On the Fast Train: Seeking Political Incentives for High-Speed Rail Construction in China

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Abstract

Recent work on China's infrastructure has argued that politicians are motivated to build long-term projects by short-term career goals. Using original data on high-speed rail infrastructure, I examine the relationship between high-speed rail, economic performance, and politicians' promotion. I do not find evidence of a significant relationship between high-speed rail approval and promotion rates, and suggest that further work is necessary to illuminate incentives for infrastructure development.

Replication code and data for this project is available on Github: https://github.com/DaevanMangalmurti/PLSC-438-Final.git

1 Introduction

Building infrastructure, like all types of public goods provision, demands political choices. These may be driven by personal priorities, as when a politician with a two-year term builds a project that will be done by reelection rather than a road requiring a decade. Choices may respond to perceived needs, as when a politician decides which neighborhood should have its roads repaired first. A core function of political science is studying public goods provision to understand who gets what, and why. Examining distributive politics is the path toward ensuring that government services meet public needs. The bigger the scale of a public good, the more urgent it is to understand the incentives governing its allocation.

In this century, China has built more infrastructure, faster, than any other country (OECD, 2023). Its infrastructure spending represents almost 1% of global GDP. China's success defies the mismatch between short-term political incentives and long-term infrastructure demands that confronts most countries.

How has China done it? In "Private Returns to Public Investment: Political Career Incentives and Infrastructure Investment in China," Lei and Zhou argue that one answer lies in China's political structure (Lei and Zhou, 2022). Unlike in democracies, where politicians answer to voters, Chinese politicians answer to their superiors. This reduces the electoral costs of building infrastructure and aligns short-term and long-term interests. Provincial Chinese politicians are charged by the central government with delivering economic growth. When prefectural politicians—mayors and party secretaries—produce economic results—e.g. by investing in infrastructure—they are demonstrating their competence, but also helping provincial politicians fulfill their mandates. In doing so, they may increase their chances of being promoted. This theory is supported by a growing body of work linking economic performancew with political advancement in China (Luo and Qin, 2021; Landry et al., 2018)

Using an original dataset on subway approvals, Lei and Zhou demonstrate that mayors who receive approval to build subways have higher promotion rates than mayors overall. They show that the mechanism for this relationship is likely an increase in economic performance after a subway is approved. A better economy signals helpfulness and contributes to a provincial politicians' objectives (Lei and Zhou, 2022).

In this paper, I apply Lei and Zhou's theory of incentives to a different kind of infrastructure: high-speed rail (HSR). Like subways, HSR is perceived as a contributor to economic growth and a desirable form of infrastructure for cities. This makes it well-suited to testing (a) whether there is a relationship between infrastructure beyond subways and prefectural officials' promotion and (b) whether the presence or absence of that relationship is due to the mechanism of economic performance.

Using an original dataset on Chinese cities' HSR approvals, I study the relationship between HSR and prefectural officials' promotion. Using a differences-in-differences identification strategy, I find that there is not a significant positive relationship between a city receiving approval for HSR and politicians' likelihood of promotion for either mayors or party secretaries. I demonstrate that a likely reason for the absence of a positive relationship in my dataset is the absence of Lei and Zhou's proposed mechanism. There is not a consistently positive relationship between high-speed rail approval and local economic outcomes. I suggest that this shows that Lei and Zhou's theory is useful but does not explain why HSR has been and continues to be built, and I conclude by explaining the next stage of my research on this topic.

2 Background: High-Speed Rail in China

In the decade to 2019, China built 25,000 kilometers of HSR, more than any other country's existing HSR network (Lawrence et al., 2019). The process for constructing a high-speed rail line can be divided into four general phases (Ma, 2022).

The process begins at the local level, where local governments prepare proposals and submit them to China Railway Corporation (CRC), the state-owned railway company. If CRC, the Ministry of Transport, and the National Development and Reform Commission (NDRC) agree that the proposed route should be considered, it is included in one of the Five-Year Plans in the Medium- and Long-Term Railway Plan (MLTRP), the central government's comprehensive 15-year HSR plan (Ma, 2022; Lawrence et al., 2019).

The project now moves into pre-feasibility evaluation by the CRC. If the proposal passes, CRC and the proposing government send it to the NDRC. If the NDRC approves the proposal, that marks the central government's formal acceptance of the project.

