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Incentives and Outcome: the "Environmental" Bias in China

Jing Wu, Yongheng Deng, JunHuang, Randall Morck,and Bernard Yeung[1]

Abstract

China, while generating fast economic growth, is also well known for its less than satisfactory environmental records. Using local governments' spending on urban infrastructure as illustration, we show empirically that such outcomes can be explained bythe incentives local governments face. Tangible growth is a dominant consideration for local government leaders' promotion. At the same time, they need fiscal resources to spend on delivering tangible growth. During the years of 2000-2009, prefecture officers'spending on urban infrastructure strongly tilts towards transportation. First, the spending significantly boosts local GDP growth. Second, it raises land prices which in turn increases available fiscal revenues that can be spent on bolstering GDP growth. Both effects raise prefecture officers' promotion probability. By contrast, spending on environmental amenities does not share similar effectsand even negatively affects the probability of officers' promotion. This explains local governments' low spending on urban environmental amenities, which is at least partly responsible for the current problem of poor urban air quality. Our analysis reveals the need to align incentives, responsibilities and budget constraint for prefecture officers. While our results do not readily suggest sub-optimal resource allocations, they are relevant for China's pursuit for environmental protection, health care, and education, as emphasized in the latest five year plan.

Key Words: urban infrastructure; environmental protection; local government; China

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[1] Jing Wu is Senior Research Fellow, Institute of Real Estate Studies, Tsinghua University and National University of Singapore;ireswujing@mail.tsinghua.edu.cn.
Yongheng Deng is Provost's Chair Professor, Professor of Finance and Real Estate, and Director of the Institute of Real Estate Studies, National University of Singapore;ydeng@nus.edu.sg.
Jun Huang is Assistant Professor, School of Accountancy, Shanghai University of Finance & Economics, huangjun@mail.shufe.edu.cn.
Randall Morck is University Professor and Stephen A. Jarislowsky Distinguished Chair in Finance, School of Business, University of Alberta, Edmonton Canada; Research Associate, National Bureau of Economic Research, Cambridge MA; randall.morck@ualberta.ca.
Bernard Yeung is Dean and Stephen Riady Distinguished Professor, NUS Business School, National University of Singapore;bizdean@nus.edu.sg.

I. Introduction

Many insights in corporation finance are built on our understanding of behavioural response to incentives given available resources and decision rights. Through theserelationships we explain organization performance and develop thoughts on organization design.

This fundamental approach can be applied to analyse not just firmbut also government behaviour. Through this lens, we advance an empirically based explanation for China's low investment on "environment" in the past. While the CCP (Chinese Communist Party) controlled governmentsengineerhighly impressive economic growth, their investmentin infrastructure is biased towards transportation and against "environment" development.The behaviour is closely related to the hierarchical assignment of duties, the promotion incentives and the source of financing available for public investment. Our analysis thus makes "environment" a case in point that exposes the potential weakness in China's hierarchical government. The same argument may explain China's lower than global average investment in education, health, and social security.

We hasten to add that we do not have evidence to say that the outcome is sub-optimal. The CCP could have adequately represented China's collective preference: income growth first and other social development later. Still, the empirical analyses meaningfully reveal potentially distortionary arrangements that could be very useful for China's consideration in furthering its reforms.

It would be useful to provide a snap shot of the institutional arrangement and how our analyses proceed. China has a hierarchic pyramidal government arrangement. The apex is the

CCP politburo. Below that are four"direct administration" cities and the provincial leadership. Underneath the provincial governing body are various levels of governments in descending order: cities, counties, municipalities, and township and villages. Note that China also has a rotation system. Officers are expected to rotate from one location to another within a few years, e.g., three years. Promotion is based on good performance, and allegedly tangible economic growth is the reliable predictor for promotion (Li and Zhou, 2005). Of course, support of higher level's political agenda is important for "survival" and likely for promotion too. The incentive system induces a nationwide location by location competitive drive for producing observation growth.

China also has a highly decentralized fiscal expenditure system. The World Bank'sChina 2030(World Bank, 2012) report states that "sub-national governments account for around 80 percent of total budgetary expenditures and bear responsibility for the provision of vital public services including basic health and education, pensions, unemployment insurance, and minimum income support."We add that they are absorbing the lion share of investment in urban infrastructure, like transportation development and environmental amenities. Yet, local government revenues based on "tax revenue sharing mechanism and intergovernmental fiscal transfers are not commensurate with local government expenditure responsibilities" (World Bank China 2030, p. 55). Local governments have to find additional revenue sources to finance their expenditures.

The two create skewed incentives and budgetary pressure on local governments. The alleged dominant consideration of economic growth for promotion induces local governments to make public expenditures according to their short run contributions to tangible economic growth.

The allocation between infrastructure spending on transportation and environmental amenities is a case in point (Figure 1). The former, relative to the latter, more readily contributes to tangible growth because it facilitates commercial development and trade. There is an additional consideration: it can more readily raise land value. It is within local governments' jurisdiction to raise revenues via land leasing. Local governments therefore are more inclined to allocate infrastructure expenditures to transportation infrastructure rather than environmental amenities. This consideration may also apply to other expenditure allocations, like those that contribute to intangible development, like education and health.

Our empirical evidence is based on city level spending on transportation infrastructures and on environmental amenities from 2000 to2009. In the next section, we document the trends of these two types of infrastructure spending. We also show that spending on environmental amenitiesis associated with improvement in air quality, a piece of evidence that spending on environmental amenities alleviates the pollution problem. In Section III, we produce empirical evidence that urban infrastructure spending is constrained and predominantly relies on land lease revenues. A tilted pattern emerges: infrastructure spending is biased towards transportation and against environmental amenities and the two appear to be substitutes. InSection IV, we show that investment in transportation has a direct impact on growth and an indirect effect via raising land lease revenues and thus gives local governments more fiscal means to pursue growth. We then confirm that, as in the literature, the probabilityof promotion is pre-dominantly determined by growth. Conclusions and discussions follow.

II. China's urban infrastructure investment and airquality

II-a: Decreasing of environmental amenity investments in the early 2000s

After Mr. Jintao Hu became the CCP's and China's new leader in 2002, the so-called "Scientific Outlook on Development (*ke xue fa zhan guan*)" was listed as a major principle of social and economic development in China. The importance of environmental protection was repeatedly emphasized by the central government, just like it is now emphasized in the 12th Five Year Plan.

Ironically, during this era local governments actually allocated less resource to urban environmental amenities, including "drainage and sewage purification", "environmental sanitation and solid waste treatment" and "gardening and greening". As depicted in Figure 2, at the national level the share of environmental amenity investment in total urban infrastructure investment gradually dropped from the peak of 25.4% in 2000 to the bottom of 19.1% in 2006, and then slightly recovered to 21.3% in 2009. Its ratio against GDP also dropped from the peak of 0.58% in 2003 to 0.41% in 2007 before the jump during the stimulus (Figure 3).

On the other hand, infrastructureinvestments concentrated in the urban transportation sector, including "roads and bridges" and "public transportation". During the past decade, the share of transportation infrastructures in total urban infrastructure investment kept increasing from 60.2% in 2000 to 72.7% in 2010. Its ratio against GDP jumped from 0.90% in 2000 to 1.71% in 2003, and then fluctuated around 1.50% until the 2009 stimulus.[2]

II-b: Pollution is still an important problem in current China

[2]Besides the three components grouped as environmental amenity investments and the two components grouped as transportation infrastructure investments here, there are also five other components in the statistics of urban infrastructure investment by Ministry of Housing and Urban-Rural Development of China. In the following analyses we exclude the components of "centralized heating" and "flood control" because they both apply to part of the cities only, and the component of "others" because its definition is opaque. The last two components, "water supply" and "gas supply", both aim at providing the basic necessaries to urban households and enterprises, and thus are not the emphasis in this paper. Nevertheless, all the following results are robust if we also introduce the total investment of water and gas supply (normalized by local GDP) as a control variable.

Meanwhile, pollution, especially poor air quality, is an increasing problem for many Chinese cities (World Bank, 2007, 2012). To illustrate, in early December 2011, the air quality reached a "crisis" level in Beijing, which attracted the attention of almost all the major media around the world.[3] On Dec 5th, the particulate measurement in Beijing exceeded the scale's maximum of 500, and thus was reported as "crazily bad" by the US embassy in Beijing. It was also reported that the pollution brought a rush of patients to hospitals during those couple of weeks, most of which suffered from heart attacks or respiratory diseases.

