Private Returns to Public Investment: Political Career Incentives and Infrastructure Investment in China

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This draft: August 12, 2020

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Abstract

Why do politicians who have short tenure expectations have incentives to invest in long-term infrastructure projects? This mismatch between politicians' short tenures and the long-term needed for infrastructure projects to come to fruition is generally expected to result in under-investment in critical infrastructure. However, recent data show that China makes massive investments in large-scale, long-term transportation projects. By proposing a political exchange model, we demonstrate a fundamental synergy between the incentives of short-term mayors and of provincial leaders that is realized as a result of subway projects. With both a difference-in-differences design and a fuzzy regression discontinuity design, we show that subway projects significantly increase the promotion chances of city mayors. Additional tests also confirm the mechanism of our theory. Mayors who obtain subway projects deliver economic benefits to provincial leaders. The provincial politicians' prospects of promotion are significantly improved thanks to these economic returns.

Keywords: China, Infrastructure, Local Government, Political Selection, Public Investment

Supplementary material for this article is available in the appendix in the online edition. Replication files are available in the *JOP* Data Archive on Dataverse (http://thedata.harvard.edu/dvn/dv/jop).

1 Introduction

One important role of government is to provide public goods. Some public goods can be provided relatively quickly, but many public goods require a long-term investment before their benefits are realized. For instance, schools, dams, and roads take time to build. Yet, local politicians tend to have short tenure and so may not have strong incentives to provide public goods that require a long-term investment regardless of the eventual benefits those public goods may render to their constituents. This mismatch between short-term political incentives and long-term public goods provision can lead to under-investment in long-term public goods.

We explore transportation infrastructure development as an important example of the mismatch between political and social welfare incentives. The development of such infrastructure as highways, railways, and subways, is vital to urban growth and market integration (Donaldson, 2018; Duranton & Turner, 2012; Zheng & Kahn, 2013). As well, subway lines may improve air quality (Gendron-Carrier *et al.* , 2018). However, most transportation infrastructure takes a long time to complete. Hence, the politician who initiates it is unlikely to be the one to receive credit when the project is completed. The mismatch between a politician's tenure and the life-cycle of infrastructure development reduces the incentives of politicians to provide such long-term public goods.

However, recent data show that China makes massive investments in large-scale, long-term transportation projects. Figure 1 presents data on railway and road investment for all members of the Organization for Economic Co-operation and Development (OECD) and representative developing countries such as China, India, Mexico, and Russia. We plot the share of investment in gross domestic product (GDP) for these countries in 2014 against their per capita GDP.[1] To assist interpretation, we also fit a linear regression line and plot the 95 percent confidence interval. We see that China invested massively in transportation

[1] 2014 is the latest year for which the data are available.

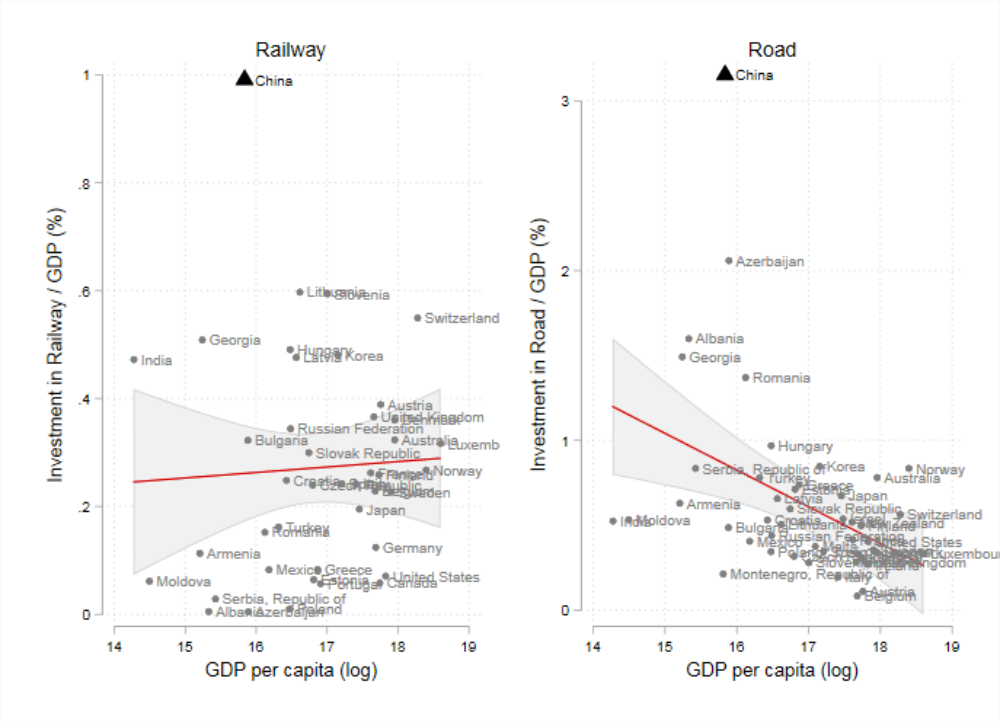

Figure 1: **Investment in Transportation Infrastructure and GDP Per Capita**. Red line is a linear fit of the data sample. The grey shaded area is the 95% confidence interval. Data sources: OECD and World Bank.

projects compared to countries with a similar income level (e.g., Mexico). In fact, China made more investment in both railways and roads than *all* the 46 countries combined in Figure 1.[2] Additional analysis based on data from 1995 to 2015 (contained in Appendix Section A) also shows that China always invested more in railway and highway in the past twenty-plus years than the United States and such developing countries as India and Mexico.

The figure helps make clear that there is a puzzle to be solved: How does China overcome the incentives mismatch and invest more in transportation infrastructure than others? To provide at least a partial explanation for this question, we focus on the political career incentives of *local* officials in China who initiate and finance the infrastructure investment. Our focus on local officials differs from earlier research that focuses on party strength (Simmons, 2016) and politicians' electoral motivation (Cho *et al.* , 2019) at the *national* level to explain

[2]China spent 300.7 billion Euro on road and 94.6 billion Euro on railway; all other 46 countries combined spent 216.7 billion Euro on road and 91.9 billion Euro on railway based on data from the OECD in 2014.

public investment.[3] Our primary concern is to understand local politicians' short-term political interests beyond any personal rent-seeking gains they may realize from infrastructure projects. When long-term public projects increase a politician's near-term ability to reap political returns, such as promotion, then s/he is eager to initiate such projects independent of local long-term gains. By studying the case of subway projects in Chinese cities, we find that there is a 21.3 percentage point increase in the chance that a mayor gets promoted to a higher position if s/he obtains a subway project. That is roughly a 50% increase from the baseline promotion rate of 43.2 percent.

Hence, our analysis demonstrates that it is the increased promotion chances for mayors, as well as the improved economic performance for provincial leaders as we will show later, that explain the political motivation for local officials to initiate large-scale, long-term infrastructure projects in China. These results help deepen our understanding of the *political* motivation (rather than economic incentives usually in the form of rent-seeking) behind infrastructure investment by focusing on the career incentives of local officials. Before providing a detailed theoretical account and offering evidence for these results, we examine the set of answers proposed in the extant literature. Those answers, as we will see, focus on conditions and mechanisms that differ from the approach taken here.

2 The Political Logic of Public Projects

Why do politicians have incentives to build infrastructure projects? Earlier research offers two explanations for this question. First, infrastructure projects offer rent-seeking opportunities to politicians (Robinson & Torvik, 2005; Keefer & Knack, 2007; Lehne *et al.* , 2018). Second, scholars studying distributive politics find that electoral incentives motivate politicians to initiate public projects. Since our concern is the political motivation behind

[3]Our empirical design also excludes such alternative explanations that focus on national-level variables by including city and year fixed effects.

infrastructure investment, we mainly review the second strand of literature in this section. We will consider the possibility of rent-seeking in Section 7.

2.1 Electoral Incentives and Public Projects

The intuition behind the electoral incentives argument is that an office-seeking politician can please the voters in her district by securing a public project. Hence, public projects are associated with higher chances of re-election in democracies. Several earlier studies provide empirical support for this theoretical prediction (Cadot *et al.* , 2006; Voigtländer & Voth, 2014; Hong & Park, 2016; Huet-Vaughn, 2019). Moreover, local leaders can even take credit of public projects so long as they can associate the public projects with their image by, for instance, making visits to the project (Cruz & Schneider, 2017).

However, electoral incentives can only explain *small-scale, short-term* infrastructure investments. Bonfiglioli & Gancia (2013) offer a theory for why electoral incentives undermine the development of *long-term* public projects. In their model, voters observe economic performance and welfare improvement during the first term of a mayor and decide whether to re-elect the mayor for a second term based. Hence, public projects that take a short period of time to complete can help the incumbent politician get re-elected because the operation of these projects bolsters the signal of the incumbent's competence. By contrast, public projects that take a long period of time to complete cannot help the incumbent signal her competence before the election by improving the local economy or providing public services. Moreover, the construction of these public projects imposes additional costs on local residents (e.g., noise, taxes), which further hurt the incumbent's re-election prospects.[4]

A few recent empirical studies lend support to the theoretical predictions made by Bonfiglioli & Gancia (2013). By investigating public projects in 61 African countries, Marx

[4]Bonfiglioli & Gancia (2013) find that uncertainty in politicians' performance increases long-term investment. Rather than focusing on uncertainty, we study how the institutional features of the Chinese system promote long-term investment.

(2018) reports that only *completed*, visible projects increase the reelection chances of local leaders. Even projects that are expected to finish soon are not associated with higher re-election chances for the incumbent. Hence, politicians have strong incentives to deliver short-term public projects that can be completed before the election. Furthermore, Williams (2017) shows that public projects in Ghana that will take a long time to complete are likely to become unfinished projects due to the "re-negotiation risks" in the long term after election.

Moreover, electoral incentives also motivate politicians to obtain *small-scale* projects. Grimmer *et al.* (2012) find that frequently claiming credit for small public projects has a larger effect on voters' support for the US House members than claiming credit for one large-scale project. Voters rarely take effort to remember such details of projects as the amount and size; yet, a high frequency of credit-taking messages helps voters update their impression of the politician. Hence, frequently securing relatively small-scale public projects is more helpful for a politician.

2.2 Large-Scale, Long-Term Public Projects in China

The discussion above leaves us a puzzle here. Why do politicians have incentives to invest in *large-scale, long-term* infrastructure projects? Building on these earlier studies, we extend the logic of electoral incentives to understand the development of large-scale, long-term infrastructure projects in China. In its essence, the electoral motivation argument posits that politicians serve the interests of those who select and promote them. In an electoral system, it is the voters who select their mayors and legislators. In a non-democratic setting, a smaller group of people do the same work (Bueno de Mesquita *et al.* , 2003). Local politician's political superiors provide the equivalent function that voters provide in democracies.[5]

Two changes take place as we replace voters by political superiors as the seletorate for

[5]We argue that the logical of electoral system can be applied to the Chinese setting in the sense that (1) local officials still have to answer to a principal and (2) like in electoral systems, local officials implement policies to win principal's support. This logic does not depend on who this principal is.

city mayors. First, the costs for pursuing public investment in large-scale infrastructure are much lower in the Chinese case. One critical cost for building public projects in democratic settings is the negative externalities (e.g., noises and pollution) and higher taxes. These costs may upset residents and so harm the re-election prospectus for the incumbent. The Chinese case differs on this critical point. While Chinese residents also have to bear noises and pollution, their views are much less important for the political career of city mayors compared to the views of mayors' political superiors. Furthermore, cities are not allowed to raise tax rates on residents. Such power is controlled by the central government. Hence, most city governments finance the public projects through city bonds, the payment of which depends mostly on the government's land sales revenue rather than raising the tax rate of local residents (Bai *et al.* , 2016).

Second, it is possible for city mayors to reap *short-term, political* benefits from long-term, large-scale public investment under the Chinese system. The "top-down" political system in China makes such short-term political benefits possible for city mayors in those cases for which there is synergy between their political interests and those of the provincial leaders to whom they answer. Earlier research demonstrates that when provincial leaders deliver improved economic performance they are more likely to be promoted to the central government (Li & Zhou, 2005; Jia *et al.* , 2015).[6] Such institutional arrangements of Chinese system that require provincial politicians to produce economic and fiscal improvements make a *political exchange* between provincial leaders and city mayors possible. The central government's demand for robust economic performance by provincial leaders means that Chinese mayors are strongly incentivized to help their superiors, the provincial leaders, produce improved economic growth and fiscal revenue in exchange for benefits for themselves.

[6]Although a recent study (Landry *et al.* , 2018) shows that provincial leaders depend more on political connections than on their economic performance to get promoted, we are not aware of any study showing that economic performance does not matter *at all* for the political promotion of provincial leaders. Our analysis at the provincial level in Section 7.2 is more consistent with Li & Zhou (2005) and Jia *et al.* (2015). We find that subway projects help provincial leaders get promoted.

One mechanism for achieving these mutual interests is to invest in large-scale, long-term infrastructure projects. These projects boost economic growth through construction investment and generate more land sales revenue. Moreover, unlike democratic settings that undermine the development of large-scale, long-term public projects, the political exchange relationship in the Chinese system incentivizes city mayors to secure large-scale, long-term infrastructure projects. This is because the longer-term and larger-scale the infrastructure projects, the huger the economic and fiscal benefits to the city (and so, the province). These benefits offered by city mayors to provincial leaders engender the incentive for provincial leaders to reward those mayors. Hence, we should expect to see that these "helpful" mayors are more likely to get promoted. Those mayors who are unable or unwilling to undertake the effort to secure large, long-term, infrastructure projects, in contrast, are unlikely to be rewarded by their political superiors.

These theoretical expectations are closely linked to the literature on Chinese political selection which finds that the economic and fiscal performance of local governments is positively associated with the promotion of local officials (Yao & Zhang, 2015; Chen & Kung, 2016; Landry *et al.* , 2018; Landry, 2008). At the core of these studies is a signaling model that mayors use their past performance as a signal of their competence. While the signaling model is powerful to explain the political selection in China, we contribute by proposing a different mechanism, namely, the political exchange between mayors and their provincial superiors. A crucial implication of our theoretical account is that even randomly-assigned public projects increase the promotion chances of city mayors so long as they improve economic and fiscal performance for provincial leaders. Our identification strategy based on the generalized DID and fuzzy RD designs helps us create such "randomness" in subway projects that is critical for our theoretical account and blocks the causal mechanism of a signaling model.[7] Relatedly, these results are also consistent with the well-documented empirical

[7]However, we should note here that the purpose of our analysis is not to say that competence does not matter at all in securing subway approval. The goal of our analysis, however, is to demonstrate that even

pattern in democracies that random shocks to economic conditions affect the re-election prospectus of the incumbent (Healy & Malhotra, 2010; Bagues & Esteve-Volart, 2016).

