public good economies with spillovers. Journal of Public Economics (2006), 90:1745-1763

[9] Bo, Zhiyue. China's Elite Politics: Political Transition and Power Balancing, Singapore: World Scientific Pub Co Inc. (2007)

[10] Bordignon, Massimo, Floriana Cerniglia, and Federico Revelli. In search of yardstick competition: a spatial analysis of Italian municipality property tax setting. Journal of Urban Economics (2003), 54:199-217

[11] Callander, Steven and Bard Harstad. Experimentation in federal systems. The Quarterly Journal of Economics (2015), 130(2): 951-1002.

[12] Case, A.C., Rosen, H. S. and Hines, J. C. Budget Spillovers and Fiscal Policy Interdependence: Evidence from the States. Journal of Public Economics (1993), 52: 285-307.

[13] Chen, Ye, Hongbin Li, Li-An Zhou. Relative performance evaluation and the turnover of provincial leaders in China, Economics Letters (2005), 88: 421-425

[14] Fisman, Raymond. Estimating the Value of Political Connections, American Economic Review (2001), 92: 1095-1102.

[15] Hsieh, Chang-Tai and Peter J. Klenow. Misallocation and Manufacturing TFP in China and India. The Quarterly Journal of Economics (2009), 124(4) 1403-1448.

[16] Jia, Ruixue. Pollution for Promotion, mimeo IIES (2014).

[17] Jia, Ruixue, Masayuki Kudamatsu and David Seim. Connections and Political Selection in China, mimeo IIES (2012).

[18] Jia, Ruixue and Huihua Nie. Decentralization, Collusion and Coalmine Deaths, Contributions to Conflict Management, Peace Economics and Development (2011), Vol. 20, 149-170.

[19] Jin, Hehui, Yingyi Qian, and Barry R. Weingast. Regional Decentralization and Fiscal Incentives: Federalism, Chinese Style. Journal of Public Economics (2005), 89 (9): 1719-42.

[20] Lazear, E., Rosen, S. Rank-ordered tournaments as optimal labor contracts. Journal of Political Economy (1981), 89: 841 - 864.

[21] Li, Hongbin and Li-An Zhou. Political Turnover and Economic Performance: the Incentive Role of Personnel Control in China, Journal of Public Economics (2005), 89:1743-62.

[22] Li, S., Li, S., Zhang, W. The road to capitalism: competition and institutional change in China. Journal of Comparative Economics (2000), 28: 269-292.

[23] Lipscomb, Molly and Ahmed Mushfiq Mobarak. Decentralization and Pollution Spillovers: Evidence from the Re-drawing of County Borders in Brazil. Review of Economic Studies (2017), 84: 464-502

[24] Maskin, Eric, Yingyi Qian, and Chenggang Xu. Incentives, information, and organizational form. The Review of Economic Studies (2000), 67 (2):359-378.

[25] Montinola, G., Qian, Y., Weingast, B.R. Federalism, Chinese style: the political basis for economic success in China. World Polit. (1995), 48, 50-81

[26] Oi, J. Fiscal reform and the economic foundations of local state corporatism in China. World Politics (1992), 45: 99 -126.

[27] Persson, Petra and Ekaterina Zhuravskaya. The Limits of Career Concerns in Federalism: Evidence from China. Journal of the European Economic Association (2016) 14 (2) 338-374

[28] Qian, Y., Roland, G. Federalism and the soft budget constraint. American Economic Review (1998), 88: 1143 - 1162.

[29] Qian, Y., Weingast, B. Federalism as a commitment to preserving market incentives. Journal of Economic Perspectives (1997), 11: 83-92.

[30] Oates W. Fiscal federalism. Harcourt Brace Jovanovich (1972), New York

[31] Shi, Xiangyu and Tianyang Xi. Race to Safety: Political Competition, Neighborhood Effects, and Coal Mine Deaths in China. Journal of Development Economics (2018), 131(C): 79-95.

[32] Shleifer, Andrei. A theory of yardstick competition. RAND Journal of Economics (1985): 319-327.

[33] Sole-Ollé, Albert. Tax mimicking and electoral control: An empirical analysis of local tax setting in Spain, Journal of Urban Economics (2006), 59: 32-53.

[34] Vega, Solmaria Halleck and J. Paul Elhorst. The SLX Model. Journal of Regional Science (2015), 55(3): 339-363.