A noteworthy fact is that air quality did not significantly improve during most of the past decade. Since mid-2000 the Ministry of Environmental Protection of China has been monitoring air quality in selected cities. Based on the figures reported on its official website,for each city-year we count the number of days that the air quality reached "Grade I" (the highest air quality grade) and calculate its ratio in the total number of days. As listed in Table 1, the average ratio did not significantly improve until the year of 2008 (especially when focusing on the median indicator), the year Beijing hosted the Olympic Games. This may partially be biased due to the expansion of cities monitored. But even if we focus just on the 37 cities that appear in the whole sample period in Panel B, the pattern shows that significant improvement came only after 2008.

II-c: Environmental amenity investments could help improve air quality

At the same time, empiricallyspending on environmental amenities could help improve local air quality immediately, as well as during the following years. In other words, the insufficient

[3] "Victory for U.S. Embassy as Beijing Chokes on 'Heavy Fog'", *Wall Street Journal*, December 5, 2011; "Flights Grounded in China as Smog Worsens", *Financial Times*, December 5, 2011; "Outrage Grows over Air Pollution and China's Response", *New York Times*, December 6, 2011; "China's Pollution Data Shrouded in Official Fog", *Bloomberg BusinessWeek*, December 8, 2011; "Death-by-Air in Beijing Shows China's Heart Risk from Worsening Pollution", *Bloomberg News*, December 16, 2011; "Official Says Air Quality in Beijing is at 'Crisis' Level", *Wall Street Journal*, December 16, 2011.

environmental amenity investment during the past decade would at least be a reason for the current poor air quality problem.

Ourempirical resultis based on the 82 cities covered in Ministry of Environmental Protection's daily air quality monitoring (except the four "direct administration" mega cities, namely, Beijing, Shanghai, Tianjin, and Chongqing).[4] The sample period is between 2001 and 2009.The dependent variable is the change in ratio of days reaching "Grade I" in air quality compared with the previous year.[5]Our focal explanatory variable is "environmental amenity development,"defined as the annual urban infrastructure investment in environmental amenities scaled by local GDP.[6]We introduce investment in transportation infrastructures for comparison sake. As for control variables, besides the lagged air quality level and city fixed effects, we firstinclude the increase of per capita GDP and its cross term with the lagged per capita GDP level to capture the potential environmental Kuznets curveeffect (Stern, Common and Barbier, 1996; Stern, 2004). Second, the air quality in one city may be affected by pollution in surrounding cities andregions. We follow Zheng, Cao and Kahn (2011) to construct a proxy of air quality change in nearby cities, which equals the weighted average of change in ratio of days reaching "Grade I" in air quality in all other cities in the same year, weighted by the reciprocal of the exponential function of distance between origin city and destination city. Finally, the lagged

[4]We exclude these four cities in all the following analyses for several reasons. First, these four cities are of the same level of province and directly report to the central government, which implies that determinants of officer promotion in these four cities should be different from those in all other cities. Second, the four cities are much larger and more developed than most other cities during the sample period. Finally, some unique occasions like the 2008 Summer Olympics in Beijing and the 2010 Expo in Shanghai can significantly affect the urban infrastructure investment pattern and local air quality, which cannot be reflected in our analyses.

[5]We also try to directly introduce the ratio level as the dependent variable, instead of the change of the ratio, while the RHS variables are consistent with Table 2. The results are robust.

[6]In this paper we choose to normalize the variables by local GDP in the same year. Another option is to normalize the variables by population; or in other words, to use the per capita indicators (e.g., per capita investment on environmental amenities) in the analyses. However, currently we can only get reliable statistics for the total volume of both urban and rural population in each city, which will make the per capita indicators downward biased (especially for the urban infrastructure statistics). Therefore we choose to adopt the GDP scaled indicators in the analyses. Nevertheless, as the robustness check we replicate all the following regressions with the per capita indicators and the results are generally robust. These results are available on request.

FDI(normalized by GDP) is also introduced to reflect the potential effect of foreign investment on air quality, which has been reported for developing economicsin Copeland and Taylor (2004).The definitions and sources of the variables are listed in the appendix.

The results listed in Table 2 suggest a significant and immediate effect of environmental investment on improving local air quality. Annual investment in environmental amenities(normalized by GDP) is significantly positive in explaining the air quality change in both the concurrent year (column 1) and two years in the future (column 3). Calculated based on the coefficients, a one standard deviation increase inthe variable will lead to an immediate increase of 0.84 percentage point in ratio of days reaching "Grade I" in the same year, as well as a 0.96 percentage point increase two years later.[7] These marginal effects are economically important, considering that on average the ratio of days reaching "Grade I" in air quality of the 82 cities only increases by 0.86 percentage point annually during the sample period. By contrast, investment in transportation infrastructure has no impact on air qualities in the model.

The effects of the control variables are also consistent with expectations in general. The per capita GDP increase is significantly negative in the model, while the square term is significantly positive, which implies a "U" curve relationship between air quality and local economic growth as suggested by the environmental Kuznets curve. Calculated based on column (1) in the table, the turning point exists at the per capita GDP level of about 127.3 thousand yuan RMB (in 2009 price). During the sample period a few most developed Chinese cities are approaching that point. The change in nearby cities' air quality has a positive

[7]For the 86 cities with air quality information, the standard deviation of investment on environmental amenity (normalized by local GDP) is 0.417 during the sample period. Together with the coefficients in Table 2, this implies that a one standard deviation increase in environmental investment will lead to 0.417×0.0201=0.0084 (0.84 percentage point) increase in the dependent variable during the same year, or 0.417×0.0231=0.0096 (0.96 percentage point) increase two years later.

coefficient as expected, but only marginally significant. This is consistent with the finding by Zheng, Cao and Kahn (2011) that in China local factors still are dominant determinants of air quality. The FDI proxy is insignificant in the model.

As suggested in Table 1, the number of cities included in air quality monitoring increasedbetween 2001 and 2005, which means that the panel adopted in column (1) to (3) is unbalanced. Those that entered late could be for reasons related to the level of pollution. In column (4) to (6)we start the time window in 2005 to have a balanced panel to avoid sampling noise. The results are robust; indeed the effect of environmental investments becomes more significant.

III. Biased infrastructure spending

III-a:Local governments are responsible for urban infrastructure expenditures

According to the Ministry of Housing and Urban-Rural Development of China (reported in "China Urban Construction Statistics Yearbook"), local (city) governments are primarily responsible for urban infrastructure investment. As shown in Figure 4, government spending accounted for 26.9% of all urban infrastructure investments in 2009, most of which were by the local governments, while the central government only contributed 4.0% in all government spending (or about 1.1% in total urban infrastructure investments).Enterprises' spending accounted for another 23.8% in total investment. However, most of these enterprises are SOEs controlled by local governments. Financial leverage helps to expand the investment. In 2009 bank loans and bonds provided funds for 39.7% of the urban infrastructure investments. At the same time, they also build up liability for the local governments or local SOEs. Accordingly, a

lion share of urban infrastructure investments is directly controlled and determined by local governments, or more precisely, by top officers in local (city) governments.[8]

III-b:City government's spending budget and preference

Given local governments' dominant position in spending on infrastructure development, we examine their budget constraints and preference. After the reform in public finance system in 1994, the central government grabs a large proportion of regular fiscal revenues; for most cities the budgetary income allotted to local governments could only meet their basic operating expenses (*chi fan cai zheng*). Local governments have to mainly use off-budget resources to invest on urban infrastructures, most of which comes from land salesorloans from banks and bond market.

Our question is what infrastructure development local governments spend on after they are able to raise funds. We focus on two major items: transportation infrastructure and environmental amenities.

Given the hierarchical system, local governments' spending allocation may cater to the preference of higher level government officers who often directly determine prefectural officers' career path. Since we are using city level data, we focus on the preference of the secretary of the provincial CCP committee (*sheng wei shu ji*), who oversee city CCP secretaries/mayors' careers. Although it is almost impossible to explicitly observe any provincial CCP secretary's preference, we may be able to gauge that reasonably well by the person's public statements.

[8]The Ministry of Housing and Urban-Rural Development of China does not provide the breakdown of the fund source data by components.