Also closely related to our work here are recent studies that focus on how the "visibility" of public projects helps incumbent improve the approval rate (Strange, 2019; Marx, 2018). These studies uncover one important mechanism through which infrastructure projects improve the political survival of incumbents in democracies. However, visibility seems less important in authoritarian China because ordinary people, the subject of study in these articles, can hardly influence the career of politicians. By contrast, our political exchange model predicts, whether visible or not, public projects that yield substantial economic and fiscal improvements are more likely to improve the career prospectus of Chinese mayors. Our research design also excludes the visibility explanation because most city mayors are promoted before subways are completed or become visible at all.

3 Background: Subway Projects in China

The case of subway projects in China provides an appropriate setting to test our theoretical claims. Since subway projects, like all other infrastructure investment, translate into the pork that city mayors obtain for provincial leaders, all promotion-seeking mayors should have incentives to build subways regardless of the conditions of the city and the opinions of the residents. Hence, to avoid over-investment in subways, the central government requires that city governments must obtain permission before they can start building a subway.

To get permission, a city government first proposes a plan for the subway system (PSS), including the layout, financing, expected utilization, and other detailed information for the network of several subway lines that the city government plans to build in the coming few years. This PSS will be reviewed first by the National Development and Reform Commission

after partialling out – rather than rejecting or, even worse, ignoring – the influence of the signal model, we still find empirical support for our theoretical account.

(NDRC), a ministry of the central government. Then, the NDRC coordinates with other central ministries (including the Ministry of Environmental Protection and the Ministry of Housing and Rural-Urban Development) to further review the PSS. If bureaucrats in all these ministries, especially the NDRC, wish to approve the PSS, the NDRC will send the PSS, together with its suggestions, to the (vice) Premier for final approval.

We focus on the approval of the subway plan (PSS). If the PSS is approved, the NDRC will disclose the approval to the public. Hence, we are able to collect a complete list of subway approvals made by the central government which we report in Appendix Table A1. However, we cannot identify the cities that had a failed application because the government is not required to disclose rejected PSS's. The lack of data for failed subway applications means that our focus is on what happens to the careers of mayors and provincial leaders following *approval* of the PSS. We then contrast their career paths with mayors and provincial leaders who do not have subways projects.

City mayors are the parties usually responsible for obtaining subway approval. When a city government plans to build a subway system, it will establish a new government agency called "the leading team for subway planning and construction." The primary function of this "leading team" is to coordinate the efforts of different departments within a city government and lead the preparation for the PSS. In most cases, city mayors are the head of "leading team" that is responsible for drafting the PSS, smoothing the application process, and implementing the construction plan. This is the primary reason why we focus on city mayors rather than city party secretaries (CPS) who are not directly involved in the process of obtaining subway approval or building a subway system.[8]

A related concern is whether city mayors can expect to obtain subway approval within their expected tenure of roughly three years. The answer is yes. On average, it takes a mayor 1.4 years to get subway approval. The longest waiting time for subway approval is only three

[8]We provide further qualitative evidence in Appendix B that city mayors rather than CPS's are the major official who lead and coordinate the application process.

years. In contrast, construction of a subway line on average takes 5.2 years after approval so that the total time from proposal to completion of construction requires, on average, 6.6 years. This is much longer than the average tenure of a Chinese mayor. Therefore, proposing mayors are not likely to pursue subway construction with the expectation of being in office at the time the project is completed.[9]

4 Data

We utilize several sources of data for empirical analysis. To begin, we collect an original data set of subway approvals. To collect these data, we rely first on the annual reports released by the China Association of Metros to obtain the list of cities which have already built a subway system or were still building their first subway line in 2017.[10] Then we searched the Internet for each city on this list to identify the original subway approval.

Furthermore, we make use of two datasets about city mayors. The first is the CCER Official Dataset (Xi *et al.* , 2018). This dataset reports the promotion of city mayors, their political connections to the provincial party secretary, and other basic characteristics (e.g., age, gender, education level, etc.). Moreover, we include additional variables recorded in the Chinese Political Elite Database (Jiang, 2018), which contains rich information on mayors' characteristics and previous work experience.

Finally, we construct city-level variables from two sources. The first is the China City Statistical Yearbook which contains rich information on Chinese cities, such as the city population, GDP, GDP growth rate, annual fiscal revenue, unemployment rate, and so on. The second data source is the China Urban Construction Statistical Yearbook which records detailed information on urban infrastructure investment and land sales data. We combine

[9] After mayors complete their tenure, their expectation is that they will be assigned to work in another place. Only 30% of mayors continue to work as CPS of the same city. Among those mayors who have obtained subway approval, only 11% of them continue to work in the same city as CPS (authors' data).

[10] The 2017 annual report is the latest one released by the China Association of Metros.

Table 1: Summary Statistics

Variable	Obs	Mean	Min	Max
Mayor promoted within three years	3,843	0.412	0.00	1.00
Mayor connection	3,839	0.011	0.00	1.00
Mayor age	3,804	50.20	33.00	61.00
City population	3,571	417.42	14.19	1591.76
City GDP (billion Yuan)	3,852	135.57	3.177	1954.74
City fiscal revenue (billion Yuan)	3,856	10.40	0.12	313.65
City GDP growth rate (%)	3,844	12.09	-19.38	109.00
Mayor obtaining subway approval	3,861	0.04	0.00	1.00
City investment in infrasturcture per capita (Yuan)	3,848	699.33	0.00	13236.19
City GDP per capita (Yuan)	3,845	32218.63	99.00	468000.00
City land sales revenue per capita (Yuan)	3,855	296.91	0.00	40277.59
City fiscal revenue per capita (Yuan)	3,855	2697.62	70.327	81467.34

all these datasets above into a city-year panel dataset for empirical tests.

Because the central government reviews subway applications based on rules adopted in 2003, we focus on subway approvals made after 2003. Moreover, to facilitate apple-to-apple comparisons, we drop a few "outlier" cities in our data sample. They include four province-level megacities, namely, Beijing, Tianjin, Shanghai, and Chongqing, and another 15 vice-province-level cities.[11] Their mayors are minister-level or vice-minister-level appointments; therefore, the promotion of mayors in these cities is completely different from that of other prefecture-level cities. Taken together, our analysis focuses on a city-level panel dataset for 265 prefecture-level cities spanning from 2003 to 2016.[12] We present the summary statistics for this city panel dataset in Table 1.

5 Identification Strategy

Our baseline identification strategy is a generalized differences-in-difference (DID) design. More specifically, we use the following equation for empirical analysis.

[11]The vice-province-level cities include Guangzhou, Wuhan, Harbin, Shenyang, Chengdu, Nanjing, Xi'an, Changchun, Jinan, Hangzhou, Dalian, Qingdao, Shenzhen, Xiamen, and Ningbo.

[12]Most data we use here are not yet available after 2016.

$$Promotion_{it} = \ _0 + \ _1 Approval_{it} + \ X_{it} \ _1 + \ _i + \ _t + \ _{it} \quad (1)$$

The outcome variable $Promotion_{it}$ is a dummy variable indicating whether or not the mayor of city i is promoted within three years from year t. We define a mayor's promotion according to the following criteria: the city mayor is promoted to (a) party secretary of a prefecture-level city; or (b) a vice-province-level position (e.g., vice governor of a province).[13] City mayors cannot be promoted directly to a province-level or even higher position without first going through (a) or (b). We use a lead of three years because the average tenure of Chinese mayors is roughly three years. We also use a mayor's promotion within one, two, four, or five years as robustness checks in the Appendix D and obtain similar results.

Our primary explanatory variable, $Approval_{it}$, is a dichotomous indicator equal to one if the mayor of city i and year t has obtained a subway approval and to zero if otherwise.[14] One methodological challenge is that it is hard to identify which mayor can claim credit for subway approval because city governments do not disclose which mayor started the work of applying for approval. We pinpoint this mayor by the following procedures: We identify the period (a) when the city government establishes the "leading team for subway planning and construction" or (b) when the city government submits PSS to the central government, whichever is available.[15] The endpoint of this period is defined as when the city government acquires approval. Usually, during this period, there is only one mayor, and we identify this mayor as the one who applies for and gets the subway approval.

However, in a few cases, cities had two mayors between when the city government applies

[13] We consider alternative measures for mayoral promotion in Appendix Table A4.

[14] Recall that we do not have data on rejected proposals so the category 0 includes any rejected proposal and any city that did not offer a proposal. Meanwhile, after mayors leave office, the indicator will be switched to 0 if the successors does not get their *own* subway approval. Therefore, our design deviates from a canonical DID design where the treatment will not switch off once it turns on.

[15] Our preferred measure is (a). When (a) is not available, we use (b).

for the subway project and when the city obtains approval. In these situations, we identify the second mayor as the credit-taker because s/he oversees the subway approval in her/his term. One problem with this coding rule is that this second mayor may have only worked on subway approval for a short time. There is one such case. The mayor of Kunming was appointed in 2013, the same year as his government obtained subway approval. Because his predecessor had worked on subway approval for a much longer time than him, we identify the earlier mayor in Kunming as the one who takes credit for the approval. We also conduct additional analysis by dropping the case of Kunming in Appendix D (Table A8) and our results still hold.

In equation (1), we also include a vector of city-level, one-year lagged time-variant control variables $X_{it\ 1}$. Lags are used to avoid post-treatment bias. $_i$ and $_t$ are city and year fixed effects respectively. We cluster standard errors at the city level to deal with city-level serial correlation. The focus of the empirical analysis is $_1$ which we expect to be positive.

After clarifying the identification strategy, we discuss how our research design overcomes several empirical challenges. One primary source of selection bias is that only certain cities can build subways. This selection problem can take various forms. First, one may wonder whether cities that received the first approval relatively recently are unlikely to obtain a second approval. But subway approval need not be a one-time occurrence for a city. In practice, 13 cities have received more than one subway approval, generally involving expansion.

Another possible form of selection bias is that mayors receiving subway approval may be more likely to be promoted because they are already more capable and politically connected. We adopt several strategies to deal with this problem. First, we include measures for the competence and political connections of city mayors as control variables. These include (1) primary economic indicators of the city (i.e., population, GDP, government fiscal revenue, and GDP growth rate) as measures for mayors' competence in promoting the local economy, (2) essential characteristics of mayors such as education, age, gender, and race, (3) mayors'

political connections with provincial leaders, and (4) earlier work experience of the mayor.[16] In the interest of space, we discuss the definition and source of these variables and report their descriptive statistics in Appendix Tables A2 and A3.

6 Does Subway Approval Improve Mayoral Promotion?

This section contains the results of our statistical analysis. We first present the results of our baseline DID design. Then we test the critical "parallel trend assumption" of a DID design and present the dynamic effects of subway approval. We finally introduce the fuzzy RD design. All results across different designs and specifications demonstrate that subway approval increases a mayor's near-term chances of being promoted.

6.1 Baseline Results with a Generalized DID Design

Table 2 contains the main results of our analysis. The outcome variable evaluates mayoral promotion in three years. The model in column (1) only includes subway approval as the explanatory variable, as well as city and year fixed effects. The model in column (2) adds mayoral characteristics, including age, gender, ethnicity, education background, political connections with the provincial party secretary, and earlier work experience. Column (3) adds major city-level variables, including city population, GDP size, government fiscal revenue, and GDP growth rate. These controls are intended to correct for any selection bias due to the expectation that more populous, prosperous, and fiscally robust cities are more likely to obtain subway approval and mayors of such cities are most likely to get promoted. In column (4), we add province-year fixed effects to control for all province- and time-specific characteristics. The political connections of provincial leaders to the central government,

[16] We use a mayor's *workplace* connections to the PPS masure political connections. This variable is coded as one if a mayor has worked with the PPS before s/he becomes the mayor. We consider another four measures for a mayor's political connections in Appendix Table A5 and obtain similar results.

Table 2: Subway Approval and Mayoral Promotion

	Mayor promoted within three years			
	(1)	(2)	(3)	(4)
Subway approval	0.251***	0.270***	0.257***	0.213**
	(0.095)	(0.096)	(0.098)	(0.096)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
Province-year FE				X
Dependent variable mean	0.426	0.429	0.432	0.432
Observations	3647	3566	3092	3071

Notes: Standard errors clustered at the city level are reported in parentheses. Control variables: (1) mayor controls include gender, ethnicity, age, education level, political connection with provincial party secretary, and previous work experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League; (2) city controls include population, GDP size, GDP growth rate, and fiscal revenue in the previous year. The Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. FE = fixed effects.

for instance, are captured by these province-year fixed effects. Subway approval is always positively and significantly associated with mayoral promotion in all these specifications.

We perform several robustness checks and placebo tests and present the results in Appendix D. We highlight some tests here. First, we use alternative measures for the economic performance of the city to avoid the influence of extreme values or misreported economic data by city governments. We do so by taking the average of city-level variables in the previous three years; replacing GDP growth by nighttime light intensity; and decomposing GDP growth into the growth of different sectors. Furthermore, we repeat our analysis with a smaller sample of cities that have obtained subway approval by 2016. By doing so, we only pick up the temporal variation of subway approval that some cities obtain subway approval earlier and some other cities later. Additionally, following Landry *et al.* (2018), we re-sturcture our dataset into a cross-sectional dataset for mayors from 2003 to 2016 and repeat our analysis with cross-sectional regressions. Finally, we also consider alternative measures

for mayoral promotion. Our results remain robust in all these above-mentioned tests.

Furthermore, we conduct several tests to test or control for the signaling mechanism. Following Chen & Kung (2016), we add mayor fixed effects into our generalized DID specification. These mayor fixed effects should capture all the time-invariant features of mayors. If we consider mayors' competence and political connections to be quite stable during their tenure (which is roughly 3 years), mayor fixed effects should capture a large portion of the influence of these variables. Our results are robust to the inclusion of mayor fixed effects. This demonstrates that when competence (and so, the associated signal) is controlled for, subway approval still increases the probability of promotion.

Finally, we conduct a placebo test by examining whether subway approval increases the promotion chances of a city party secretary (CPS). As discussed in Section 3, the CPS is not responsible for subway application or construction; therefore, we should not observe increased promotion chances for the CPS due to subway approval. And indeed we do not find that subway approvals are correlated with the promotion of CPS.

