Political Structure and Balance of Power

Evidence from Mid-level Officials' Promotion in China

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Abstract

The purpose of this paper is to analyze the government leadership structure of China and its effect on the promotion practices for Party secretaries and government mayors by answering three questions: 1) How do local Chinese officials manipulate GDP growth for promotion according to the crucial junctures in their careers? 2) How does the central government strategically react to such manipulation in terms of promotion decisions? 3) How does the interplay between the mayor and secretary under the distinct dual-head leadership structure affect GDP growth manipulation? To address these questions, a comprehensive dataset was collected on the career trajectories of 536 prefecture Party secretaries and 583 mayors. The first outstanding characteristic was how their promotion prospects depend on age. A game theory model was designed to generate testable predictions about the dynamic relationship between secretaries' and mayors' ages and their decisions to manipulate GDP growth. It was found that both secretaries and mayors manipulate GDP growth during the last opportunity for promotion to primary vice-provincial positions with real authority. Aware of these manipulations, higher-level authorities have set a higher promotion standard for these secretaries. secretaries at their critical age must achieve a 1.45% higher nominal GDP growth rate on average (12.5% of the average GDP growth) than secretaries at other age ranges to be promoted. Additionally, it was found that secretaries at their critical ages manipulate less when paired with mayors who were qualified to succeed them as secretaries, since short-term policy measures used by secretaries to "stimulate" economic development can hinder the mayors' prospective pursuit of high GDP growth, highlighting how the presence of mayors can act as a control on secretaries.

1 Introduction

As the world's second-most-populous country, the third largest country, and the country with the second highest GDP, China is an increasingly powerful state in the geopolitical landscape. At the same time, the Chinese government's approach to governance is distinct from other democratic, as well as non-democratic countries. In addition to a hierarchical central-local government structure, China adopts a dual-head, horizontal leadership structure, where each municipality is governed by both a Party leader and a government leader. What are the different incentives of these two types of leaders? How does the dual-head leadership structure affect the strategic interactions between these two heads? This paper will make an attempt to answer these questions, and fill the literary gap in the topic.

A natural context is to study the leaders' incentives of promotion given by the central government. Unlike the dual-head leadership structure in Russia, where officials are promoted either by the party line or the government line, the standard next step for a government head in China usually means promotion as Party leader (Party secretary). The literature has jointly studied the promotion of provincial-level officials and GDP growth, arguing that the central government adopts the "Tournament Model", where it promotes provincial officials based on their economic performance, represented by GDP growth (Li and Zhou, 2005; Jia et al., 2023). Without re-elections or supervision, such incentives lead to manipulation of GDP figures by local officials (Wallace, 2016).

Building on the literature, this paper argues that it's important to distinguish government heads from Party secretaries in the context of promotion, as they face different promotion incentives. These diverging incentives lead to optimal GDP manipulation at different stages of their careers, resulting in a scenario where one role counterbalances or checks the other, creating a unique dynamic in the political landscape. The present research paints a holistic picture of the manipulation choices of local officials under promotion incentives, the strategic responses by the central government anticipating manipulation, and the strategic interplay between two leaders under the dual head leadership structure.

In order to study these questions, a unique dataset was collected on the promotion paths of all prefecture level Party secretaries and mayors during 2010-2015. By focusing on mayors and prefecture level Party secretaries, this paper ensures a sample size large enough for the separate examination of the incentives driving these two categories of officials. Furthermore, officials' prior political and career history was measured, encompassing experiences that significantly influence their future promotions and policy directions. The highest rank these officials achieved was recorded for each of these experiences. This study also addresses a gap in previous literature regarding officials' actual educational qualifications, which is unrelated to their ranks. Additionally, these local officials occupy a lower tier in the administrative hierarchy compared to provincial-level officials. This aspect of their position reduces their exposure to the potentially confounding influences of nepotism with central government members, offering a more unobstructed view of their career progressions and decision-making processes.

Moreover, it was investigated whether Party secretaries and mayors succeeded in advancing to vice-provincial positions and noted the timing of these promotions. For Party secretaries, promotion to primary vice-provincial positions with real authority depends on economic performance, while advancement to secondary vice-provincial positions requires a sufficiently long tenure. For mayors, promotion to the Party secretary position is more contingent on the departure of the current secretary. Both Party secretaries and mayors tend to exaggerate economic data before their last promotion opportunity to primary vice-provincial positions with real authority, typically occurring at the age of 55 for Party secretaries and between the ages of 53 and 54 for mayors, depending on the current Party secretary's departure.

In order to understand the complicated strategic interplay of this dual-head structure, a game theory model was built to test its implications. The model predicts that while both Party head and government head are motivated by promotion and may manipulate GDP, there is a trade off between the benefit of manipulation and the cost of getting caught. As a result, manipulation is higher at their last chance for promotion. In response, the higher-level authorities will reduce the GDP figures during officials' last chance of promotion, knowing manipulation will be highest there. This ensures less data manipulation, the selection of

capable party secretaries and prevents otherwise qualified party secretaries of other age ranges from losing promotion opportunities. Promotion standards for 55-year-old Party secretaries, based on GDP growth, were raised on average by 1% to 1.5%, significantly higher than those of Party secretaries of other ages.

Finally, but most important, China's unique dual leadership system was analyzed, where mayors have a significant probability of being promoted to the position of Party secretary in their own city. This incentivizes mayors to reduce data manipulation to avoid negative consequences on their own future development and promotion prospects. As mayors' probability of succeeding to Party secretary increases within one term (five years), it was found that the tendency of 55-year-old Party secretaries to over report GDP growth significantly decreases as the tenure of their paired mayors increases. This demonstrates that the unique dual-head leadership system not only fosters better collaboration between Party secretaries and mayors but also encourages mutual constraint and restricts substantial manipulation, especially when these two categories of leaders have diverging goals, thus mitigating the challenges posed by limited supervision from same-level disciplinary secretaries serving as Party secretaries and mayors' subordinates.

This paper contributes to several streams of literature.

First, it contributes to the literature on the promotion of Chinese officials, showing that Party secretaries are evaluated based on their performance on economic growth, while mayors are not. By distinguishing primary promotions (promotion to positions with more authority and higher rank) from secondary promotions (promotion to positions with less authority but higher rank), demonstrating that performance on economic growth only matters for the former. If these two types of promotions are not distinguished, the estimation is susceptible to measurement error.

Second, it contributes to the literature on GDP manipulation in China. By comparing it with electricity consumption growth, a significant increase in GDP growth was found for secretaries of age 55. It also demonstrated that secretaries tend to over report GDP performance before their last opportunity for promotion to primary vice-provincial level positions. The age constraint of promotion used in this paper is inferred from actual promotions, avoiding the use of "official retirement ages" or age limits that lack support from data, which has

been widely used in the literature (e.g. Kou and Tsai 2014). Previous literature focusing on data manipulation concentrated on provincial-level officials, thereby giving more consideration to political cycles (Wallace, 2016). In this paper, targeting prefecture-level officials, a dynamic decision-making model was constructed to analyze how the motivation for GDP growth manipulation varies among secretaries of different ages.

Third, this paper also addresses the literature on how anticipation of future career prospects affect officials' decision-making. Literature has found that in democratic countries incumbent official making decision depended on probability of winning re-election (Biglaiser and Mezzetti, 1997). In this paper, it was found that mayors, as the likelihood of succeeding the secretary position increases, tend to reduce the secretary's behavior of over reporting GDP growth or the use of various short-term measures to inflate GDP.

Finally, this research adds to the understanding of dual-head leadership structures by examining China's unique system. While not directly comparing it with the Soviet Union, findings indirectly relate to Lane and Ross (1994) observations about the Soviet system. Lane and Ross noted the challenges the Soviet Party faced in influencing government appointments, which contributed to its eventual collapse. In contrast, this paper reveals that China's dual-head system, involving both government departments and Party systems, allows for interchangeable promotions between government officials and Party leaders. This key distinction underlines a fundamental difference in operational dynamics between China's leadership structure and what was observed within the Soviet Union. While also studying the dual-head structure in China, Li (2023) focused on the political structure in ancient China and documented how the central government set up deputy positions at the local level to divide power and prevent local tendencies towards independence. This paper contrasts Li's paper in analyzing the balancing of power under diverging promotion incentives, and providing empirical evidence from the modern context.

The paper proceeds as follows: Section 2 introduces China's political institutions, Section 3 covers data collection, categorization, and statistical analysis, Section 4 presents the reduced form empirical results which is the foundation of the decision making model, Section 5 formalizes the decision making process of prefectural secretaries, prefectural mayors and higher-level authorities, Section 6 tests and discusses how the predictions are revealed in the

data, and Section 7 summarizes.

2 Background

2.1 Hierarchy in China

In China, especially before the institutional reforms in 2017, nearly all state-owned institutions held administrative ranks. These ranks were standardized from top to bottom and applied across all 31 provinces, municipalities, and autonomous regions within the mainland. This administrative rank system extended beyond Party and government officials, encompassing institutions such as public schools, hospitals, research organizations, and state-owned enterprises. From primary school principals to university Party secretaries, and from township health clinics to hospital directors in Beijing, all adhered to the same administrative rank system. This system consisted of five levels, corresponding to China's administrative hierarchy: national level, provincial level, prefectural level, county-level, and township-level. Figure 1 provides an illustration of this hierarchical structure.

Excluding the military, administrative institutions in China primarily operated within four parallel branches: the Party, the National People's Congress (NPC), the government, and the Chinese People's Political Consultative Conference (CPPCC). Each branch had its own subordinate departments and lower-level administrative institutions. Typically, the head of a department in a higher-level administrative institution held the same administrative rank as the chief official of the corresponding lower-level administrative institution. For example, within the government branch, the head of the Finance Department of provincial government held the same rank as the mayor of a prefecture-level city. Similarly, within a province, the Party secretary (the head of the Party branch), the chairman of the NPC (the head of the NPC branch), the governor (the head of the government branch), and the chairman of the CPPCC (the head of the CPPCC branch) all held the same rank known as the "zhengshengji", or the full provincial level. Focusing on the provincial level, vice positions within these four branches, such as vice Party secretary and vice governor, vice chairman of the NPC, and vice chairman of the CPPCC, held the rank of "fushengji", or the vice-provincial-level. Figure 2 and Figure 3 illustrate the positions within the Party branch and the government branch at

various levels.

At the legal level, the heads of departments under these four branches held the same rank as the Party secretary, NPC chairman, governor, and CPPCC chairman of the lower-level administrative institution. However, it's important to note that Party leaders at the corresponding rank, while their administrative rank might match that of other administrative branch leaders, always held a higher political status. In practice, Party department heads often concurrently held the position of standing member of the Party committee, granting them a higher rank even than regular deputy officials in the government. For example, the head of the organization department of the provincial Party committee typically also served as a standing member of the provincial Party committee, which came with greater political privileges than regular vice governors.

While Party department head ranks surpassed those of their counterparts in the government, such as the head of the organization department of the provincial Party committee having a higher rank than the head of the financial department of the provincial government, the Party secretary and the governor usually held the same rank at the provincial level. Similarly, in most cases at the prefecture-city level, the Party secretary and the mayor also held the same rank, known as the "zhengtingji", or the prefectural level. Theoretically, the Party secretary was responsible for Party affairs and cadre selection, while the mayor tended to focus more on economic activities. However, given the Party's comprehensive control, particularly over administrative institutions at the prefecture-level city or lower, this distinction might not be very pronounced in practice.

Similarly, at the provincial level, the heads of the NPC and the CPPCC also held the same rank as the Party secretary and the governor. However, their powers differed significantly. The Party and government held real decision-making authority, while the NPC and the CPPCC, especially at the provincial and lower levels, often served as preparatory institutions for retiring officials—what is often referred to as secondary organizations. While the NPC theoretically resembled parliamentary systems in democratic countries with legislative powers, in China, the NPC functioned more like a rubber stamp. The political status of the CPPCC was even lower than that of the NPC. It was a unique manifestation of China's united front with non-Communist parties and individuals, as China has eight democratic parties along-

side the Communist Party. These democratic parties operated under the leadership of the Communist Party, and their leaders were also integrated into the NPC and the CPPCC. The primary role of the CPPCC was advisory, providing suggestions to the Communist Party and government, and its actual influence was smaller than that of the NPC. Consequently, for officials, transitioning from the Party or government to the NPC or the CPPCC usually signified the end of their political careers and prepared them for retirement. However, since the NPC and the CPPCC held the same rank as the corresponding Party committees and governments, vice chairmen of the NPC and the CPPCC often became ideal positions for rewarding retiring officials.

In this article, we focus on prefecture-level cities, which are below the provincial level and above the county-level. In China, prefecture-level cities hold a unique status. Legally, they don't even exist; they're designated institutions of provincial-level Party committees and governments. However, this intermediary tier between the province and county has a longstanding history and has become an established administrative level. There are four directly administered municipalities in China: Beijing, Shanghai, Tianjin, and Chongqing, each having the administrative status of a province. Aside from these four cities, there are 15 cities that hold a vice-provincial-level status. Both of their Party secretaries and mayors are vice-provincial-level officials. Additionally, all provincial capitals are special prefecture-level cities because the Party secretary of these capitals is customarily held by a standing member of the provincial Party committee, also making them vice-provincial-level officials. Many mayors of these capital cities also have experience as Party secretaries in other prefecture-level cities within the province. Unlike ordinary mayors of prefecture-level cities, these mayors of provincial capitals have opportunities for promotion to vice-provincial-level officials directly. Finally, there are some important cities. The most notable example is Suzhou in Jiangsu Province. The Party secretary of Suzhou is typically also a standing member of the provincial Party committee. In fact, most of these secretaries of provincial capital cities and important cities also serve as alternate members of the Central Committee, which distinguishes them from normal secretaries significantly. In this article, we won't discuss the promotion and economic performance of Party secretaries and mayors in these cities. Additionally, the concept of "prefecture-level city" that we're discussing doesn't include these mentioned special cities.

Figure 4 illustrates the different administrative tiers of cities.

2.2 Why prefectural level

In China, there are a total of 333 prefecture-level administrative divisions, of which 293 are prefecture-level cities, excluding border regions and a few ethnic autonomous areas. There is a significant disparity in population among prefecture-level cities, ranging from a few hundred thousand (notably, Sansha City, with a population of only 3,000 located in the middle of South China Sea, is often not considered a real prefecture-level city) to over ten million. Typically, a prefecture-level city's population falls in the range of one to eight million. Similarly, the territorial jurisdiction of these cities varies substantially. Excluding prefectures like Sansha, the smallest prefecture-level city covers an area of 1,440 square kilometers, while the largest extends over 370,000 square kilometers (excluding ethnic minority prefectural-level autonomous districts). Economic volume and development levels also exhibit significant disparities among prefecture-level cities, even when excluding border areas, ethnic minority regions, provincial capitals, and economically important cities in various provinces.

Prefectural secretaries are usually promoted within their province, competing with their peers in the same province. After excluding the capital city and important prefectures where secretaries are customarily held by a standing member of the Provincial Party Committee, prefecture cities in the same province (excluding Xinjiang and Xizang/Tibet) are less diverse.

The primary focus of this article is on the Party secretaries and mayors of various prefecture-level cities. While they are nominally considered middle-level officials in China, they do not fit the conventional middle-class category. In China, officials at or above the vice-provincial level are regarded as senior officials. In Xi Jinping's anti-corruption campaign, corrupt officials at or above the vice-provincial level were referred to as "tigers," while officials at or below the prefectural level were called "flies." Therefore, for officials at the prefectural level, the temptation to be promoted to the vice-provincial level, particularly to influential positions, is substantial. In China, there are approximately 2,000 officials at the vice-provincial level, including the secondary positions in the NPC and CPPCC, while there are around 10,000 officials at the full prefectural level. China's total civil service population is approximately 7 million, and about 90 million people working in institutions with admin-

istrative ranks, such as public schools or hospitals. As the most influential officials at the prefectural level, Party secretaries and mayors represent the top 0.1% of Chinese officials, making them elite members of society. Detailed data on their working experience, education background, promotion dates, and other vital information can be obtained from public report and official resume.

In China, it's a common practice for the Party secretary of a province and the provincial governor to be appointed from different regions. They cannot be officials who are native to the province or have worked in the province for an extended period, although the provincial governor can be promoted to the position of Party secretary within the same province. On the other hand, the Party secretaries and mayors of prefecture-level cities are typically officials under provincial organization department, often promoted from within the province, and rarely appointed from other provinces. Therefore, in comparison to the connections between provincial-level officials, and members of the Politburo, it's challenging for the Party secretary and governor of a province to have hometown connections or previous working relationships with Party secretaries and mayors of prefecture-level cities within the same province. As a result, the political connections between the Party secretary and governor of a province and the Party secretaries and mayors of prefecture-level cities within the province tend to be more distant. Compared to promotion of provincial Party secretaries and governors, promotion of Party secretaries and mayors of prefecture-level cities within the same province are less influenced by political connection.

2.3 Unique dual-head system in China

In the usual promotion sequence, becoming a Party secretary is often the final step before being promoted to the vice-provincial level. This promotion opportunity is particularly enticing for Party secretaries. Conversely, becoming a mayor often requires first becoming a Party secretary before having a chance to be promoted to the vice-provincial level. Therefore, if pursuing the promotion to Party secretary doesn't lead to the opportunity for a vice-provincial level promotion due to age factors, the motivation to pursue this promotion might be significantly diminished.

In the prefecture-level administrative tier, while the political status of a Party secretary

is higher than that of a mayor, their administrative ranks are the same when neither holds concurrent positions in superior institutions. Both hold the position of a member of the Provincial Party Committee, which grants them the qualification to report upwards and participate in various meetings. However, a mayor also concurrently holds the position of vice Party secretary of prefecture, which means, within the Party's organizational system, the mayor is still subordinate to the Party secretary. Furthermore, a Party secretary can be directly promoted to vice-provincial level positions, whether they are influential positions like standing member of the provincial Party committee or vice governor, or rank-based promotions like vice chairman of the provincial People's Congress or vice chairman of the provincial CPPCC. In contrast, mayors of prefecture-level cities have very limited chances to be directly promoted to vice-provincial level positions. For most mayors, becoming a Party secretary is the necessary path to eventually being promoted to a vice-provincial level position.

In summary, for grassroots Chinese officials, whether they start in Party committees or government institutions, they usually need to alternate between Party and government positions to secure promotions. A typical promotion trajectory could be county mayor, county Party secretary, vice prefecture mayor, standing member of prefectural Party committee (including vice prefectural Party secretary), prefecture mayor, prefectural Party secretary, vice governor, standing member of provincial Party committee (including vice secretary of provincial Party committee), governor, provincial Party secretary. Figure 5 illustrates the promotion sequence from county level to vice-provincial level.