There were totally 82 provincial CCP Secretaries in these 27 provinces during the period between 2000 and 2009. We conduct the following to develop annual indices for their preference on types of infrastructure development. We first Google-search the name of each provincial CCP secretary (with title) for every year.The total number of entriesis the denominator for our indices. To construct the numerator, we search for every year the officer's name (also with title) plus key words which are usually adopted in Chinese officers' speeches and articles: "infrastructure (*ji chu she shi*)" or "urban development (*cheng shi jian she*)" for all urban infrastructure investments, "transportation (*jiao tong*)" for transportation related urban infrastructure investments, and "environmental protection (*huan bao* or *huan jing bao hu*)" for urban environmental infrastructure investments. Dividing the count of the entries in the joint search by the aforementioned denominator yields the yearly indicators for each provincial CCP secretary's preference for infrastructure investment, transportation, and environmental protection, respectively. A provincial CCP Secretary with a higher score in the infrastructure investment index could be expected to more heavily emphasize infrastructure development; the indexes of transportation and environmental protectionreflect the person's specific emphasis in the corresponding fields.[9]

For all the samples included in the analysis (283 cities, 10 years), the averages of the three indices are 0.16 for infrastructure investment, 0.29 for "transportation infrastructure investment" and 0.22 for "environmental protection investment."Thus, broadly, provincial CCP Secretaries advocate investing in transportation more intensively than environment protection, at least in their speeches. In the following, we examine how that affects city level spending on these types of infrastructure development.

[9]As a recent example, Zheng et al (2011) adopt the same strategy to build a Google index to measure the degree of developers' emphasis on the energy-saving performance of their housing developments in China.

By the end of 2009 there are 287 cities on or above municipal level (*di ji shi*) in mainland China. Our empirical analyses cover 283 of them during the sample period of 2000-2009, again excluding the four "direct administration" cities.The dependent variable is the ratio of investmentson transportation infrastructuresand environmental amenities scaled by local GDP in the same year, respectively. As for the explanatory variables, three variables are introduced as proxies of local governments' budget constraints, including the lagged budgetary local income, the lagged land sales income, and the lagged loan balance, all of which are normalized by local GDP in the same year. Meanwhile, the lagged Google indexes defined above are introduced as explanatory variables. The control variables include lagged per capita GDP, lagged FDI, lagged investment (excluding urban infrastructure investment) and lagged government expenditure,with the latter three variables normalized by local GDP. More detailed descriptions of the variables are available in the appendix.The city fixedeffects model is suggested by the standard Hausman test, and standard error estimates are clustered by province.

The results are reported in Table 3. First, the effect of budgetary income is insignificant in explaining both investments on transportation infrastructures and environmental amenities, which is consistent with the institutional setting and implies that the budgetary income is not a major funding source of urban infrastructure investment.

The lagged land sales income, however, is significantly positive in explaining transportation infrastructure investment. According to the coefficient in column (1), a one standard deviation increase in land sales income will lead to 0.14 percentage point increase ($2.398\times0.057\approx0.137$) in the ratio between transportation investment and local GDP in the following year, or the equivalent of about 15.3% of the average GDP scaled transportation investment volume during the sample period. By contrast, the land sales income variable is

insignificant in explaining environmental amenity investment. Similarly, the loan balance indicator is positive and marginally significant in the transportation infrastructure investment model, and insignificant in the environmental amenity investment model. These observations suggest that when local governments get extra funds from land auctions, they mainly choose to invest in the transportation field, but not in environmental protection. Or, more strongly stated, cities would only raise money from land sales and loans for investing in transportation infrastructures. Interestingly, cities that have attracted foreign direct investment in the past would spend more in environmental amenities.

Turning to the effect of provincial officers' preference, we find that the variable oflagged Google index on infrastructure investment is only positive and marginally significant in explaining transportation infrastructures, but negative (although insignificant) in explaining environmental amenities. This implies that when the higher officer calls for infrastructure investment, the prefectural top officers choose to spend on transportation to the extent of possibly cutting back on investment in environmental amenities.

The results are robust if we introduce the specific Google indexes instead of the general Google index for emphasis in infrastructure investment. The index on higher up officers' explicit preference for developing transportation infrastructure is marginally significantly positive in explaining spending on transportation infrastructures (column 2). Most interestingly, the indicator on higher up officers' emphasis on environment is ***negative***and marginally significantin explaining spending on environmental amenity investments (column 4).Apparently, prefectural officers do not even pay lip services to superiors' call to invest in environmental amenities!

To further gauge the split of spending on transportation infrastructure and environmental amenities, we use the share of each sector in the combined spending as the dependent variable (Table 4). The irrelevancy of the official budget constraint is consistent with that in Table 3; it has insignificant impact on the split. We further observe that land sales income is significantly positive in explaining the proportion of infrastructure spending on the transportation type but negative and significant in explaining the proportion spent on environmental amenities. This supports the impression of a biased attitude: when prefectural officers have to spend much on transportation infrastructures, they cut back on spending on environmental amenities.

The effect of provincial officers' preference on spending proportions further strengthens the impression. The proxy of provincial officers' preference on infrastructure investment is significantly positive in explaining the proportional spending on transportation infrastructureand significantlynegative in explaining the proportional spending on environmental amenities. The magnitudes of these two effects are close. Thus, when a higher up officer calls on infrastructure investment, the prefecture officers tend to interpret it as a call for investing in transportation and they cut down spending on environmental amenities to accommodate.

A major concern in the above analysis is the effect of local governments' land sales income;endogeneity may be a potential problem here. Currently in China the volume of land supply is controlled by local governments. If one prefecture top officer plans to invest on a huge infrastructure project in the following years, he/she may choose to supply more land this year to collect funds. In this case the effect of land sales income~~*RATIO_LANDINC*~~ may be biased due to the inversed causality.Hoping to correct for this problem, in Table 5we introduce the lagged average land price, instead of the lagged land sales income, to the model, which implies that we mainly focus on the extra income from land market due to high land price. The results are robust.

IV. Incentive and preference towards spending on transportation infrastructures

The observed prefectural officers' biased inclination to spend on transportation infrastructure may be related to their promotion incentives. It is well known that economic growth is a prime determinant for promotion (Li and Zhou, 2005). While all kinds of government spending add to aggregate demand and can stimulate growth, spending on transportation infrastructure relative to spending on environmental amenities has a more immediate impact on tangible growth because it facilitates business growth. While better environment can attract investment and immigrants, its effect is less tangible and slow to come. The other reason is that spending on transportation infrastructure can raise land value and land leases are an important source of revenues for prefectural governments.

IV-a: Transportation infrastructure raises GDP growth

Indeed, in the Chinese context several papers have shown that infrastructure investment could substantially and immediately boost local tangible economic growth. Based on the province-level economic growth model, D´emurger (2001) suggests that infrastructure endowment, especially the transportation facilities, is a key factor in explaining the growth gap between different provinces in China. Lin and Song (2002) conclude in similar findings via the city-level analysis. Their cross section model suggests that cities with higher growth rate in paved roads could be expected to enjoy higher tangible economic growths during the same speed. Fan and Zhang (2004) point out that infrastructure investment is also an important driver of tangible economic growth in the rural area in China.

Due to the lack of some key information like capital stock, currently it is not feasible to strictly construct an economic growth model like D´emurger (2001) in the city level. Instead we

general follow the strategy by Lin and Song (2002) to estimate a reduced form model on factors affecting cities'tangible economic growth to verify the positive linkage between investment on transportation infrastructure and income growth.

The empirical model is also based on the 283 cities between 2000 and 2009. Our dependent variable is the annual per capita GDP growth for each city (in log term).[10] Besides the lagged per capita GDP level, the explanatory variables also include the two types of urban infrastructure investments, FDI, total investment (excluding urban infrastructure investment), and government expenditure in the previous year, which are all expressed as the ratio against GDP in the same year. Other factors like population growth, natural source endowment, stock of human capital areunfortunately not available at annual frequency. We mitigate the problem by introducing city fixed effects (the fixed effect model is suggested by the standard Hausman test).[11]Standard error estimates are clustered by province.

The results of the basic specification are listed in Table 6. While the coefficients of the other control variables are generally consistent with expectations (in particular, the investment and government expenditure is significant in boosting followingyear's GDP growth), we mainly focus on the effects of urban infrastructure investments. As listed in column 1, controlling for other factors, the lagged ratio between transportation infrastructure investment and local GDP is positive and statistically significant in the model, which implies that transportation infrastructure investment could have an immediate and significant effect in boosting local GDP growth. More specifically, according to the coefficient, a one standard deviation increase of transportation

[10]We also try introducingthe GDP growth rate as the dependent variable, in order to prevent the potential error in the imputed population indicator. The results are robust.