6.2 Dynamic Effects Analysis

One critical assumption of the DID design is the "parallel trends assumption." To test this assumption and demonstrate the dynamic effect of subway approval on a mayor's promotion, we employ the model specification below:

$$Promotion_{it} = \sum_{= \quad 4;\ 6+1}^{X^{+5}} Approval_{i(t+\ )} + \ ! X_{it\ \ 1} + \ _i + \ _t + \ _{it} \tag{2}$$

where $Approval_{i(t+\ )}$ is a set of dummy variables indicating whether city i has obtained subway approval at time $t+\ $. Hence, measures the effect of subway approval both before the city has obtained approval (i.e., > 0) and after the city has obtained subway approval for years (i.e., < 0).[17] The parallel trends assumption requires that all (when > 0)

[17]For example, $Approval_{i(t-2)} = 1$ means year t is two years after the year when city i gets its first subway

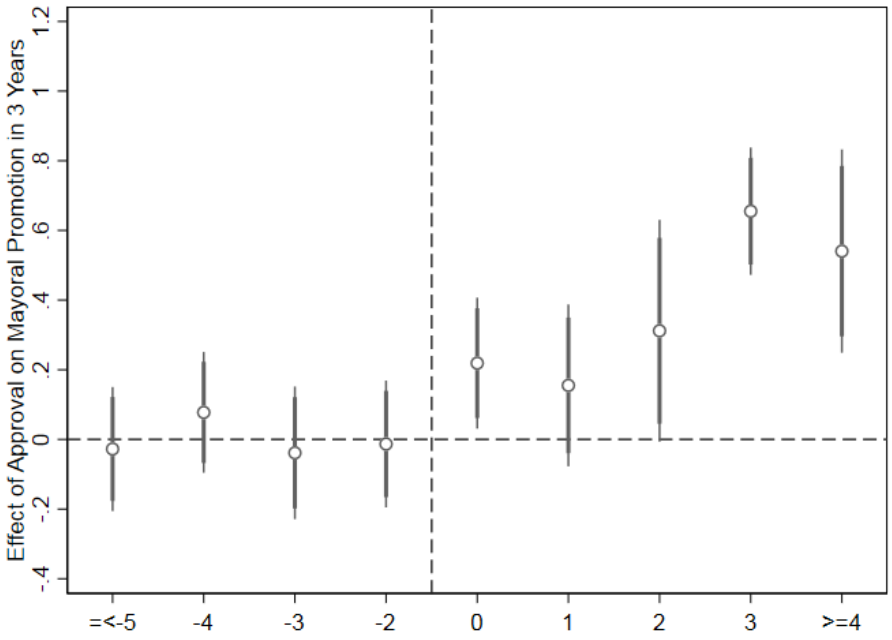

Figure 2: **Dynamic Effects of Subway Approvals on Mayor Promotion**. Each circle indicates a point estimate for the effect of subway approval and the vertical bars are the 90% and 95% confidence intervals. Negative numbers on the horizontal axis refer to the years before a city receives subway approval. Numbers without signs on the horizontal axis indicate the years since the city receives subway approval. We omit the year before the city obtains subway approval as baseline. All coefficients should be interpreted in comparison with this baseline year.

are not significantly different from zero.

Figure 2 contains the results of the dynamic test.[18] It shows that before the city obtains subway approval (-5 to -1 on the X-axis), the expectation of future approval does not affect the mayor's promotion.[19] However, once the city receives subway approval, its mayor has a significantly higher chance of getting promoted. This effect continues to hold as long as the mayor who obtained the approval is still in office. Additional analysis in Appendix Section E (Table A14) shows that, after that mayor leaves office, the effect of subway approval on the promotion of future mayors drops to around zero. Hence, future mayors who have not worked

approval, and $Approval_{i(t+2)} = 1$ means year t is two year prior to that.

[18] We report regression results in Appendix Section E.

[19] A joint F-test gives F-stats = 0.58 and cannot reject the null hypothesis $\quad_{-2} = \quad_{-3} = \quad_{-4} = \quad_{-5} = 0$.

on the subway's approval do not enjoy a higher chance of promotion. Taken together, these results demonstrate that our DID design satisfies the critical parallel trends assumption.

6.3 A Fuzzy Regression Discontinuity Design

To be eligible for creating a subway system, a city must satisfy four central government requirements. These four required criteria include (1) the city's annual fiscal revenue exceeds 10 billion Yuan; (2) the city's GDP reaches at least 100 billion Yuan; (3) the city's population exceeds 3 million people; and (4) more than 30 thousand people per hour are expected to use a subway line. While cities satisfying these four requirements are not guaranteed to have subways, those not satisfying them are not eligible to have a subway. These requirements offer us an opportunity to identify the effect of subway approvals through a fuzzy RD design.

We use city population to construct the fuzzy RD design. We first explain why the other three criteria cannot be employed in a discontinuity design. Most obviously, we cannot use the fourth requirement because only those cities that apply for subway approval are required to calculate the expected number of users. Second, local governments in China manipulate such key economic figures as GDP and fiscal revenue (Wallace, 2016). The chances are that the manipulation of these economic statistics will result in a non-random sorting of GDP and fiscal revenue. Hence they are not a good basis for a reliable RD design (McCrary, 2008). Appendix Section F contains density plots and results for McCrary tests for the first three requirements. We find clear sorting patterns for GDP and fiscal revenue figures around the critical thresholds required to build subways. Hence, GDP and fiscal revenue are not appropriate running variables due to these sorting patterns around the cutoffs.

To use the city population as the running variable in our fuzzy RD design, it must satisfy another two requirements. First, cities whose population is just above 3 million and just below 3 million are expected to be similar to each other. This requirement is imposed to ensure that the fuzzy RD design creates a balanced treatment and control group. To show this is the case, we test if pre-treatment covariates are balanced around the population cutoff.

We apply this test to all control variables used in Table 2, which include the mayor's basic characteristics, political connections, and earlier work experience, and the city's economic performance (lagged by one year). Appendix Figure A4 contains the results of the balance tests. We see that all variables are balanced, showing that cities whose population is slightly larger than 3 million people are quite similar to those whose population is just below 3 million.[20]

The second criterion for a valid running variable is that the cutoff cannot be used as the threshold for other policies or programs. If this requirement is not satisfied, we cannot tell if any observed effect is caused by subway approval or, instead, by other public policies that use the same population threshold. However, we believe that the compound treatment problem is not a primary threat to our population fuzzy RD design. For instance, to the best of our knowledge, a population of 3 million is not a cutoff for mayors' wage rates or fiscal transfers to cities in China, both of which are popular sources of compound treatment in population RD designs in European countries (Eggers *et al.* , 2018).[21]

We adopt a parametric, instrumental variable (IV) approach to the fuzzy RD design. More specifically, we first assume that the promotion of city mayors takes the following functional form:

$$Promotion_{it} = \ _0 + \ _1 \widehat{Approval}_{it} + \ f(Z_{i;t\ \ 2}; Pop_{i;t\ \ 2}) + \ X_{it\ \ 1} + \ _i + \ _t + \ _{it} \qquad (3)$$

[20] To overcome the problem of multiple testing in the balance test, we conduct additional tests to control for family-wise error rate in Appendix Table A15 following Eggers *et al.* (2015).

[21] Yet, this cutoff of 3 million people could be associated with a different set of land and population policies. Cities above 3 million people are categorized as "type II major cities" in China. In these "type II major cities," land sales quota and *hukou* quota (i.e., the quota for legally registered residents in urban China) are larger than for smaller cities. To avoid the influence of these compound treatments, (1) we control for population size to block the confounding influence of the different *hukou* policies for "type II major cities"; (2) we also test whether subway approval is associated with a larger area of land sales in Section 7 and do not find evidence to support this claim.

where $Z_{i;t\ 2}$ is the IV, i.e., a dummy variable indicating whether or not the city is home to more than 3 million residents; hence, $f(Z_{i;t\ 2}; Pop_{i;t\ 2})$ is a function of the running variable (i.e., the population size of the city) and its interaction with $Z_{i;t\ 2}$. The first stage of the our model is specified by the following equation:

$$Approval_{it} = \ _0 + \ _1 Z_{i;t\ 2} + \ f(Z_{i;t\ 2}; Pop_{i;t\ 2}) + \ X_{it\ 1} + \ _i + \ _t + \ _{it} \tag{4}$$

where subway approval is predicted by the IV. One potential problem of this parametric fuzzy RDD strategy is that we have to assume a functional form of $f(Z_{i;t\ 2}; Pop_{i;t\ 2})$ and the results are dependent on this assumption. We also include city fixed effects $_i$ and year fixed effects $_t$ in order to alleviate the potential bias caused by city-level unobserved factors (Holbein, 2016).

Finally, we select the optimal bandwidth for fuzzy RD design by following Imbens & Kalyanaraman (2012). The optimal bandwidth is roughly 1.06 million people around the cutoff (3 million people). In other words, we focus on cities whose population size ranges from 1.94 to 4.06 million. While the bandwidth may seem wide, cities included in this range are medium-sized Chinese cities.[22] Furthermore, given that the standard deviation of city population size is 2.4 million, our bandwidth of 1.06 million people is not wide. To further alleviate the concern that results and inference are sensitive to the choice of bandwidth, we repeat our analysis with both narrower and wider bandwidths than 1.06 million people as a robustness check. The results are generally consistent with those reported in this section. Finally, we only focus on cities with GDP larger than 100 billion Yuan and annual fiscal revenue higher than 10 billion Yuan, because only these cities are eligible to build subways.

The results based on the fuzzy RD design are reported in Table 3. First, we check if the results are susceptible to the weak instrument problem. We report the first-stage results in Panel B and the F Statistics of the first stage at the bottom of Table 3. The coefficient of the

[22]The median population size for a Chinese city is 3.6 million.

Table 3: Subway Approval and Mayors' Promotion: Fuzzy RD Design

Panel A (second stage):	Mayor promoted in three years		
	(1)	(2)	(3)
Subway approval	0.478***	0.496***	0.411***
	(0.051)	(0.178)	(0.140)
Population	0.425	-0.182	-0.415
	(0.754)	(0.822)	(1.135)
Population × IV	-0.262	1.201	0.976
	(2.320)	(3.279)	(2.968)
Panel B (first stage):	Subway approval		
	(4)	(5)	(6)
IV (Population >3 million)	1.012***	1.013***	1.012***
	(0.027)	(0.037)	(0.078)
City FE	X	X	X
Province-Year FE	X	X	X
Mayor characteristics		X	X
City characteristics			X
Observations	148	143	143
Cragg-Donald F statistic	53.47	34.12	29.27

Notes: Bandwidth is 1.06 million people, which is selected based on the optimal bandwidth methods by Imbens & Kalyanaraman (2012). Rectangular kernel is used. Standard errors clustered at the city level are reported in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. FE = fixed effects. IV = instrumental variable (i.e., population >3 million).

IV is positive and significant at the 1% level. Moreover, F statistics of all specifications are safely larger than 10, the conventional cutoff to identify a weak instrument. These results demonstrate that our IV is not a weak instrument.

The second-stage results are reported in Panel A.[23] The results across all specifications show that subway approval increases the promotion chances of mayors. One may also notice that the coefficients reported in Table 3 are larger than those in Table 2. We believe that this difference between the DID design and fuzzy RD design is mainly due to the different data samples utilized in these two tests. Most notably, the sample for the fuzzy RD design is medium-sized cities with a population of around 3 million, while the DID design uses all the

[23]We report the graphical presentation of the fuzzy RD results in the Appendix Figure A8.

cities. The effect of subway approval may be more salient for cities right around the cutoff of 3 million residents, and the fuzzy RD design captures this local average treatment effect of the compliers.

We perform several robustness checks to the results that were presented in Table 3. First, we check placebo cutoff (2 million, 4 million and 5 million population) to see whether our fuzzy RD design is valid. Not surprising, we don't find any significant results (in Appendix Table A20). Second, we investigate whether the results are robust to alternative functional forms. In Appendix Table A18, we further add the quadratic term for the running variable and its interaction with the IV. We obtain similar results. Moreover, we show that the results are robust to alternative bandwidth choices and kernel choices in Appendix Figure A10 and Table A19, respectively.

7 Mechanism and Alternative Explanations

Results reported in the previous section show that subway approval enhances the promotion chances of mayors. In this section, we examine the mechanism underlying these results. There are two parts to the mechanism. First, subway approval is expected to produce the economic performance that provincial leaders require. Second, the improved economic performance that is expected to accompany subway approval should help provincial leaders get promoted. In this section, we present evidence for both parts of the mechanism and then consider several alternative explanations.

7.1 Economic and Fiscal Benefits

To show that subway approval improves the city's economic and fiscal indicators we use the following model specification:

$$Y_{it} = \sum_{4;\ 6+1}^{X^{5}} Approval_{i(t+\ )} + ! X_{it\ 1} + \ _{i} + \ _{t} + \ _{it} \qquad (5)$$

where $Approval_{it}$ is a dummy variable indicating whether city i in year t got its first subway approval. Moreover, similar to equation (2), we add in nine different dummy variables, $Approval_{i(t+\ )}$, to check if the effect of subway approval on the city's economic performance only starts to appear after the city has obtained the approval.

The results are contained in Figure 3. We first examine the per capita infrastructure investment and GDP per capita in Panels A and B. In both cases, future subway approvals do not have a significant effect before the city receives approval (-5 to -2 on the X-axis). However, once a city obtains subway approval (0 to 4 on the X-axis), its investment in infrastructure per capita sees a jump of roughly 500 Yuan (per capita), and the reported city GDP per capita also becomes significantly higher. Both effects become more substantial as time goes by, showing that subway projects produce long-term investment and growth.

Next, we test whether subway projects enhance government fiscal revenue. In Panel C of Figure 3, we report the dynamic effects of subway approval on total government fiscal revenue per capita. We see that after the city obtains subway approval its fiscal revenue increases significantly. One possible threat to the validity of this finding is that there could have been selection effects at work. Specifically, it might have been the case that cities with better fiscal records were more likely to get subway approval. However, in fact the ex ante fiscal revenue of cities that received subway approval was not, on average, higher than was true for cities that did not receive or did not pursue subway approval.