This dual-headed political model is unique and differs from the administrative models commonly seen in other countries. For instance, in the United States, lower-level governments are not accountable to higher-level governments; they are only accountable to their own voters. Additionally, in the federal government of the United States, the Speaker of the House of Representatives usually doesn't ascend to the presidency, and retiring Vice Presidents don't typically transition to becoming Speakers of the House. There is no hierarchical promotion relationship between the executive and legislative branches. In India, although the civil servant system (IAS) and the elected official system are somewhat similar in terms of a dual-headed system, officials in these systems have limited interaction, and there is no

sequential promotion relationship between them. When comparing to other non-democratic countries, a prominent example of a dual-headed system is Iran. However, to some extent, Iran shares similarities with India. The interaction between Iran's religious clergy system and government officials is not very frequent. Among other socialist countries, China's system remains highly unique. Former Soviet Union and Cuba also had similar dual-headed systems, but their dual-headed systems resemble those of India or Iran with infrequent interactions between different systems. For example, in the former Soviet Union, if an official originated from the government system, the ideal promotion trajectory would be mayor, vice governor, governor/Republic minister, vice chairman of minister conference of Republic. To provide a specific example, Leonid Brezhnev mostly worked within the Party system throughout his life, while Alexei Kosygin worked predominantly in government departments. Figure 6 illustrates the promotion trajectory of Leonid Brezhnev and Alexei Kosygin before join Political Bureau and Figure 7 illustrates the promotion trajectory of Xi Jinping and Li Qiang before join Political Bureau.

Among the existing socialist countries, Vietnam's promotion trajectory is the most similar to China's. In Vietnam, the provincial People's Committee functions as the government, and the chairman of the provincial People's Committee corresponds to China's provincial governor. Like China, it's a common phenomenon in Vietnam for governors to be promoted to provincial Party committee secretaries. However, unlike China, there's a significant difference in political status between provincial Party committee secretaries and governors in Vietnam. Among the members of the 13th Central Committee of the Communist Party of Vietnam (most recent central committee, elected at 2021), almost all the serving provincial Party committee secretaries are elected as central committee members, but there are very few governors elected as central committee members. In contrast, in China, both serving provincial Party secretaries and governors are inevitable central committee members[1]. For a province, both the prefectural Party secretary and mayor are inevitable members of the

[1]The central committee re-elect every 5 years, the incumbent provincial Party secretaries and governors are inevitable central committee members for the new central committee as long as they will not retire soon, however, provincial Party secretaries and governors are not required to select from central committee members.

provincial Party committee. Thus, compared to Vietnam, government leaders at various levels in China have relatively greater autonomy and more comparable political rights to their counterparts in the Party.

Even when compared to ancient China, the current system has many differences. Li (2023) pointed out that the dual-head system in ancient China was effective in reducing rebellions, using officials such as Tongpan (assistant prefecture mayor specialize in justice) and Tongzhi (vice prefecture mayor) as examples. In ancient times, the gap between the Prefect and Tongzhi was much larger than the gap between the secretary and the mayor today. More importantly, the possibility of Tongzhi being promoted to Prefect was very limited, and even if promoted, it was more likely to be a transfer to a different place rather than taking over as the Prefect in the same jurisdiction. In fact, in the closest example to modern times, the Qing Dynasty, the promotion path for local officials was County Magistrate, Prefectural Magistrate (mayor of vice-prefecture level administrative district), and then Prefect, in that order. It did not require passing through the positions of vice Prefect or Assistant Prefect at the prefecture level, which is quite different from the present. Furthermore, in the Qing Dynasty, the appointment of Prefect or higher civil officials was centralized in the Ministry of Personnel and need permit from Emperor. The majority of Prefects were appointed from officials who had previously served in the central government and frequently transferred across provinces, which is also very different from the modern era. Today in China, almost half of the secretaries are promoted from mayors of the same city and very limited of prefecture secretaries or mayors are from outside of province.

In summary, the dual-head system implemented in China today has two characteristics that are not present in ancient China or contemporary other countries. First, the treatment of the two heads is extremely balanced, from administrative level to political treatment to salary treatment, all very similar. Second, the promotion path is very special, secretaries likely to be succeeded by mayors after leaving office. From a political perspective, this arrangement cleverly avoids one-person rule, and from an economic perspective, it allows the secretary and the mayor to balance long-term development with immediate interests from promotion. In this article, we attempt to explain China's economic data based on this unique setup. Ultimately, this also helps us understand why higher-level authorities are

able incentivizes officials to promote economic development by rewarding those who excel in economic performance.

3 Data

3.1 Data component

As mentioned earlier in this article, this paper exclusively focuses on ordinary prefecture-level cities, excluding directly-administered municipalities, vice provincial-level cities, important cities where the Party secretary concurrently holds the position of a standing member of the provincial Party committee, vice prefecture-level cities, and county-level cities. Additionally, due to data limitations and the unique characteristics of border regions, this study does not include minority autonomous prefectures or prefectures in Xinjiang, Tibet, and other similar areas. Finally, all prefecture-level cities considered in this article are from mainland China and do not include Hong Kong, Macau, and Taiwan.

The data used in this article primarily consists of four main parts:

1. The first part includes panel data for each prefecture-level city for each year. This data is sourced from official government-published statistical report for each year. It includes city population, birth rate, death rate, total GDP, GDP growth rate, GDP per capita, industrial proportion, agricultural proportion, investment amount, fiscal budget revenue, and more.

2. The second part consists of VIIRS nighttime light data used to cross-reference with GDP data from official statistical yearbooks published by prefecture governments. This study covers nighttime light data for the years from 2010 to 2013.

3. The third part includes GDP growth targets set by the central government and provincial government at the beginning of each year. These data are collected from the annual central government work report and annual government work reports of each province.

4. The fourth part includes the profiles of the prefectural Party secretaries and mayors for each year. If there are multiple Party secretaries or mayors within a year, those with a tenure exceeding 6 months are considered. If no Party secretary or mayor holds the position for more than 6 months, the position is considered vacant. The original data for Party secretaries and mayors primarily come from officially published resumes. In cases where official resumes

are incomplete, they are supplemented with information from publicly available official news reports.

The original data of resumes are presented in textual narratives, including ethnicity, official education, and tenure periods. I have compiled and organized the data, using numerical variables to record each official's political career experiences. For instance, whether they have worked in the central government, their highest administrative position held during central institution service, whether they have worked in the Communist Youth League, their highest administrative position held during Youth League service, whether they have served as a senior cadre's secretary, and their highest administrative position held during such service, and so on.

I have also recorded the officials' work experience in government positions prior to their current roles as Party secretary or mayor. Correspondingly, I have similarly recorded the officials' work experience in Party positions prior to their current roles. I have also tracked whether each Party secretary was promoted from the position of prefecture mayor and whether each mayor was subsequently promoted to the position of Party secretary. The officials' careers are tracked prior to their roles as Party secretary or mayor.

I have also documented whether they eventually received a promotion to the rank of vice-provincial-level cadre or higher and the timing of their promotion to vice-provincial-level cadre. I have also tracked whether each official faced prosecution due to corruption. The data about promotion and punishment are updated until the end of 2022.

Additionally, I have attempted to reconstruct the true education level of each Party secretary and mayor. Previous research indicates that education level significantly impacts an official's potential for promotion. However, previous studies did not differentiate between officials' first degrees, full-time degrees, and their officially highest degrees.

In China, the first degree refers to the degree obtained after taking the national college entrance exam and entering a university. If an individual did not participate in the national college entrance exam, their first degree is the highest full-time degree they obtained. The full-time degree refers to the highest education level achieved through regular academic study. The officially highest degree, on the other hand, includes in-service/part-time degrees obtained from Party schools, as well as distance learning degrees. In reality, such degrees are

relatively easy for officials to obtain. For senior officials, obtaining a part-time degree from a university in their primary jurisdiction or affiliated with their province does not necessarily involve academic study.

All the data of officials used in this paper were collected and organized by myself from published resumes and news reports.

3.2 Statistic summary

In my database, I have recorded a total of 536 Party secretaries. The average age of these Party secretaries when they first assumed the position of prefectural Party secretary was 50.8 years old. Figure 8 displays the age distribution of these Party secretaries at the time they took on the role of prefectural Party secretary. On average, these Party secretaries served for 3.83 years. Among them, 62% were eventually promoted to the rank of vice-provincial-level cadre, and 33% of them attained vice-provincial-level positions with real authority, or simply called primary vice-provincial-level positions, which are vice-provincial-level positions not belong to provincial or national NPC or CPPCC, such as vice governor, deputy minister and standing member of provincial Party committee. When we focus solely on those Party secretaries who achieved primary vice-provincial-level positions, we find that their average tenure was 3.37 years. For those who were promoted to vice-provincial-level positions belong to the NPC or CPPCC, the average tenure was 4.83 years.

Figure 9 depicts the distribution of years of service as prefectural Party secretary for those who were promoted to primary vice-provincial-level positions. From the graph, it can be observed that Party secretaries who aspired to further promotions typically needed to serve in their roles for at least one to two years. In the database, there are a total of 586 pairs of Party secretaries and prefectures, as some Party secretaries have served in multiple prefectures. Among these pairs, 79.7% of Party secretaries had previous experience as mayors before assuming the position of Party secretary. Additionally, 48.5% of Party secretaries were promoted to the position of Party secretary from the mayor of the same city. 23% of these Party secretaries were sentenced due to corruption. Among all secretaries, 5.6% of Party secretaries were investigated for corruption during their tenure and were ultimately sentenced.

Considering the time frame, we have recorded a total of 1406 combinations of Party secretaries and prefectures for each year. Figure 10 displays the age distribution of Party secretaries during their tenure. The average age of Party secretaries in office is 52.8 years old. Among these 1406 combinations, there were a total of 131 secretaries promoted to primary vice-provincial-level positions, with an average promotion rate of 9.3%.

In my database, a total of 583 mayors are recorded. The average age of these mayors when they first took office is 48.8 years old. Figure 11 displays the age distribution of mayors when they assumed the position of mayor for the first time. The average tenure of mayors is 3.33 years, and 62.6% of them eventually get promoted to the position of Party secretary, with 36.7% of mayors being directly promoted to become Party secretaries in the same city. Normally, mayors need to serve in their role for at least 2 years to have a successful transition to secretaryship. 38.9% of mayors are eventually promoted to the rank of vice-provincial-level cadre or above. If we focus on those mayors who are promoted to the vice-provincial-level or above, we find that 80.2% of them have prior experience as Party secretaries.

In the database, there are a total of 586 pairs of mayors and prefectures, as some mayors have served in multiple prefectures. 20.3% of these mayors are sentenced due to corruption. Among all mayors, 2.1% of mayors are investigated and eventually sentenced due to corruption during their tenure.

In the end, considering all the data over time, we have a total of 1394 mayor-year pairs recorded. Figure 12 illustrates the age distribution of mayors during their tenure. The average age of mayors during their tenure is 50.3 years old. Figure 13 shows the age of mayors when they transition from being mayors to becoming Party secretaries. The average age at this transition is 52.2 years old.

3.3 Age constraint of promotion and retirement

Although the legal retirement age for Party secretaries below the vice-provincial-level is 60 years old, in practice, the opportunity for Party secretaries to be promoted to the position of primary vice-provincial-level cadres ceases at the age of 56. The Chinese government hasn't officially published the deadline for promotions at each level, and many previous studies on age constraints for promotions, such as Kou and Tsai (2014), may be misleading. Since I

have collected the exact month when the prefectural Party secretary was promoted to the vice-provincial-level cadre position, I can draw conclusions directly from the data rather than relying on unofficial reports. I find that only 3 Party secretaries, got promoted to primary vice-provincial-level positions after the age of 57[2]. Figure 14 illustrates the age distribution of Party secretaries when they are promoted to the positions of vice-provincial governor or provincial standing member of the provincial Party committee. It's quite evident that there is a distinct break-point at the age of 56.

Similarly, for mayors, although the legal retirement age is 60 years old, the practical opportunity for mayors to be promoted to Party secretaries ceases around the age of 57. Only a very few mayors have the chance to be promoted to Party secretaries after the age of 57. What's even more crucial for mayors is whether they have the chance for further promotion after transitioning to Party secretaries. As mentioned earlier, if a Party secretary wishes to be promoted to a vice-provincial-level position, they must have served as a Party secretary for at least one year. Therefore, for mayors aiming to retain the possibility of being promoted to primary vice-provincial-level positions, they must become Party secretaries by the age of 54 or earlier. Figure 15 displays the age distribution of all prefectural Party secretaries who had experience as mayors and were ultimately promoted to primary vice-provincial-level positions when they transitioned from being a mayor to a Party secretary. It's evident that there are distinct breakpoints around the age of 54.

4 Reduced Form Empirical Results

4.1 Which position need better GDP performance

In previous research on the promotion mechanisms of Chinese officials, several factors have been identified as influencing promotions, including but not limited to relationships with

[2]Among them, there are two special cases. One is Huang Ke, the Party secretary of Chongzuo prefecture, who is of Zhuang ethnicity and became the president of the high court of Guangxi Zhuang autonomous region. Another is Ye Zhuang, a member of leadership of Sichuan provincial government and the secretary-general. Following the 2013 Ya'an earthquake, he assumed the additional responsibility of Party secretary in Ya'an and was subsequently promoted to the position of vice governor during his tenure.

higher-level governments (Yi and Liu, 2022), education backgrounds, and in-service economic performance metrics such as GDP growth rates. Luo and Qin (2021) argued that the promotion of prefectural Party secretaries is linked to GDP growth rates, while the promotion of mayors does not show a significant correlation with GDP growth rates. However, Luo and Qin did not control for officials' career experiences.

In our study, we re-examined the correlation between promotions and GDP performance. Additionally, as GDP data for the previous year is typically published in March of the following year, using current-year GDP data to infer its influence on the probability of promotion in the same year is highly inappropriate. Given that we collected precise promotion dates for all officials down to the month, promotion periods do not need to be constrained by calendar years. Considering that GDP data for each year is typically published in March of the following year, we believe that the GDP data for each year affects the probability of promotion within the 12 months from April of the following year to March of the third year. To investigate this, we conducted the following regression analysis:

$$\begin{aligned} Promotion_{ict} = a + bGDPgrowth_{ct} + cSecExperience_{it} + dSec_{it} \\ + fCity_{ct} + \delta_c + \eta_t + \epsilon_{ict} \end{aligned} \tag{1}$$

On the left side, the variable is the dummy of promotion result for secretary i of prefecture city c, with next 12 month after government publish the GDP information of year t. I set four values for the dummy, 0 for not get promotion, including retirement, transfer to other prefecture level position and get punishment, 1 for get promoted to NPC or CPPCC, 2 for get promoted to vice governor and 3 for get promoted to standing member of provincial party committee. On the right side, the first variable, a, is the constant, the second variable captures the GDP growth rate of prefecture city c at year t, the third variable is a control variable captures the experience of secretary i at year t, such as experience as mayor or youth league, the forth variable is another control variable captures the character of secretary i at year t, such as gender or age, the fifth variable is the statistical data of prefecture city c at year t, such as population and total GDP, and the rest are prefecture city fixed effect, year fixed effect and error term. Results are shown in Table 1.

I found the positive correlation between promotion and GDP performance, as demon-

strated in previous research, does indeed exist. Then, we redefined the "promotion" variable as a binary dummy variable (0/1), where 1 represents promotion, including promotion to NPC or CPPCC, vice governor, or standing member of provincial party committee. 0 represents not receiving any promotion. We also tested the probit model, and the results were consistent. However, due to the distinct pathways of promotion for secretaries, such as the promotion to primary vice-provincial-level officials (vice-governor or standing committee member) versus promotion to NPC or CPPCC, we aimed to clarify which type of promotion was driving the results.

First, I retained only those secretaries who did not receive a promotion and those who were promoted to NPC or CPPCC. Then, I run the following regression:

$$\begin{aligned} Level\_Promotion_{ict} = a + bGDPgrowth_{ct} + cSecExperience_{it} \\ + dSec_{it} + fCity_{ct} + \delta_c + \eta_t + \epsilon_{ict} \end{aligned} \tag{2}$$

On the left side, the dependent variable as a binary dummy variable (0/1), where 1 represents promotion to NPC or CPPCC and 0 represents not receiving any promotion. On the right side, the independent variables are the same with regression (1).

The results are shown in Table 2. Clearly, GDP growth rate no longer significantly affects the promotion to NPC or CPPCC, in contrast to the previous findings. Instead, the length of tenure as a secretary has a greater impact on the probability of being promoted to vice chairman of the People's Congress or the Political Consultative Conference. In fact, this type of promotion that becoming a vice chairman of NPC or CPPCC seems more like a consolation prize for secretaries who have served for many years in various places, and have neither outstanding performance nor significant misconduct.

Next, I focused on those secretaries who promoted to primary vice-provincial-level positions. I run the following regression:

$$\begin{aligned} Real\_Promotion_{ict} = a + bGDPgrowth_{ct} + cSecExperience_{it} \\ + dSec_{it} + fCity_{ct} + \delta_c + \eta_t + \epsilon_{ict} \end{aligned} \tag{3}$$

On left side, I once again defined a binary promotion variable (0/1), where 0 indicates

no promotion to a primary vice-provincial-level position, including retirement, transfer to other prefecture-level position, get punishment and get promoted to NPC or CPPCC, and 1 indicates promotion to vice governor or standing committee member. On the right side, the independent variables are the same with Regression 1. The results are shown in Table 3. I discovered a clear correlation between GDP growth rate and the probability of promotion to vice governor or standing committee member, with extra 1% of GDP growth reported, there is almost extra 1% probability to get promoted to primary vice-provincial-level position, with the average probability of promotion is only about 9% for each year. I also tested the probit model, and the results were stable.

4.2 Which year of GDP performance matter

I test the influence of GDP performance of previous years and current year. I rerun the regression 3, but changes the definition of dependent variable of promotion and independent variable of GDP growth of year t. For dependent variable, I simply use the promotion status of calendar year t and for independent variable, I use three different measurements of GDP growth: GDP growth of year t, GDP growth of year t-1, and the average of GDP growth of secretaries' tenure. Compare to use the GDP growth at year t as independent variable and promotion status of next 12 months after publish the GDP growth as dependent variable, the magnitude of coefficient b decreases and significance disappear when using either year t-2, year t, or tenure average as independent variable and promotion status of calendar year t as dependent variable. Results are shown in Table 4.

Therefore, I argue that the latest available GDP growth before promotion decision has a much greater impact on whether a promotion is granted than the GDP growth in the preceding years, and since the GDP growth of current year is not available during the year, so it could not have a significant influence on promotion at current year. In all the aforementioned regressions, our promotion data were based on promotions occurring within 12 months after the release of GDP data for the respective prefecture at year t.