[11]In China the accurate statistics on population is only available via the population census every ten years (2000 and 2010). The population levels in the other years are imputed based on these two years with the assumption of constant population growth rate during this decade. Accordingly we could not introduce the annual population growth rate in the model as the explanatory variable.

investment can lead to an additional 0.31 percentage point of local per capita GDP growth in the next year (exp(1.025×0.0030)≈0.0031). This finding is consistent with those by D´emurger (2001) and Lin and Song (2002). As we speculated, the effect of environmental amenity investments is statistically insignificant albeit positive.In column 2 and 3 more lagged terms of urban infrastructure investments are introduced, but none of them are statistically significant.

IV-b:Transportation infrastructure investments raise land sales revenue

The classical framework of Rosen (1979) and Roback (1982) suggests that in equilibriumreal estate pricesare fully determined by expected economic growth and quality-of-life (QOL) of the city. Accordingly, since urban infrastructure investment could enhance both QOL and economic growth, they could raisereal estateprices. As stated earlier, currently in China land sales income is an important off-budget funding source for local governments. This means that growth in real estateprices (land prices) would directly lead to more funds for local governments. If investments in transportation infrastructure and in environmental amenities affect land prices differently, local governments may have different inclinations in these investments.

The empirical model is also based on the 283 cities between 2000 and 2009. The dependent variable is the average land price change including all usages (in log term; in 2009 yuan). Besides the two types of urban infrastructure investments, the control variables include land price level (in log term), change in per capita GDP (in log term), FDI, total investment (excluding urban infrastructure investment), and government expenditure in the previous year,

with the latter three scaled by local GDP.[12]The fixed effects model is suggested by the standard Hausman test, and standard error estimates are clustered by provinces.

As listed in Table 7, controlling for other factors, lagged transportation infrastructure investment significantly positively raises land price, and the effect is economically important. According to the coefficient, a one standard deviation increase in transportation infrastructure investment (normalized by GDP) will lead to a land price growth rate of 5.6 percentage point in the following year (1.025×0.055≈0.0564), or the equivalent of about 24.4% of the average annual land price growth rate for these 283 cities during the sample period. Meanwhile, its two year lagged term is also positive and marginally significant. However, the effect of environmental amenity investment is insignificant in all the specifications.

This result suggests that transportation infrastructure investment could substantially raise land prices in the following yearsand thus higher land sales revenuesfor local governments. Together with the earlier findings in Table 3, the observation suggests a positive feedback cycle between local governments' transportation infrastructure investment and land sales income. Local governments use land sales income to develop transportation infrastructures, which then helps them get more land sales income in the future. This could provide strong incentives for prefectural officers to invest in transportation infrastructure. Besides, the higher land sales revenue can also help finance local governments' other investment projects or expenditures, which, according to the models on GDP growth discussed earlier, can significantly boost local GDP growth too. But all these effects do not exist, or at least much weaker, in investment in environmental amenities.

[12] We do not include the land supply volume as an explanatory variable because it may be endogenous: currently the land supply volume is almost totally controlled by local government; thus local officers may choose to provide more land to expand total revenues from land sales, or reduce the supply volume with the hope of raising land price. Nevertheless, the results are robust if we introduce land supply volume as a control variable.

IV-c:Promotion incentives

Existing empirical papers point to that provincial level GDP growth is the most important key performance indicatorin determining promotion (Li and Zhou, 2005).The observed prefectural officers' preference in spending on transportation infrastructure rather than environmental amenities is likely related to this promotion incentive. First, as we have just shown, transportation infrastructure investment has immediate and significantly positive impact on local GDP growth. Second, the investment raises land prices and thus local governments' revenues from land leases which allow them to spend more to promote growth.

We examine the determinants of promotion using a probit model in the 283 cities. The dependent variable is whether the secretary/mayor of a city gets promoted or not within a year, which equals 1 if the officer moves to a higher level (including a mayor promoted to be a CCP secretary in the same or another city), and equals 0 if he/she remains on the current position, or moves to another position in the same or lower level, or retires. "Abnormal" changes, e.g., death, arrest due to corruption, etc., are excluded fromthe sample. We exclude secretary/mayor'sfirst year in their position. Also, we only include the secretaries/mayors who took current positions in or after the year of 2000 in order to calculate some of our control variables reliably.

We have two sets of focal independent variables. The first set is GDP growth performance. We use three proxies: the average GDP growth rate during the secretary/mayor's current tenure from the first to the last year, the difference betweenthe secretary/mayor's own performance and the average GDP growth rates of all other cities within the same province during the same interval, and finally the difference betweenthe secretary/mayor's own average performance and the average GDP growth rate of his/her predecessor's tenure.

The second focal independent variable is infrastructure spending. To capture that, we use theratios of the twotypes of urban infrastructure investment scaled by GDP, average over an official's tenurefrom the first to the last year. Promotion may be based on more than just GDP growth. These ratios may be correlated with development not measured by GDP growth but nevertheless leads to promotion; an example is environmental development.

Personal attributes of the officers are also included in the model. The definitions of the variables are listed in the appendix. City fixed effects are included, and standard error estimates are clustered by secretaries/mayors considering that one officer may appear in the panel for multiple times. Since the determinants of promotion may differ between secretaries and mayors, we run the probit model in each of these two groups, with theresults reported in Table 8and 9, respectively.

Our results suggest that, for both the CCP secretaries and mayors, among all GDP growth performance measures, only the difference between the officer's own performance and his/her predecessor is significantly positive in the model, which implies that promotion is based on out-performing predecessor in growth. The result is compelling. Consider the great inter-city variance in China: a direct comparison in GDP growth rate between different cities is quite misleading. Instead the performance of the predecessor could be a more suitable benchmark in evaluation an officer's performance. Besides, this GDP performance indicator is also more significant in the mayor group than in the CCP secretary group, which is consistent with existing literatures in the provincial level. Typically the tasks for CCP secretaries are more diversified than just the high GDP growth rate.

Investment in transportation infrastructure is insignificant in explaining the probability for promotion. The result indicates that officers' spending on transportation infrastructure is motivated by its contribution to growth, or its ability to raise income from land leaseswhich can then be spent on generating growth.

A notable finding is that spending on environmental amenities significantly negatively impact on the probability of promotion in both the CCP secretary and mayor groups. This provides an additional explanation for officers' inclination to invest little on environmental amenities, although how to explain such effect remains an open question. One possible explanation is that "environmentalists" are more likely to offend other officials and drivers for "business" based growth.

The effect of age is most significant, especially for the CCP secretaries. Officers who arrived in current position too late are less likely to get further promoted. The effect of gender is just opposite in the two groups: female CCP secretaries are more likely to get promoted, while female mayors are less likely. The officers' education background could not significantly affect their career path. As for the previous working experience, experience in other provinces is helpful for the mayors, but not for the secretaries. Those who used to work in SOEs are less likely to get promoted, especially for the secretaries.

As a robustness check, we repeat our probit by modeling whether the one CCP secretary/mayor achieved in promotion within 2, or 3, or 4 years so that each individual enters the panel only once in each run.[13]Besides we also run the duration model (Cox proportional hazard model) instead of the probit model. Both of these results are consistent with the results in

[13]In our sample, the average length in position is 3.36 years for CCP secretaries and 2.91 years for mayors.

Table 8 and 9: the effect of environmental amenity investment significantly negatively affects promotion for both CCP secretaries and mayors, while the effect of transportation infrastructure investment is insignificant; the impact of GDP growth (compared with the predecessor) is also positive and statistically significant for mayors, although less significant for CCP secretaries.

V. Conclusions

China, while generating miraculously fast economic growth, is also well known for its pollution and less than satisfactory environmental records. Likewise, its provision of vital public services including basic health and education and social security has been at an alarmingly low rate. These have drawn both national and international attention. Its 12th five year plan states 'green' and provision of public services as important targets. The World Bank's "China 2030" report also raises these as critical issues that China needs to address to make its growth sustainable.