Once the proposal has been been accepted by the NDRC, it goes through feasibility evaluations. These include review by the CRC, NDRC, and up to five other ministries. During this period, the proposal is often revised substantially to satisfy their requirements. Once all parties are satisfied, the proposal, now called a "project feasibility report" is sent back to the NDRC for approval. The final phase, during which the relevant local government begins preparing for construction, comes once the project feasibility report is approved (Ma, 2022).

The HSR network has widely been seen as the product of top-down efforts by China's central government. While the central government sets targets in terms of rail construction and oversees the operation of HSR routes, the HSR approval process clearly shows that HSR is heavily dependent on local government involvement. Recent work has shown that this is true to a greater degree than previously thought. Cities will spend years lobbying and negotiating with the central government for approval to construct or extent HSR routes. This can extend to maintaining offices in Beijing to push for a city's interests (Ma, 2022; Ji and Ma, 2022).

Although central government approval is a prerequisite for building HSR, the cost of a dedicated HSR station—a requirement for most Chinese cities' initial HSR lines—and land acquisition is mostly borne by local governments (Yang and Han, 2020; Yuan et al., 2023; Wang et al., 2021). Route operations are also partially subsidized by the local government—an issue because many HSR lines lose money (Ma, 2022). The fact that governments lobby for permission to build HSR nonetheless demonstrates that HSR is perceived as having significant benefits. Studies of HSR development in Chinese cities has found that the siting of HSR lines has been used to try to shift cities' economic centers of gravity (Wang et al., 2022; Chen et al., 2021; Zhu, 2021; Chi and Han, 2023); to decrease travel times with the aim of improving connectivity and economic synergy (Huang and Zong, 2022; Lawrence et al., 2019; Xu and Chen, 2014); and to increase investment and revenue (Wang et al., 2022; Yang and Han, 2020). While productivity gains from reduced travel time are well-documented, the actual economic benefits are not. Studies have found evidence that HSR construction leads to changes

in urbanization patterns and that housing and land near HSR stations increases in value (Wang et al., 2022; Yang and Han, 2020). Globally, HSR has been shown to increase local GDP growth through greater connectivity, but it has also been found to negatively affect peripheral regions and industrial areas by concentrating labor and capital in hub cities (Chi and Han, 2023; Zhu, 2021). Recent work on China has also found that cities that build HSR experience increases in their financing costs for other projects (Ruan et al., 2023; Yuan, 2023; Jian, 2019).

All of this indicates that while HSR is regarded as a net economic boon, its actual effect may be more mixed at the local level. At the provincial level, higher connectivity should result in higher GDP growth and per capita GDP. The fact that local governments continue to lobby for and build HSR lines indicates that, similar to subway lines, HSR has large perceived economic benefits. Since HSR routes are often finished after the term of the prefectural officials under whom they were started, HSR is therefore a useful test of Lei and Zhou's theory that investing in infrastructure signals "helpfulness" to provincial leaders and can show whether that relationship holds even for projects with mixed economic consequences at the local level but positive provincial outcomes.

3 Data

I rely on two datasets for my empirical analysis. I begin by collecting an original dataset of 103 observations on intercity high-speed rail construction between 2003 and 2022, which I subset to 2003-2016 to match my second dataset. Intercity high-speed rail includes regional HSR lines with speeds of 200-350 km/h. I focus on intercity railways because they require the greatest involvement from local governments. Like all HSR lines, intercity lines are approved by the central government, but they receive more significant financing from local governments than national HSR, and their day-to-day operations are more highly subsidized by cities. As such, intercity HSR requires high levels of initiative and lobbying from local governments. If infrastructure investment is used to generate economic growth and signal helpfulness and competence, HSR should provide the closest analogue to Lei and Zhou's subway dataset and therefore be a useful test of the applicability of their incentive theory to other infrastructure projects.

I collect the names and routes of intercity HSR projects from Wikipedia [1]. Where it is publicly available, I use the year in which the NDRC approved a route's project feasibility report as the year of approval. Otherwise I use the year in which construction began. In many cases construction begins in the same year as approval, so I do not lag the year in which construction began to find approval. One exception to this was HSR

[1] https://en.wikipedia.org/wiki/List_of_high-speed_railway_lines_in_China.

in Tangfang and Langshan, which was approved in 2009 but did not start until 2015 [2]. I use 2009 as the year of approval and, following Lei and Zhou, would expect to see economic effects soon after approval was announced. When I run my identification strategy on lagged data I do not find any changes in the significance of the relationship between HSR approval and promotion.