4.3 GDP performance and promotion of mayor

I also tested the impact of GDP performance on the promotion of mayors but did not find stable results. I run the following regression:

$$\begin{aligned} Promotion_{ict} = a + bGDPgrowth_{ct} + cMayorExperience_{it} + dMayor_{it} \\ + fCity_{ct} + \delta_c + \eta_t + \epsilon_{ict} \end{aligned} \tag{4}$$

On the left side, the variable is the dummy of promotion result for mayor i of prefecture city c, with next 12 month after government publish the GDP growth of year t. I set four values for the dummy, 0 for not get promotion, including retirement, transfer to other prefecture-level city as mayor, transfer to prefecture-level institutions such as provincially-owned enterprises or universities as secretary or executive leader, or get punishment, 1 for get promoted to be director of department of provincial government, such as director of department of commerce and department of education (not including directors of department that are usually held concurrently by the vice governor, such as department of police), or to be executive vice director of a department of the provincial party committee (the director of such department held concurrently by the standing member of provincial party committee), such as the executive vice director of provincial organization department. 2 for get promoted to party secretary of any prefecture cities and 3 for get promoted to any vice provincial positions. Results are shown in Table 5.

I rerun the Regression 4, however, I once defined a binary promotion variable (0/1), where 1 indicates promotion to secretary position or vice-provincial-level position, 0 otherwise. On the right side, the independent variables are the same with Regression (1) but for mayors instead of for secretaries, the results are shown in Table 6. I also tested the probit model, and the results were stable.

One conceivable reason is that about 40% of the mayors are promoted to become secretaries of their own cities. Therefore, to some extent, the tenure of secretaries determines the timing of mayors transitioning to become secretaries. Moreover, the promotion of secretaries to primary vice-provincial-level positions based on excellent GDP performance is limited and more secretary positions are left vacant because the secretary is promoted to secondary vice-provincial-level positions unrelated to economic performance or because the secretary

steps back to the second line due to age concerns, allowing the mayor to take over. As a result, there might be a lack of strong connection between GDP growth and the promotion of mayors.

Based on these findings, combined with our previous discovery of promotion breakpoints, we can draw the following conclusions: GDP growth of each year primarily affects the chances of secretaries being promoted to primary vice-provincial-level positions next year before the age of 56, for secretaries aged 57 to 60, the assistance in promotion to the NPC and CPPCC is minimal, and for mayors, the influence of GDP performance on promotion to secretaries is limited.

5 Model

5.1 Model foundation

In Section 2, I explained that in China, both the Party secretary of a normal prefecture-level city and the mayor of a normal prefecture-level city hold the rank of prefecture level. However, prefecture secretary is typically the final step in the promotion process before becoming a vice-provincial-level official. In contrast, only 6 mayors were directly promoted to a vice-provincial-level position out of 611 mayor-prefecture pairs (583 mayors) in our dataset[3]. If mayors wish to be promoted to vice provincial-level officials, promotion to secretary is the

[3]Among these six individuals, one comes from a minority ethnic group, one is female, and another individual is both a member of a minority ethnic group and female. Additionally, two of them were previously directors of department in central government ministries and returned to central government ministries or departments directly under central jurisdiction as vice-provincial-level officials after serving in local government positions. In China, it is customary to have at least one female member in the provincial Party standing committee and one female vice-governor. In minority autonomous regions, both primary and secondary officials should include a certain proportion of officials from the minority ethnic group. Therefore, female and minority ethnic cadre sometimes have an advantage in receiving unconventional promotions. It is a common practice in central government ministries to temporarily assign senior officials at the prefecture-level who are being prepared for promotion or reassignment to work at the local governments for one or two years. This helps enrich their work experience. In fact, only one mayor during the period covered by my database, Chen Baocheng, the mayor of Dongguan Prefecture, was directly promoted to the vice-provincial-level cadre, becoming the vice governor of Guangdong Province.

most direct route. Over 80% of mayors who were eventually promoted to vice-provincial level positions first got promoted as prefecture secretary.

In Section 3, I showed that even though the official retirement age for prefecture-level officials is 60 years old, in practice, most prefecture secretaries and mayors do not stay in their positions until retirement. More importantly, from previous data analysis, we found that for prefecture Party secretaries, the latest age to be promoted to primary vice-provincial-level positions, such as vice governor or provincial standing committee member, is 56 years old. Therefore, if a prefecture Party secretary wishes to impress higher-level authorities with their economic growth performance, the latest time should be at the age of 55, as GDP statistics are usually completed and reported in February or March of the following year.

In Section 4, I presented the empirical result that prefecture Party secretaries with better economic performance are more likely to be promoted to primary vice-provincial-level positions. However, there is no significant correlation between a prefecture mayor's promotion to secretary and economic growth. Similarly, there is no significant correlation between a prefecture Party secretary's promotion to positions with vice-provincial-level privileges, such as vice chairman of the provincial People's Congress or vice chairman (NPC) of the provincial Committee of the Chinese People's Political Consultative Conference (CPPCC), and economic growth. Since prefecture Party secretaries typically hold the position for 3-4 years, and the initial economic performance largely depends on the policy effects left by their predecessors, our data demonstrates that the promotion of prefecture Party secretaries is most strongly related to economic performance in the year preceding their promotion and, but not to their economic performance at the beginning of their tenure.

For a prefecture Party secretary, promotion to a primary vice-provincial-level position carries significant benefits. Firstly, compared to the official retirement age of 60 for prefecture-level officials who can only hold the powerful position until 57 to 58 in most situations, vice-provincial-level officials can usually hold the powerful positions until the age of 60. They can also continue to hold a second-line position such as vice chairman of the provincial NPC or CPPCC until 63, thereby extending their political life and increasing political and living benefits every year thereafter. Secondly, promotion to a vice-provincial-level position

provides further opportunities for advancement[4]. Finally, promotion to a vice provincial-level position offers additional retirement benefits and privileges. Therefore, promotion to primary vice-provincial-level position is highly attractive for prefecture Party secretaries. In fact, this is also the major motivation for mayors to aspire to become prefecture Party secretaries even though mayors and secretaries are officials at the same rank, with similar benefits.

The selection and appointment of vice-provincial-level officials in a province are the result of discussions between the provincial standing committee of the Party and the central organization department. The promotion of a prefecture secretary to the position of vice governor or provincial standing committee member is usually an internal promotion within the province. Here, we do not specifically distinguish between the roles of the provincial standing committee and the central organization department; we collectively refer to them as higher-level authorities. Compared to the promotion of provincial officials or county-level officials, the connection between higher-level authorities and prefecture officials is less influenced by political or personal connections.

5.2 Model setup

In this section, we construct a theoretical model based on the standard career concern model (Holmström, 1999) and a decision-making model to maximize lifetime expected utility, to explain the decision-making process and outcomes of three important players in the promotion process of prefecture-level officials in China: the Prefecture Party Secretary (secretary), the Prefecture Mayor (mayor), and the Higher-Level Authorities. The model is testable through empirical methods based on our data.

First, we assume that the higher-level authorities simply want to identify the most capable officials, and all the utility from this promotion process is derived from promoting capable secretaries. The higher-level authorities cannot directly observe the abilities of the secretaries but can observe the GDP growth rate reported by each secretary each year.

For secretaries, the GDP growth rate they report at age "t" consists of three components.

[4]Until 2023, there are 27 officials coverd in my dataset that worked as prefecture secretaries or mayors in 2010-2015 serve as provincial secretary, minister, gorvernor or other full-provincial-level officials, some of them may become vice-national-level officials such as vice-prime-minister in 2027

$$GDPgrowth_{it} = a_i + m_{it} + \eta_{it} \tag{5}$$

On the right side, the first part is their ability, denoted as a_i, the second part is the manipulation decided by secretary which is the reported GDP growth minus what really happened, denoted as m_{it}, and the last part is the economic fluctuations, denoted as η_{it}, with expected value equal to zero. Both of the ability and fluctuations are objective and beyond secretary's control. Here t is the age at the end of current year, and we have t=n+t_0, t_0 as the age of secretary assigned as secretary and "n" as the difference between current year and t_0, which mean the n^{th} year as secretary could determine m.

Here m represents the GDP growth achieved through illegal or short-term means at the expense of the prefecture's future development. This may include but is not limited to excessive auctions of state-owned land to raise funds to increase investment to boost economic growth, negotiations with local companies to obtain advance tax payments in exchange for future tax exemptions, tacit approval of environmental violations or illegal construction by companies, and direct falsification of economic data, among other actions. Such behavior can boost GDP growth for the current year but harm future economic development. Moreover, due to the existence of audits and reporting mechanisms, it may be discovered by the higher-level authorities, leading to disciplinary action against the secretary and the loss of promotion opportunities or even their position.

5.3 Utility function of Secretaries

I assume that before the start of each year, the higher-level authorities will receive each prefecture Party secretaries' economic growth report of previous year and decided who to promote. Each secretary learn about promotion status at the beginning of each year. For given secretary i, if she fails to get promoted and have not reached actual retirement age at the end of this year t, she chooses m_{it} during the year t based on η_{it}, and then report $GDPgrowth_{it}$ to higher-level authorities.

For secretaries, each year they have probability of being promoted to a vice-provincial-

level position in the following year. As mentioned earlier, the probability of promotion is related to economic performance, which in turn is directly related to their ability.

Since at the beginning of each year, the central government sets economic growth targets for each province. Therefore, the provincial Party committee and provincial government establish a target for their jurisdiction that is typically equal to or higher than the national requirement. In majority cases (992/1372), the GDP growth rates reported by the prefectures will meet this target, since falling short of the target implies incompetence. Furthermore, I found there are 131 secretaries got real promotion and only 7 of them failed to meet both of the requirement from central government and provincial government[5]. From the Data, I found the density of GDP growth report is single peak and the peak location is slight higher than province requirement, showed by Figure 16. Since the density is decreasing after fulfill the requirements, for each extra unit of GDP growth given secretary reported, she will surpass less and less peers after fulfill the requirements after pass the peak of provincial requirement.

In conclusion, I assume that the probability of promotion, denoted as $p(g)$ with $p'(g) > 0$, $p''(g) \leq 0$ and $p(g) > 0$.

Here, we assume that secretaries are risk-neutral, so their utility function consists of a Bayesian utility function. If the secretaries' age still qualified for promotion before the start of next year, $t \leq 56$, the utility function of given year includes four components each year:

First is the basic utility of serving as a secretary, denoted as u_s.

Second, if they are promoted at the beginning of current year due to their GDP performance from the previous year, they receive additional utility as a vice-provincial-level official, denoted as u_e.

Third, if they are promoted at the beginning of current year due to their GDP performance from the previous year, after the decision making process, they will expect to receive additional retirement utility, denoted as u_r, and utility from extending political life (3 years in most cases) as a vice-provincial-level official.

[5]In fact among these 7 secretaries, 3 of them from provinces that no secretaries fulfill both of national requirement and provincial requirement at that year, which means it's very rare to get a real promotion without fulfill national and provincial requirement of GDP growth.

Fourth, if they don't get promoted in beginning of the current year, they incur a cost for the year based on the choice of m_t they made at the end of current year, and m_{t-1} from the previous year, denoted as $C_t(m_{t-1}, m_t)$.

As mentioned earlier, one of the primary methods to accelerate GDP growth in the short term is to increase government investment, which relies on raising more funds through various channels.The main methods for raising funds are through borrowing and land transfer fees. When the government issues bonds through urban investment groups or other economic entities, a higher debt ratio will correspondingly increase the cost of financing. Similarly, putting more land up for auction increases the supply of land and lowers the unit price of land. Both of these factors make fund raising an increasingly challenging process. Therefore, we assume C_{m_{t-1},m_t} is a convex and increasing function with weighted m_{t-1} and m_t, and $C_{m_{t-1},m_t} > 0$.

In conclusion, the utility function of each secretary at year t is:

$$U_{t_0+1} = u_s - C_{t_0+1}(m_{t_0}, m_{t_0+1}) \tag{6}$$
$$\text{if } t = t_0 + 1$$

$$U_{t_0+n} = u_s + u_e - \{\prod_{t=t_0+2}^{t_0+n} [1 - p_t(g_{t-1})]\} * [u_e + C_{t_0+n}(m_{t_0+n-1}, m_{t_0+n})] \tag{7}$$
$$\text{if } t_0 + 1 < t < 56$$

$$U_{56} = \{1 - \prod_{t=t_0+2}^{56} [1 - p_t(g_{t-1})]\} * u_f \tag{8}$$
$$\text{if } t = 56$$

Here we assure secretary assigned as secretary for a given prefecture at age t_0. Since many policies may have been determined by previous secretary so we assume there's m_0 as given. Except that, as this is not a full year, so we call this year as year 0 as secretary, and normalize the utility and cost from this year 0 equal to 0. Furthermore, it's very rare for secretaries getting promotion within a year after being assigned, we assume the probability of promotion of next year is 0.

Function (6) captures the total utility of year 1 as secretary, it only have two components, the basic utility as secretary and the cost from m, since probability of promotion at the beginning of year 1 is 0.

Function (7) captures the total utility of year n as secretary, the first two components capture the utility as primary vice-provincial-level official, and the third component captures the expect utility loss with probability that failed to get promoted at any year from year 2 to n.

Function (8) captures the expect total utility of retirement and extending of political life as primary vice-provincial-level official with probability that succeed to get promoted at any year from year 2 to 56.

Since the GDP growth reported by secretary is determined by function (5) and both of a_i and η_{it} are objective, each secretary can only choose m_{it}. Each secretary i, need to choose $(m_{t_0+1}, \dots, m_{55})$ to maximize the sum of utility over all years from the year 1 as secretary to retirement.

$$\begin{aligned} ExpectUtility_i = \quad & u_s * (1-\beta^{55-t_0})/(1-\beta) + \beta * u_e * (1-\beta^{54-t_0})/(1-\beta) \\ & - \sum_{n=2}^{55-t_0} \{\{\beta^{n-1} * \prod_{t=t_0+2}^{t_0+n} [1-p_{it}(g_{t-1})]\} * [u_e + C_{it}(m_{t-1}, m_t)]\} - C_{it_0+1}(m_{t_0}, m_{t_0+1}) \\ & + \beta^{57-t_0}\{1 - \prod_{t=t_0+2}^{57} [1-p_{it}(g_{t-1})]\} * u_f \end{aligned} \tag{9}$$

$$\text{if } t_0 < 54$$

Here the first line on the right side capture the total utility with time discount β as secretary and extra utility as primary vice-provincial-level official, the second line capture the total expect utility loss if a given secretary failed to get promotion at each year with time discount, and the cost of m at first year, the third line capture the expect total extra utility as primary vice-provincial-level official after retirement with time discount.

$$ExpectUtility_i = \quad u_s + \beta * p_{56}(g_{55}) * u_f - C_{55}(m_{t_{54}}, m_{t_{55}}) \tag{10}$$

if $t_0 = 54$

since $p'(m) > 0$ and $p''(m) \leq 0$ if $p(m) > 0$, and $\frac{\partial C(m_{t-1},m_t)}{\partial m_{t-1}} > 0$, $\frac{\partial C(m_{t-1},m_t)}{\partial m_t} > 0$, $\frac{\partial^2 C(m_{t-1},m_t)}{\partial m_{t-1}^2} > 0$ and $\frac{\partial^2 C(m_{t-1},m_t)}{\partial m_t^2} > 0$, there's solution $m^* = (m^*_{t_0+1}, \dots, m^*_{55})$.

5.4 Simple version of the model

In this case, I use a simple two-stage model to analyze the secretary's decision making. For simplicity, I assume the expectation of shock $\eta_{it} = 0$. I further assume the secretary could only choose $m \neq \tilde{m}$ at one single age, either at age 54 or age 55, and for all other age, we have $m_t = \tilde{m}$ and setting $g_t = \tilde{g}$. I also assume m of previous year and m of current year have same influence on cost of current year, which means $\frac{\partial C(m_{t-1},m_t)}{\partial m_{t-1}} = \frac{\partial C(m_{t-1},m_t)}{\partial m_t}$. At last, I assume $p_t(g_{t-1}) = \tilde{p}$ for all t except at age 54 and 55, and $p'(g_{t-1}) > 0$ and $p''(g_{t-1}) < 0$. Since utility before age 54 is independent with choice of m_{54} and m_{55}, and choice of change m_{54} or m_{55} have exact same influence on change of U_{56}, so the secretary choose to change m at either age 54 or age 55 to maximize: $U_{54} + \beta * U_{55}$

If secretary choose to change m_{54}, then need to max:

$$\begin{aligned} U_{54} + \beta * U_{55} \;=\; & u_s + u_e - (1-\tilde{p})^{53-t0}[u_e + C(\tilde{m}, m_{54})] \\ & + \beta * \{u_s + u_e - (1-\tilde{p})^{53-t_0} * (1-p_{54})[u_e + C(m_{54}, \tilde{m})]\} \end{aligned} \tag{11}$$

If secretary choose to change m_{55}, then need to max:

$$\begin{aligned} U_{54} + \beta * U_{55} \;=\; & u_s + u_e - (1-\tilde{p})^{53-t0}[u_e + C(\tilde{m}, \tilde{m})] \\ & + \beta * \{u_s + u_e - (1-\tilde{p})^{54-t_0}[u_e + C(\tilde{m}, m_{55})]\} \end{aligned} \tag{12}$$

Marginal utility of changes m_{54} from $\tilde{m}$ is:

$$\begin{aligned} \left.\frac{dU_{54}}{dm_{54}}\right|_{m_{54}=\tilde{m}} = & -(1-\tilde{p})^{53-t_0} C'_{54} + \beta(1-\tilde{p})^{53-t_0} p'_{54} u_e \\ & - \beta(1-\tilde{p})^{53-t_0} C'_{54} + \beta(1-\tilde{p})^{53-t_0} p_{54} C'_{54} + \beta(1-\tilde{p})^{53-t_0} p'_{54} C_{54} \end{aligned} \tag{13}$$

Marginal utility of changes m_{55} from $\tilde{m}$ is:

$$\left.\frac{dU_{55}}{dm_{55}}\right|_{m_{55}=\tilde{m}} = -\beta(1-\tilde{p})^{53-t_0} C'_{55} + \beta(1-\tilde{p})^{53-t_0} \tilde{p} C'_{55} \tag{14}$$

The difference between $\frac{dU_{54}}{dm_{54}}\Big|_{m_{54}=\tilde{m}}$ and $\frac{dU_{55}}{dm_{55}}\Big|_{m_{55}=\tilde{m}}$ is:

$$\frac{dU_{55}}{dm_{55}}\Big|_{m_{55}=\tilde{m}} - \frac{dU_{54}}{dm_{54}}\Big|_{m_{54}=\tilde{m}} = \beta(1-\tilde{p})^{53-t_0}[C' - \beta p'(u_e + C)] \tag{15}$$

Here $C' = \frac{\partial C(\tilde{m},m_{54})}{\partial m_{54}}\Big|_{m_{54}=\tilde{m}} = \frac{\partial C(\tilde{m},m_{55})}{\partial m_{55}}\Big|_{m_{55}=\tilde{m}}$, $C = C(\tilde{m},\tilde{m})$, $p(\tilde{m}) = p$, $p'_{54}(\tilde{m}) = p'_{55}(\tilde{m}) = p'$. From section 4, we know for secretary, report each extra unit of GDP growth rate would give less than 1% of probability getting promoted to primary provincial position, which means the p' is relative small. Assume $C' > \beta p'(u_e+C)$, we have $\frac{dU_{55}}{dm_{55}}\Big|_{m_{55}=\tilde{m}} - \frac{dU_{54}}{dm_{54}}\Big|_{m_{54}=\tilde{m}} > 0$. Intuitively, at age 55, there's no future potential cost for manipulate GDP growth since the secretary will leave the office no mater getting promotion or not. As long as the extra utility as primary vice-provincial-level official for single year is not huge enough, secretary should have more incentive to manipulate GDP growth at age 55 instead of age 54. Furthermore, if we assume in different provinces k, the $p_k(g)$ is different for same GDP growth reported, assume province k with higher probability for promotion than province j, we should have $p_k > p_j$ when $p'_k(\tilde{m}) = p'_j(\tilde{m}) = p'$. Then for same p', $\beta(1-p)^{53-t_0}[C' - \beta p'(u_e + C)]$ decreasing with p, that means the difference between marginal utility of manipulation for secretary at age 55 and at age 54 should be smaller at provinces with more chances of promotion.