[35] Xu, Chenggang. The fundamental institutions of China-s reforms and development. Journal of Economic Literature (2011), 49 (4):1076-1151.

[36] Yao, Yang and Muyang Zhang. Subnational leaders and economic growth: evidence from Chinese cities. Journal of Economic Growth (2015), 20 (4):405-436.

[37] Young, A. The razor's edge: distortions and incremental reform in the People's Republic of China. Quarterly Journal of Economics (2000), (4):1091-1135.

[38] Yu, Jihai, Li-An Zhou, Guozhong Zhu. Strategic Interaction in Political Competition: Evidence from Spatial Effects across Chinese Cities. Regional Science and Urban Economics (2016), 57:23-37.

[39] Zhou Li-An, Jing Tao. Guanyuanjinsheng yu bianjiexiaoying: yi shengqu jiaojiedidai weili (Officials' Promotion and Border Effect), Jinrongyanjiu (Journal of Financial Research) (2011), 369, 15-26

Table 3.1: Summary Statistics

Variables	Obs.	Mean	S.D	Min	Max
Outcome Variables: *center-border* ratios					
Luminosity	2800	0.898	0.297	0.207	2.16
Road density	1030	1.088	0.289	0.067	3.128
School density	689	1.092	0.208	0.164	3.103
Hospital density	692	0.989	0.206	0.007	2.984
Main explanatory variables					
# Eff. contiguous competitors (C) ($\sum_{j\neq i}^{n_p} w_{ij,p} NoTurnover_{jt}$)	3130	3.090	1.493	0	8
# Contiguous competitor deaths (Dj) ($\sum_{j\neq i}^{n_p} w_{ij,p} Death_{jt}$, 170 cells has a non-zero value)	3130	0.048	0.215	0	2
Politician turnover (T) ($NoTurnover_{it}$)	3130	0.1885	0.3912	0	1
Prefecture-level controls					
log(Revenue)	2792	13.038	1.185	9.549	16.851
log(Population)	2792	5.843	0.659	2.85	7.121
log(GDP)	2767	15.919	0.960	13.014	18.934
GDP growth rate	2763	12.793	3.733	-19.38	37
Unemployment rate(%)	2706	0.612	0.500	0.045	11.544
log(Wage per capita)	2755	10.149	0.499	7.501	12.678
Politician's characteristics					
Age	2743	52.634	3.523	41	61
Tenure	2743	3.419	1.687	0	9
Experience	2705	33.209	5.070	15	58
Education	2760	18.358	2.021	12	24
Male (Yes=1, No=0)	2771	0.958	0.201	0	1
Minority (Yes=1, No=0)	2767	0.067	0.249	0	1
Local (Yes=1, No=0)	2743	0.036	0.187	0	1
Economist (Yes=1, No=0)	2714	0.078	0.269	0	1

Table 3.2: Border Effect on the Luminosity: OLS

	DevRatio: Luminosity in Center / Luminosity in Border					
	(1)	(2)	(3)	(4)	(5)	(6)
# eff. contiguous competitors (C)	0.0146**	0.0070***	0.0079***	0.0077***	0.0072***	0.0081**
	(0.0074)	(0.0022)	(0.0024)	(0.0025)	(0.0025)	(0.0032)
politician turnover (T)	0.0397	0.0087**	0.0097**	0.0101**	0.0104**	0.0119*
	(0.0285)	(0.0043)	(0.0044)	(0.0048)	(0.0048)	(0.060)
Prefecture FE	N	Y	Y	Y	Y	Y
Year FE	N	N	Y	Y	Y	Y
Controls	N	N	N	Y	Y	Y
Regional trends	N	N	N	N	Y	Y
Politician FE	N	N	N	N	N	Y
#clusters	279	279	279	279	279	279
#observations	2477	2465	2465	2329	2329	2329

[1] Controls include lagged prefectural socio-economic characteristics: log population, unemployment rate, literacy rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education and major, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 3.3: Border Effect on the Luminosity: Instrumented Results