The outcome is due to China's public governance structure: sub-national government officers' job promotion incentive, assigned responsibilities, and their resources constraints. Prefectural governments are given the lion share of the responsibilities to provide urban infrastructure development and the aforementioned public services; they absorb about 80 percent of the expenditures. Yet, local government budgetary revenues based on tax revenue sharing and intergovernmental fiscal transfers are far from adequateness. At the same time, prefectural officers face a promotion criterion that emphasizes delivering tangible economic growth. Given this governance system, understandably prefectural officers' spending focuses on what delivers tangible growth.

In this paper, we use spending on urban infrastructure as a case in point illustration. We first find that from 2000 to 2009, prefectural officers' spending on urban infrastructure tilts

towards transportation and is biased against environmental amenities. Superior's public statements on investing in transportation infrastructure raise that type of spending; but, the same calls for spending on environment do not stimulate spending on environment. This happens in spite of that China's environment is deteriorating and that the central government repeatedly emphasizes the importance of environmental protection, and the observation that spending on environmental amenities has significant positive environmental impact, e.g., on air quality.

We further find empirical evidence that spending on transportation infrastructure raises GDP growth, a key promotion determinant, and also land prices. Prefectural governments have the rights to use land leases to raise off-budget revenues. These are the reasons for the tilted spending on transportation.

An interesting observation is that spending on environmental amenities negatively impact on the probability of promotion. Apparently, dragging the tangible growth feet is not welcome.

We cannot be sure if our results suggest inefficient resource allocation, however. It remains plausible that the governments' action matches people's preference: people want to get rich first and afterwards they will spend on improving the environment, on education and health, and generally on less tangible development to improve the quality of life.

Still, our analysis reveals the need to align incentives, assigned responsibilities and budget constraint.Clearly, incentives guide behaviour: officers will enthusiastically fulfill the part of assigned responsibilities that are rewarded and ignore those that are not incorporated in the incentive system. Also, the budgetary process can affect behaviour too: officials will carry out activities that raise their available resources and thus their spending on activities that raise their rewards.

China’s new five year plan emphasizes protecting the environment, raising public services on health care and the quality of education. These jobs have localized idiosyncrasies and are still best assigned to local government officers. However, the central needs to cater to the match between the reward system and assigned jobs as well as checking against biased behaviour stemming from the budgetary process.

Appendix: Data Description

(1) City Level Statistics

By the end of 2009 there are 287 cities on or above municipal level (*di ji shi*) in mainland China. Our empirical analyses cover 283 of them, excluding the four "direct administration" municipalities (namely, Beijing, Shanghai, Tianjin, and Chongqing). The annual series between 2000 and 2009 are introduced. Except for the variable of air quality, which is available in 82 cities only, all the variables are applied to the whole sample of 283 cities.

The variables' definitions, sources and major statistics are listed in Table A-1. All the monetary variables are normalized by local GDP volume in the same year unless otherwise stated.

(2) Information on City Officers

During the sample period between 2000 and 2009, there are totally 976 CCP secretaries and 1075 mayors in the 283 cities. (According to our definition in this paper, if a turnover happens in or before June 30th, the corresponding city-year will be allocated to the newly-appointed officer, otherwise it will come to the predecessor.)

When a secretary or mayor is appointed, his/her official resume will be publicly reported in local medias, from which we collect the information on the officers' personal characteristics, previous working experience, and whether he/she gets promoted or not after current position. The variables' definitions, sources and major statistics are listed in Table A-2.

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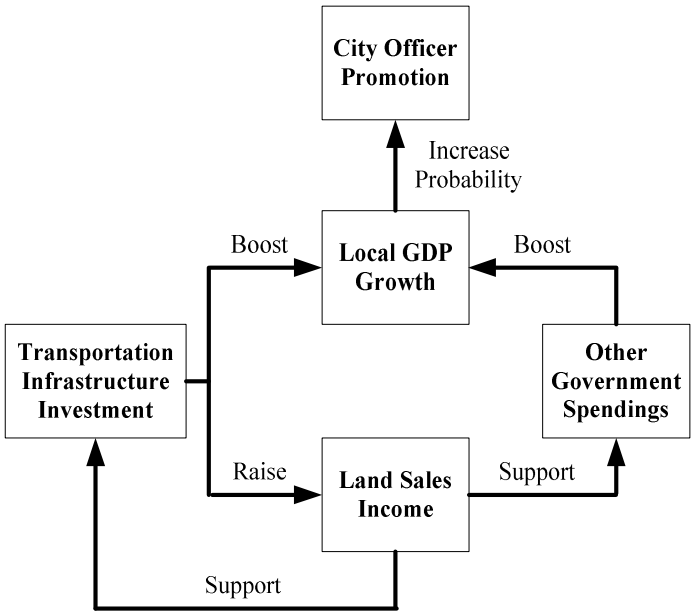
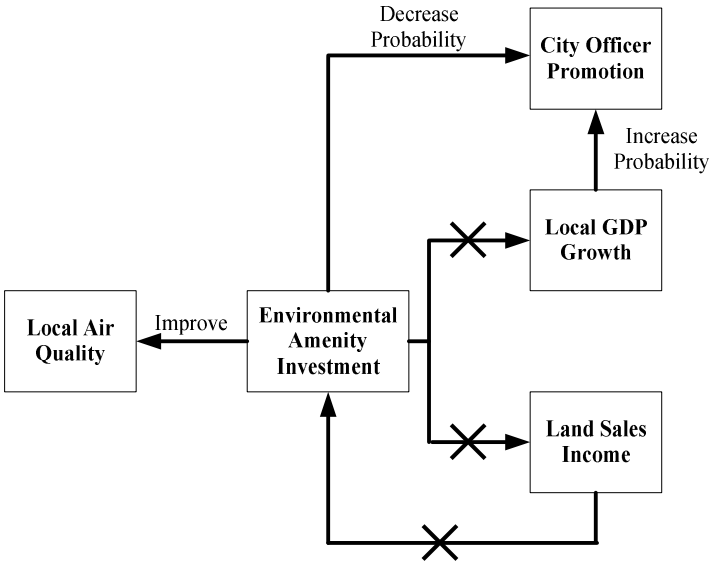


(A) For the transportation infrastructures:



(B) For the environmental amenities:

Figure 1: Local Governments' Incentives and Urban Infrastructure Investments

Figure 2: Structure of Urban Infrastructure Investments in the National Level

Source: Ministry of Housing and Urban-Rural Development of China, “China Urban Construction Statistics Yearbook”.

Figure 3: Ratio of Urban Infrastructure Investments against GDP

Source: Ministry of Housing and Urban-Rural Development of China, “China Urban Construction Statistics Yearbook”.

Figure 4: Fund Sources of Fixed Asset Investment on Urban Infrastructure

Source: Ministry of Housing and Urban-Rural Development of China, “China Urban Construction Statistics Yearbook”.

Table 1: Average Ratio of Days Reaching "Grade I" in Air Quality

A. All the Cities Included

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Median	12.53%	13.97%	14.79%	13.39%	12.47%	13.29%	14.79%	15.17%	18.68%	18.14%
Average	18.29%	21.22%	21.13%	20.07%	19.15%	18.14%	18.97%	20.88%	23.54%	23.27%
Std. Dev.	20.81%	23.11%	21.46%	21.42%	19.28%	18.02%	17.46%	18.19%	18.98%	17.17%
Observations	37	47	47	47	84	86	86	86	86	86

B. The 37 Cities Appeared in All Years

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Median	12.53%	13.97%	14.79%	10.38%	14.79%	15.89%	14.79%	16.39%	18.68%	20.33%
Average	18.29%	20.18%	20.10%	19.04%	21.50%	21.63%	21.62%	23.98%	27.55%	28.30%
Std. Dev.	20.81%	21.49%	20.39%	20.48%	20.26%	19.60%	18.97%	20.57%	22.87%	21.09%
Observations	37	37	37	37	37	37	37	37	37	37

Note: A city is included in the analysis only if all the days in that year were monitored.

Source: Ministry of Environmental Protection of China.

Table 2: Can Environmental Amenity Investment Help Improve Local Air Quality?