Similarity, we could have

$$\frac{dU_{t_0+1}}{dm_{t_0+1}}\Big|_{m_{t_0+1}=\tilde{m}} - \frac{dU_{t_0+2}}{dm_{t_0+2}}\Big|_{m_{t_0+2}=\tilde{m}} = (\beta^2 - 1 - 2p\beta^2 + p^2\beta^2)C' + \beta p'(u_e + C)$$
$$\text{if } t_0 < 54$$

Based on previous literature (Wang et al., 2009), the time discount β for Chinese people is around 0.74, with significant positive correlation with Male, Age and education background of Economics, so here I simply use $\beta = 0.8$. From Section 2 I calculated that on average, 9.3% of secretaries got promoted to primary vice-provincial-level position each year. Exclude those secretaries in office within a year that normally unqualified for promotion, here I use $\tilde{p}$=0.1. Then we could have

$$\frac{dU_{t_0+1}}{dm_{t_0+1}}\Big|_{m_{t_0+1}=\tilde{m}} - \frac{dU_{t_0+2}}{dm_{t_0+2}}\Big|_{m_{t_0+2}=\tilde{m}} \approx \beta p'(u_e + C) - 0.5C'$$

If we further assume $C' > 2\beta p'(u_e+C)$, which means the $\frac{dU_{t_0+1}}{dm_{t_0+1}}\Big|_{m_{t_0+1}=\tilde{m}} < \frac{dU_{t_0+2}}{dm_{t_0+2}}\Big|_{m_{t_0+2}=\tilde{m}}$, that secretaries would have higher and higher incentive to manipulate the GDP growth until

the final stage. If we have $C' < 2\beta p'(u_e + C)$, which means the marginal utility decreasing by age until before the final stage, then we should observe U-shaped relationship between the reported GDP growth on average by secretaries' age and the age of secretary. More importantly, we know:

$$\left.\frac{dU_{t_0+1}}{dm_{t_0+1}}\right|_{m_{t_0+1}=\tilde{m}} - \left.\frac{dU_{t_0+2}}{dm_{t_0+2}}\right|_{m_{t_0+2}=\tilde{m}} = (\beta^2 - 1 - 2\tilde{p}\beta^2 + \tilde{p}^2\beta^2)C' + \beta\tilde{p}'(u_e + C)$$

increasing with $\tilde{p}$ if we control p', that means we should observe the GDP growth reported at age $t_0 + 1$ and age $t_0 + 2$ are closer at provinces with higher probability for promotion compare to provinces with lower probability for promotion. In conclusion, the U shape curve should be flatter at provinces with higher probability for promotion compare to provinces with lower probability for promotion.

To more concretely demonstrate this model, I have defined a series of specific functions according to the trends in the data and in combination with assumptions, which have been incorporated into the model. For details, please see the appendix.

5.5 Decision making of Higher authority

Next, we can further assume that if the higher-level authorities observe these reported results and understands the motivations of prefecture Party secretaries, what should they do? The higher-level authority's motivation is to select secretaries with higher ability (a), not necessarily higher reported GDP growth (g). The higher-level authorities can only observe the GDP growth reported by secretaries but also knows the age of each secretary. Therefore, if the higher-level authority believe secretary does not make strategic moves but simply makes decisions based on the decision model mentioned earlier, the higher-level authorities will adjust their expectations of the secretary's true ability based on the age of the secretary.

Assume the utility of higher-level authorities is:

$$V = E(U(a|g, age)) + X$$

Here X captures all other unobservable factors higher-level authorities care about promotion, such as political connection or personal taste. For simplicity, I assume X is independent with g and t, and E(X)=0. Assume higher-level authorities will promote secretary if $V > \bar{u}$, then

we have $g^*(age) = a^* + E(m|age)$ for secretary at different age solves $E(U(a|g, age) = \bar{u}$. Since we have already know that secretary would have higher incentive to manipulate GDP growth at age 55 compare to age 54, we know $E(m|age = 55) > E(m|age = 54)$. In order to select secretaries with expected ability no less than a^*, higher-level authority should set $g^*(age = 55) > g^*(age = 54)$, which means we should observe that the higher-level authorities have different promotion standards for secretaries of different ages.

However, if secretary finds out that higher-level authority sets different promotion standard depends on secretary's age, then secretary will have less incentive to over-report GDP growth at the age they should over-report more originally solved by Equation 9. On the other side, secretary will have more incentive to over-report GDP growth at the age they should over-report less originally. As a result, the difference between promotion standard at different age should be less significant. Even if secretary report GDP growth strategically, since the higher-level authority will update belief, so in the equilibrium situation there will still be different promotion standards at different age, but the difference will be less. Unfortunately, I could not distinct whether the different standard of promotion is the equilibrium situation that both secretary and higher-level authority behave strategically, or simply because secretary just solve their decision-making model and not find out higher-level authority know their trick and set different promotion standard.

5.6 Example of mayor's choice

Finally, for the mayor, the motivation is more complex. First, if the secretary get promotion, there is higher probability for the mayor to succeed as the secretary if mayor is qualified, which means by helping secretary manipulate GDP growth, mayor could slightly increase the probability of getting promoted to secretary. Even though we found there's no significant correlation between mayor's promotion and GDP performance in Section 5, it could because only very limited number of secretaries get promoted to primary vice-provincial-position at the same time mayors of same city are qualified for promotion. Second, the mayor would consider their own future in the succeeding years, which means over-report GDP growth will increase future cost of manipulation after succeeding as secretary. Third, if mayor choose not to cooperate with secretary, there would be social cost.

For simplicity, here I focus on a special case about what mayors would do when the secretary of same city at age 55. From previous sub-section, we know secretary would have high incentive to bump the GDP performance at age 55. More importantly, compare to secretaries younger than 55, secretary at age 55 would be more likely to leave the office in next one or two years. As a result, even if secretary at age 55 didn't get a promotion next year, it would be very likely for the mayor to succeed as secretary in next one or two years. Then we could assume the GDP performance will have no influence on mayor's promotion.

Then the utility function of mayor when the secretary she paired with at age 55 is:

$$U(l) = \beta * Q(t) * E[u_s - C(m_s - l, m)] - s(l)$$

Here t is the round up term by year as mayor until the end of year and we have Q(t)=1 if $t \leq 3$ which means normally mayor who has serve as mayor at least for 2.5 years will automatically succeed as secretary if secretary leave the office. And Q(t)=0 if $t < 3$ since the higher authorities could be more likely assign another secretary for mayors with less experience especially those who are not assigned by central or provincial government with prefecture-level before appointment as mayor. l is the cooling down effect that mayor want to reduce from m_s decided by secretary, with $\frac{dC(m_s-l,m)}{dl} < 0$. s($l$) is the social cost with secretary because of l, with $s^{'}(l) > 0$. We know

$$\frac{dU}{dl}(Q=1) = -\frac{dC(m_s - l, m)}{dl} - s^{'}(l) > -s^{'}(l) = \frac{dU}{dl}(Q=0)$$

which means only mayors qualified for succeed as secretary have incentive to reduce the m_s decided by secretary at age 55.

Redefine

$$t = \frac{(year - Mayor\_startyear) * 12 + 3 - Mayor\_startmonth}{12}$$

as the exact length in office as mayor until next March to report the GDP growth rate. We could further generalize Q(t) from binary function to continues function with $Q'(t) > 0$, which means the probability for mayor to succeed as secretary when incumbent secretary leave the office increase with the length mayor in office. We should have $MU_l(t)$ increase with t, therefore $l^*(t)$ increase with t, which means mayors the longer stay in office, the more willing to reduce the GDP growth over reported by secretary at age 55.

6 Empirical Result

6.1 Summary of testable predictions

There are five testable predictions concluded from previous section.

Prediction 1: Secretaries have more incentive to boost GDP growth at age 55, compare to age 54 and age 56.

Prediction 2: Compare to provinces with higher promotion rate, secretaries from provinces with lower promotion rate have more incentive to boost GDP growth at age 55.

Prediction 3: Higher level authority have incentive to set different promotion standards for secretaries at different age.

Prediction 4: Mayors have incentive to boost GDP growth at age 54 since it's the last chance to promote as secretary with probability of promotion to primary vice-provincial-level position.

Prediction 5: Mayors with higher probability to succeed as secretary have more incentive to reduce the manipulation of GDP growth made by secretaries.

6.2 Last chance for secretary

Prediction 1:

Secretaries have a greater incentive to boost GDP growth at age 55 since the next year is their last chance to be promoted to a primary vice-provincial-level position, and there is less future cost for over-reporting GDP growth at this age. However, fabricating GDP data comes with costs, which encompass two aspects: 1) the risk of detection by the discipline committee, and 2) the potential complications of future manipulation in subsequent years as a result of previous manipulations. Importantly, the motivations for secretaries and mayors differ when it comes to data fabrication.

Firstly, secretaries and mayors have different potential rewards that they can obtain through data fabrication. As summarized earlier, secretaries can significantly increase their chances of direct promotion to a position with real authority at the vice-provincial-level by improving GDP performance, creating a strong incentive for such promotion. However, the

same does not hold true for mayors. It's extremely rare for "normal" prefecture mayors (those where the prefecture secretary is not a standing member of the provincial party committee, not the capital of the province, and not the most/second most important prefecture of the province) to be promoted to any vice-provincial-level positions.

Furthermore, secretaries have a motivation to start manipulating GDP data in their first year of office because by the second year when the data is published, they will have completed one year in their position and become eligible for promotion. Secretaries need to be cautious about manipulating GDP growth too significantly in a certain year, as if they artificially inflate the growth and don't receive a promotion in the following year, it could make it harder to manipulate data in the future and reduce their chances of promotion. However, for secretaries who are 55 years old, this concern might not apply, since secretaries over 55 has barely no incentive to manipulate data. As a result, there's two sharp changes, one happened between age 54 and age 55, that for secretaries at age 54 or earlier, they need to worry about the potential future cost of GDP manipulation, but for secretaries at age 55 or later, they don't need to worry about that. The other change happened between age 55 and age 56, for secretaries at age 55 or earlier, they have incentive to bump the GDP growth, but for secretaries at age 56 or later, they have no incentive to do so. This explains why secretaries at the age of 55 might be more inclined to manipulate data. To test the prediction of my model that secretary at age 55 have more incentive to manipulate GDP than secretary at other age, I ran the following regression:

$$GDPgrowth_{ct} = a + bSecAge55_i + cSecExperience_{it} + dSec_{it} + fCity_{ct} + \delta_c + \eta_t + \epsilon_{ict} \tag{16}$$

Here, I am interested in the second term on the right side, which is a 0/1 variable for 55-year-old secretaries. 0 represents secretaries of other ages, while 1 represents secretaries at aged 55. The results I found are shown in Table 7. It's evident that secretaries at aged 55 report higher GDP growth (0.7% of growth rate) than secretaries of other ages when controlling for other variables.

Since age of secretary may correlated to many other characters, I only compare if there's

similar effect when secretary at age 54. I checked the balance of each control variables and result showed on Table 8. Then I replace the dummy of SecAge55 by SecAge54 and rerun the regression, I didn't find secretaries at aged 54 report higher GDP growth. Result showed on Table 9. Then I checked all other potential ages from 50-53, result showed on Table 10. I also observed that secretaries over the age of 56 had significantly lower GDP performance, results showed on Figure 17.

To test whether this effect arises from genuine additional effort or data manipulation, we replaced the locally published GDP data on the left side with other indicator of economic development such as the growth in satellite nighttime light and electricity consumption. The results indicated that secretaries at aged 55 do not show a significant relationship with these indicator that difficult to manipulate. Therefore, I believe this significant change likely stems from the manipulation of GDP data in pursuit of promotion. Furthermore, I use the government investment as dependent variable and found secretaries may increase government investment to boost the GDP growth, result showed on Table 11.

6.3 Heterogeneity of provinces

Prediction 2

Compared to provinces with higher promotion rates, secretaries from provinces with lower promotion rates have a greater incentive to boost GDP growth at age 55. In China, the probability of secretaries of prefecture-level cities getting promoted varies significantly among different provinces, primarily due to three factors.

First, in China, except for Xinjiang and Xizang (Tibet), each province has a maximum of 13 standing committee members and up to 8 vice governors. Among these 13 standing committee members, few positions are not open for secretaries of prefecture-level cities to get promoted. The provincial Party secretary and the governor are full-provincial-level officials, and the vice Party secretary is often considered the most senior vice-provincial-level official, which is the final step before promotion to full-provincial-level. In the time frame covered by the database, there are no examples of secretaries from regular prefecture-level cities being promoted to the position of vice province Party secretary. Additionally, the province commission for discipline inspection is under vertical management, and the secretary is typically

appointed by the central commission for discipline inspection. Moreover, one member of the standing committee represents the local military force, holding the rank of major general. As a result, only a maximum of 8 positions can theoretically be promoted directly by secretaries of prefecture-level cities. In practice, some positions, such as executive vice provincial governors and the director of the provincial organization department, are rarely directly promoted by secretaries of prefecture-level cities. Among the vice governors, the highest-ranking vice governor, usually known as the executive vice provincial governor, is conventionally held by a member of the provincial standing committee. In some places, the second-ranking vice governor can also become a member of the provincial Party standing committee. By convention, one vice governor is not a member of the Communist Party. Therefore, there are typically only 5 to 6 positions available for direct promotion by secretaries of prefecture-level cities. In practice, the Party standing committees and vice governors may not be fully staffed for a long time, and it is quite common to have a vacancy for one standing committee member or vice governor. In summary, only about 10 positions are typically available for direct promotion by secretaries of prefecture-level cities. Therefore, for larger provinces with a higher number of regular prefecture-level cities in their jurisdiction, such as Guangdong (which has 19 regular prefecture-level cities, excluding the vice-provincial-level cities of Guangzhou and Shenzhen), the difficulty of promotion is higher compared to provinces with fewer regular prefecture-level cities, such as Zhejiang (which has 9 regular prefecture-level cities, excluding the vice-provincial-level cities of Hangzhou and Ningbo).

Second, there is a significant difference in economic development between different provinces in China. Guangdong Province, with the highest total GDP in 2022, had a total GDP exceeding 1.9 trillion in US dollars, while Qinghai Province, with the lowest total GDP, had less than 54 billion (excluding Xizang(Tibet), which has the lowest total GDP in China). Excluding border areas, traditional ethnic minority regions and Hainan Province, Gansu Province has the lowest total GDP, with a total GDP of only 167 billion. After the implementation of reform and opening up, the eastern regions were the first to achieve rapid development, and as a result, the central government transferred officials from economically developed southeastern coastal areas to regions with lower economic development, such as the northeast, northwest, and southwest. Therefore, many officials from central government

and vice-provincial-level officials from more developed provinces are assigned to less developed provinces, rather than promoting local officials within these less developed provinces. For example, as mentioned earlier, in Gansu Province (which has 13 regular prefecture-level administrative units, excluding the provincial capital, Lanzhou, where it's conventionally held by a provincial standing committee member as the party secretary), the probability of secretaries of prefecture-level cities being promoted to primary vice-provincial-level positions is lower compared to more developed provinces such as Shandong province (which has 14 regular prefecture-level administrative units, excluding the vice-provincial-level cities of Jinan and Qingdao).

Third, there are political reasons that will not be further discussed here.

I calculated the total number of secretaries from 2010 to 2015 and how many secretaries got promoted to primary vice-provincial-level positions, including provincial standing committee members and vice governors, in each province. I simply set the average probability of promotion to primary vice-provincial-level positions for secretaries of normal prefecture-level cities.

$$\bar{p}_k = \frac{total\ number\ of\ secretaries\ getting\ promoted\ to\ primary\ vice-provincial\ position}{total\ number\ of\ secretaries}$$

There are 24 provinces in my database and I found $\bar{p}$ is varies from 0.03 to 0.17, exclude Qinghai province with only one normal prefecture-level city after excluding prefecture-level minority autonomous district and provincial capital.

Compare to prefecture secretary from provinces with higher promotion rate, who decide to report a given GDP growth rate to achieve a certain probability of promotion, prefecture secretary from provinces with lower promotion rate need to report higher GDP growth rate to achieve same promotion probability.

Compare to prefecture secretary from provinces with higher promotion rate, prefecture secretary from provinces with lower promotion rate, reporting one additional percentage of GDP growth will surpass less colleagues, since the density decrease with growth rate reported after full-fill the provincial requirement.

As a result, we know the marginal utility of manipulation at age 55 compare to manipula-

tion at age 54 would be higher for secretaries from provinces with lower promotion probability than from provinces with higher promotion probability. Secretaries from high promotion rate provinces will have less incentive to manipulate GDP at age 55 compare to manipulate at age 54 and secretaries from low promotion rate provinces will have more incentive to manipulate GDP at age 55 compare to manipulate at age 54.

I also run the regression of Equation 16 separately with data of top25 % provinces and bottom 25% provinces on $\bar{p}$, the result showed on Table 12. I found secretary from provinces with low probability of promotion reported significant higher GDP at age 55. Secretaries reported about an extra 1% of GDP growth compare to the average GDP growth reported by secretaries at other age, which is 10.7%.

Since we found there's no positive correlation between GDP growth reported and age of secretary, if I assume $C' < 2\beta p'(U_e + C)$, that means we should observe the U-shape relationship between GDP growth reported and age of secretary, and the curve should be flatter at provinces with higher probability of promotion.