The rest of the data used in this paper comes from Lei and Zhou (2022), who collect data on prefectural and provincial officials' promotion demographics and promotion rates, cities' performance on a range of economic indicators, and subway approval from the China Association of Metros, CCER Official Dataset, Chinese Political Elite Database, Chinese City Statistical Yearbook, and China Urban Construction Statistical Yearbook. I follow Lei and Zhou in dropping 15 vice-provincial level cities from my dataset because of their different promotion processes compared to normal prefectural cities (Lei and Zhou, 2022). These cities are Guangzhou, Wuhan, Harbin, Shenyang, Chengdu, Nanjing, Xi'an, Changchun, Jinan, Hangzhou, Dalian, Qingdao, Shenzhen, Xiamen, and Ningbo.

4 Methodology

My primary identification strategy uses a difference-in-difference approach. My regression specification is of the following form:

$$Promotion_{pit} = \beta_0 + \beta_1 HSRApproval_{i,t} + \gamma X_{i,t-1} + \theta_i + \pi_t + \varepsilon_{it}.$$

My outcome variable is the variable $Promotion_{pit}$, which indicates whether a prefectural official from city i is promoted within three years of year t, the year of HSR approval. The index p indicates whether the official in question is a mayor or a party secretary. I follow Lei and Zhou in defining a mayor's promotion as promotion to "party secretary of a prefecture-level city or a vice-province-level position." A party secretary's promotion is promotion to a province-level party secretary position. Since the both mayors and party secretaries serve for an average of three years, promotion is within three years.

Receiving HSR approval is a long-term process that requires involvement from both a city's mayor and its party secretary. There is no definitive way beyond intensive qualitative interviews of determining which official in a given city may have been responsible for securing approval. As such, I use a generalized treatment variable, $HSRApproval_{it}$ that equals 1 if a city, i has been approved for an HSR line in year t, and 0 otherwise.

My regression equation uses a vector of city control variables that includes the time variant characteristics of a city: population, GDP growth, gdp per capita, and annual

[2] Reported in the *Beijing Daily*, http://bj.people.com.cn/n2/2015/1230/c82840-27429354.html and bj.people.com.cn/n2/2015/1230/c82840-27429354.html.

Table 1: Summary Statistics

Variable	N	Mean	Min	Max
Mayor promoted within three years	3,843	0.41	0.00	1.00
Party secretary promoted within three years	3,829	0.17	0.00	1.00
High-speed rail project approved	3,861	0.03	0.00	3.00
City population	3,571	417.42	14.19	1,591.76
City GDP (billion ¥)	3,852	135.57	3.18	1,954.74
City fiscal revenue (billion ¥)	3,856	10.39	0.12	313.65
City investment in infrastucture per capita (¥)	3,848	699.33	0.00	13,236.19
City GDP per capita (¥)	3,845	32,218.63	99.00	467,749.00
City land sales revenue per capita (¥)	3,855	296.91	0.00	40,277.59
City fiscal revenue per capita (¥)	3,855	2,697.62	70.33	81,467.34

Summary stats for rows 1 and 4-10 replicate Table 1 in Lei and Zhou 2022.

revenue. I lag these variables by one year to avoid post-treatment effects. Depending on the outcome variable in question, I also control for mayors' characteristics or party secretaries' characteristics. Finally, I include fixed effects for the city, θ_i and year, π_t. I report standard errors clustered at the city level.

In addition to my baseline identification strategy, I test a fuzzy regression discontinuity approach to assessing the relationship between promotion and HSR approval. The problem this approach faces is that there is no well-defined cutoff in my data between cities that are eligible for HSR and those that are not. Through the 2010s, the objective of Chinese central government policy was to ensure that all cities with populations above 1 million were connected via HSR. There are practically no cities in my dataset with populations below 1 million. Instead, I run a fuzzy RD model at city populations of 3 million, the same cutoff used for subway approval by Lei and Zhou. This approach faces sorting issues and I do not report the results over concerns over the validity of the approach and wildly varying coefficient estimates. The results can be found in the appendix.