(Dependent Variable: Change in Ratio of Days Reaching "Grade I" in Air Quality)

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Environmental Amenity Investment	0.0201			0.0336		
(normalized by GDP)	(1.87)*			(2.55)**		
Transportation Infrastructure Investment	-0.0010			0.0001		
(normalized by GDP)	(-0.36)			(0.03)		
Lagged Environmental Amenity Investment		-0.0027			0.0070	
(normalized by GDP)		(-0.23)			(0.47)	
Lagged Transportation Infrastructure		-0.0001			-0.0004	
Investment		(-0.02)			(-0.10)	
(normalized by GDP)						
Two Year Lagged Environmental Amenity			0.0231			0.0282
Investment			(1.97)**			(2.08)**
(normalized by GDP)						
Two Year Lagged Transportation			0.0006			0.0029
Infrastructure Investment			(0.17)			(0.72)
(normalized by GDP)						
Lagged Air Quality Level	-0.7070	-0.7040	-0.7019	0.2607	0.2673	0.2809
	(-13.50)***	(-13.27)***	(-13.40)***	(4.04)***	(4.08)***	(4.33)***
Per Capita GDP Growth	-3.6434	-3.2916	-3.0613	-3.0852	-2.6632	-2.6999
	(-2.82)***	(-2.54)**	(-2.36)**	(-1.71)*	(-1.46)	(-1.50)
Per Capita GDP Growth * Lagged Per Capita	0.3100	0.2738	0.2488	0.2515	0.2054	0.2066
GDP Level	(2.42)**	(2.13)**	(1.93)*	(1.40)	(1.14)	(1.16)
Weighted Change of Air Quality in Other	0.9833	1.0871	1.1391	1.2946	1.6109	1.6113
Cities	(1.41)	(1.56)	(1.63)	(1.52)	(1.89)*	(1.90)*
Lagged Foreign Direct Investment	-0.0014	-0.0009	-0.0012	-0.0007	0.0003	-0.0007
(normalized by GDP)	(-0.64)	(-0.39)	(-0.52)	(-0.19)	(0.09)	(-0.18)
CityFixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.350	0.345	0.352	0.147	0.126	0.142
Number of observations	486	486	486	369	369	369

Note: (1) t statistics in parentheses

(2) * p< 0.1, ** p< 0.05, *** p< 0.01

Table 3: Determinants of City-Level Urban Infrastructure Investments (I)

Dependent Variables	Transportation Infrastructure Investment (normalized by GDP)		Environmental Amenity Investment (normalized by GDP)	
Independent Variables	(1)	(2)	(3)	(4)
Lagged Local Budgetary Finance Income	-0.0149	-0.0158	-0.0103	-0.0110
(normalized by GDP)	(-0.29)	(-0.31)	(-0.85)	(-0.90)
Lagged Local Land Sales Income	0.0572	0.0585	0.0046	0.0043
(normalized by GDP)	(2.77)**	(2.81)***	(0.76)	(0.72)
Lagged Loan Balance	0.0044	0.0046	0.0003	0.0001
(normalized by GDP)	(1.45)	(1.55)	(0.20)	(0.11)
Lagged Google Index on Infrastructure Investment	0.6739		-0.1459	
	(1.22)		(-0.82)	
Lagged Google Index on Transportation		0.5761		
		(1.40)		
Lagged Google Index on Environmental Protection				-0.1868
				(-1.23)
Lagged Per Capita GDP Level	0.1299	0.1650	-0.0072	-0.0087
	(0.62)	(0.76)	(-0.08)	(-0.09)
Lagged Foreign Direct Investment	0.0285	0.0289	0.0205	0.0196
	(1.10)	(1.12)	(2.51)**	(2.37)**
Lagged Investment other than Urban Infrastructures	0.0049	0.0050	0.0011	0.0011
	(1.34)	(1.37)	(0.96)	(0.89)
Lagged Government Expenditure	0.0109	0.0122	0.0050	0.0041
	(1.05)	(1.14)	(0.97)	(0.83)
CityFixed Effect	Yes	Yes	Yes	Yes
R^2	0.05	0.05	0.02	0.02
Number of observations	2419	2419	2419	2419

Note: (1) the cities are clustered by province.

(2) t statistics in parentheses.

(3) * p< 0.1, ** p< 0.05, *** p< 0.01.

Table 4: Determinants of City-Level Urban Infrastructure Investments (II)

Dependent Variables	Transportation Infrastructure Investment (share in transportation & environmental investment)		Environmental Amenity Investment (share in transportation & environmental investment)	
Independent Variables	(1)	(2)	(3)	(4)
Lagged Local Budgetary Finance Income	-0.0078	-0.0080	0.0078	0.0078
(normalized by GDP)	(-0.96)	(-0.97)	(0.96)	(0.92)
Lagged Local Land Sales Income	0.0051	0.0052	-0.0051	-0.0051
(normalized by GDP)	(1.98)*	(2.02)*	(-1.98)*	(-1.96)*
Lagged Loan Balance	0.0006	0.0006	-0.0006	-0.0006
(normalized by GDP)	(1.31)	(1.34)	(-1.31)	(-1.34)
Lagged Google Index on Infrastructure Investment	0.1593		-0.1593	
	(1.87)*		(-1.87)*	
Lagged Google Index on Transportation		0.0813		
		(1.18)		
Lagged Google Index on Environmental Protection				-0.0596
				(-1.05)
Lagged Per Capita GDP Level	0.0223	0.0235	-0.0223	-0.0163
	(0.67)	(0.65)	(-0.67)	(-0.49)
Lagged Foreign Direct Investment	-0.0050	-0.0050	0.0050	0.0048
(normalized by GDP)	(-1.66)	(-1.70)	(1.66)	(1.59)
Lagged Investment other than Urban Infrastructures	0.0004	0.0004	-0.0004	-0.0004
(normalized by GDP)	(0.72)	(0.73)	(-0.72)	(-0.72)
Lagged Government Expenditure	0.0004	0.0007	-0.0004	-0.0009
(normalized by GDP)	(0.22)	(0.36)	(-0.22)	(-0.46)
CityFixed Effect	Yes	Yes	Yes	Yes
R^2	0.01	0.01	0.01	0.03
Number of observations	2417	2417	2417	2417

Note: (1) the cities are clustered by province.

(2) t statistics in parentheses.

(3) * p< 0.1, ** p< 0.05, *** p< 0.01.

Table 5: Determinants of City-Level Urban Infrastructure Investments (Robustness Check)

Dependent Variables	Transportation Infrastructure Investment (normalized by GDP)		Environmental Amenity Investment (normalized by GDP)	
Independent Variables	(1)	(2)	(3)	(4)
Lagged Local Budgetary Finance Income	-0.0046	-0.0049	-0.0100	-0.0108
(normalized by GDP)	(-0.10)	(-0.10)	(-0.84)	(-0.89)
log (Lagged Average Land Price)	0.0917	0.0980	0.0042	0.0029
	(3.26)***	(3.33)***	(0.37)	(0.25)
Lagged Loan Balance	0.0054	0.0056	0.0003	0.0002
(normalized by GDP)	(1.77)*	(1.88)*	(0.28)	(0.17)
Lagged Google Index on Infrastructure Investment	0.5974		-0.1543	
	(1.22)		(-0.85)	
Lagged Google Index on Transportation		0.5534		
		(1.42)		
Lagged Google Index on Environmental Protection				-0.1905
				(-1.24)
Lagged Per Capita GDP Level	0.0721	0.0990	-0.0094	-0.0088
	(0.33)	(0.45)	(-0.11)	(-0.10)
Lagged Foreign Direct Investment	0.0262	0.0266	0.0202	0.0193
(normalized by GDP)	(1.03)	(1.06)	(2.57)**	(2.41)**
Lagged Investment other than Urban Infrastructures	0.0071	0.0072	0.0014	0.0013
(normalized by GDP)	(1.78)*	(1.83)*	(1.08)	(1.01)
Lagged Government Expenditure	0.0095	0.0107	0.0050	0.0041
(normalized by GDP)	(0.87)	(0.95)	(0.95)	(0.81)
CityFixed Effect	Yes	Yes	Yes	Yes
R^2	0.04	0.05	0.02	0.02
Number of observations	2417	2417	2417	2417

Note: (1) the observations are clustered by province.

(2) t statistics in parentheses.

(3) * p< 0.1, ** p< 0.05, *** p< 0.01.

Table 6: Can Urban Infrastructure Investment Boost Local GDPGrowth?