Next, we focus more closely on a specific type of fiscal revenue for city governments, namely land sales revenue. Since the state owns all the land, only the government can sell land use rights through auctions in China. These land auctions have recently become a primary source of fiscal revenue for many city governments. In Panel D of Figure 3, we test if subway projects increase the land sales revenue for a city government. We use land sales revenue per capita as outcome variable. As shown in Panel D, from the second year onward after a city obtains subway approval, land sales revenue for the city government becomes significantly higher. We do not find a significant effect on land sales revenue before subway

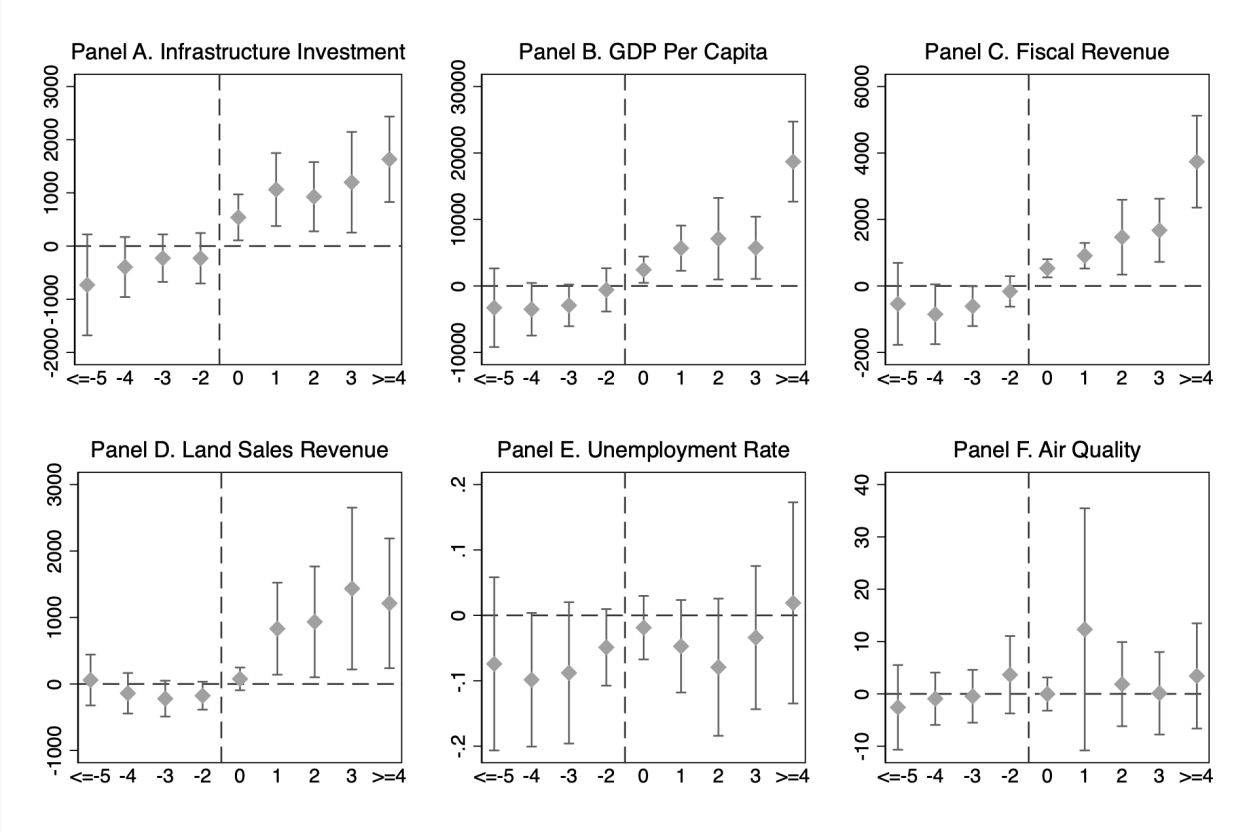

Figure 3: **Dynamic Effects of Subway Approvals on Economic Performance, Unemployment Rate and Air Quality**. Each circle indicates a point estimate. Vertical bars are 95% confidence intervals. The dummy variable indicating one-year prior treatment status (i.e. when $= +1$) is omitted from the regression.

approval.[24]

Taken together, the results contained in Panels A to D in Figure 3 demonstrate that subway approval significantly improves the economic and fiscal performance of the city (and so, the province). Note that most of these improvements take place as soon as the city obtains subway approval. Moreover, these economic and fiscal indicators continue to increase after the city obtains subway and after the mayor leaves office. Hence, provincial leaders can observe the improved economic and fiscal performance of the city relatively quickly, thus justifying the increased promotion chances of mayors in the near term.

[24]Readers who are interested in why land sales revenue increases are directed to Appendix Figure A11. We show that the increased *land price* rather than a larger area of land explains the higher land sales revenue.

A competing explanation to that offered here focuses on the contention that subway projects can improve the welfare of city residents. Rather than the hypothesized synergy between the career of mayors and provincial leaders given subway approval, perhaps the welfare improvement for citizens explains the improved promotion chances for city mayors who have obtained subway approval. The welfare improvement explanation, however, is unlikely to explain mayoral promotion because welfare improvements will be realized primarily after the subway begins operation. Completion of the subway, however, does not occur while the mayor who secured approval is in office. Still, two potential welfare improvements may occur before the subway becomes operational and so we must consider their impact.

Subway construction implies that more workers will be hired to design and build subway lines. Furthermore, new businesses will begin to develop along the future subway lines. Hence, a city building a subway is expected to have a lower unemployment rate. An additional beneficial economic impact is likely to arise once residents learn that their city is going to build a subway. They may then delay their plans to buy cars, choosing to use public transportation more. This may lead to better air quality. We test these two conjectures in Panels E and F of Figure 3. The evidence does not support these two conjectures.

7.2 The Promotion of the Provincial Party Secretary

We now investigate whether subway projects help the provincial party secretary (PPS) get promoted. Since we argue that the PPS rewards mayors who obtain subway projects, we should expect that subway projects also improve the promotion chances of the PPS. Otherwise, the PPS is unlikely to have the required incentive to reward a subway project.

We examine the effect of subway approvals on the promotion of the PPS in Table 4. We focus on PPS's rather than governors because PPS's have the strongest influence on mayors' political career in a province.[25] The outcome variable is a dummy variable indicating whether

[25]As a placebo test, we check the effect of subway approval on the promotion of provincial governor (who do not exert as strong influence on the political career of Chinese mayors as PPS's) in Appendix Table A21.

the PPS is promoted to the level of vice-premier within three years.[26] We choose three years to be consistent with our main specifications. The results are also robust when we use the promotion of PPS within one, two, four, or five years as the outcome variable (see Appendix Table A22).

In the first column of Table 4, we only include our major explanatory variable, namely an indicator for whether a city in the province obtained a subway approval, as well as province and year fixed effects. Then in column (2), we further add the age, education level, and gender of the PPS. In column (3), we include such province-level variables as GDP size, population size, fiscal revenue size, and GDP growth rate (all lagged by one year). Across all specifications, we see that subway approval is always positively and significantly associated with the promotion of PPS. These results demonstrate that subway projects are useful "pork" that may help the PPS build up performance and get promoted to the central government. Moreover, we also plot the dynamic effect of subway approval on the promotion of PPS's in Appendix Figure A12. This figure demonstrates that the improved promotion chances of PPS's only show up *after* the province obtains a subway approval.

7.3 Future Utilization Rate

Although subway projects do not produce short-term welfare improvements in terms of either jobs or air quality for residents (see Panels E and F of Figure 3), subway approvals pave the way for welfare improvements for residents once the subway lines start to operate. Hence, an alternative explanation for our results is that mayors who have obtained subway projects are rewarded for these long-term welfare improvements. In this case, promotion reflects the "current value" of future welfare improvements.

We do not find evidence that subway projects help governors get promoted.

[26] This level includes membership in the Politburo, membership in the central Secretariat, vice premier of the State Council, vice president of the National People's Congress, and the vice president of the Chinese People's Political Consultative Conference.

Table 4: Subway Approval and the Promotion of Provincial Party Secretary

	PPS promotion		
	(1)	(2)	(3)
Subway approval	0.159*	0.165**	0.161**
	(0.085)	(0.072)	(0.071)
Province FE	X	X	X
Year FE	X	X	X
PPS controls		X	X
Province controls			X
Provinces	26	26	26
Observations	390	390	390

Notes: Standard errors clustered at the province level are reported in parentheses. We exclude four municipalities and Tibet. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. FE = fixed effects. PPS promotion = provincial party secretary is promoted within three years.

A direct implication of this view is that, among all the mayors who have obtained subway approvals, on average, those who are promoted should have produced more of these long-term welfare improvements for their residents compared to those mayors with subway approval who are not promoted. To test this implication, we collected subway ridership data from the China Association of Metros. They have released detailed subway ridership data since 2013. We use the number of subway riders to measure the future welfare improvement because taking the subway (and any consequences of this action) is a direct way to assess the value that the subway added to the city's residents. However, additional tests utilizing these data (contained in Appendix Table A23) do not find that subways in cities whose mayor was promoted have more subway riders. These results demonstrate that the promotion is not a reflection of future utilization of subways.

7.4 Strategic Appointment of Mayors

Another inference that might be drawn from our findings is that provincial leaders appoint politically connected individuals as mayors in cities that will then obtain subway approval.

If this is the case, our results are driven by factional political ties rather than by a political exchange relationship between mayors and provincial leaders. However, the evidence already presented refutes this argument. We have controlled for different measures of mayors' political connections with the PPS or governor of the province. The explanation for promotions proffered here remains robust in the models that control for these indicators. This is true both for the generalized DID design and the fuzzy RD design.

To alleviate any further concern for the strategic appointment of politically connected mayors just before the announcement of subway approvals, we test if city mayors are more likely to be replaced in one, two, or three year(s) before the city is granted subway approval. The results are presented in Appendix Table A24. From this table, we see that the turnover rate of mayors is not significantly different in years shortly before the city obtains subway approval than other times. This demonstrates that there is no systematic pattern in which provincial leaders replace city mayors shortly before a city obtains subway approval.[27]

7.5 Corruption

Finally, we consider whether subway construction breeds rent-seeking opportunities that make it feasible for mayors to trade money for promotion. To test if this mechanism can explain our results, we first identify all mayors who were investigated for corruption by utilizing the CCER Official Database and the Chinese Political Elite Database. We code a mayor as a "corrupt mayor" if s/he has *ever* been investigated for corruption. As reported in Appendix Table A26, we do not find that subway projects are correlated with a higher chance of mayors being investigated for corruption controlling for city-level variables and mayor characteristics (including mayors' political connections with provincial leaders). This provides at least suggestive evidence that personal rent seeking is not a major goal for pursuing subway investment. Similarly, our results are also robust to the inclusion of "corrupt mayor" as a control variable (see Appendix Table A27).

[27] We also check the turnover of less educated mayor in Appendix Table A25 and obtain similar results.

Moreover, we also explore whether lower-tier city officials reap private benefits in subway investment. We employ the data on corruption investigations against officials at all levels of political appointment from Wang & Dickson (2019) and test if cities that pursue subway investment have more city officials investigated for corruption. As reported in Appendix Table A28, we do not find evidence to support this conjecture.

Finally, we employ a third variable to measure the corruption of city officials. Following Chen & Kung (2019), we proxy the local corruption by the presence of discounted land sales to companies associated with the so-called "princelings," namely, the relatives of Politburo members. As shown in Appendix Table A29, we do not find evidence that mayors who obtain subway approvals are more likely to sell land at a discounted price to such political elites as princelings than other mayors who do not secure a subway approval.[28] Neither do we find that the inclusion of discounted land sales to princelings as a control variable changes the main findings reported in Table 2. Taken together, perhaps surprisingly, our analysis does not support the notion that mayors pursue subway projects to reap economic rents.

8 Concluding Remarks

Why do city mayors have incentives to make investment in long-term transportation infrastructure projects such as subway lines? With original panel data of Chinese cities from 2003 to 2016, we show that mayors obtaining subway approval have an additional 21.3 percentage points chance of getting promoted. By focusing only on cities with a population around 3 million and employing a fuzzy RDD, we find that mayors with subway approvals have an additional 33.7 percentage points chance of being promoted in these medium-size cities. These results explain why Chinese mayors have the incentives to work on subway projects

[28] However, our analysis does show that *subsequent* mayors are more likely to sell land to princelings at a discounted price. While this finding indicates that subway projects breed elite favoritism in the long run, the fact that *future* mayors may benefit economically from subway projects does not explain why the incumbent mayor who is *not* expected to reap rents would initiate a subway project in the first place.

even if they are unlikely to be in o ce at the completion of the project.

Moreover, our results point to the ine ectiveness of the seemingly powerful, approval-based system for infrastructure investment in China. Although one initial goal of the central government approval is to reduce politically-motivated infrastructure investment (Huang, 1999), we demonstrate that the central bureaucracy (e.g., the NDRC) does not eliminate the politics-driven infrastructure projects. Further, we demonstrate a fundamental synergy between the incentives of mayors and of provincial party secretaries that is realized as a result of subway projects (and, by inference, other large infrastructure projects). Mayors who have subway approval deliver economic bene ts to the PPS. The PPS's prospects of promotion are signi cantly improved thanks to these economic returns. In response, provincial party secretaries promote those mayors who subway approval proved bene cial for the PPS. Thus, as one hand rewards the other, both mayors and PPS's can rise in the political hierarchy.

Hence, going back to the puzzle of the extremely high infrastructure investment in China (Figure 1), we show that this is at least partly due to the strong political career incentives of its local o cials. More speci cally, two features of the Chinese system sustain this result. First, the central government evaluates provincial o cials mainly based on their economic performance. Second, city o cials, who plan, propose, and implement subway projects, are held accountable to higher-ups rather than local residents. To the extent that these two institutional features are quite unique in China, the lower infrastructure investment in other countries perhaps has a more local explanation than is suggested in other research that looks at national factors (Choet al. , 2019; Simmons, 2016). More broadly, countries that are more likely to reward local o cials for initiating long-term investment in the short term (either through economic or political means), especially before the completion of the tenure of local o cials, will have higher infrastructure investment. Out study demonstrates how the China achieves this goal by combining a top-down political hierarchy that holds mayors accountable to provincial leaders and a growth-oriented system to evaluate performance of provincial leaders.