Finally, after running my initial identification strategy, I turn to investigating the economic performance mechanism proposed by Lei and Zhou. For each of the indicators of economic performance I use, I use an equation of the following form:

$$Indicator_{it} = HSRApproval_{i,t+n} + \gamma X_{i,t+n} + \theta_i + \varepsilon_{it}.$$

The outcome variable is an indicator of one of five measures of economic performance: infrastructure investment, per capita GDP, per capita revenue from land sales, annual revenue per capita, and the unemployment rate. I regress the outcome vari-

Table 3: Regression Table

HSR Approval and Prefectural Official Promotion

Promotion within three years

	Mayor				Party Secretary			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HSR_Approval	-0.006	0.000	-0.003	-0.057	0.024	0.025	0.034	-0.002
	(0.045)	(0.045)	(0.048)	(0.056)	(0.028)	(0.027)	(0.030)	(0.039)
Num.Obs.	3843	3761	3247	3247	3829	3661	3165	3165
FE: City_Code	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X
Province-year FE				X				X

Standard errors in parentheses are clustered at the city level. Mayor controls are: gender, ethnicity, age, education, political connection with provincial party secretary, and previous work experiences. Party secretary controls are: gender, ethnicity, age, education, political connection with provincial party secretary, and previous work experiences. City controls are population, GDP, fiscal revenue, and GDP growth rate in the previous year. FE means fixed effects. Mayor and city control variables are taken from Lei and Zhou 2022.

able on the treatment variable, *HSRApproval*, lagged and lead up to five years in either direction (represented by n. My control variables are city characteristics, mayor characteristics, and party secretary characteristics. I include city fixed effects.

5 Results

Table 2 shows the results of my baseline difference in difference analysis. The outcome variable is promotion within three years for both mayors and party secretaries.

Model (1) regresses the outcome variable on approval of an HSR plan during a mayor's term and includes city and year fixed effects. Model (2) regresses the outcome variable on approval of an HSR plan during a mayor's term and adds controls for the mayor's characteristics, including gender, ethnicity, age education, 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. Model (3) adds controls for the city's population, GDP, fiscal revenue, and GDP growth in the previous year (to avoid reporting post-treatment effects). Model (4) adds province-year fixed effects.

The table shows that there is not a significant relationship, or much of a relationship at all, between mayors' promotion and a city receiving HSR approval during their term. Model (4) finds that HSR approval decreases mayors' promotion chances by 5.7 percentage points, but this is still not significant. The absence of a relationship between HSR approval and mayors' promotion remains true when the outcome variable is changed to promotion within five, four, or two years. In the appendix (Table 2A), I show that for the first three models, there is a small but slightly significant negative relationship between a mayor's promotion chances within one year and HSR approval when approval is lagged by two years, with a coefficient range of -5.6 to -6.2 percentage points, which would suggest that HSR construction two years prior to the year in question decreases a mayor's chances of promotion in that year by 5.6 to 6.2 percentage points. This effect disappears in model four. I interpret that finding as suggesting that mayors coming into a city that has already had HSR approval face greater difficulty in getting promoted, either because there are fewer large infrastructure projects they can use to demonstrate their competence and helpfulness, or because HSR worsens a city's economic condition through the negative effects on financing costs described by Ruan et al. 2023.

Models (5) through (8) follow the same specifications as models (1) through (4), but with party secretary promotion within three years as the outcome variable and controlling for party secretaries' gender, ethnicity, age education, 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 in models (6), (7), and (8). I find a small and positive relationship between HSR approval and party secretaries' promotion in models (5) through (7), but this turns negative in model (8) and is not significant. Changing the timeline of the outcome variable and lagging HSR approval leads to inconsistent flipping of signs, but no significant results.

There is not a significant relationship, either positive or negative, between HSR approval and prefectural officials' promotion. To investigate why this might be, I examine the effects of HSR approval on four indicators of economic performance: infrastructure investment, per capita GDP, land sales revenue, and fiscal revenue, which I display in Figure 1.

In Fig. 1a, I find that infrastructure investment rises in the years immediately after a city receives HSR approval, then decreases dramatically. This suggests that HSR approval does not yield significant benefits to investment in infrastructure, possibly because financing HSR construction makes it more difficult for cities to attract investment for other projects by worsening their fiscal situations (Ruan et al., 2023). Fig. 1b finds no relationship between per capita GDP and HSR approval, though the consistency of the 0 coefficient and size of the standard error suggests that there may be issues in calculating that relationship.