(Dependent Variable: dlog(Per Capita GDP))

Independent Variables	(1)	(2)	(3)
Lagged Environmental Amenity Investment	0.0027		
(normalized by GDP)	(0.98)		
Lagged Transportation Infrastructure Investment	0.0030		
(normalized by GDP)	(2.91)***		
Two Year Lagged Environmental Amenity Investment		0.0020	
(normalized by GDP)		(0.88)	
Two Year Lagged Transportation Infrastructure Investment		-0.0003	
(normalized by GDP)		(-0.32)	
Three Year Lagged Environmental Amenity Investment			0.0027
(normalized by GDP)			(0.86)
Three Year Lagged Transportation Infrastructure Investment			-0.0003
(normalized by GDP)			(-0.34)
Lagged Per Capita GDP Level	-0.0023	-0.0159	-0.0327
	(-0.26)	(-1.66)	(-3.18)***
Lagged Foreign Direct Investment	-0.0007	-0.0006	-0.0007
(normalized by GDP)	(-1.22)	(-0.86)	(-1.01)
Lagged Investment other than Urban Infrastructures	0.0007	0.0008	0.0008
(normalized by GDP)	(3.76)***	(4.50)***	(4.88)***
Lagged Government Expenditure	0.0014	0.0011	0.0014
(normalized by GDP)	(2.64)**	(2.04)*	(1.87)*
CityFixed Effect	Yes	Yes	Yes
R^2	0.17	0.10	0.08
Number of observations	2464	2201	1937

Note: (1) the cities are clustered by province.

(2) t statistics in parentheses.

(3) * p< 0.1, ** p< 0.05, *** p< 0.01.

Table 7: Can Urban Infrastructure Investment RaiseLocal Land Price?

(Dependent Variable: dlog(average land price))

Independent Variables	(1)	(2)	(3)
Lagged Environmental Amenity Investment	-0.0847		
(normalized by GDP)	(-1.01)		
Lagged Transportation Infrastructure Investment	0.0550		
(normalized by GDP)	(2.89)***		
Two Year Lagged Environmental Amenity Investment		0.0538	
(normalized by GDP)		(0.77)	
Two Year Lagged Transportation Infrastructure Investment		0.0240	
(normalized by GDP)		(1.46)	
Three Year Lagged Environmental Amenity Investment			0.0652
(normalized by GDP)			(0.81)
Three Year Lagged Transportation Infrastructure Investment			0.0366
(normalized by GDP)			(1.09)
log (Lagged Average Land Price)	-0.8120	-0.8103	-0.9054
	(-23.72)***	(-23.97)***	(-21.50)***
Lagged dlog (Per Capita GDP)	3.2169	3.2197	1.9227
	(3.64)***	(3.67)***	(2.69)**
Lagged Foreign Direct Investment	-0.0291	-0.0301	-0.0396
(normalized by GDP)	(-1.99)*	(-1.89)*	(-2.50)**
Lagged Investment other than Urban Infrastructures	0.0086	0.0082	0.0099
(normalized by GDP)	(4.06)***	(3.72)***	(3.82)***
Lagged Government Expenditure	0.0412	0.0421	0.0320
(normalized by GDP)	(3.61)***	(3.33)***	(2.20)**
CityFixed Effect	Yes	Yes	Yes
R^2	0.51	0.51	0.53
Number of observations	1892	1884	1623

Note: (1) the cities are clustered by province.

(2) t statistics in parentheses.

(3) * p< 0.1, ** p< 0.05, *** p< 0.01.

Table 8: Factors Affecting Prefectural CCP Secretaries' Promotion

(Dependent Variable: whether the CCP secretary gets promotion within the year)

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Average GDP Growth Rate during the Tenure	-0.0538	-0.0529				
	(-1.83)*	(-1.75)*				
Relative GDP Growth Rate Compared with All Other Cities Within the Same Province			-0.0510	-0.0650		
			(-0.97)	(-1.20)		
Relative GDP Growth Rate Compared with Last Officer in the Same Position					0.0543	0.0563
					(2.39)**	(2.28)**
Average of Ratio between Environmental Amenity Investment and GDP during the Tenure		-0.8449		-0.9022		-0.9260
		(-2.80)***		(-2.96)***		(-2.91)***
Average of Ratio between Transportation Infrastructure Investment and GDP during the Tenure		0.0256		0.0030		-0.0436
		(0.25)		(0.03)		(-0.38)
Whether the Officer is Female	0.6284	0.6001	0.6845	0.6672	0.7632	0.7475
	(1.65)*	(1.57)	(1.85)*	(1.80)*	(1.95)*	(1.88)*
Whether the Officer is Minority	-0.1993	-0.2153	-0.2369	-0.2616	-0.4022	-0.4589
	(-0.59)	(-0.62)	(-0.71)	(-0.77)	(-1.13)	(-1.26)
Whether the Officer is Local	0.2057	0.2589	0.1713	0.2369	-0.0273	0.0109
	(0.70)	(0.86)	(0.58)	(0.78)	(-0.08)	(0.03)
The Age He/She Took Current Position	-0.1279	-0.1231	-0.1280	-0.1226	-0.1270	-0.1207
	(-5.28)***	(-4.99)***	(-5.25)***	(-4.94)***	(-4.72)***	(-4.38)***
Whether the Officer Has Master/PhD Degree	-0.2258	-0.2298	-0.2540	-0.2508	-0.3179	-0.3184
	(-1.13)	(-1.16)	(-1.27)	(-1.27)	(-1.43)	(-1.44)
Whether the Officer Has Worked in Central Government	-0.1331	-0.0620	-0.1566	-0.0596	0.0481	0.1924
	(-0.37)	(-0.17)	(-0.44)	(-0.17)	(0.13)	(0.54)
Whether the Officer Has Worked in Provincial Government	-0.0339	-0.0465	-0.0558	-0.0653	0.0160	0.0195
	(-0.21)	(-0.28)	(-0.34)	(-0.40)	(0.09)	(0.11)
Whether the Officer Has Worked in Universities	-0.1277	0.0499	-0.2404	-0.0433	0.0197	0.2333
	(-0.33)	(0.13)	(-0.62)	(-0.11)	(0.05)	(0.54)
Whether the Officer Has Worked as SOE Executives	-1.4130	-1.5280	-1.4468	-1.5622	-1.5614	-1.6652
	(-3.61)***	(-3.78)***	(-3.64)***	(-3.80)***	(-4.13)***	(-4.35)***
Whether the Officer Has Worked in CCYL	0.1491	0.1605	0.1656	0.1688	0.3143	0.3272
	(0.74)	(0.76)	(0.79)	(0.78)	(1.40)	(1.42)
Whether the Officer Has Worked in Other Provinces	0.7488	0.6846	0.7634	0.6905	0.7350	0.6530
	(3.35)***	(3.08)***	(3.38)***	(3.08)***	(3.08)***	(2.79)***
Whether the Officer Has Worked/Studied Abroad	-0.0284	0.0715	-0.0875	0.0261	-0.0369	0.1000
	(-0.11)	(0.27)	(-0.33)	(0.10)	(-0.14)	(0.38)
Whether the Officer Works As Top Officer in a City for the First Time	0.1452	0.1051	0.1674	0.1150	0.0892	0.0181
	(0.71)	(0.48)	(0.81)	(0.52)	(0.42)	(0.08)

CityFixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
PseudoR^2	0.32	0.33	0.32	0.33	0.33	0.34
Number of observations	1552	1529	1552	1529	1528	1509

Note: (1) the observationsare clustered by secretaries.

(2) z statistics in parentheses.

(3) * p< 0.1, ** p< 0.05, *** p< 0.01.