Another critical question is whether similar results can be found in other types of infrastructure investment. While answering this question requires us to investigate other forms of public projects, the logic of our current work implies that all infrastructure investment that stimulates economic and scal performance in the city should increase the promotion chances of city mayors. Hence, we should expect to obtain similar results if we study such infrastructure projects as airports. Another critical requirement is that provincial leaders can clearly identify the credit-takers for public projects. Many inter-city transportation infrastructure projects (such as highways and high-speed railways) may fall prey to this problem, thus making the theoretical prediction less clear.

Hence, future research can further investigate why the Chinese government can promote investment in inter-city highways and high-speed railways. To answer this question, we may need to study another institutional feature of the Chinese political system that is not investigated in this paper, namely the coordination function of the central government (Lei & Nugent, 2018). Whether such coordination based on a \top-down" authoritarian regime is part of the explanation for the massive infrastructure investment in China deems further investigation. More generally, to what extent institutional features at the national level, compared to the local political dynamics examined in this article, can explain the variation of long-term, large-scale infrastructure investment demands more systematic analysis.

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Acknowledgement : Zhenhuan Lei is deeply grateful to his dissertation advisor, Bruce Bueno de Mesquita, for guidance, advice, and encouragement in all stages of the writing of this manuscript. The authors thank Tianyang Xi and Yang Yao for sharing the CCER O cials Dataset, and Rafael Ch, William Godel, Jean Hong, Yue Hou, Ruixue Jia, James Kung, Pierre Landry, Yishuang Li, Xiaobo Lu, Zhaotian Luo, Xiao Ma, Edmund Malesky, Melanie Manion, Dan Mattingly, Xun Pang, Julia Payson, Eleanor Powell, Adam Przeworski, Pablo Querubin, Peter Rosendor , Arturas Rozenas, Shanker Satyanath, Peng Shen, Shiran Victoria Shen, Victor Shih, Alastair Smith, Austin Strange, Milan Svolik, Roco Titiunik, Erik Wang, Yuhua Wang, Dave Weimer, Tianyang Xi, Yang Xie, Yiqing Xu, Hye Young You, Congyi Zhou, as well as three anonymous reviewers for helpful comments and feedback. Mengdi Yue has provided excellent research assistance. Previous versions of this manuscript were presented at the annual conferences of MPSA and APSA, as well as internal workshops at University of Wisconsin-Madison, New York University, and Peking University.

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Online Appendix

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A Additional Analysis on Cross-Country Comparison on Infrastructure Investment

In this section, we present additional information on the Chinese infrastructure investment compared with other countries. First, we present in Figure A1 that the total value of Chinese investment in railway or in road was clearly higher than any other country plotted here. Again, the data show that China made more investment in either railway or in road than all other 46 countries plotted in Figure A1. With such huge gap between the Chinese investment level and that in other countries, the result that China invests more in major transportation infrastructure is not sensitive to the choice of measurement.

Figure A1: Total Investment in Transportation Infrastructure and GDP Per Capita . Red line is a linear t of the data sample. The grey shaded area is the 95% con dence interval. Data sources: OECD and World Bank.

Another concern is that the choice of year, 2014, is problematic. It may be the case

that China invested a lot only in this one year. To show that 2014 is not the only year when China made massive investment in railway and road, we plot the investment in road and railway (as share of GDP) from 1995 to 2015 for four countries, namely China, Mexico, India, and the United States in Figure A2. One clear pattern arises in this gure. China has spent a higher share of GDP on developing railway and road projects than the other three countries in the past twenty-plus years. Year 2014 is not the only year when China made more investment than the other three countries; nor is it the year when the Chinese investment in railway or in roar reached the peak.

Figure A2: Infrastructure Investment in China, Mexico, India and the US

B Additional Information on the Application Process

In this section, we provide additional information on how cities apply to the central government for subway approval by conducting several case studies. The purpose of these case studies is to provide some background information to readers regarding the process of subway applications.

When cities plan to submit subway applications, they set up a new government agency usually called \the leading team for or subway planning and construction." This new agency is not required by law to be established. It is, however, established to coordinate the complex process of submitting subway applications to provincial and central government. The head of this \leading team" is usually the city mayor mainly because the work of this \leading team" is to coordinate di erent agencies within city government rather than city party committee or other branches of the local party-state system.

For example, Figure A3 is the governmental announcement to reshu e the members of the \leading team" for Dongguan, a prefecture-level city in Guangdong Province[29]. The leader of this \leading team" is the city mayor and the vice leader is the executive vice mayor. Most members of this \leading team" are directors of bureaus within the city government. Furthermore, city party secretary (CPS) is not a member of this \leading team" probably because city mayor is in a better position to coordinate the bureaus within the city government.

Then what does this \leading group" do exactly? The city government of Liuzhou, a prefecture-level city in Guangxi Province, disclosed the detailed tasks of the \leading group" and the process of subway application to the public[30]. We should note here that such information disclosure is not the standard maintained in most cities in China. Hence, we

[29]The original document can be found at http://www.dg.gov.cn/007330010/0202/201610/88962478e193413caa7bd6e606f7dcd6.shtml. Accessed on November 9, 2019.

[30]We nd the o cial document at the government website: http://www.liuzhou.gov.cn/xxgk/jcxxgk/zcwj/sjfggz_42671/201808/t20180816_1154085.html . Accessed on November 9, 2019.

Figure A3: The \Leading Group" for Dongguan

can only analyze the case of Liuzhou, which generously discloses the information on how it planed to apply for subway approval. Dy doing so, we hope to get some insights into the process of subway applications.

There are two parts of the work: prepare a plan of subway system (PSS) and lobby the provincial and central government. However, in its essence, the ultimate goal of lobbying the provincial government is to ask provincial o cials to lobby the central ministries on behalf of the city. Nevertheless, before city governments lobby their superiors, they need to do some preparations. First, the \leading group" has to prepare a balance table that demonstrates the city is scally and economically eligible to build a subway system. Second, the \leading group" should contact and coordinate with the organizations designated by provincial and central government to evaluate the project plan. Then there will be several rounds of back-

and-forth to revise the project plan as suggested by the evaluation team. Then the \leading group" will submit the revised PSS to the central government. After all of these preparations, the \leading group" will send several city o cials to lobby bureaucrats at central ministries.

Since \lobbying" seems to play a key role in the whole process, we discuss further what \lobbying" means in the context of subway application in China. Although we do not have direct knowledge of the lobbying process, it seems that \lobbying" is mainly a process for city o cials to communicate directly with those central o cials who evaluate their subway application. The words used in Liuzhou's o cial document is to \report to" the National Development and Reform Commission (NDRC) and to \actively visit" the Ministry of Housing and Rural-Urban Development. Moreover, the lobbying o cials are also usually key gures in city government rather than CPS or other cadres in the city party committee. For example, while we know little about who represented Liuzhou to lobby Beijing, the government of another city, Wuhu, disclosed that it had sent the executive vice mayor to lobby bureaucrats at the NDRC.[31]

We can learn three things from this arrangement of having key gure in the city government to lobby Beijing. First, if the main task of lobbying is to seek favoritism by using politicians' personal network (known as*guanxi* in Chinese), the city should probably send the CPS who usually enjoys a higher rank and has broader political network than the mayor or executive vice mayor. Second, this arrangement shows once again that CPS is not the major party who directly participates in the process of applying for subway approval. Third, it seems that city governments are not ordered or directed by provincial or central government to build subways. If cities are simply agents of provincial and central government and only implement their plans, then we would not see the \lobbying" part of the application. In other words, subway projects are indeed initiated by city governments.

Below, we report all the cities that have completed the process of subway application

[31]We know this from a press statement released by the government of Wuhu:http://whfgw.wuhu.gov.cn/fgywz/20151210/336242.html . Accessed on November 9, 2019.

and obtained subway approval from 2003 to 2016 in Table A1. In this list, we do not include four province-level municipalities. The sources of these data are either the o cial website of the National Development and Reform Commission[32]. In some other cases, the provincial Development and Reform Commission discloses subway approvals to the public.

Table A1: The List of Subway Approvals

City	Approved year	Approved subway plan (Chinese)
Changchun	2010	• % Î ë h S ¤ ú ¾Ä 2010 -2016
Dalian	2009	' Þ Î h S ¤ ú ¾Ä 2009-2016
Dalian	2015	' Þ Î h S ¤ , Œ ú ¾Ä 2015 2020
Wuhan	2011	f I Î h S ¤ Ñ ú ¾Ä 2010-2017
Wuhan	2015	f I Î h S ¤ , ú ¾Ä 2015 2021
Wuhu	2016	œV h S ¤ ú ¾Ä 2016 -2020
Nanjing	2005	W¬ Î ë h S ¤ ú ¾Ä 2004-2015
Nanjing	2015	W¬ Î h S ¤ , Œ ú ¾Ä 2015 2020
Chengdu	2005	ý Î ë h S ¤ ú ¾Ä
Chengdu	2013	ý Î h S ¤ Ñ ú ¾Ä 2013 2020
Chengdu	2016	ý Î h S ¤ , ú ¾Ä 2016 2020
Shenyang	2005	ˆ 3 ë h S ¤ ú ¾Ä
Shenyang	2012	ˆ 3 Î h S ¤ Ñ ú ¾Ä 2012|2018
Xi'An	2006	• ‰ Î ë h S ¤ ú ¾Ä 2006 -2015
Xi'An	2013	• ‰ h S ¤ Ñ ú ¾Ä 2012 2018
Suzhou	2007	Ï Þ Î ë h S ¤ ú ¾Ä
Suzhou	2012	Ï Þ Î h S ¤ ú ¾Ä (2010-2015)
Kunming	2009	Î ë h S ¤ ú ¾Ä
Kunming	2013	Î h S ¤ Ñ ú ¾Ä 2013 2019

[32]Most information is contained in the web-page under \information disclosure": http://zfxxgk.ndrc.gov.cn/web/dirlist.jsp?dirid=9&pid=9 . For instance, here is s the subway approval to Suzhou in 2012: http://zfxxgk.ndrc.gov.cn/web/iteminfo.jsp?id=350 . Both are accessed on November 9, 2019.

Table A1 { continued from previous page

City	Approved year	Approved subway plan (Chinese)
Hangzhou	2005	m Þ Î ë h S ¤ ú ¾Ä
Hangzhou	2013	m Þ Î h S ¤ Ñ ú ¾Ä 2013-2019
Hangzhou	2016	m Þ Î h S ¤ , ú ¾Ä 2017-2022
Lanzhou	2012	p Þ Î h S ¤ Ñ ú ¾Ä 2011^ 2020t
Urumqi	2012	L • (P Î h S ¤ ú ¾Ä 2012^ 2019t
Urumqi	2016	L • (P Î h S ¤ , Œ ú ¾Ä 2016-2021
Xuzhou	2013	• Þ Î h S ¤ Ñ ú ¾Ä 2013^ 2020t
Changzhou	2012	8 Þ Î h S ¤ Ñ ú ¾Ä 2011-2018
Taiyuan	2012	* Ÿ Î h S ¤ Ñ ú ¾Ä 2012 2018t
Harbin	2005	È è 0 Á å Ñ 10t Ä
Harbin	2012	È è Î h S ¤ Ñ ú ¾Ä 2008^ 2018t
Zhengzhou	2009	Ñ Þ Î ë h S ¤ Ñ ú ¾Ä 2008-2015
Zhengzhou	2014	Ñ Þ Î h S ¤ Ñ ú ¾Ä 2014^ 2020t
Changsha	2009	• ™ h S ¤ , n ú ¾Ä (2008^ 2015t)
Changsha	2012	• ™ Î h S ¤ Ñ ú ¾Ä (2012^ 2018t)
Ningbo	2008	• â Î ë h S ¤ ú ¾Ä 2006-2015
Ningbo	2013	• â Î h S ¤ Ñ ú ¾Ä 2013^ 2020t
Wuxi	2008	à ! Î h S ¤ Ñ ú ¾Ä (2008-2015)
Wuxi	2013	à ! Î h S ¤ Ñ ú ¾Ä 2013^ 2018t
Qingdao	2009	R › Î h S ¤ Ñ ú ¾Ä 2009-2016
Qingdao	2013	R › Î h S ¤ Ñ ú ¾Ä 2013^ 2018t
Fuzhou	2009	• Þ Î ë h S ¤ Ñ ú ¾Ä
Fuzhou	2015	• Þ Î h S ¤ , Œ ú ¾Ä 2015^ 2021t
Dongguan	2009	ž Î ë h S ¤ ú ¾Ä (2009|2015 t)
Dongguan	2013	ž Î h S ¤ Ñ ú ¾Ä 2013^ 2019t
Naning	2010	W• Î h S ¤ Ñ ú ¾Ä 2009-2015
Naning	2015	W• Î h S ¤ Ñ ú ¾Ä 2015^ 2021t

Table A1 { continued from previous page

City	Approved year	Approved subway plan (Chinese)
Hefei	2010	¥ Î h S ¤ Ñ ú ¾Ä (2009-2016)
Hefei	2014	¥ Î h S ¤ Ñ ú ¾Ä 2014 ~ 2020
Shijiazhuang	2012	ó ¶ „ Î h S ¤ Ñ ú ¾Ä 2012 ~ 2020
Guiyang	2010	5 3 Î h S ¤ Ñ ú ¾Ä (2010-2020)
Guiyang	2016	5 3 Î h S ¤ ú ¾Ä 2016 ~ 2022
Xiamen	2011	¦ è Î h S ¤ Ñ ú ¾Ä 2011 ~ 2020
Xiamen	2016	¦ è Î h S ¤ , Œ ú ¾Ä 2016-2022
Hohhot	2015	|Œ i y Î h S ¤ Ñ ú ¾Ä 2015 ~ 2020
Jinan	2015	N W Î h S ¤ Ñ ú ¾Ä 2015 ~ 2019
Luoyang	2016	3 Î h S ¤ , ú ¾Ä 2016-2020
Shaoxing	2016	Í t Î h S ¤ , ú ¾Ä 2016-2021
Nantong	2014	W Î h S ¤ Ñ ú ¾Ä 2014 ~ 2020
Baotou	2016	4 Î h S ¤ , ú ¾Ä 2016 ~ 2022)
Nanchang	2009	W Î h S ¤ Ñ ú ¾Ä 2009-2016
Nanchang	2015	W Î h S ¤ , Œ ú ¾Ä 2015 ~ 2021

C Additional Information on Control Variables

Table A2: Description and Source of Control Variables

Variable name	Description	Source
City population	Continuous variable	CCSY
City GDP size	Continuous variable	CCSY
City scal revenue size	Continuous variable	CCSY
City GDP growth rate	Continuous variable	CCSY
Mayor age	Continuous variable	CCER
Mayor education	Dummy: 1 = college degree or above (party school included) ; 0 = otherwise	CPED
Mayor gender	Dummy: 1 = male; 0 = female	CPED
Mayor race	Dummy: 1 = Han; 0 = otherwise	CPED
Mayor's experience in the central government	Dummy: 1 = mayor worked at the central government; 0 = otherwise	CPED
Mayor's experience in the provincial government	Dummy: 1 = mayor worked at the provincial government; 0 = otherwise	CPED
Mayor's experience in the county government	Dummy: 1 = mayor worked at the county government; 0 = otherwise	CPED
Mayor's experience in SOE	Dummy: 1 = mayor worked at a SOE earlier; 0 = otherwise	CPED
Mayor's experience in university	Dummy: 1 = mayor worked at a university earlier; 0 = otherwise	CPED
Mayor's experience in Youth League	Dummy: 1 = mayor worked in the Youth League earlier; 0 = otherwise	CPED
Mayor's birthplace connection with PPS	Dummy: 1 = mayor was born in the same prefecture as PPS; 0 = otherwise	CCER
Mayor's alumni connection with PPS	Dummy: 1 = mayor went to the same college as PPS; 0 = otherwise	CCER
Mayor's workplace connection with PPS	Dummy: 1 = mayor and PPS used to work in the same government agency; 0 = otherwise	CCER
Mayor's promotion connection with PPS	Dummy: 1 = mayor was appointed by the current PPS; 0 = otherwise	CCER
Mayor's promotion connection with PG	Dummy: 1 = mayor was appointed by the current PG; 0 = otherwise	CPED

Notes: This table reports the list of control variables that we use in this paper. CPED = Chinese Political Elite Database; CCER = CCER O cial Dataset; CCSY = China City Statistical Yearbook; SOE = state-owned enterprises; PPS = provincial party secretary; PG = provincial governor.