	DevRatio: Luminosity in Center/ Luminosity in Border					
	(1)	(2)	(3)	(4)	(5)	(6)
# eff. contiguous competitors (C)	0.2204	0.0179**	0.0137*	0.0166*	0.0143*	0.0201*
	(0.1766)	(0.0087)	(0.0078)	(0.0086)	(0.0089)	(0.0105)
politician turnover (T)	0.0083	0.0242	0.0190	0.0237	0.0189	0.0219
	(0.1356)	(0.0198)	(0.0172)	(0.0192)	(0.0205)	(0.0242)
First Stage						
	# effective contiguous neighbors (C)					
# contiguous competitor deaths (Dj)	-0.2813**	-0.8106***	-0.9223***	-0.8689***	-0.8320***	-0.7682***
	(0.1160)	(0.0711)	(0.0706)	(0.0714)	(0.0704)	(0.0901)
	politician turnover (T)					
leader's death (Di)	-0.7078***	-0.7072***	-0.7327***	-0.7324***	-0.7227***	0.7021***
	(0.0493)	(0.0483)	(0.0508)	(0.0511)	(0.0521)	(0.0715)
Prefecture FE	N	Y	Y	Y	Y	Y
Year FE	N	N	Y	Y	Y	Y
Controls	N	N	N	Y	Y	Y
Regional trends	N	N	N	N	Y	Y
Politician FE	N	N	N	N	N	Y
#clusters	279	279	279	279	279	279
#observations	2817	2817	2493	2333	2089	2089

[1] Controls include lagged prefectural socio-economic characteristics: log population, unemployment rate, literacy rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education and major, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 3.4: Border Effect on the Short-term Inputs

	RoadRatio: Road density in Center/ Road density in Border							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
# eff. contiguous competitors (C)	0.0200**	0.0190**	0.0189**	0.0207*	0.0613*	0.0684*	0.0715*	0.0720*
	(0.0078)	(0.0077)	(0.0079)	(0.0093)	(0.0372)	(0.0389)	(0.0388)	(0.0395)
First Stage								
# contiguous competitor deaths (Dj)					-0.7153***	-0.6961***	-0.7074***	-0.6325
					(0.1206)	(0.1230)	(0.1212)	(0.1379)
Politician turnover	Y	Y	Y	Y	Y	Y	Y	Y
Prefecture, Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	Y	Y	Y	N	Y	Y	Y
Regional trends	N	N	Y	Y	N	N	Y	Y
Politician FE	N	N	N	Y	N	N	N	Y
#clusters	279	279	279	279	279	279	279	279
#observations	821	796	796	796	821	796	796	796

[1] Controls include lagged prefectural socio-economic characteristics: log population, unemployment rate, literacy rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education and major, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 3.5: Border Effect on the Long-term Inputs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	SchRatio: School density in Center/ School density in Border							
# eff. contiguous competitors (C)	0.0041*	0.0060**	0.0058**	0.0067*	-0.0019	-0.0006	0.0018	0.0015
	(0.0025)	(0.0026)	(0.0025)	(0.0033)	(0.0141)	(0.0175)	(0.0176)	(0.0193)
	HosRatio: Hospital density in Center/ Hospital density in Border							
# eff. contiguous competitors (C)	0.0029	0.0034	0.0034	0.0067*	0.0051	0.0101	0.0197	0.0115
	(0.0027)	(0.0033)	(0.0034)	(0.0051)	(0.0121)	(0.0174)	(0.0190)	(0.0208)
Politician turnover	Y	Y	Y	Y	Y	Y	Y	Y
Prefecture, year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	Y	Y	Y	N	Y	Y	Y
Regional trends	N	N	Y	Y	N	N	Y	Y
Politician FE	N	N	N	Y	N	N	N	Y
#clusters	279	279	279	279	279	279	279	279
#observations	556	518	518	518	556	518	518	518

[1] Controls include lagged prefectural socio-economic characteristics: log population, unemployment rate, literacy rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education and major, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 3.6: Border Effect on the Inputs with Negative Externalities

	Pollution: average pm 2.5 in Center/ average pm 2.5 in Border							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
# eff. contiguous competitors (C)	0.0002	0.0003	0.0003	0.0007	-0.0015*	-0.0014*	-0.0017*	-0.0020*
	(0.0002)	(0.0002)	(0.0002)	(0.0009)	(0.0008)	(0.0008)	(0.0009)	(0.0010)
Politician turnover	Y	Y	Y	Y	Y	Y	Y	Y
Prefecture, year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	Y	Y	Y	N	Y	Y	Y
Regional trends	N	N	Y	Y	N	N	Y	Y
Politician FE	N	N	N	Y	N	N	N	Y
#clusters	279	279	279	279	279	279	279	279
#observations	1554	1437	1437	1437	1554	1437	1437	1437