To test this prediction, I compared average of GDP growth reported by secretary i at year t minus average GDP growth of province k at year t, reported by prefecture secretaries with different age, which is:

$$\overline{GDPgrowth\ by\ age} = \overline{GDPgrowth_{ct} - \overline{GDPgrowth_{kt}}}$$

from 6 provinces with highest $\bar{p}$ (top 25%) and 6 provinces with lowest $\bar{p}$ (bottom 25%), showed on Figure 18.

6.4 Different standards for secretary

Prediction 3

Higher-level authorities have an incentive to establish different promotion standards for secretaries of different ages. This is because if higher-level authorities understand the motives behind local Party secretaries falsifying GDP growth, they should adjust their belief in the ability of these secretaries based on their behavior. The goal of higher-level authorities is to select capable individuals who can drive genuine economic growth, rather than those who simply report higher GDP growth rates.

For secretaries aged 54 and 55, their differences in other dimensions are minimal. Therefore, if higher-level authorities do not have information about which year secretaries are likely to manipulate GDP growth data, the promotion criteria for 54-year-old and 55-year-old secretaries should be similar. In other words, the average GDP growth rate for promoted 54-year-old secretaries should be similar to that of promoted 55-year-old secretaries.

However, if higher-level authorities can predict that secretaries are more likely to manipulate GDP growth data in their last year when they can directly promote to primary vice-provincial-level positions, then they should establish different promotion criteria. Assuming that 55-year-old secretaries might have inflated their reported GDP growth rates compared to 54-year-old secretaries, higher-level authorities can raise the promotion criteria for the former to eliminate this inflation. This ensures that promoted 55-year-old secretaries have capabilities similar to those promoted at the age of 54. In fact, higher authorities could set different promotion standards for different ages, resulting in varying average GDP performance reported by secretaries who are promoted to primary vice-provincial positions the following year, as depicted in Figure 19.

Furthermore, based on our model, even when comparing only those secretaries who were promoted to primary vice-provincial-level positions, we should still observe that 55-year-old secretaries reported higher GDP growth rates, as shown in Table 13. I found that Party secretaries at age 55 have to report, on average, a 1.45% higher GDP growth rate (12.5% of the average GDP growth rate in my data) than Party secretaries at other ages to secure their promotions. However, I didn't find such effect at other ages.

I also tested whether different promotion standards based on age lead to variations in the promotion rates for each age group. However, there was no significant difference among the ratios of secretaries getting promoted to primary vice-provincial positions at each age, as shown in Figure 20.

6.5 Ambition of mayors

Prediction 4

As mentioned earlier, mayors' promotions are weakly connected to GDP performance. However, if mayors aspire to further their careers, the most likely route is to become a

secretary, with the easiest path being promotion to the same prefecture city's secretary after the incumbent secretary is promoted.

More than 80% of mayors who eventually get promoted to vice-provincial-level or higher positions have prior experience working as secretaries, and over 70% of mayors are promoted to the position of secretary within the same city after the previous secretary is elevated to the vice-provincial level. After mayors are promoted to secretary, they need to work in that position for at least one year to have a chance for further promotion (only one mayor became a vice-provincial-level official within a year after being promoted to secretary in my dataset).

Therefore, we can infer that if a mayor is involved in the secretary's GDP growth manipulation plan and the secretary gets promoted as planned, the mayor has a high likelihood of succeeding the secretary. In the following one or two years, it would be difficult for the mayor to manipulate data, thereby reducing their future chances of promotion.

Since the last opportunity for secretaries to receive a promotion based on GDP performance is at the age of 56, even though mayors can be promoted to secretary before the age of 57 based on our statistical summary, the last opportunity for mayors to succeed as secretary with a probability of receiving further promotion to a primary vice-provincial-level position based on GDP performance is at the age of 54. During the final opportunity for mayors to be promoted to vice-provincial-level positions, particularly at ages 53-54, a certain level of effect similar to that of 55-year-old secretaries is observed.

I conducted the following regression:

$$\begin{aligned} GDPgrowth_{ct} = a + bMayorAge54_{it} + cMayorExperience_{it} \\ + dMayor_{it} + fCity_{ct} + \delta_c + \eta_t + \epsilon_{ict} \end{aligned} \tag{17}$$

I found the coefficient of dummy of MayorAge54 is positive and significant, which means mayors reported significant higher GDP at age 54, results showed on Table 14. However, such effect does not exist if we use data more difficult to manipulate such as night light or electricity instead of GDP growth reported. Furthermore, I didn't find any positive effect at age 56 (there's even unstable negative effects, showed on Table 14) for mayors even if age 57 is the last chance for mayors to get promoted to secretary. This shows the true incentive for mayors to manipulate GDP growth is to use secretary as a step-stone to get further

promotion to vice-provincial-level officials, especially to primary vice-provincial-level position and if can't get further promotion, getting promoted to secretary itself is less attractive. This ambition also makes mayors have incentive to reduce the manipulation made by secretaries, if mayors believe they have higher enough probability to succeed as secretary next year, which would be discussed in next subsection.

6.6 Help or not

Prediction 5

As mentioned earlier, the average term for a mayor is around 3.3 years. Consequently, the probability of succeeding a secretary varies during different periods of a mayor's tenure. For instance, if a mayor just takes the office and the secretary immediately steps down, it's more likely that a new secretary will be appointed rather than promoting the mayor directly. Therefore, for a mayor in office for just one year, there might be motivation to cooperate with the secretary in data manipulation, since it's less likely for a mayor to succeed them. However, if a mayor has been in office for three years or longer, the succession to secretary might be more expected. Additionally, if a 56-year-old secretary is not promoted, there's still a high probability of them leaving their position. In such a scenario, cooperating with the secretary in data manipulation holds little benefit for the mayor. Furthermore, since mayors and secretaries both hold the position of prefecture-level officials and don't have significant rank differences or strict hierarchical relationships, mayors have the ability to refuse requests from secretaries to manipulate data.

As a result, if the hypothesis presented earlier regarding mayors being able to counterbalance secretaries is indeed valid, we should observe that the effect of secretaries manipulating data at the age of 55 primarily comes from mayors stay in office for only one or two years, since they are less likely to succeed as secretary. Consequently, I ran the following regression:

$$\begin{aligned} GDPgrowth_{ct} = a &+ bSecAge55_{it} + cMayor\_over2years_{ict} \\ &+ dSecAge55_{it} * Mayor\_over2years_{ict} + fSecExperience_{it} + gSec_{it} \\ &+ hMayorExperience_{it} + mMayor_{it} + nCity_{ct} + \delta_c + \eta_t + \epsilon_{ict} \end{aligned} \tag{18}$$

In this case, we are interested in the interaction term. The first part of the interaction term is the binary variable representing whether the secretary is 55 years old or not as discussed earlier. The second part represents a dummy variable indicating whether the mayor is experienced, where 1 denotes that the mayor has begun their second or more full year term in office (i.e., experienced mayor with more likely to succeed as secretary if secretary get promotion after report GDP growth at the beginning of next year), and 0 represents the opposite scenario. The other two variables on the right side are control variables related to mayors. The results I found are shown in Table 15. I also ran regressions without controlling for the situation of secretaries, and the results remained stable. It can be observed that the effect of secretaries manipulating data at the age of 55 indeed comes mainly from their collaboration with less experienced mayors, indicating the presence of a check and balance mechanism between mayors and secretaries.

For a mayor, the probability of succeeding as a secretary when the incumbent secretary leaves is correlated with the number of years served as mayor. If the prediction is correct, we should observe that for mayors in office for more than two years but less than five years (one term), the longer they serve as mayor, the more likely they are to succeed after the incumbent secretary leaves. Typically, mayors do not assume the position of secretary within two years of taking office as mayor. For the very few officials who are promoted to secretary within this short period, they are mostly individuals sent down by higher-level institutions with the intention of training and promoting them. Their behavior and circumstances differ significantly from those of regular mayors. Additionally, the probability of a mayor who has served for more than one full term, i.e., five years, becoming the secretary is not correlated with their time in office. The reason is quite simple: if a mayor has been in office for five years and has not been promoted, it is more likely due to deliberate arrangements made by the higher-level government.

This also implies that the longer mayors stay in office (over two years but within five years) the more they inclined to reduce the manipulations carried out by the secretary at age 55. To test this, I run the following regression:

$$
\begin{aligned}
GDPgrowth_{ct} = a &+ bSecAge55_{it} + cSecAge55_{it} * Mayorlength_{ict} \\
&+ dSecExperience_{it} + fSec_{it} + gMayorExperience_{it} + mMayor_{it} \\
&+ nCity_{ct} + \delta_c + \eta_t + \epsilon_{ict}
\end{aligned} \tag{19}
$$

I observed that the reported GDP growth by the secretary at the age 55 decreases with the length of time the mayor is in office increases. Results showed on Table 16.

7 Conclusion

In this paper, I initially confirmed the existence of a tournament model, where in higher-level authorities promote officials based on their GDP performance. Specifically, at the prefecture-level, prefectural Party secretaries with better economic performance are more likely to be promoted to primary vice-provincial-level positions. However, promotions to positions such as vice president of the provincial People's Congress or Political Consultative Conference, which hold less power and are more about length as secretary and prefecture level official, show no significant correlation with in-office GDP performance. Similarly, mayors' promotions are also not significantly related to GDP performance but significantly positive correlated to length in office.

Summarizing the promotions of over 500 secretaries, we found that the final age for prefecture-level Party secretaries to be promoted to primary vice-provincial-level positions is 56. Since Chinese local governments usually announce the previous year's GDP data in March of the following year, prefectural Party secretaries have an incentive to manipulate data at the age of 55 in order to secure their promotion by the time they turn 56, without incurring future potential costs of manipulation. Our findings were supported by nighttime light data and electricity consumption.

Higher-level authorities would observe secretaries' incentive for manipulation at age 55 and establish higher promotion standards based on this to ensure that when promoting prefectural Party secretaries at the age of 55, their reported GDP growth rates are more accurate and reliable, rather than being influenced by manipulated data. This helps ensure

the selection of more capable and performance-driven officials, rather than just those skilled at exaggerating GDP growth rates.

The primary motivation for mayors seeking promotion to the position of Party secretary is to pursue chances of further promotion to become primary vice-provincial-level officials, as the role of prefectural secretary is viewed as only a stepping stone. Since mayors, especially those who are experienced, are likely to succeed secretaries either due to promotion or retirement of the current secretaries, incumbent mayors who hold office for over 2 full years at the end of year choose not to engage in data manipulation, as it could affect their future economic performance if they succeed the secretary position, thereby reducing their probability for further promotion. Additionally, the balanced status of secretaries and mayors empowers mayors to resist secretaries' requests to manipulate data. Therefore, the effect of secretaries' data manipulation at the age of 55 is primarily attributed to the collaboration of relatively junior mayors, highlighting how the presence of mayors can act as a check on secretaries, such that reduced short-sighted economic policies solely aimed at promotion and ensured long-term development.

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Appendix

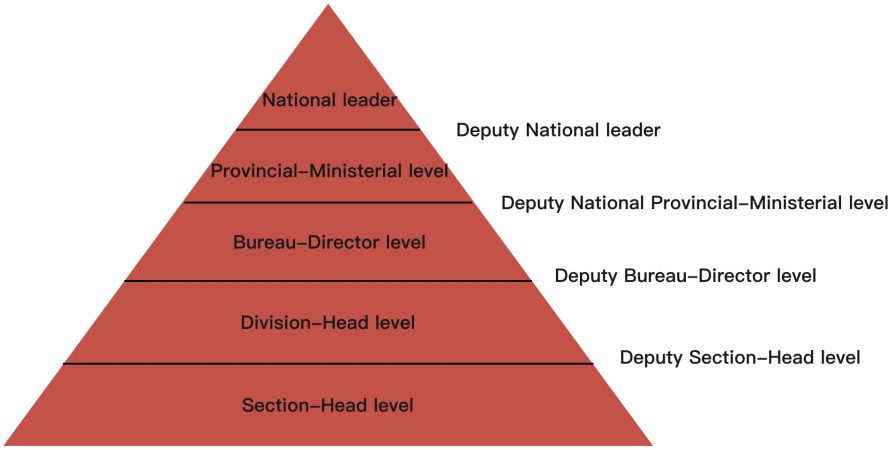


Figure 1: Hierarchy in China (Page 5)

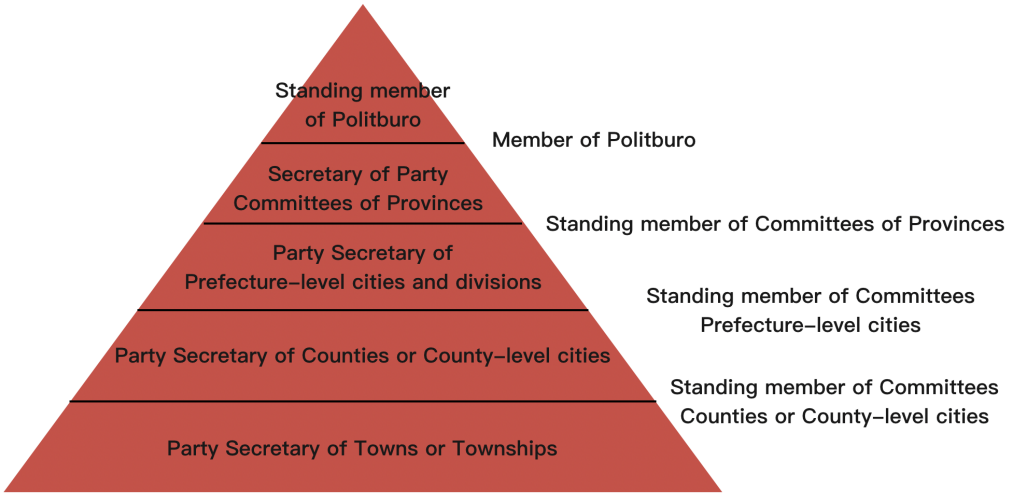


Figure 2: Level of Party (Page 5)

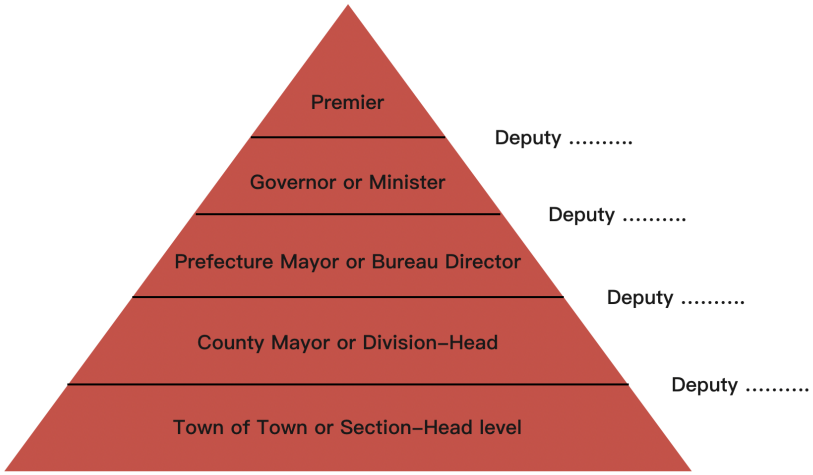


Figure 3: Level of Government (Page 5)

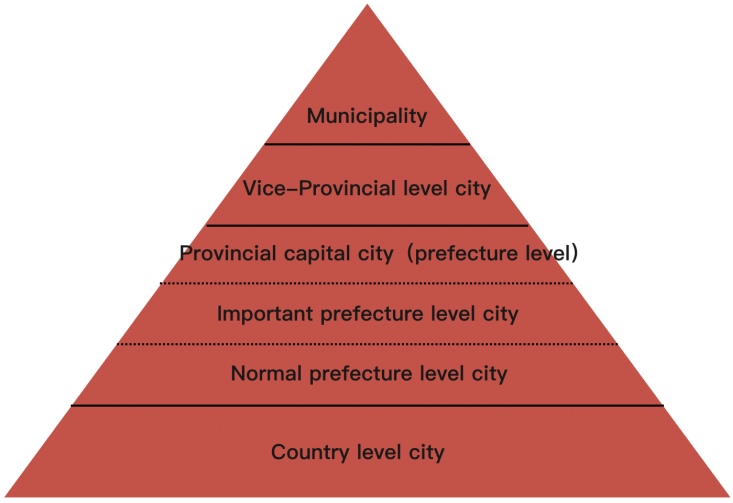


Figure 4: Level of City (Page 7)

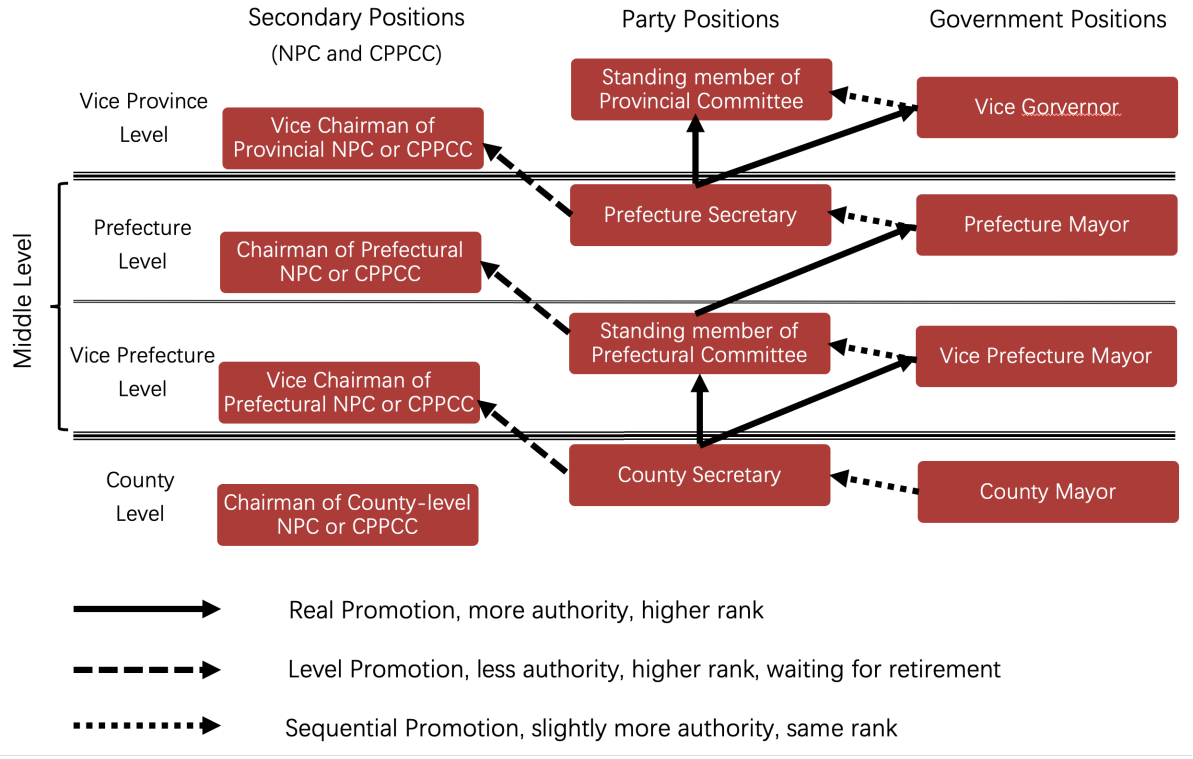


Figure 5: Promotion Sequence In Modern China (Page 11)

Note: It's very rare for a standing member of provincial or prefectural committee to be directly promoted to the position of provincial or prefectural secretary, bypassing the role of governor or mayor. An exception to this occurs in Autonomous Districts or Prefectures of Ethnic Minorities, where the governor or mayor is typically selected from officials belonging to an ethnic minority. However, even not the main stream of promotion, it's possible for county or prefectural secretary promoted to the position of standing member of provincial or prefectural committee, bypassing the role of vice governor or vice mayor.