Table A3: Summary Statistics of Control Variables

Variable name	Obs	Mean	Std.Dev.	Min	Max
City population	3157	5.807	.655	2.652	7.052
City GDP size	3391	15.751	.963	12.669	18.98
City scal revenue size	3395	12.898	1.166	9.412	17.121
City GDP growth rate (%)	3384	12.5	4.6	-19.4	109
Mayor age	3608	50.037	3.847	33	60
Mayor education	3625	.609	.488	0	1
Mayor gender	3634	.94	.238	0	1
Mayor race	3632	.928	.259	0	1
Mayor's experience in the central government	3632	.088	.283	0	1
Mayor's experience in the provincial government	3610	.473	.499	0	1
Mayor's experience in the county government	3634	.521	.5	0	1
Mayor's experience in SOE	3634	.203	.402	0	1
Mayor's experience in university	3634	.017	.128	0	1
Mayor's experience in Youth League	3634	.195	.397	0	1
Mayor's birthplace connection with PPS	3643	.013	.114	0	1
Mayor's alumni connection with PPS	3643	.044	.206	0	1
Mayor's workplace connection with PPS	3643	.01	.099	0	1
Mayor's promotion connection with PPS	3636	.633	.482	0	1
Mayor's promotion connection with PG	3575	.622	.485	0	1

Notes: This table contains the descriptive statistics of control variables that we use in this paper. CPED = Chinese Political Elite Database; CCER = CCER O cial Dataset; CCSY = China City Statistical Yearbook; SOE = state-owned enterprises; PPS = provincial party secretary; PG = provincial governor.

D Additional Tests on the DID Design

Table A4: Subway Approval and Mayoral Promotion: Alternative Measure of Promotion

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
Panel A:	Only promotion to vice-province-level positions			
Subway approval	0.189***	0.199***	0.199***	0.193***
	(0.059)	(0.061)	(0.066)	(0.061)
Panel B:	Including promotion to important prefecture-level positions in provincial government			
Subway approval	0.217**	0.236***	0.222**	0.165*
	(0.086)	(0.087)	(0.092)	(0.090)
Panel C:	Further including promotion to prefecture-level positions in central government			
Subway approval	0.200**	0.220***	0.210**	0.141
	(0.083)	(0.084)	(0.090)	(0.091)
Panel D:	Further including promotion to other prefecture-level positions in provincial government			
Subway approval	0.191***	0.216***	0.225***	0.179*
	(0.069)	(0.075)	(0.081)	(0.093)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
Province-year FE				X
Observations	3633	3558	3084	3063

Notes: This table shows that the results in Table 2 are robust to alternative measures for promotion. To construct different alternative measures for mayoral promotion, we consider the following subsequent positions after mayors leave office: (a) party secretary of a prefecture-level city; (b) a vice-province-level position (e.g., vice governor of a province); (c) an important prefecture-level position in provincial government or party committee; (d) a prefecture-level position in the central government; and (e) other non-important prefecture-level position in provincial government. We define important prefecture-level positions in province by following the same coding rule adopted by the CCER official database (Xi et al., 2018). That is, we code the following positions as important prefecture-level appointments in the provincial government or party system: the head of general office, department of finance, department of police, or Development and Reform Commission in the provincial government, and the executive vice-director of general office, the commission of politics and law, the commission for discipline inspection, the department of personnel, or the department

of propaganda in the provincial party system. In our main analysis, we follow Landryet al. (2018) and de ne promotion using (a) and (b). Our de nition of promotion in each panel are as follow: For panel A, we restrict to de nition (b); for panel B, we include (a), (b) and (c); for panel C, we include (a), (b), (c), and (d); and for panel D, we include all of them. Standard errors clustered at the city level are reported in parentheses. Control variables: (1) mayor controls include gender, ethnicity, age, education level, political connection with provincial party secretary, and previous work experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League; (2) city controls include population, GDP size, GDP growth rate, and scal revenue in the previous year. The Signi cance levels: * $p < 0:1$, ** $p < 0:05$, *** $p < 0:01$. FE = xed e ects.

Table A5: Subway Approval and Mayoral Promotion: Alternative Measures for Political Connections

	Mayoral promotion in three years				
	(1)	(2)	(3)	(4)	(5)
Subway approval	0.213**	0.212**	0.208**	0.159*	0.167*
	(0.096)	(0.096)	(0.097)	(0.095)	(0.095)
City FE	X	X	X	X	X
Province-year FE	X	X	X	X	X
Mayor controls	X	X	X	X	X
City controls	X	X	X	X	X
Measures for political connections:					
Mayor's workplace connections with PPS	X				
Mayor's hometown connections with PPS		X			
Mayor's alumni connections with PPS			X		
Mayor's promotion connections with PPS				X	
Mayor's promotion connections with PG					X
Cities	246	246	246	246	246
Observations	3092	3092	3092	3089	3032

Notes: This table shows that the results in Table 2 are robust to alternative measures for a mayor's political connections with the provincial party secretary (PPS) or with the provincial governor (PG). We use the workplace connection with the PPS to proxy for a mayor's political connections with the provincial leaders in Table 2, which we replicate here in column (1) for comparison. We consider here another four different measures for political connections to either the PPS or PG in this Appendix table. The definition of these different measures for political connections are contained in Appendix Table A2. Control variables: (1) mayor controls include gender, ethnicity, age, education level, and previous work experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League; (2) city controls include population, GDP size, GDP growth rate, and fiscal revenue in the previous year. Standard errors clustered at the city level are reported in parentheses. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. PPS = provincial party secretary. PG = provincial governor. FE = fixed effects.

Table A6: Subway Approval and Mayors' Promotion with Alternative Outcome Measures

	Promotion in 1 year		Promotion in 2 years		Promotion in 4 years		Promotion in 5 years	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Subway approval	0.125**	0.117**	0.202**	0.187**	0.256**	0.214**	0.264**	0.230**
	(0.054)	(0.054)	(0.087)	(0.079)	(0.100)	(0.102)	(0.103)	(0.103)
City FE	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X
Province-year FE		X		X		X		X
Mayor controls		X		X		X		X
City controls		X		X		X		X
Observations	3647	3092	3647	3092	3647	3092	3647	3092

Notes: This table shows that the main results are robust to alternative outcome measures. To do so, we use mayor's promotion in one, two, four or ve years as outcome variable and obtain similar results as those reported in Table 2. Control variables: (1) mayor controls include mayor's gender, ethnicity, age education level, mayor's political connection with provincial party secretary, and mayor's previous working experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League; (2) city controls include city's population size, GDP size, GDP growth rate, and scal revenue in the previous year. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. FE = xed e ects.

Table A7: Subway Approval and Mayor's Promotion with Alternative Measures for Cities' Economic Performance

	Mayor promoted in three years		
	(1)	(2)	(3)
Subway approval	0.197*	0.338***	0.316***
	(0.102)	(0.107)	(0.114)
Population (3-year mean)	0.367	0.271	0.430
	(0.368)	(0.560)	(0.441)
Fiscal revenue (3-year mean)	-0.030	-0.121	-0.122
	(0.137)	(0.168)	(0.159)
GDP (3-year mean)	-0.031	-0.237	-0.213
	(0.234)	(0.245)	(0.245)
GDP growth rate (3-year mean)	0.006		
	(0.005)		
Nighttime light intensity		-0.094	
		(0.158)	
GDP growth: agriculture (3-year mean)			-0.013
			(0.010)
GDP growth: manufacture (3-year mean)			-0.000
			(0.008)
GDP growth: service (3-year mean)			-0.002
			(0.011)
City FE	X	X	X
Province-year FE	X	X	X
Mayor controls	X	X	X
Observations	2592	1884	2125

Notes: This table shows that the main results are robust to the inclusion of alternative measures for cities' economic performance. In column (1), we use the average of cities' population size, GDP size, GDP growth rate, and scal revenue in the previous three years as control variables. The average of city-level variables in the previous three years is less sensitive to the in uence of extreme values. Next, in column (2) we replace GDP growth rate by nighttime light intensity, which is measured by Log average nighttime brightness per square km. The data come from Jiang (2018), where the author merges the nighttime light intensity data from National Oceanic and Atmospheric Administration of the United States with the panel data for Chinese cities. Because many Chinese cities manipulate their economic data, we use nighttime light intensity to have a less biased measure for cities' economic performance. Finally, in column (3), we decompose economic growth into the growth in three sectors and include them as control variables. Across all these speci cations, we obtain similar results as those reported in Table 2. Mayor controls include mayor's gender, ethnicity, age education level, mayor's political connection with provincial party secretary, and mayor's previous working experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: † $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. FE = xed e ects.

Table A8: Subway Approval and Mayor's Promotion: Drop Kunming

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
Subway approval	0.243**	0.267***	0.253**	0.201**
	(0.100)	(0.101)	(0.104)	(0.100)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
Province-year FE				X
Dependent variable mean	0.426	0.429	0.432	0.432
Observations	3633	3554	3080	3080

Notes: This table shows that the main results are robust to exclusion of Kunming from our dataset. Control variables: (1) mayor controls include mayor's gender, ethnicity, age education level, mayor's political connection with provincial party secretary, and mayor's previous working experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League; (2) city controls include city's population size, GDP size, GDP growth rate, and scal revenue in the previous year. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: *p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

Table A9: Subway Approval and Mayoral Promotion: A Smaller Sample

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
Subway approval	0.165	0.189*	0.195*	0.390**
	(0.111)	(0.101)	(0.095)	(0.165)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
Province-year FE				X
Observations	294	288	269	269

Notes: We limit the sample to the 21 prefecture-level cities that have obtained subway approval by 2016 in this table. Hence, all the variation of subway approval comes from the temporal variation that some cities obtain subway approval earlier and some other later. Control variables: (1) mayor controls include gender, ethnicity, age, education level, and previous work experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League; (2) city controls include population, GDP size, GDP growth rate, and scal revenue in the previous year. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: *p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

Table A10: Subway Approval and Mayoral Promotion: Cross-Sectional Analysis

	Mayoral Promotion			
	(1)	(2)	(3)	(4)
Subway approval	0.286*	0.303*	0.320**	0.327*
	(0.169)	(0.161)	(0.155)	(0.174)
Successor mayor				0.024
				(0.237)
City FE	X	X	X	X
Leaving year-province FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
No. of observations	890	862	757	757

Notes: As an additional test, we check if our results remain robust in cross-sectional regression analysis. We re-structure the data as a cross-sectional data of all mayors whose tenure falls between 2003 and 2016. The main focus of these regressions is a dummy variable indicating whether a city mayor obtains subway approval in his/her tenure. The outcome variable is a dummy variable which equals one if a mayor is promoted and equals zero if otherwise. In column (4), we construct another variable \successor mayor" which equals to one if a mayor does not obtain subway approval but his/her predecessors have obtained subway approval. The coe cient of this additional variable captures whether successors enjoy higher promotion chances. In this table, we nd that (a) mayors who obtain subway approval are more likely to be promoted, and (b) successors are not more likely to get promoted. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * $p < 0:1$, ** $p < 0:05$, *** $p < 0:01$. FE= xed e ects.

Table A11: Placebo Test: Subway Approval and the Promotion of City Party Secretary

	CPS promoted in three years		
	(1)	(2)	(3)
Subway approval	-0.071	-0.081	-0.073
	(0.045)	(0.050)	(0.050)
City FE	X	X	X
Province-Year FE	X	X	X
CPS characteristics		X	X
City characteristics			X
Observations	3633	3472	3015

Notes: This table shows that subway approval does not increase the promotion chance for city party secretary (CPS). This result is consistent with our theory because CPS is not responsible for applying for subways in China. When a city applies for subway approvals, the city government usually establishes a new government agency called \the leading task group for subway planning and construction" and city mayor is usually the head of this organization based on our limited knowledge. Hence, it is safe to assume that subways are pork provided by city mayors to provincial leaders in most cases, and so, we should not observe increased promotion chances for CPS due to subway approvals. We code CPS promotion as one if the CPS is promoted to the level of vice-governor/vice-minister within three tears. Control variables: (1) CPS characteristics include CPS's age, gender, ethnicity, CPS's connections with PPS based on workplace, CPS's education level and CPS's previous working experience in this city government, the provincial government, the central government, state-owned enterprises, university, and the Communist Youth League; (2) city characteristics include city's population size, GDP size, GDP growth rate, and scal revenue in the previous year. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * $p < 0:1$, ** $p < 0:05$, *** $p < 0:01$. FE = xed e ects. CPS = city party secretary.