[1] Controls include lagged prefectural socio-economic characteristics: log population, unemployment rate, literacy rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education and major, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 3.7: GDP Ranking Effect

	DevRatio: Luminosity in Center/ Luminosity in Border							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Strong		*Weak*		*Strong*		*Weak*	
# *Strong* eff. neighbors	0.0130**	0.0148**	0.0045	0.0053	0.0447*	0.0481*	0.0028	0.0027
	(0.0067)	(0.0065)	(0.0035)	(0.0040)	(0.0260)	(0.0286)	(0.0088)	(0.0094)
# *Weak* eff. neighbors	0.0044	0.0039	0.0083***	0.0076***	-0.0072	-0.0105	0.0205*	0.0196*
	(0.0056)	(0.0059)	(0.0025)	(0.0026)	(0.0214)	(0.0231)	(0.0120)	(0.0117)
Politician turnover	Y	Y	Y	Y	Y	Y	Y	Y
Prefecture, year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	N	Y	Y	N	N	Y	Y
#observations	917	885	1548	1483	917	885	1548	1483

[1] Controls include lagged prefectural socio-economic characteristics: log population, unemployment rate, literacy rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education and major, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 3.8: Across-province Neighborhood

	DevRatio: Luminosity in Center/ Luminosity in Border							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
# across-province neighbors	0.0010	0.0039	0.0051	0.0087	0.0038	0.0139	0.0067	0.0170
	(0.0046)	(0.0052)	(0.0050)	(0.0093)	(0.1223)	(0.0908)	(0.0830)	(0.0950)
Politician turnover	Y	Y	Y	Y	Y	Y	Y	Y
Prefecture, year FE	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	Y	Y	Y	N	Y	Y	Y
Regional trends	N	N	Y	Y	N	N	Y	Y
Politician FE	N	N	N	Y	N	N	N	Y
#clusters	279	279	279	279	279	279	279	279
#observations	821	796	796	796	821	796	796	796

[1] Controls include lagged prefectural socio-economic characteristics: log population, unemployment rate, literacy rate, log wage per capita; and politician's characteristics: his age, gender and ethnicity, his education and major, his working experience (year), whether he is from the province he governs.

[2] Reported in parentheses are standard errors clustered at the prefecture level. Significant at * 10%, ** 5%, *** 1%.

Table 3.9: Reduced Forms: Competitor Deaths on Boundary Segment

	(1)	(2)	(3)	(4)	(5)	(6)
	Roads (Density)					
	segment contiguous to prefec -ture with dead competitor			Whole border		
Contiguous competitor death	0.3160***	0.3055**	0.2623**	0.2469*	0.3372**	0.4664***
	(0.1135)	(0.1291)	(0.1041)	(0.1445)	(0.1685)	(0.1793)
Politician turnover	Y	Y	Y	Y	Y	Y
Prefecture, year FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	Y	N	Y	Y
Regional trends	N	N	Y	N	N	Y
#observations	135	130	130	543	528	528