Table 9: Factors Affecting Prefectural Mayor' Promotion

(Dependent Variable: whether the mayor gets promotion within the year)

Independent Variables	(1)	(2)	(3)	(1)	(2)	(3)
Average GDP Growth Rate during the Tenure	-0.0122	-0.0080				
	(-0.67)	(-0.43)				
Relative GDP Growth Rate Compared with All Other Cities Within the Same Province			-0.0163	-0.0185		
			(-0.55)	(-0.62)		
Relative GDP Growth Rate Compared with Last Officer in the Same Position					0.0893	0.0943
					(5.22)***	(5.29)***
Average of Ratio between Environmental Amenity Investment and GDP during the Tenure		-0.4012		-0.4069		-0.5400
		(-1.77)*		(-1.81)*		(-2.11)**
Average of Ratio between Transportation Infrastructure Investment and GDP during the Tenure		-0.0618		-0.0658		-0.1162
		(-0.84)		(-0.90)		(-1.42)
Whether the Officer is Female	-0.4199	-0.4275	-0.4278	-0.4328	-0.4764	-0.4700
	(-1.92)*	(-1.97)**	(-1.95)*	(-2.00)**	(-2.05)**	(-2.06)**
Whether the Officer is Minority	-0.0977	-0.1197	-0.1056	-0.1256	-0.2292	-0.2929
	(-0.38)	(-0.44)	(-0.41)	(-0.46)	(-0.81)	(-0.98)
Whether the Officer is Local	-0.2777	-0.3114	-0.2647	-0.3038	-0.3809	-0.4649
	(-1.27)	(-1.40)	(-1.21)	(-1.37)	(-1.67)*	(-2.00)**
The Age He/She Took Current Position	-0.0401	-0.0393	-0.0405	-0.0391	-0.0341	-0.0304
	(-2.27)**	(-2.21)**	(-2.30)**	(-2.20)**	(-1.82)*	(-1.60)
Whether the Officer Has Master/PhD Degree	-0.0555	-0.0404	-0.0604	-0.0422	0.0278	0.0684
	(-0.45)	(-0.33)	(-0.50)	(-0.34)	(0.21)	(0.52)
Whether the Officer Has Worked in Central Government	0.4202	0.4040	0.4125	0.4033	0.4103	0.3954
	(1.56)	(1.48)	(1.53)	(1.49)	(1.53)	(1.46)
Whether the Officer Has Worked in Provincial Government	0.2185	0.2510	0.2168	0.2519	0.1734	0.2055
	(2.11)**	(2.36)**	(2.10)**	(2.37)**	(1.60)	(1.83)*
Whether the Officer Has Worked in Universities	0.3128	0.3456	0.3010	0.3362	0.4313	0.4827
	(1.02)	(1.05)	(0.98)	(1.02)	(1.37)	(1.43)
Whether the Officer Has Worked as SOE Executives	-0.2055	-0.1868	-0.2189	-0.1957	-0.2916	-0.2455
	(-1.02)	(-0.91)	(-1.09)	(-0.96)	(-1.31)	(-1.07)
Whether the Officer Has Worked in CCYL	0.0644	0.0608	0.0674	0.0601	0.0078	0.0266
	(0.36)	(0.34)	(0.38)	(0.33)	(0.04)	(0.14)
Whether the Officer Has Worked in Other Provinces	-0.6255	-0.6188	-0.6300	-0.6188	-0.6950	-0.6895
	(-2.84)***	(-2.88)***	(-2.84)***	(-2.87)***	(-2.94)***	(-3.03)***
Whether the Officer Has Worked/Studied Abroad	-0.0648	-0.0416	-0.0651	-0.0396	-0.0114	0.0319
	(-0.32)	(-0.21)	(-0.32)	(-0.20)	(-0.05)	(0.15)
Whether the Officer Works As Top Officer in a City for the First Time	-0.4419	-0.4106	-0.4393	-0.4052	-0.5148	-0.4397
	(-2.20)**	(-2.06)**	(-2.17)**	(-2.02)**	(-2.43)**	(-2.13)**

CityFixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
PseudoR^2	0.21	0.22	0.21	0.22	0.23	0.24
Number of observations	1513	1499	1513	1499	1503	1489

Note: (1) the observationsare clustered by mayors.

(2) z statistics in parentheses.

(3) * p< 0.1, ** p< 0.05, *** p< 0.01.

Table A-1: City Level Variables

Variable	Definition	Source	Mean	Std. Dev
Environmental Amenity Investment	Annual investment on urban infrastructures in the categories of "Drainage Works(including sewage purification)", "Environmental Sanitation (including solid waste treatment)", and "Gardening and Greening"; normalized by local GDP in the same year.	Ministry of Housing and Urban-Rural Development (*China Urban Construction Statistical Yearbook*)	0.363	0.356
Transportation Infrastructure Investment	Annual investment on urban infrastructures in the categories of "Road and Bridges" and "Public Transportation"; normalized by local GDP in the same year.		0.895	1.025
Air Quality	Percentage of days in the year when the air quality reaches "Grade I" (the highest grade).	Ministry of Environmental Protection (the official website)	0.207	0.198
Per Capita GDP	Local annual per capita GDP (after adjusting according to two economic censuses); in thousand yuan RMB (in 2009 price).	National Bureau of Statistics (*China City Statistical Yearbook*; *China Statistical Yearbook for Regional Economy*; *Bulletins of Population Census* in 2000, 2010)	0.507	0.727
Budgetary Government Income	Local governments' annual budgetary finance income; normalized by local GDP in the same year.		5.005	1.770
Government Expenditure	Local governments' annual budgetary expenditure; normalized by local GDP in the same year.		11.347	6.326
Total Investment	Annual investment (excluding those on urban infrastructures); normalized by local GDP in the same year.		42.276	18.759
Loan Balance	Commercial banks'loan balance at the end of the year; normalized by local GDP in the same year.		74.810	38.102
FDI	Annual foreign direct investment; normalized by local GDP in the same year.		2.241	3.060
Land Sales Income	Annual land sales revenues; normalized by local GDP in the same year.	Ministry of Land Resource (*China Yearbook of Land Resources*)	2.144	2.398
Land Supply Volume	Annual land sales volume; in million sq.m of land area.		5.070	7.266
Land Price	Average price of land parcels sold during the year; in yuan (in 2009 price) per sq.m of land area.		261.903	244.824
Google Index on Infrastructure Investment	Index on the density that the corresponding provincial CCP secretary calls for infrastructure investment in the year; see the text for more details.	Authors' calculations based on Google searches.	0.161	0.063
Google Index on Environmental Protection	Index on the density that the corresponding provincial CCP secretary calls for environmental protection in the year; see the text for more details.		0.218	0.094
Google Index on Transportation Development	Index on the density that the corresponding provincial CCP secretary calls for transportation development in the year; see the text for more details.		0.289	0.092

Note: The air quality variable covers 86 cities, while all the other variables cover all the 283 cities.

Table A-2: City Officer Variables

Variable	Definition	CCP Secretary		Mayor	
		Mean	Std. Dev.	Mean	Std. Dev.
Promotion	Whether the officer in position at the beginning of the year gets promoted within the year (see the text for detailed definition of promotion); 1=yes, 0=o/w.	0.110	0.313	0.201	0.401
Gender	Gender of the officer in the city-year; 1=female, 0=male.	0.024	0.152	0.043	0.202
Ethnic Group	Whether the officer in the city-year is of a minority ethnic group; 1=yes, 0=o/w.	0.069	0.253	0.058	0.233
Home Town	Whether the officer in the city-year was born in this city; 1=yes, 0=o/w.	0.050	0.217	0.097	0.296
Age	Age of the officer in the city-year when he/she first occupied current position.	49.817	3.614	48.175	3.943
Education Level	Whether the officer in the city-year is with a master or higher degree; 1=yes, 0=o/w.	0.692	0.462	0.701	0.458
Working Experience in Central Government	Whether the officer in the city-year has worked as a senior officer in the central government; 1=yes, 0=o/w.	0.049	0.216	0.053	0.223
Working Experience in Provincial Government	Whether the officer in the city-year has worked as a senior officer in a provincial government; 1=yes, 0=o/w.	0.603	0.489	0.483	0.500
Working Experience in Universities	Whether the officer in the city-year has worked as a senior officer in a university or research institute; 1=yes, 0=o/w.	0.041	0.199	0.035	0.185
Working Experience in SOEs	Whether the officer in the city-year has worked as a senior officer in a state-owned enterprise; 1=yes, 0=o/w.	0.055	0.229	0.087	0.282
Working Experience in Chinese Communist Youth League	Whether the officer in the city-year has worked as a senior officer inthe Chinese Communist Youth League; 1=yes, 0=o/w.	0.133	0.340	0.098	0.298
Working Experience in Other Government	Whether the officer in the city-year has worked in other provinces; 1=yes, 0=o/w.	0.101	0.302	0.068	0.251
Working/Study Experience Abroad	Whether the officer in the city-year has worked or studied outside mainland China; 1=yes, 0=o/w.	0.073	0.261	0.094	0.292
Working Experience as City Officer	Whether this is the first time for the officer in the city-year to be the top officer in a prefectural level city; 1=yes, 0=o/w.	0.276	0.447	0.894	0.308