Table A12: Subway Approval and Mayoral Promotion: with Mayor Fixed E ects

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
Subway approval	0.122*	0.134**	0.132*	0.146**
	(0.066)	(0.067)	(0.067)	(0.068)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
Mayor Tenure				X
Observations	3398	3364	2905	2674

Notes: We report the results with mayor xed e ects controlled. Hence, we will be able to control the true ability of mayors and rule out the signal model. We couldn't control province-year FE because it will cost a lot of degree of freedom. Standard errors clustered at the city level are reported in parentheses. Control variables: (1) mayor controls include only time variant variables: age, and political connection with provincial party secretary; (2) city controls include population, GDP size, GDP growth rate, and scal revenue in the previous year. The Signi cance levels: * $p < 0:1$, ** $p < 0:05$, *** $p < 0:01$. FE = xed e ects.

Table A13: Subway Approval and Mayor's Promotion: Heterogeneous e ect over Age

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
Subway approval	0.216*	0.226*	0.211*	0.175
	(0.125)	(0.119)	(0.126)	(0.147)
Mayor Age over 50	-0.011	0.042	0.044	0.054
	(0.026)	(0.032)	(0.035)	(0.036)
Subway approval	0.071	0.063	0.066	0.055
Mayor Age over 50	(0.121)	(0.118)	(0.125)	(0.161)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
Province-year FE				X
Observations	3608	3566	3092	3071

Notes: This table shows that the main results are robust when we consider the heterogeneous e ect of age. It shows that there is no di erence in the e ect when the mayor's age is above 50. Control variables: (1) mayor controls include mayor's gender, ethnicity, age, education, mayor's political connection with provincial party secretary, and mayor's previous working experience in county government, provincial government, central government, state-owned enterprises, university, and the Communist Youth League; (2) city controls include city's population size, GDP size, GDP growth rate, and scal revenue in the previous year. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: *p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

E Technical Details on the Dynamic E ects of Subway Approval

In this section, we present supporting results for the dynamic e ects of subway approval on mayoral promotion. In the rst two columns of Table A14, we present the results based on the speci cation introduced in our paper. We re-write the speci cation below.

$$\text{Promotion}_{it} = \sum_{=\ 4;\ 6+1}^{+5} \text{Approval}_{i(t+\ )} + !X_{it\ \ 1} + \ _i + \ _t + \ _{it} \qquad (6)$$

where $\text{Approval}_{i(t+\ )}$ is a set of dummy variables indicating whether city i has obtained subway approval at time $t+\ $. Hence, measures the e ect of subway approval both before the city has obtained approval (i.e., $>\ 0$) and after the city has obtained subway approval for years (i.e., $<\ 0$).[33] The parallel trends assumption requires that all (when $>\ 0$) are not signi cantly di erent from zero. From the rst two columns in Table A14, we see that this is indeed the case. We plot Figure 2 based on column (1).

We next adopt an even more exible speci cation in the models presented in columns (3) and (4) of Table A14. The model speci cation is illustrated as the equation below:

$$\text{Promotion}_{it} = \sum_{=\ 4;\ 6+1}^{+5} \text{Approval}_{i(t+\ )} + \sum_{=+1}^{+4} \text{Leave}_{i(t+\ )} + !X_{it\ \ 1} + \ _i + \ _t + \ _{it} \qquad (7)$$

where $\text{Approval}_{i(t+\ )}$ is still a set of dummy variables indicating whether city i has obtained subway approval at time $t+\ $. In addition, we further introduce a series of dummy variables, $\text{Leave}_{i(t+\ )}$, that indicate for each year that it is the th year after the mayor who obtained subway approval left o ce in order to capture the e ect of subway approval on a mayor's promotion after the mayor who obtained subway approval leaves o ce.

The parallel trends assumption now requires that both (when $>\ 0$) and are

[33] For example, $\text{Approval}_{i(t\ \ 2)} = 1$ means year t is two years after the year when city i gets its rst subway approval, and $\text{Approval}_{i(t+2)} = 1$ means year t is two year prior to that.

not signi cantly di erent from zero. The substantive interpretation is that before the city receives its subway approval and after the mayor who obtained approval leaves o ce, subway approvals should no longer help with promotion. The positive and signi cant e ect of subway approvals on mayoral promotion are expected to appear only after the city receives subway approval and before the relevant mayor leaves o ce. In columns (3) and (4), we nd that this is indeed the case.

Table A14: Test Parallel Trends Assumption

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
To be approved in 5 or more years	-0.028	-0.046	-0.080	-0.091
	(0.090)	(0.099)	(0.093)	(0.103)
To be approved in 4 years	0.078	-0.001	0.073	0.001
	(0.088)	(0.104)	(0.089)	(0.104)
To be approved in 3 years	-0.039	-0.107	-0.047	-0.109
	(0.097)	(0.104)	(0.098)	(0.103)
To be approved in 2 years	-0.013	-0.062	-0.003	-0.042
	(0.092)	(0.094)	(0.094)	(0.092)
To be approved in 1 year (baseline)				
Approval year	0.219**	0.202**	0.228*	0.243*
	(0.095)	(0.090)	(0.135)	(0.134)
Approved for 1 year	0.155	0.053	0.167	0.101
	(0.118)	(0.129)	(0.156)	(0.166)
Approved for 2 years	0.312*	0.214	0.322	0.261
	(0.162)	(0.173)	(0.201)	(0.210)
Approved for 3 years	0.655***	0.496***	0.683***	0.563***
	(0.093)	(0.169)	(0.139)	(0.192)
Approved for 4 or more years	0.540***	0.531***	0.576***	0.611***
	(0.148)	(0.170)	(0.178)	(0.197)
Mayor left for 1 year			0.176	0.155
			(0.165)	(0.165)
Mayor left for 2 years			0.122	0.096
			(0.197)	(0.205)
Mayor left for 3 years			0.175	0.210
			(0.191)	(0.197)
Mayor left for 4 or more years			-0.050	-0.013
			(0.107)	(0.111)
City FE	X	X	X	X
Year FE	X	X	X	X
Baseline controls		X		X
Province-year FE		X		X
Observations	3647	3092	3647	3092

Notes: This table reports the regression results for Figure 2. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

F Additional Tests on the Fuzzy RD Design

Figure A4: Balance Test on Pre-treatment Covariates. Each circle is a point estimate and horizontal bars are the 95% con dence intervals. Two variables mayor education and mayor provincial experience are close to be imbalanced. To check whether it is imbalanced by chance, we check adjusted p-value in Table A15. We further check the heterogeneous treatment e ect over mayor education and province experience in Table A16, and whether there is a strategic appointment of less educated mayor in Table A25. Those results altogether suggest mayor education and mayor provincial experience are imbalanced by chance. Due to the limit of our data, we cannot conduct balance test on other pre-treatment variables that we do not have the data yet. However, based on the results contained in this gure, we do not nd any strong imbalances among the observed variables we use in this study.

Table A15: Balance Test on Pre-treatment Covariates

	Original Results		FWER P-values		
	(1)	(2)	(3)	(4)	(5)
	Coe cient	P-values	Westfall-Young	Bonferroni-Holm	Sidak-Holm
Mayor age	1.034	0.702	0.830	1.000	0.821
Mayor gender	0.209	0.747	0.900	1.000	0.978
Mayor race	-0.019	0.518	0.900	1.000	0.978
Mayor education	-0.615	0.073	0.740	0.392	0.329
Central government experience	-0.289	0.371	0.880	1.000	0.955
Mayor province experience	-0.630	0.072	0.850	1.000	0.860
Mayor county experience	0.003	0.887	1.000	1.000	0.987
Mayor SOE experience	0.421	0.421	0.900	1.000	0.978
Mayor university experience	-0.000	.	0.880	1.000	0.966
Youth league experience	-0.314	0.530	0.880	1.000	0.966
Political connection	0.108	0.591	0.900	1.000	0.978
GDP per capita	-0.048	0.217	0.880	1.000	0.954
Fiscal revnue per capita	0.045	0.476	0.910	1.000	0.978
GDP growth rate	0.949	0.987	0.900	1.000	0.978

Notes: We report the p-values for balance tests on pre-treatment covariates for our fuzzy RDD. Column (1) reports the coe cients for pre-treatment covariates. Column (2) contains the original p-values. A dot (.) means there is not enough statistical variation to calculate a p-value. When we conduct multiple balance tests for di erent pre-treatment variables, it is possible that the result for a few of them may present statistical signi cance by chance. This may be the case for the signi cant results (at the 10% level) for our balance tests on mayors' education and prior work experience in the provincial government. To detect whether this is the case and to rule out such \random" statistical signi cance by chance, we employ the family wise error rates (FWER) shown in columns (3) to (5). They adjust p-values by using multiple hypothesis testing techniques, a method designed exactly for our purpose here. More speci cally, we employ three di erent types of FWER analysis, namely, (a) Westfall-Young p-value based on Jones et al. (2019); (b) Bonferroni-Holm p-value based on Holm (1979); and (c) Sidak-Holm p-value based on Sidak (1967). Bonferroni-Holm p-value adjustment and Sidak-Holm p-value adjustment follows a step-down algorithm, while Westfall-Young p-value adjustment uses a re-sampling strategy. Columns (3) to (5) contain the results, respectively. These results demonstrate that the weak signi cance associated with mayor education and mayor province experience are indeed due to chance, and so, lend further credence to our fuzzy RDD.

Table A16: Subway Approval and Mayor's Promotion: Heterogeneous e ect over Edcuation and Province Experience

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
Subway approval	0.906***	0.748***	0.923***	0.826***
	(0.090)	(0.126)	(0.122)	(0.146)
Subway approval	-0.161	-0.418**		
Mayor Education	(0.164)	(0.167)		
Subway approval			-0.245	-0.326
Province Province Experience			(0.163)	(0.252)
Mayor Education	0.004	-0.181	0.004	-0.216
	(0.071)	(0.222)	(0.070)	(0.226)
Mayor Province Experience	0.113**	-0.403**	0.115**	-0.376*
	(0.051)	(0.188)	(0.051)	(0.188)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor controls	X	X	X	X
City controls	X	X	X	X
Only Eligible Cities		X		X
Observations	1161	133	1161	133

Notes: This table shows that the main results are robust when we consider the heterogeneous e ect of education and province experience. It shows there is a heterogeneous e ect over education but not over province experience. The sample is restricted to observations with population is within 1.058 million around 3 million population cuto . Column (2) and (4) are further restricted to eligible cities with scal revenue higher than 10 billion yuan and GDP higher than 100 billion yuan. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * $p < 0:1$, ** $p < 0:05$, *** $p < 0:01$. FE = xed e ects.

Figure A5: Distribution of City Population Size

Figure A6: Distribution of City GDP Size

Figure A7: Distribution of City Fiscal Revenue Size

Figure A8: Graphical Presentation of the Fuzzy RD Design (Reduced Form)

Figure A9: Graphical Presentation of the Fuzzy RD Design (First Stage)

Table A17: Manipulation Tests of Candidate Discontinuities

Candidate Discontinuity	T-statistics (P-value)
Permanent resident = 3 million	0.1232 (0.902)
Fiscal revenue = 10 billion Yuan	1.1934 (0.233)
GDP = 100 billion Yuan	3.4452 (0.001)

Notes: We check whether there is a density jump at the proposed cuto for three potential running variables: permanent resident (population), scal revenue, and GDP following McCrary (2008). The T-statistics and P-values are calculated usingrddensity package. We nd no evidence of density jump for population around the cuto being 3 million population. However, there is a clear evidence for GDP at 100 billion Yuan cuto , and there is a slight possibility for scal revenue, since the p-value is around 0.2.

Table A18: Fuzzy Regression Discontinuity Design: Check Functional Form

Panel A (second stage):	Mayor promoted in three years		
	(1)	(2)	(3)
Subway approval	0.723***	0.516**	0.814***
	(0.216)	(0.259)	(0.283)
Population	0.250	1.503	-3.250
	(2.365)	(2.257)	(2.788)
Population^2	-0.492	0.765	-2.381*
	(1.706)	(1.250)	(1.378)
Population IV	-13.115***	-9.964**	-5.369
	(4.338)	(4.500)	(5.205)
Population^2 IV	13.032***	8.350**	11.033*
	(2.074)	(4.240)	(6.015)
Panel B (rst stage):	Subway approval		
	(4)	(5)	(6)
IV (Population > 3 million)	0.985***	0.960***	0.871***
	(0.047)	(0.094)	(0.204)
City FE	X	X	X
Province-Year FE	X	X	X
Mayor characteristics		X	X
City characteristics			X
Observations	148	143	143

Notes: We check the functional form of our parametric fuzzy RDD by including quadratic term of running variable and its interaction with instrumental variable. The results are robust to this alternative functional form. Furthermore, the coe cients of these two additional quadratic terms are mostly small and insigni cant, showing that the in uence of higher terms of running variable is not strong. Standard errors clustered at the province and year level are reported in parentheses. Signi cance levels: * $p < 0:1$, ** $p < 0:05$, *** $p < 0:01$. FE= xed e ects. IV=instrumental variable (i.e., population > 3 million).

Table A19: Fuzzy Regression Discontinuity Design: Check Alternative Kernel

Panel A (second stage):	Mayor promoted in three years			
Kernel Used	Triangular	Cosine	Quartic	Epanechnikov
	(1)	(2)	(3)	(4)
Subway approval	0.544***	0.533***	0.606***	0.521***
	(0.153)	(0.149)	(0.125)	(0.149)
Population	-1.095	-1.069	-1.441	-1.013
	(1.055)	(1.043)	(0.947)	(1.056)
Population IV	0.366	0.417	0.548	0.433
	(2.237)	(2.307)	(1.938)	(2.357)
Panel B (rst stage):	Subway approval			
	(5)	(6)	(7)	(8)
IV (Population > 3 million)	1.011***	1.010***	0.998***	1.010***
	(0.047)	(0.048)	(0.047)	(0.050)
City FE	X	X	X	X
Province-Year FE	X	X	X	X
Mayor characteristics	X	X	X	X
City characteristics	X	X	X	X
Observations	143	143	143	143

Notes: We check our parametric fuzzy RDD by alternative kernels. We choose triangular kernel, cosine kernel, quadratic kernel and Epanechnikov kernel. The results are consistent with our main results using rectangular kernel. Standard errors clustered at the province and year level are reported in parentheses. Signi cance levels: *p < 0:1, ** p < 0:05, *** p < 0:01. FE= xed e ects. IV=instrumental variable (i.e., population > 3 million).