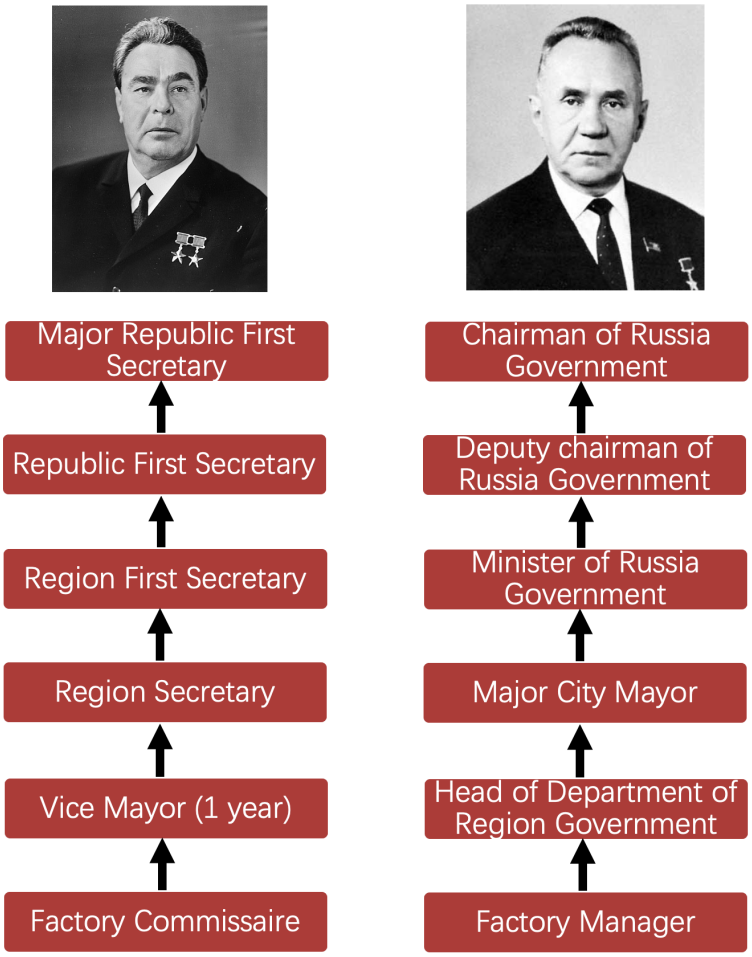


Figure 6: Promotion Trajectory of Leaders of the USSR (Page 12)

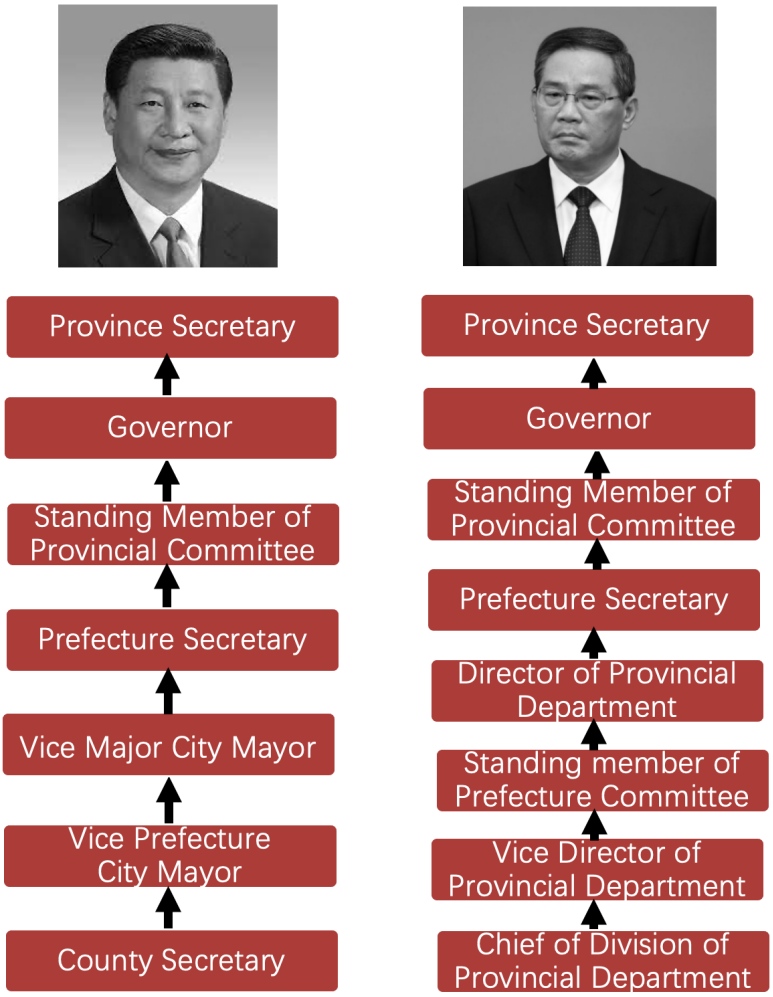


Figure 7: Promotion Trajectory of Leaders of the PRC (Page 12)

Note: In fact, Xi Jinping's position didn't change from vice prefecture city mayor to vice major city mayor. The political status of Xiamen city changed at 1988, from normal prefecture level city to vice provincial level city (city specifically designated in the state plan). So his rank changed from vice prefecture level to full prefecture level even though he still works as vice mayor of Xiamen. When Li Qiang served as standing member of prefecture committee, he also concurrently serves as a county Party secretary.

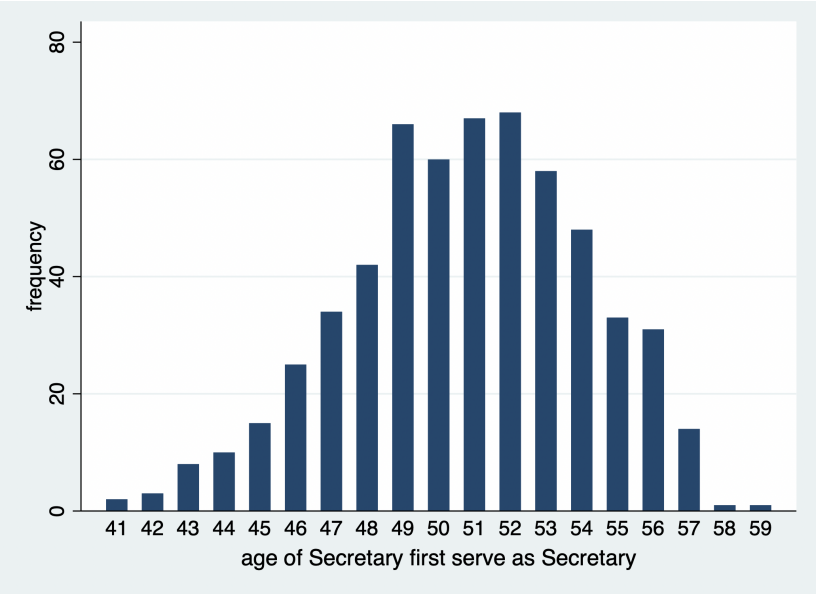


Figure 8: (Page 14)

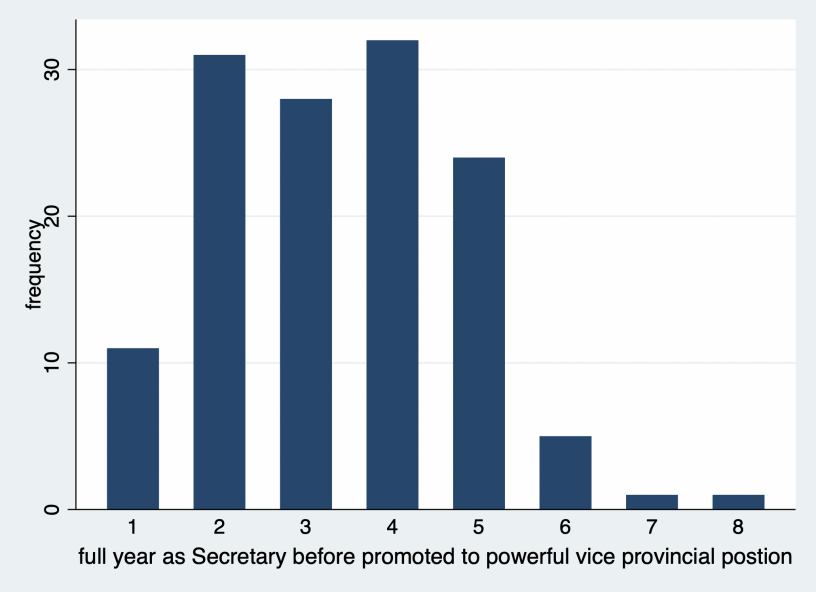
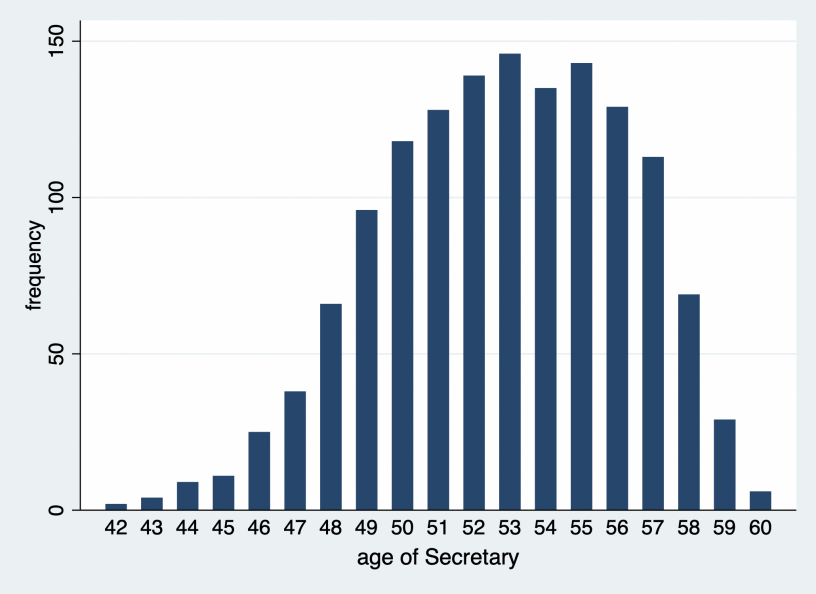


Figure 9: (Page 14)



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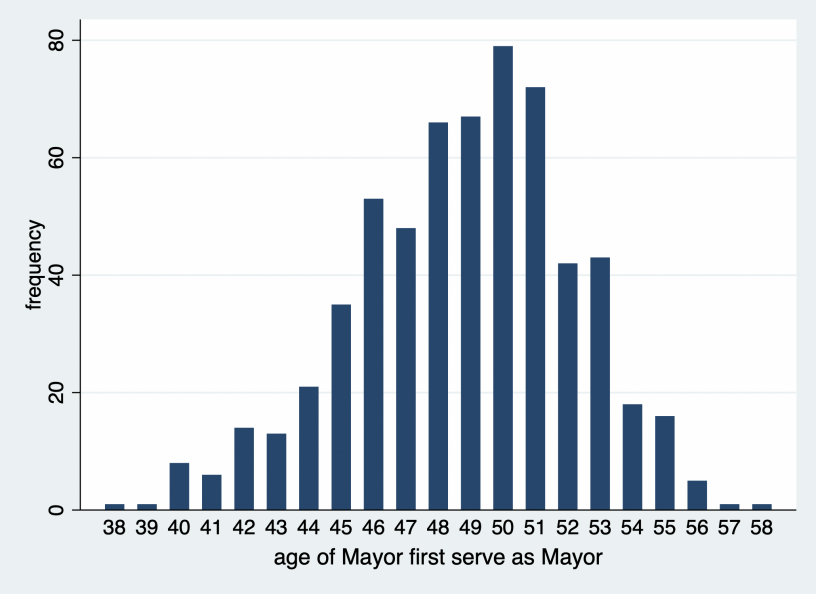


Figure 11: (Page 15)

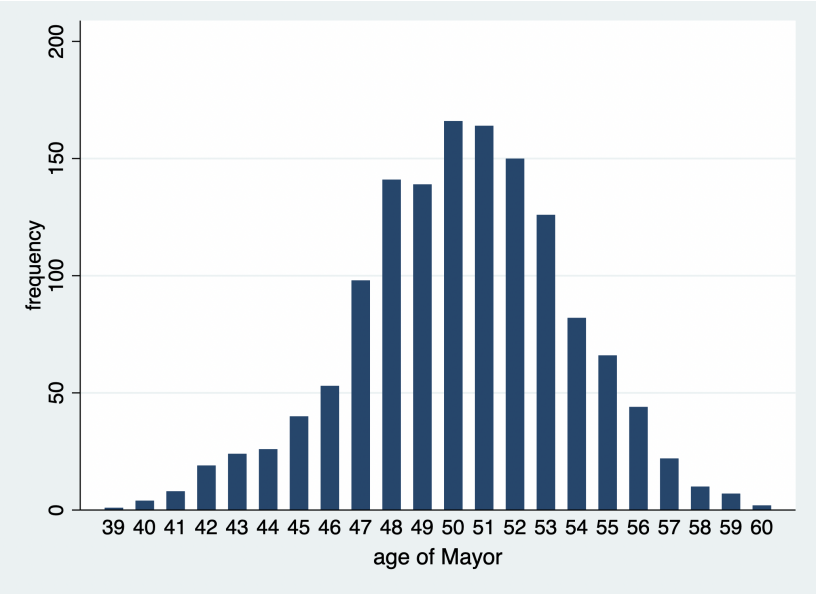
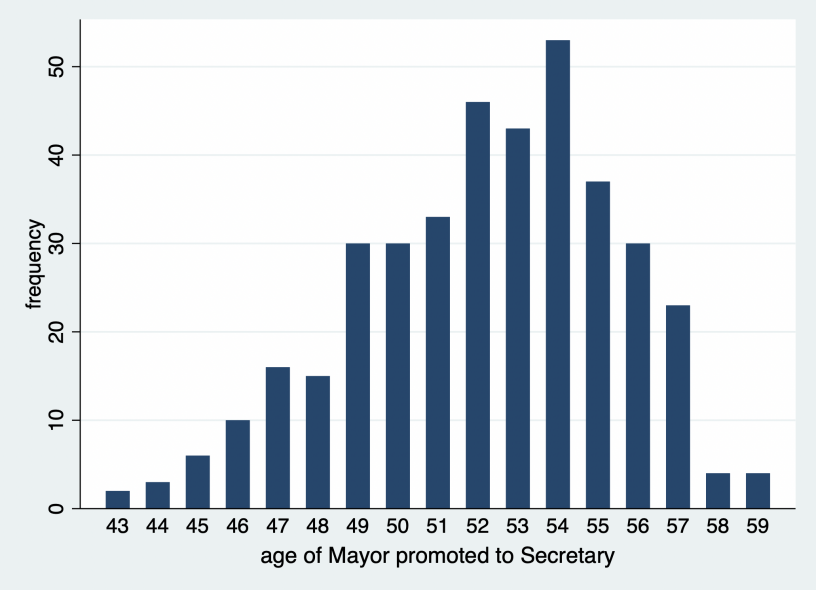


Figure 12: (Page 15)



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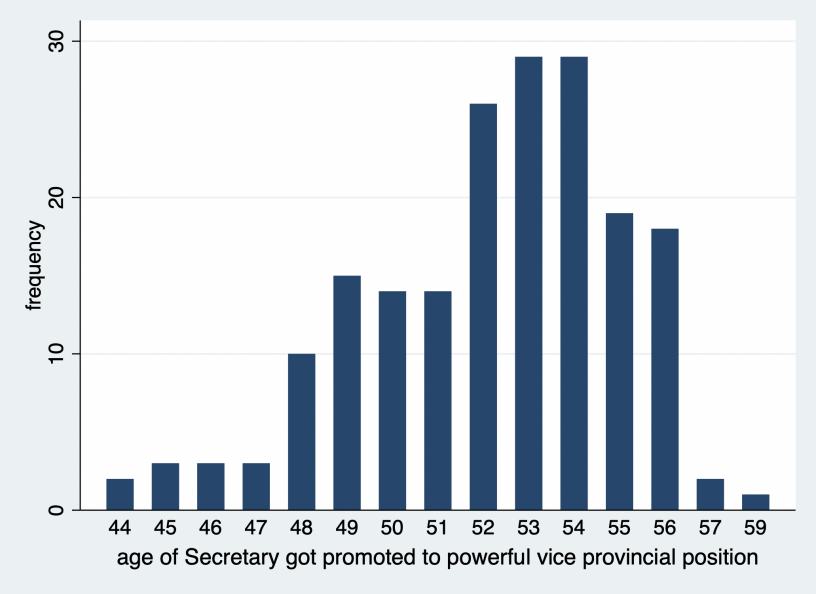


Figure 14: (Page 16)

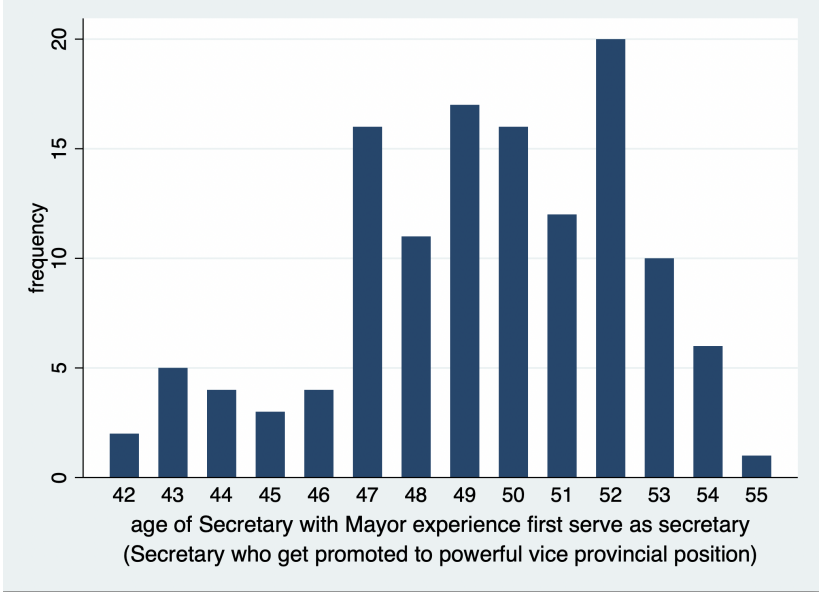


Figure 15: (Page 16)