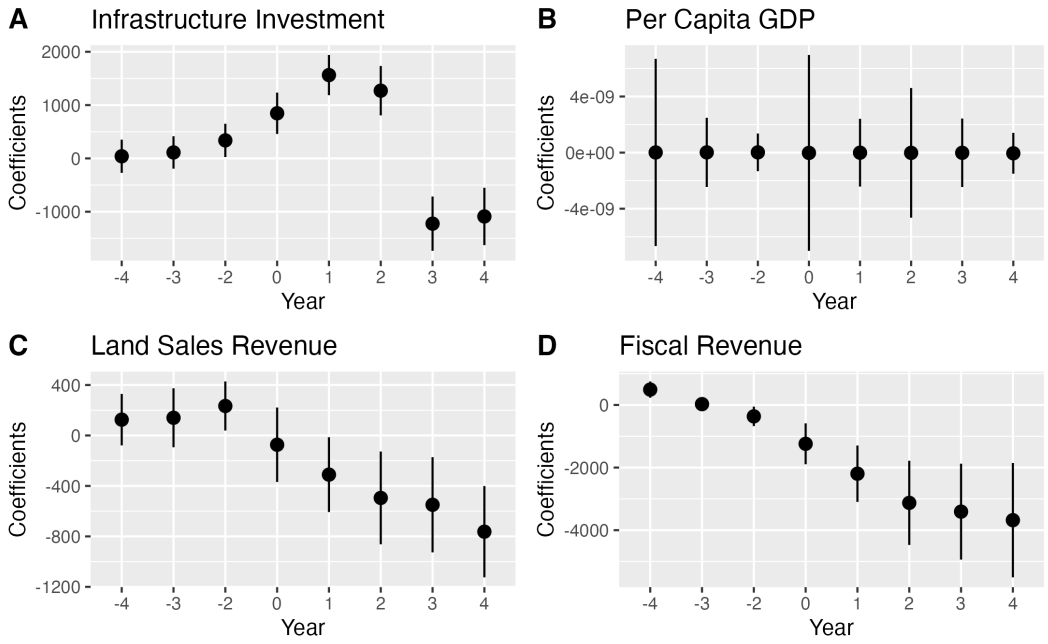

Figure 1: Dynamic Effects of HSR Approval on Economic Indicators

In Fig. 1c, I turn to land sales revenue, which cities earn by auctioning land to private buyers (Lei and Zhou (2022)). I find that land sales revenue declines each year after HSR approval, which is contrary to prior findings (Wang et al. (2022)) but may be supported by the fact that cities provide land for the construction of HSR lines and stations. In doing so, they may reduce the land available for auctions and thereby decrease their land sales revenue. Finally, in Fig. 1d I also find that fiscal revenue declines after HSR approval, although this appears to be a continuation of pre-approval trends. This finding is also surprising.

In sum, Fig. 1 shows that the mechanism linking long-term infrastructure construction with short-term political incentives does not hold in the case of HSR. HSR does not lead to improved economic performance, at least in my sample. This helps explain why HSR approval is not linked to higher chances of promotion in my difference-in-difference analysis. Unlike subway approval, HSR approval is not an omen of stronger economic performance, and therefore does not fulfill a signaling purpose for prefectural officials' political superiors.

6 Conclusion

This study sought to determine whether prefectural officials in China are motivated to construct high-speed rail infrastructure by the prospect of economic benefits that lead to increased chances of promotion. I find that there is not a relationship between HSR approval and either officials' chances of promotion or their cities' economic per-

formance after approval. Despite this, high-speed rail continues to be built across China. My results suggest that the explanation for why politicians build HSR is not based on its economic and career benefits, and that there is a different reason for seeking HSR lines and approval. I plan to continue this study with an expanded dataset of HSR lines and construction across China to determine if my results remain true and if there is a different mechanism linking politicians' short-term interests with their record of building long-term infrastructure.

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A Appendix

Table 1A: RD Regression Table

	(1)	(2)	(3)	(4)	(5)	(6)
fit_HSR_Approval	126.968	-31.167	237.438	-69.996	58.851	-4.334
	(167.969)	(59.817)	(10253.638)	(97.103)	(173.537)	(10.987)
Per_pop_2	17.638	-0.546	-9.636	-12.831	-25.999	0.618
	(22.429)	(8.239)	(279.110)	(12.257)	(69.107)	(7.156)
iv1_int	-16.050	-0.750	13.873	11.555	24.517	-0.332
	(23.775)	(8.180)	(457.474)	(12.964)	(66.116)	(6.423)
Num.Obs.	534	523	518	536	523	518

Table 2A: Regression Table

HSR Approval and Prefectural Official Promotion

Promotion within one year

	Mayor				Party Secretary			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lag(HSR_Approval, n = 2)	-0.062**	-0.062**	-0.056*	-0.039	0.014	0.013	0.013	0.021
	(0.023)	(0.023)	(0.024)	(0.032)	(0.020)	(0.020)	(0.023)	(0.026)
Num.Obs.	3843	3761	3247	3247	3829	3661	3165	3165
FE: City_Code	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X
Province-year FE				X				X

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001