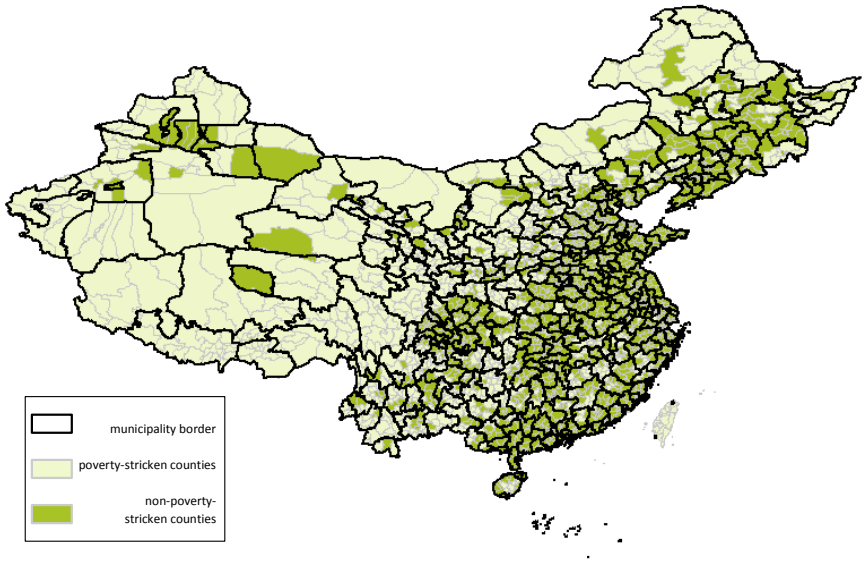


Figure 3.1: Spatial Distribution of Poverty-stricken Counties

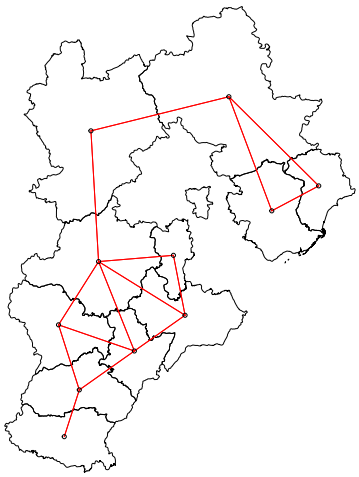


Figure 3.2: Neighbors in Hebei Province (Example)

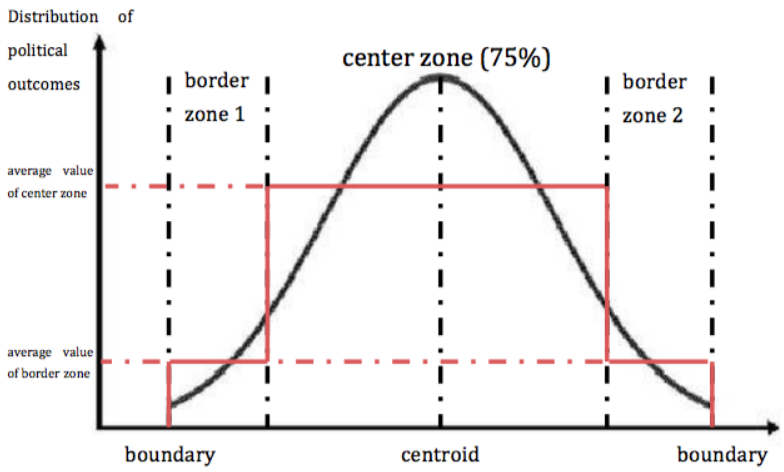
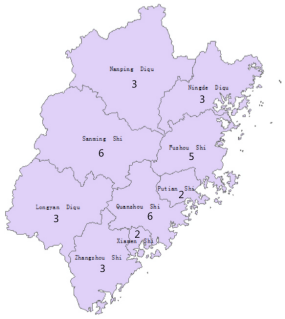
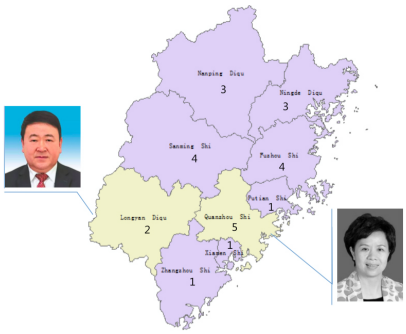


Figure 3.3: Distribution of Outcomes and *center-border* Ratio

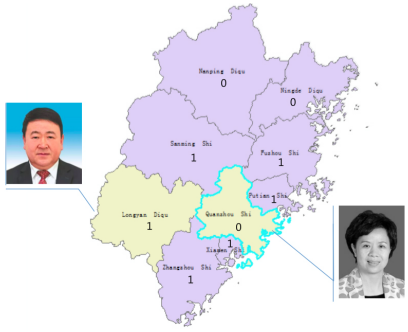
Appendix C.1: Example in Defining Explanatory Variable and Instrument Variable



- Number of contiguities:
  $= \sum_{j \neq i}^{n_p} w_{ij,p} \cdot 1$



- Two turnovers occur
  # eff. contiguous competitors (C)
  $= \sum_{j \neq i}^{n_p} w_{ij,p} NoTurnover_{jp,t}$



- # contiguous competitor deaths (Dj)=
  $\sum_{j \neq i}^{n_p} w_{ij,p} Death_{jp,t}$

Appendix C.2: Border Regions (blue) and non-Border Regions (purple)