Table A20: Fuzzy Regression Discontinuity Design: Check Placebo Cuto

Panel A (second stage):	Mayor promoted in three years		
Placebo Cuto (Population)	2 million	4 million	5 million
	(1)	(2)	(3)
Subway approval	0.254	0.554	-115.538
	(0.428)	(0.477)	(16014.997)
Population	0.003	15.576	-56.079
	(0.880)	(13.481)	(7897.617)
Population IV	-2.033**	-3.991	-125.828
	(0.838)	(5.490)	(17408.760)
Panel B (rst stage):	Subway approval		
	(4)	(5)	(6)
IV (Population > Cuto)	-0.340	1.449	-0.003
	(0.247)	(1.532)	(0.590)
City FE	X	X	X
Province Time trend	X	X	X
Mayor characteristics	X	X	X
City characteristics	X	X	X
Observations	136	72	168

Notes: We check our parametric fuzzy RDD by checking placebo cuto of running variable. We choose 2 million, 4 million and 5 million population as our placebo cuto . Rectangular kernel is used. Due to the number of observation, we control for province time trend instead. The results show that there is no e ect when we specify a placebo cuto . Standard errors clustered at the province and year level are reported in parentheses. The coe cients and standard errors are huge in some columns due to the weak instrument problems in the rst stage, which also con rms the validity of 3 million population cuto . Signi cance levels: * $p < 0:1$, ** $p < 0:05$, *** $p < 0:01$. FE= xed e ects. IV=instrumental variable (i.e., population > cuto speci ed respectively).

Figure A10: Fuzzy Regression Discontinuity Design Results with Alternative Bandwidth Choices . Each circle indicates a point estimate for the e ect of subway approval on the promotion of city mayors in three years. Vertical bars are the 90% and 95% con dence intervals. All baseline control variables and two-way xed e ects are included.

G Additional Tests on Mechanism and Alternative Explanations

Figure A11: Dynamic E ects of Subway Approvals on Land Price and Area for Government Land Sales . Each circle indicates a point estimate. Vertical bars are 95% con dence intervals. The dummy variable indicating one-year prior treatment status is omitted from the regression. Given the importance of land sales revenue for local governments, we further di erentiate two channels in this gure. First, the land around subway lines may be sold at ahigher price. Additionally, subway lines extend the urban periphery of the city so that the city can sell land over alarger area. To test these two possibilities, we further collect land sales data for city governments from the China Land and Resources Statistical Yearbook, which contains the land sales data for all prefecture-level cities from 2004 to 2016. To measure land price, we use (1) land price per hectare and (2) land price per transaction. In Panels A and B of Figure A11, we use these two measures for the land price as outcome variables. In both panels, we see that land price increases after the city obtains the subway approval, showing that subway projects generate more land sales revenue by increasing the land price. Next, we test if subway approval allows a city government to sell a larger area of land. We use total area of land sales (hectare) and land area per transaction as outcome variables. We show these results in Panels C and D of Figure A11. Contrary to the expectation, we do not nd any signi cant results. This means that subway projects do not help city governments sell a larger amount of land.

Figure A12: Dynamic E ects on the Promotion of Provincial Party Secretaries .
Each circle indicates a point estimate for the e ect of subway approval and the vertical bars are the 90% and 95% con dence intervals. Negative numbers on the horizontal axis refer to the years before a province receives subway approval. Numbers without signs on the horizontal axis indicate the years since the province receives subway approval. We omit the year before the province obtains subway approval as baseline. All coe cients should be interpreted in comparison with this baseline year.

Table A21: Placebo Test: Subway Approval and the Promotion of Provincial Governor

	Gubernatorial promotion		
	(1)	(2)	(3)
Subway approval	0.078	0.065	0.052
	(0.058)	(0.063)	(0.065)
Province FE	X	X	X
Year FE	X	X	X
Governor controls		X	X
Province controls			X
Provinces	26	26	26
Observations	390	390	390

Notes: Standard errors clustered at the province level are reported in parentheses. We exclude four municipalities and Tibet. Signi cance levels: * p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects. Gubernatorial promotion = Provincial governor promoted within three years.

Table A22: Subway Approval and the Promotion of Provincial Party Secretary with Alternative Outcome Measures

	PPS promoted in X years			
	(1) 1 year	(2) 2 years	(3) 4 years	(4) 5 years
Subway approval	0.085*	0.140**	0.134*	0.131*
	(0.042)	(0.062)	(0.072)	(0.074)
PPS age	-0.001	-0.011*	-0.035***	-0.042***
	(0.004)	(0.007)	(0.009)	(0.010)
PPS education	0.104*	0.142	0.183	0.230
	(0.054)	(0.101)	(0.135)	(0.165)
Female PPS	0.135***	0.291***	0.506***	0.463***
	(0.044)	(0.078)	(0.095)	(0.092)
Province GDP	0.293	0.746	0.603	0.641
	(0.329)	(0.536)	(0.664)	(0.744)
Province population	-0.117	-0.413	-1.084	-1.164
	(0.380)	(0.640)	(0.888)	(1.135)
Province fiscal revenue	-0.088	-0.344	-0.303	-0.401
	(0.173)	(0.307)	(0.457)	(0.529)
Province GDP growth	0.394	0.407	0.835	0.768
	(0.259)	(0.557)	(0.725)	(0.773)
PPS corruption	-0.041	-0.081	-0.102	-0.089
	(0.037)	(0.067)	(0.121)	(0.132)
Provinces	26	26	26	26
Observations	390	390	390	390

Notes: This table shows that the results in Table 4 are robust to alternative measures for the promotion of PPS (i.e., promotion in one, two, four or five years). All specifications include province and year fixed effects. Standard errors clustered at the province level are reported in parentheses. We exclude four municipalities and Tibet. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. PPS = provincial party secretary.

Table A23: Mayor Promotion and Subway Ridership Intensity

	Promoted mayor	Not promoted mayor	Mean di erence
Subway ridership intensity	5787.500	7958.333	-2170.833
	(770.074)	(1455.369)	(1902.721)
Subway ridership intensity > 7,000	0.375	0.500	-0.125
	(0.183)	(0.151)	(0.238)

Notes: We measure subway ridership by \ridership intensity," de ned as the number of subway riders per day per kilometer (people/day/kilometer). The central government has required that all subway lines should carry at least 7,000 people/day/kilometer. Hence, we test whether those cities whose mayors are promoted due to a subway project were mayors of cities that enjoyed more signi cant ridership intensity in the future. Because the China Association of Metros only reports rider statistics for cities that have already operated a subway system, we only have ridership data for 20 cities that obtained subway approval in or before 2016. Out of these 20 cities, 8 cities' mayors were promoted after they obtained this city's rst subway approval. The other 12 cities' mayors were laterally transferred or asked to retire even though these mayors obtained the rst subway approval for the city. With this small sample of cities, we only report a T-test of the di erence of ridership intensity between promoted mayors and non-promoted mayors. This table shows that subways in cities whose mayor was promoted do not have more subway ridership intensity, nor are they more likely to pass the central government's ridership intensity requirement than mayors who were not promoted. These results demonstrate that the promotion is not a re ection of future utilization of subways. Unit for subway ridership intensity is people/day/kilometer. Standard errors are reported in parentheses.

Table A24: Is There Strategic Appointment of Mayors before Subway Approvals?

	Turnover of City Mayor		
	(1)	(2)	(3)
1 year before subway approval	-0.020		
	(0.070)		
2 years before subway approval		-0.016	
		(0.078)	
3 years before subway approval			0.128
			(0.086)
City FE	X	X	X
Year FE	X	X	X
Outcome variable mean	0.285	0.285	0.285
Observations	3410	3409	3408

Notes: This table shows that there is no evidence that more mayor turnover occurs before a city gets subway approval. It is unlikely that a mayor is strategically appointed to a city which will get a subway approval so that the mayor can get credits for obtaining subway approval. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

Table A25: Is There Strategic Appointment of Mayors before Subway Approvals?

	Turnover of Less Educated Mayors		
	(1)	(2)	(3)
1 year before subway approval	0.032		
	(0.057)		
2 years before subway approval		0.002	
		(0.058)	
3 years before subway approval			-0.005
			(0.039)
City FE	X	X	X
Year FE	X	X	X
Outcome variable mean	0.119	0.119	0.119
Observations	3410	3409	3408

Notes: This table shows that there is no evidence that more less-educated mayor turnover occurs before a city gets subway approval. We de ne less-educated mayor as a mayor without a college degree. It is unlikely that a less-educated mayor is strategically appointed to a city which will get a subway approval so that the mayor can get credits for obtaining subway approval to compensate its disadvantage in education. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

Table A26: Subway Approval and Corruption

	Mayor investigated for corruption			
	(1)	(2)	(3)	(4)
Subway approval	-0.100	-0.072	-0.064	-0.038
	(0.117)	(0.114)	(0.133)	(0.142)
Successor				0.092
				(0.243)
City FE	X	X	X	X
Leaving year-province FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
No. of observations	899	862	757	757

Notes: In this table, we test if mayors who obtain subway approval are more likely to be investigated for corruption. We do not nd evidence to support this claim. Mayors who have obtained subway approval are not more likely to be investigated for corruption. However, their successors are slightly more likely to be investigated for corruption; nevertheless, this results is not statistically signi cant either. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

Table A27: Testing Corruption Mechanism

	Mayor promoted in three years		
	(1)	(2)	(3)
Subway approval	0.252***	0.257***	0.213**
	(0.095)	(0.098)	(0.096)
Corrupt mayor	0.031	0.022	0.015
	(0.051)	(0.056)	(0.060)
City FE	X	X	X
Year FE	X	X	X
Province-Year FE			X
City and mayor controls		X	X
Outcome variable mean	0.412	0.416	0.416
Observations	3647	3092	3092

Notes: This table shows that by including a measure of the corruption of mayors, our results are still robust. Standard errors clustered at the city level are reported in parentheses. Signi cance levels: * p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

Table A28: Subway Approval and O cial Corruption: Cross-Sectional Analysis

Panel A:	Number of Corruption Cases			
	(1) Bureau	(2) Division	(3) Section	(4) All
Subway approval	0.003	1.348	-5.007	-3.656
	(0.539)	(2.593)	(4.818)	(6.179)
Panel B:	Corruption Cases Per Million People			
	(5) Bureau	(6) Division	(7) Section	(8) All
Subway approval	-0.023	0.630	-0.349	0.258
	(0.171)	(0.633)	(1.125)	(1.563)
Province xed e ects	X	X	X	X
City controls	X	X	X	X
No. of observations	233	233	233	233

Notes: In this table, we test whether cities that have obtained subway approval have more corrupt o cials. The independent variable in this table, Subway approval, is an indicator variable which equals one if the city has obtained any subway approval by 2016, and is coded as zero if otherwise. For dependent variables, we consider the total number of corrupted o cials with the political appointment at the level of Bureau director (…@§), Division chief (¿ §), and section head (Ñ §) during the anti-corruption campaign launched by the Chinese President Xi Jinping from 2012-2016. The data source for corrupt o cials is Wang & Dickson (2019). Moreover, we also investigate the e ect of subway approval on total number of corrupted o cial, regardless of the bureaucratic level of the o cial. All dependent variables in Panel A are reported in total number, while those reported in Panel B are measured as number of cases per million people, the latter of which is intended to control for the size of population (or at least partly, the size of city o cials). The structure of dataset is cross-sectional. We control for province xed e ects and city-level variables in 2004, the initial year, to avoid the post-treatment bias. We nd no evidence that subway approval is associated with more corruption cases. Robust standard errors clustered at the province level are reported in parentheses. Signi cance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A29: Subway Approvals and Discounted Land Sales to Princelings

	Discounted Land Sales to Princelings$_{j,t+1}$				
	(1)	(2)	(3)	(4)	(5)
Subway approval	0.040	0.034	0.015	-0.013	0.021
	(0.076)	(0.076)	(0.076)	(0.083)	(0.084)
Successor mayor					0.131**
					(0.064)
City FE	X	X	X	X	X
Year FE	X	X	X	X	X
Mayor controls		X	X	X	X
City controls			X	X	X
Province-year FE				X	X
Observations	2861	2787	2365	2350	2350

Notes: In this table, we test whether mayors that have obtained subway approval are more likely to sell land to princelings' companies at a lower price. The outcome variable is an indicator variable that equals one if the city c sells any land at a discounted price to any pricenling rms (i.e., rms that are invested by relatives of Politburo members) in year t + 1, and to zero if otherwise. The data of this variable are drawn from Chen & Kung (2019). Readers interested in the details of this variable are also directed to this paper. All control variables are the same as those used in Table 2. From this table, we do not nd evidence that mayors who obtain subway approvals are more likely to sell land at a discounted price to princelings. However, future mayors are more likely to do engage in such rent-seeking activities (\successor mayor" shown in column (5)). While this shows that subway investment may pave the way for future corruption, the rent-seeking activities of successorsdo not explain why incumbent mayors should take the e ort to obtain subway approval. Moreover, as shown in the Table A30 in the next page, our main ndings remain robust when we control for discounted land sales to princeling rms. Robust standard errors clustered at the city level are reported in parentheses. Signi cance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. FE = xed e ects.

Table A30: Subway Approval and Mayoral Promotion: Controlling for Discounted Land Sales to Princelings

	Mayor promoted in three years			
	(1)	(2)	(3)	(4)
Subway approval	0.309***	0.337***	0.313***	0.282***
	(0.097)	(0.097)	(0.096)	(0.099)
Any discounted land sales	-0.017	-0.012	-0.010	-0.004
	(0.026)	(0.026)	(0.027)	(0.030)
Size of discounted land sales	0.006	0.009	0.011	-0.010
	(0.016)	(0.017)	(0.017)	(0.020)
City FE	X	X	X	X
Year FE	X	X	X	X
Mayor controls		X	X	X
City controls			X	X
Province-year FE				X
Observations	2865	2812	2610	2594

Notes: In this table, we test whether our results based on a generalized di erences-in-di erences design shown in Table 2 are robust to the inclusion of discounted land sales to princeling rms (i.e., rms that are invested by relatives of Politburo members). All control variables are the same as those used in Table 2. We nd that our results are still robust. Moreover, consistent with Chen & Kung (2019), we do not nd evidence that discounted land sales to princeling rms is meaningfully correlated with mayoral promotion. Robust standard errors clustered at the city level are reported in parentheses. Signi cance levels: *p < 0:1, ** p < 0:05, *** p < 0:01. FE = xed e ects.

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