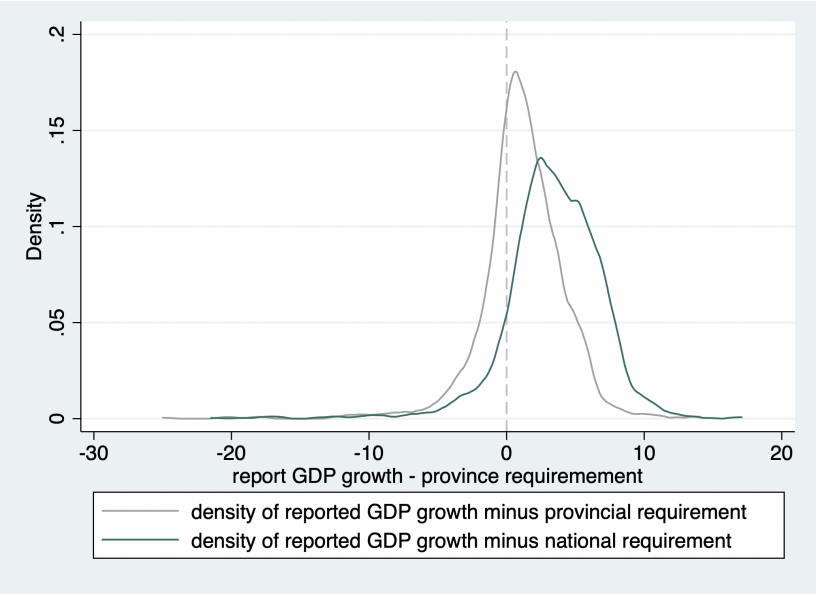
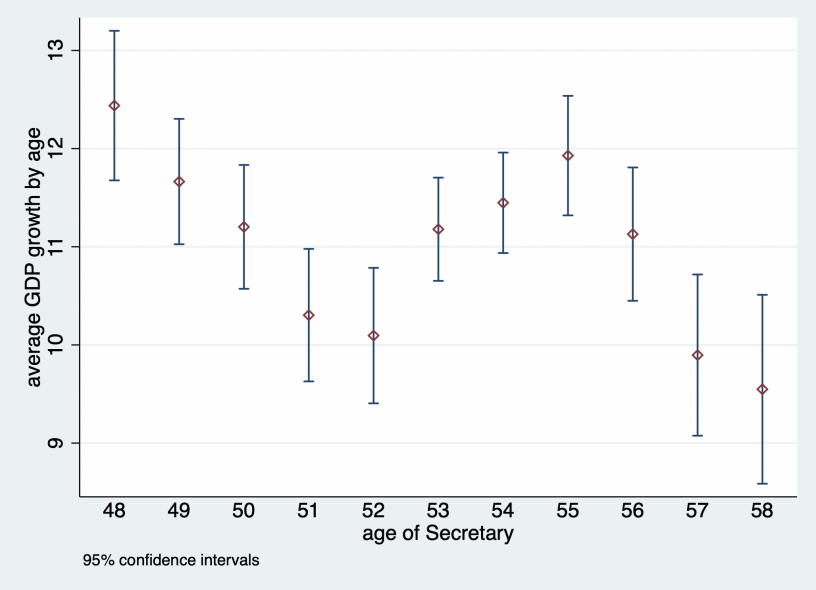


Figure 16: (Page 25)



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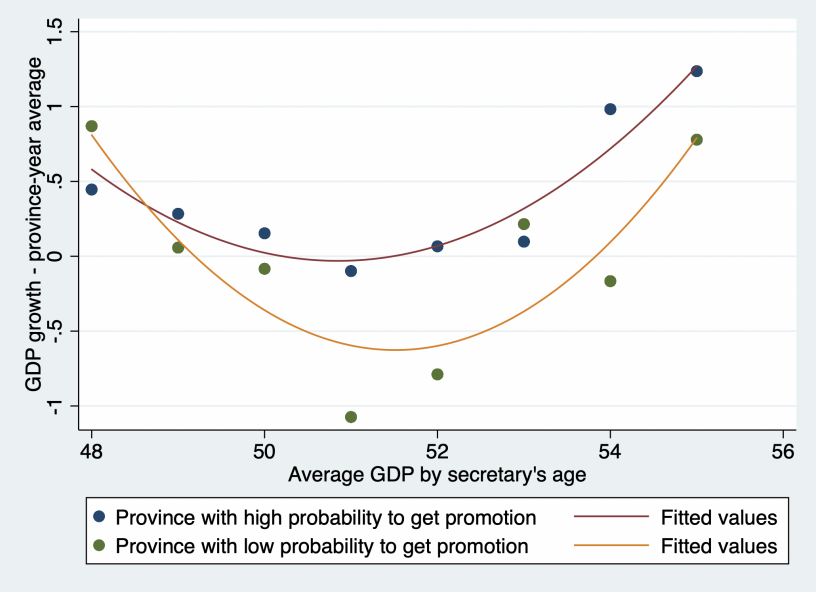

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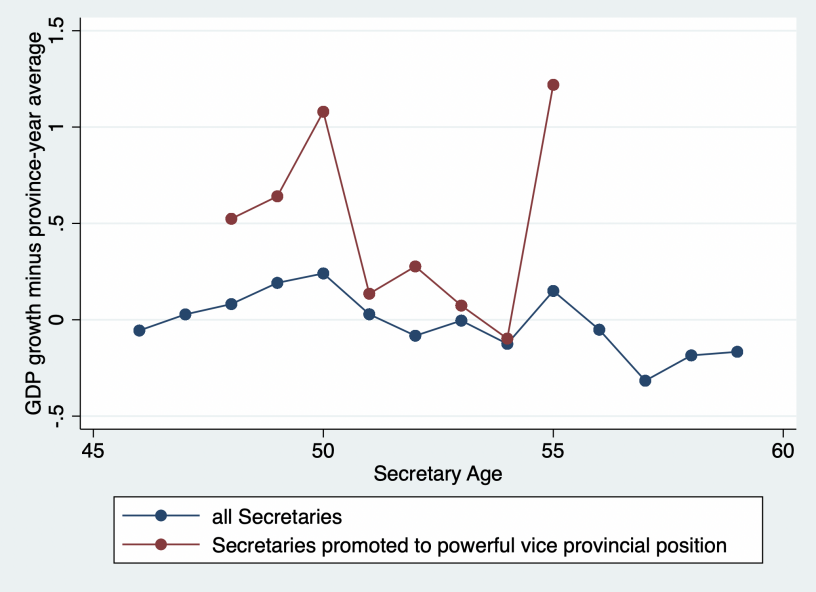

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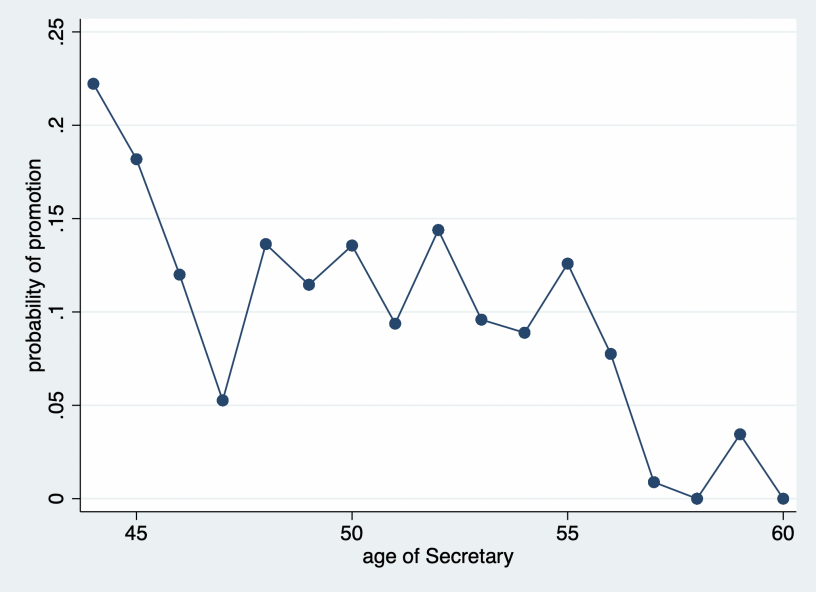

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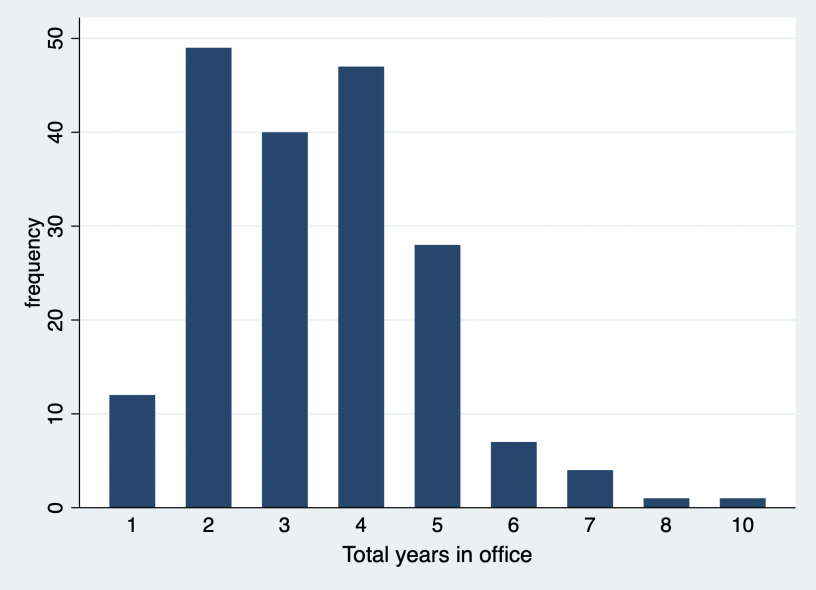

Figure 21: Appendix: Years in office of secretaries get promoted to primary positions

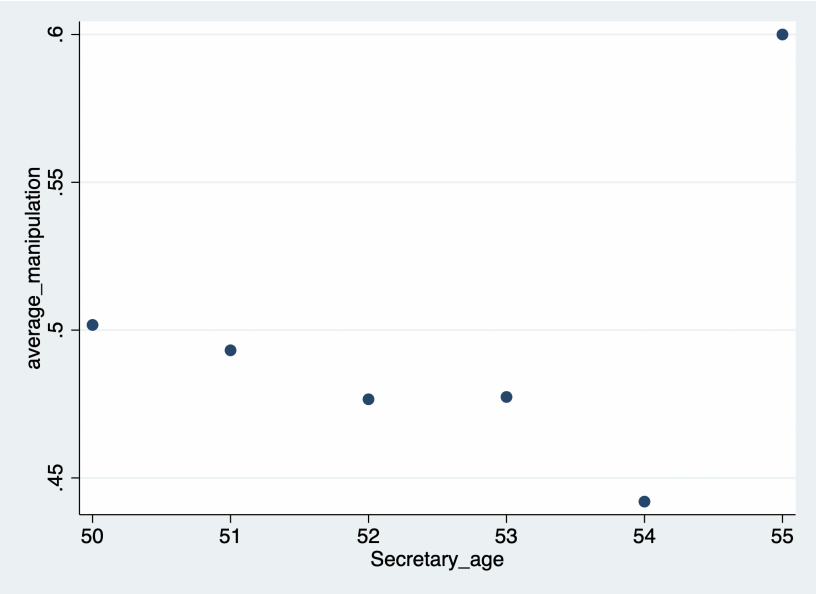

Figure 22: Appendix: Model Simulation

Table 1: Secretary promoted to vice provincial position

	(1)	(2)	(3)	(4)
GDP Growth	0.0196**	0.0204**	0.0214**	0.0236***
	(0.0083)	(0.0083)	(0.0084)	(0.0091)
Years as Secretary	0.0142		0.0333**	0.0315**
	(0.0118)		(0.0140)	(0.0141)
Experience of Youth-league	-0.0247		-0.0520	-0.0492
	(0.0319)		(0.0336)	(0.0335)
Full time Education		-0.0344	-0.0708	-0.0638
		(0.0431)	(0.0489)	(0.0486)
Final Education		0.0411	0.0305	0.0303
		(0.0478)	(0.0482)	(0.0474)
Gender		-0.0790	0.0474	0.0179
		(0.1190)	(0.1188)	(0.1162)
Secretary Experience	Yes	No	Yes	Yes
Secretary Characters	No	Yes	Yes	Yes
Prefecture Statistic	No	No	No	Yes
Obs	1395	1390	1384	1365

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. The positive correlation shows the higher GDP growth reported, the better position secretary got promoted to. For all four columns, I control year fixed effect and prefecture fixed effect. The variable Years as secretary captures the official's total length working as secretary in one or different prefectures. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 2: Secretary promoted to People's Congress or CPPCC

	(1)	(2)	(3)	(4)
GDP Growth	0.0006	0.0013	-0.0001	0.0010
	(0.0024)	(0.0025)	(0.0026)	(0.0029)
Years as Secretary	0.0211***		0.0188***	0.0185***
	(0.0040)		(0.0051)	(0.0050)
Experience of Youth-league	0.0091		0.0044	0.0059
	(0.0125)		(0.0134)	(0.0134)
Full time Education		0.0131	0.0034	0.0066
		(0.0208)	(0.0197)	(0.0193)
Final Education		0.0161	0.0123	0.0123
		(0.0167)	(0.0155)	(0.0154)
Gender(Female)		0.0544	0.0603	0.0598
		(0.0584)	(0.0696)	(0.0696)
Secretary Experience	Yes	No	Yes	Yes
Secretary Characters	No	Yes	Yes	Yes
Prefecture Statistic	No	No	No	Yes
Obs	977	969	966	956

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. For all four columns, I control year fixed effect and prefecture fixed effect. The coefficient shows for each extra year as secretary, the probability of getting promotion to secondary vice-provincial-level position increased about 2%. The data excludes secretaries got promoted to primary vice-provincial-level positions. The variable Years as secretary captures the official's total length working as secretary in one or different prefectures. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 3: Secretary promoted to primary vice provincial position

	(1)	(2)	(3)	(4)
GDP Growth	0.0077**	0.0076**	0.0078**	0.0090**
	(0.0034)	(0.0033)	(0.0034)	(0.0038)
Years as Secretary	-0.0005		0.0014	0.0007
	(0.0048)		(0.0065)	(0.0066)
Experience of Youth-league	-0.0170		-0.0308**	-0.0300**
	(0.0136)		(0.0140)	(0.0140)
Full time Education		-0.0164	-0.0316	-0.0300
		(0.0187)	(0.0202)	(0.0205)
Final Education		0.0197	0.0152	0.0151
		(0.0189)	(0.0191)	(0.0189)
Gender(Female)		-0.0567	0.0046	-0.0100
		(0.0516)	(0.0535)	(0.0529)
Secretary Experience	Yes	No	Yes	Yes
Secretary Characters	No	Yes	Yes	Yes
Prefecture Statistic	No	No	No	Yes
Obs	1395	1390	1384	1365

Note: Secretary Experience, Secretary Characters, and Prefecture Statistic defined same as previous table. The dependent variable defines as follow, 1 for get promotion to primary provincial position including vice governor or higher position, and 0 for no promotion or promoted to secondary vice-provincial-level position. The coefficient shows with extra 1% of GDP growth reported, the secretary would get 0.8% to 0.9% higher probability of getting promoted. The average probability of being promoted to primary vice-provincial-level position is only 9% each year. The variable Years as secretary captures the official's total length working as secretary in one or different prefectures. For all four columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 4: Secretary promoted to primary vice provincial position

	(1)	(2)	(3)	(4)
GDP Growth of Two Years	0.0013			
Before Year of Turnover	(0.0040)			
Latest Reported GDP		0.0090***		
Growth Before Turnover		(0.0038)		
GDP Growth of			0.0012	
Year of Turnover			(0.0026)	
Average GDP Growth				0.0091
During Tenure				(0.0058)
Full time Education	-0.0249	-0.0242	-0.0028	-0.0705*
	(0.0248)	(0.0203)	(0.0151)	(0.0402)
Final Education	-0.0051	0.0117	0.0165	0.1137***
	(0.0211)	(0.0188)	(0.0145)	(0.0361)
Experience of Youth-league	-0.0240	-0.0272*	-0.0058	-0.0333
	(0.0158)	(0.0145)	(0.0116)	(0.0266)
Gender(Female)	-0.0340	-0.0333	0.0099	0.1192
	(0.0533)	(0.0490)	(0.0470)	(0.1348)
Secretary Experience	Yes	Yes	Yes	Yes
Secretary Characters	Yes	Yes	Yes	Yes
Prefecture Statistic	Yes	Yes	Yes	No
Obs	1136	1365	1365	578

Note: Secretary Experience, Secretary Characters, and Prefecture Statistic defined same as previous table. Column(1) captures the correlation between GDP growth of year t-2 and promotion happened on year t. Column(2) captures the correlation between GDP growth of year t-1 and promotion happened from March of year t to February of year t+1. Column(3) captures the correlation between GDP growth of year t and promotion happened on year t. Column(4) captures the correlation between average GDP growth of secretary and promotion status of secretary, based on 578 secretary-prefecture pairs, here the Secretary Experience does not include the length of experience, such as length as prefecture level official, since length changes every year. For all four columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 5: Promotion of Mayors

	(1)	(2)	(3)	(4)
GDP Growth	-0.0080	-0.0057	-0.0074	-0.0091
	(0.0080)	(0.0082)	(0.0082)	(0.0091)
Length in office	0.0584***		0.0697***	0.0708***
	(0.0134)		(0.0162)	(0.0168)
Experience of Youth-league	-0.0196		-0.0216	-0.0339
	(0.0232)		(0.0260)	(0.0262)
Full time Education		-0.0223	-0.0203	-0.0228
		(0.0425)	(0.0439)	(0.0445)
Final Education		0.0035	-0.0029	-0.0133
		(0.0357)	(0.0380)	(0.0385)
Gender(Female)		-0.0950	-0.0627	-0.0409
		(0.0935)	(0.0988)	(0.0998)
Mayor Experience	Yes	No	Yes	Yes
Mayor Characters	No	Yes	Yes	Yes
Prefecture Statistic	No	No	No	Yes
Obs	1389	1378	1378	1360

Note: Mayor Experience includes, but is not limited to, the mayors' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Mayor Characters including but not limited to mayors' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. The dependent variable Promotion of mayors define as follow, 0 for not get promotion, 1 for promotion to department director of provincial government or first vice director of department of provincial committee, 2 for promotion to secretary, 3 for any vice-provincial-level position. There's no significant correlation between GDP growth and higher probability to get promoted to better positions. However, the coefficient shows positive correlation between years served as mayor and promotion. For all four columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 6: Mayors get promotion to Secretary or higher position

	(1)	(2)	(3)	(4)
GDP Growth	0.0015	0.0037	0.0018	-0.0001
	(0.0081)	(0.0082)	(0.0084)	(0.0092)
Length in office	0.0487***		0.0668***	0.0681***
	(0.0133)		(0.0160)	(0.0166)
Experience of Youth-league	-0.0134		-0.0157	-0.0277
	(0.0257)		(0.0285)	(0.0289)
Full time Education		-0.0120	-0.0073	-0.0097
		(0.0421)	(0.0433)	(0.0441)
Final Education		-0.0059	-0.0137	-0.0235
		(0.0372)	(0.0402)	(0.0409)
Gender(Female)		-0.0861	-0.0597	-0.0390
		(0.1032)	(0.1101)	(0.1118)
Mayor Experience	Yes	No	Yes	Yes
Mayor Characters	No	Yes	Yes	Yes
Prefecture Statistic	No	No	No	Yes
Obs	1389	1378	1378	1360

Note: Mayor Experience, Mayor Characters and Prefecture Statistic defined same as previous table. The dependent variable Promotion of mayors define as follow, 0 for not get promotion or promotion to department director of provincial government or first vice director of department of provincial committee, 1 for promotion to secretary or any vice-provincial-level position. There's no significant correlation between GDP growth and higher probability to get a real promotion. However, the coefficient shows positive correlation between years serve as mayor and real promotion. Only 6 mayors got promoted to vice-provincial-level position directly among 609 mayor-prefecture pairs. For all four columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 7: GDP growth reported by prefectural government

	(1)	(2)	(3)
Secretary at Age 55	0.5574**	0.5579**	0.7225***
	(0.2756)	(0.2741)	(0.2476)
Experience of Academia	-0.2428*	-0.3610**	-0.2599**
	(0.1423)	(0.1484)	(0.1257)
Experience of Study Abroad	0.5394**	0.4031	0.5576**
	(0.2497)	(0.2753)	(0.2785)
Gender(Female)		-0.9547*	-0.4297
		(0.4989)	(0.4587)
Secretary Experience	Yes	Yes	Yes
Secretary Characters	No	Yes	Yes
Prefecture Statistic	No	No	Yes
Obs	1395	1384	1365

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. The coefficient shows that secretaries at 55 reported extra 0.6%-0.7% GDP growth rate on average, compare to secretaries at other age. For all three columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 8: Balance check for Secretary at age 54 and 55

	mean		t-test	
	Age 54	Age 55	t	p
Minority	0.04895	0.05926	-0.38	0.705
First Degree	1.049	1.1778	-1.13	0.261
Full time Education	1.4825	1.4593	0.21	0.835
Final Education	2.972	3.0222	-0.64	0.521
Experience of Local Government	1.5524	1.3407	1.25	0.214
Experience of Central Government	0.12587	0.2	-0.94	0.348
Experience of Provincial Government	2.014	2.0222	-0.05	0.959
Experience of Leader's Secretary	0.65035	0.71111	-0.42	0.675
Experience of Enterprise	0.48951	0.42222	0.64	0.525
Experience of Youth-league	0.47552	0.4963	-0.19	0.850
Experience of Academia	0.18182	0.26667	-1.06	0.288
Experience of Study Abroad	0.13986	0.14074	-0.02	0.983
Years as Secretary	3.6364	3.4222	0.87	0.383
Government Income	9.8e+05	9.5e+05	0.26	0.792
Population Growth Rate	6.2835	6.4696	-0.26	0.797
Population	4.1296	4.308	-0.60	0.552
Total GDP	1.3e+07	1.4e+07	-0.31	0.761
GDP per capita	37486	35495	0.66	0.507

Note: Minority is 0/1 variable, 0 for Han and 1 for minority ethic group. First Degree is 0/1/2 variable, 0 for not taking college entrance exam, 1 for 2-years college, 2 for 4-years university. Experience of Study Abroad is 0/1 variable. All other experience is 0/1/2/3 variable, 0 for no such experience, 1 for working as section-level (town-level) official, 2 for working as county-level official, 3 for working as prefecture-level official. GDP and Government Income in Chinese yuan. Population in millions. Population Growth Rate in percentage.

Table 9: GDP growth reported by prefectural government

	(1)	(2)	(3)
Secretary at Age 54	0.2121	0.2248	0.2038
	(0.1751)	(0.1730)	(0.1588)
Experience of Academia	-0.2577*	-0.3807**	-0.2847**
	(0.1438)	(0.1510)	(0.1296)
Study abroad	0.5461**	0.4194	0.5696**
	(0.2483)	(0.2734)	(0.2769)
Gender(Female)		-0.9519*	-0.4213
		(0.4967)	(0.4549)
Secretary Experience	Yes	Yes	Yes
Secretary Characters	No	Yes	Yes
Prefecture Statistic	No	No	Yes
Obs	1395	1384	1365

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. The coefficient shows that secretaries at 54 didn't report a significant higher GDP growth rate compare to secretaries at other age. For all three columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 10: GDP growth reported by prefectural government

	(1)	(2)	(3)	(4)
Secretary at Age 50	-0.0225			
	(0.1867)			
Secretary at Age 51		-0.1372		
		(0.2243)		
Secretary at Age 52			-0.1119	
			(0.1983)	
Secretary at Age 53				-0.0205
				(0.1742)
Experience of Academia	-0.2818**	-0.2808**	-0.2824**	-0.2821**
	(0.1295)	(0.1294)	(0.1295)	(0.1295)
Study abroad	0.5651**	0.5618**	0.5646**	0.5632**
	(0.2770)	(0.2764)	(0.2771)	(0.2773)
Gender(Female)	-0.4138	-0.4140	-0.4161	-0.4198
	(0.4643)	(0.4566)	(0.4528)	(0.4548)
Secretary Experience	Yes	Yes	Yes	
Secretary Characters	Yes	Yes	Yes	Yes
Prefecture Statistic	Yes	Yes	Yes	Yes
Obs	1365	1365	1365	1365

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. he coefficient shows that secretaries at 50, 51, 52, or 53 didn't report a significant higher GDP growth rate compare to secretaries at other age. For all four columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 11: Other measurement of development

	(1)	(2)	(3)
	light growth	electricity growth	investment growth
Secretary at Age 55	0.0055	-0.0045	0.0357*
	(0.0041)	(0.0188)	(0.0195)
Experience of Academia	0.0028	0.0228	-0.0090
	(0.0032)	(0.0146)	(0.0187)
Study Abroad	-0.0094*	-0.0235	0.0213
	(0.0054)	(0.0199)	(0.0358)
Gender(Female)	-0.0011	-0.0154	0.1280**
	(0.0081)	(0.0517)	(0.0562)
Secretary Experience	Yes	Yes	Yes
Secretary Characters	Yes	Yes	Yes
Prefecture Statistic	Yes	Yes	Yes
Obs	816	1310	659

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. Column(1) use city light growth from 2010-2013. Column(2) use electricity consumption growth from 2010-2015. Column(3) use investment growth from 2010-2012. For all three columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 12: GDP growth of prefectures in different provinces

	(1)	(2)	(3)	(4)
	high probability	high probability	low probability	low probability
Secretary	-0.0733	-0.1751	0.9608**	0.9124***
at Age 55	(0.5154)	(0.5505)	(0.4078)	(0.3081)
Experience	0.5750*	0.3906	-0.7625**	-0.2006
of Academia	(0.2910)	(0.2757)	(0.3221)	(0.3051)
Study Abroad	0.4119	0.3510	1.3611	1.0169
	(0.6572)	(0.5395)	(1.1086)	(0.9164)
Gender	-2.8723**	-3.9104***	0.0521	1.2442
(Female)	(1.1169)	(1.1557)	(1.5063)	(1.2275)
Age	0.1026	0.0435	-0.1209	-0.0962
	(0.0930)	(0.0788)	(0.0996)	(0.0871)
Secretary Experience	Yes	Yes	Yes	Yes
Secretary Characters	Yes	Yes	Yes	Yes
Prefecture Statistic	No	Yes	No	Yes
Obs	198	191	379	370

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. Columns (1) and (2) including data from provinces with top 6 highest promotion rate, which is top 25% provinces. Columns (3) and (4) including data from provinces with bottom 6 highest promotion rate which is the bottom 25% provinces. The result is robust if including two more provinces as high probability provinces to make the Observations balance in each group. With the new defined high probability group (330 observations, closest to 370), there's still no significant positive correlation between secretary at age 55 and GDP growth rate. The magnitude is 0.18 and variance is 0.35. For all four columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 13: GDP reported before secretaries got promoted

	(1)	(2)	(3)
Secretary at Age 54	-0.4632	-0.3693	-0.3311
	(0.5757)	(0.5102)	(0.4508)
Secretary at Age 55	0.9459***	1.4066***	1.4563**
	(0.2800)	(0.3848)	(0.5351)
Secretary Experience	Yes	Yes	Yes
Secretary Characters	No	Yes	Yes
Prefecture Statistic	No	No	Yes
Obs	142	142	141

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. Data included the latest available GDP growth rate before secretaries got promoted to primary vice-provincial-level positions. Coefficient calculated from regression on dummy of SecAge54 and dummy of SecAge55 separately. For all three columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 14: GDP growth reported by prefectural government

	(1)	(2)	(3)
Mayor at Age 54	0.5151**	0.6416***	0.4564***
	(0.2043)	(0.2010)	(0.1670)
Mayor at Age 56	-0.6740**	-0.5152*	-0.3971
	(0.3383	(0.3069)	(0.2955)
Mayor Experience	Yes	Yes	Yes
Mayor Characters	No	Yes	Yes
Prefecture Statistic	No	No	Yes
Obs	1389	1378	1360

Note: Mayor Experience includes, but is not limited to, the mayors' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Mayor Characters including but not limited to mayors' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. Coefficient calculated from regression on dummy of MayorAge54 and MayorAge56 separately. For all three columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 15: GDP growth reported by prefectural government

	(1)	(2)	(3)
Mayor in office for over 2 years	-0.1294	-0.1519	0.0965
	(0.1671)	(0.1863)	(0.1690)
Sec at Age 55	0.2653	0.3710	0.7471
	(0.5382)	(0.5323)	(0.4876)
Sec at Age 55*Mayor in office for over 2 years	0.6407**	0.5872*	0.7518**
	(0.2901)	(0.3231)	(0.3122)
Secretary Experience	Yes	Yes	Yes
Secretary Characters	No	Yes	Yes
Mayor Experience	Yes	Yes	Yes
Mayor Characters	No	Yes	Yes
Prefecture Statistic	No	No	Yes
Obs	1380	1361	1343

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Mayor Experience includes, but is not limited to, the mayors' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Mayor Characters including but not limited to mayors' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. The interaction captures the difference between pair of secretary at age 55 and mayor in office over 2 full years at the end of current year and pair of secretary not at age 55 and mayor in office less or equal to 2 years at the end of current year. For all three columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Table 16: GDP growth reported by prefectural government

	(1)	(2)	(3)
Sec at Age 55	2.6787*	2.4336	2.6420*
	(1.5049)	(1.5588)	(1.5764)
Mayor Length in Office	-0.0917	-0.0818	-0.0846
Sec at Age 55=0	(0.1566)	(0.1787)	(0.1699)
Mayor Length in Office	-0.8468**	-0.7383*	-0.7295*
Sec at Age 55=1	(0.3645)	(0.3984)	(0.3991)
Secretary Experience	Yes	Yes	Yes
Secretary Characters	No	Yes	Yes
Mayor Experience	Yes	Yes	Yes
Mayor Characters	No	Yes	Yes
Prefecture Statistic	No	No	Yes
Obs	677	668	664

Note: Secretary Experience includes, but is not limited to, the secretaries' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Secretary Characters including but not limited to secretaries' gender, education and ethnic group. Mayor Experience includes, but is not limited to, the mayors' work experience at central Party/government institutions, state-owned enterprises, and the Youth League. It also records the highest rank achieved during each experience. Mayor Characters including but not limited to mayors' gender, education and ethnic group. Prefecture Statistic including the total GDP, GDP per capital, population and etc. The third row shows there's negative correlation between mayor's length in office and GDP growth rate reported by secretary at age 55, with each one extra year as mayor, the GDP rate reported would be 0.7%-0.8% less. For all three columns, I control year fixed effect and prefecture fixed effect. All standard errors are clustered at prefecture level. Significant at *10%, **5%, ***1%.

Model Result Based on Specific Function Form

$$U_{t_0+1} = u_s - C_{t_0+1}(m_{t_0}, m_{t_0+1}) \tag{20}$$

Here I normalize $u_s = 0$, and assume $u_r = 3 * u_e$. [6] From the dataset, the average GDP growth is about 10% and the primary promotion rate is about 9%, after exclude the secretaries not qualified for promotion, the promotion rate would be higher. I assume the promotion probability is equal to:

$$p_t = g_{t-1} = 0.1 + m_{t-1}$$

Since I have already assume the cost function is a increasing convex function, for simplicity, assume:

$$C_t(m_{t-1}, m_t) = m_{t-1}^2 + m_t^2$$

Since from the Figure 18, we could observe that it's very rare for secretaries get promoted to primary positions after 5 full years' service as secretary, so I assume each secretary chooses the future manipulation strategy depend on a five-years tenure or until age 56 (choose m for each year for at most next four years before age 56). The general utility function at $t_0 + n$:

$$U_{t_0+n} = u_s + u_e - \{ \prod_{t=t_0+2}^{t_0+n} [1 - p_t(g_{t-1})] \} * [u_e + C_{t_0+n}(m_{t_0+n-1}, m_{t_0+n})] \tag{21}$$

$$\text{if } t_0 + 1 < t < 56$$

I substitute with specific function and the utility function at time t is:

$$U_t = u_e - [\prod_{t=t_0+2}^{t_0+5} (0.1 - m_{t-1})] * [u_e + m_{t-1}^2 + m_t^2] \tag{22}$$

$$\text{if } t_0 < 52$$

Since I have already assume the time discount is 0.8, then I have expect utility for secretary

[6] since u_r captures the utility as primary vice-provincial-level officials during the extending political life and also at age 56, plus the extra benefit after leave the primary position before 60. Assume the extra benefit as vice provincial official after leave the primary position is equal to 1/3 of u_e each year and the life expectancy is 80. Then $u_r = [(1 - 0.8^3)/(1 - 0.8) + 1/3 * 0.8^3 * (1 - 0.8^{21})/(1 - 0.8)] * u_e \approx 3u_e$

start to serve as secretary from age 46 as an example.

$$
\begin{aligned}
ExpectUtility_{it_0=46} &= U_{47} + 0.8 * U_{48} + 0.8^2 * U_{49} + 0.8^3 * U_{50} \\
&+ 0.8^4 * (1 - p_{47}) * (1 - p_{48}) * (1 - p_{49}) * (1 - p_{50}) * u_e \\
&+ 0.8^5 * (1 - p_{47}) * (1 - p_{48}) * (1 - p_{49}) * (1 - p_{50}) * u_e \\
&+ 0.8^6 * (1 - p_{47}) * (1 - p_{48}) * (1 - p_{49}) * (1 - p_{50}) * u_e \\
&+ 0.8^7 * (1 - p_{47}) * (1 - p_{48}) * (1 - p_{49}) * (1 - p_{50}) * u_e \\
&+ 0.8^8 * (1 - p_{47}) * (1 - p_{48}) * (1 - p_{49}) * (1 - p_{50}) * u_e \\
&+ 0.8^9 * (1 - p_{47}) * (1 - p_{48}) * (1 - p_{49}) * (1 - p_{50}) * 3 * u_e \\
&= -m_{46}^2 - m_{47}^2 \\
&+ [1 - (0.9 - m_{47})] * 0.8 * u_e - (0.9 - m_{47}) * 0.8 * (m_{47}^2 + m_{48}^2) \\
&+ [(1 - (0.9 - m_{47})(0.9 - m_{48})] * 0.8^2 * u_e \\
&- (0.9 - m_{47})(0.9 - m_{48}) * 0.8^2 * (m_{48}^2 + m_{49}^2) \\
&+ [(1 - (0.9 - m_{47})(0.9 - m_{48})(0.9 - m_{49})] * 0.8^3 * u_e \\
&- (0.9 - m_{47})(0.9 - m_{48})(0.9 - m_{49}) * 0.8^3 * (m_{49}^2 + m_{50}^2) \\
&+ 0.8^4 * (0.9 - m_{47})(0.9 - m_{48})(0.9 - m_{49}) * (0.9 - m_{50}) * u_e * (1 - 0.8^5)/0.2 \\
&+ 0.8^9 * (0.9 - m_{47})(0.9 - m_{48})(0.9 - m_{49}) * (0.9 - m_{50}) * 3 * u_e
\end{aligned}
\tag{23}
$$

To maximize this expect utility, I could calculate the best strategy of m($m47^*$, $m48^*$,$m49^*$, $m50^*$), choose by secretaries start at age 46.

Similarity, I could have the expect utility for secretaries start to serve as secretary from different age, from 47 to 54. In my dataset, there are 25 secretaries start to serve as secretary at age 46, 34 secretaries start at age 47, 42 secretaries start at age 48, 66 secretaries start at age 49, 60 secretaries start at age 50, 67 secretaries start at age 51, 68 secretaries start at age 52, 58 secretaries start at age 53, and 48 secretaries start at age 54. I calculate the best strategy of m for secretaries start at each age, and use the number of secretaries as weight. Taking weighted average of manipulation of 50-years-old secretary as an example:

$$
weighted\, m_{50} = \frac{m_{50}^*(t_0 = 46) * 25 + m_{50}^*(t_0 = 47) * 34 + m_{50}^*(t_0 = 48) * 42 + m_{50}^*(t_0 = 49) * 66}{25 + 34 + 42 + 66}
$$

I set the $u_e = 0.005$ [7] and $m < 0.1$, the weighted average m for secretaries at each age from 50 to 55 shows at Figure 19. [8] We can find it has the U shape trend between GDP manipulation and age of secretary that we anticipated based the original general model.

[7] the trend between weighted average GDP manipulation and age of secretaries is similar if set $u_e = 0.01$

[8] since I calculate the strategy choose by secretaries from $t_0 = 46$, so age 50 is the first age with secretaries serving as secretary at different years.