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Incentives and Outcome: the "environmental" bias in China

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I: Introduction

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

This fundamental approach can be applied to analyse not just firm but also government behaviour. Through this lens, we advance an empirically based explanation for China's low investment on "environment" in the past. While the governments controlled by the CCP engineered highly impressive economic growth, their investment in infrastructure is biased towards transportation and against "environment" development. We show that 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

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argument may explain China's lower than global average investment in education, health, and social security. Yet, we hasten to add that we do not have evidence to say that the outcome is sub-optimal. The CCP could have adequately represented the collective preference: grow first and other social development later. Still, the empirical analyses meaningfully reveal potential 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 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., in three years. Promotion is based on good performance, and allegedly tangible economic growth is the reliable predictor for growth (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's China 2030 (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 other revenue sources to finance their expenditures.

The two create skewed incentives and budgetary constraint pressure on local governments. The alleged dominant consideration of economic growth for promotion incentivizes local governments to make public expenditures according to contributions to tangible economic growth. The allocation between infrastructure spending on transportation and environmental amenities is a case in point. 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 on that contribute to intangible development, like education and health.

Our empirical evidence is based on city level data on allocation of infrastructure expenditures on transportation infrastructures and on environmental amenities from 2000 to 2009. In the next section, we document the trends of the two types of infrastructure investments. We also show that spending on environmental amenities is associated with improvement in air quality, a piece of evidence that spending on environmental amenities alleviate 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. In Section IV, we show that investment in transportation has a direct impact on growth and that 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 probability of promotion is pre-dominantly determined by growth. Conclusions and discussions follow.

II: China's urban infrastructure investment and air quality

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

After Mr Jintao Hu become CCP 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, and 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 1, 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 2).

On the other hand, most investments 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 stimulus.[2]

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

Meanwhile, pollution, especially poor air quality, is an increasingly major urban 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 "crazy bad" by the US embassy in Beijing. It

[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.

[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.

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). This may partially be biased due to the expansion of cities included in the monitoring. But even if we focus on the 37 cities that appear in the whole sample period in Panel B, the pattern shows that significant improvement came only after 2008, the year Beijing hosted the Olympic Games.

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

At the same time, we can show empirical results which suggest that spending on environmental amenities could help improve local air quality immediately, as well as during the following years. In other words, the insufficient environmental amenity investment during the past decade would be at least one reason for the current problem of poor air quality.

The empirical model is 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

[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

2009. The dependent variable is the change in ratio of days reaching "Grade I" in air quality compared with the previous year.[5] On the RHS, we focus on the effect of 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, first we include the increase of per capita GDP and its cross term with the lagged per capita GDP level to capture the potential environmental Kuznets curve effect (Stern, Common and Barbier, 1996; Stern, 2004). Second, the air quality in one city may be affected by pollutions imported from surrounding cities and regions. 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 FDI (normalized by GDP) is also introduced to reflect the potential effect of foreign investment on air quality, which has been revealed in some existing literatures based on developing economics (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. The variable of annual investment on environmental

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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.

amenities 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 in investment on environmental amenities (normalized by GDP) 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 increase by 0.86 percentage point annually during the sample period. By contrast, we cannot observe any impacts of transportation infrastructure investments 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 effect of nearby cities' air quality change is positive in the model as expected, but only marginally significant. This is consistent with the finding by Zheng, Cao and Kahn (2011) that in China the impacts of local factors still dominate in determining air quality. The FDI proxy is insignificant in the model.

[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.

As suggested in Table 1, the number of cities included in the air quality monitoring was increasing between 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 choose to start with the year of 2005 to create a balanced panel to avoid sampling noise. The results are robust (actually the effect of environmental investments is even 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"), urban infrastructure investment in China has been dominated by the local (city) governments. As shown in Figure 3, 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 also helps to expand the investment. In 2009 bank loans and bonds provided funds for 39.7% of the urban infrastructure investments. But they are the burdens of local governments or local SOEs. For example, in 2009 the loan and bond service cost the local governments about 58.8 billion yuan. 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 the 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 budgetary finance income, and hence for most cities the budgetary income allotted to local governments could only meet their basic operating expenses (*chi fan cai zheng*), but could not provide enough funds for large projects like urban infrastructure development. Accordingly, the local governments have to mainly use off-budget income to invest on urban infrastructures, most of which comes from land sales revenue, or loans from banks or bond market. Thus the question is what infrastructure development the local governments spend on after they are able to raise these 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 reasonably gauge that by the person's public statements.

There were totally 82 provincial CCP Secretaries in these 27 provinces during the period between 2000 and 2009. We conduct the following to gauge their preference on infrastructure

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

development. We first Google-search for the names of provincial CCP secretary (with title) in the corresponding province. The total number of entries is the denominator in our index. To construct the numerator, we search for the officer's name (also with title) plus certain key word 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 joint searches by the aforementioned denominator yields the proxy for each provincial CCP secretary's preference for infrastructure investment, transportation, and environmental protection, respectively. A provincial CCP Secretary with a higher score in infrastructure investment index could be expected to more heavily emphasize infrastructure development; the indexes of transportation and environmental protection reflect 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 Google indexes are 0.16, 0.29 and 0.22, respectively. This implies that the provincial CCP Secretaries advocate investing in transportation more intensively than environment protection, at least in their speeches. We examine how they affect a city's spending on these types of infrastructure development in the following.

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

[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.

investments on transportation infrastructures and 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 fixed effect model is suggested by the standard Hausman test, and standard error estimates are clustered by province.

The results are reported in Table 3. First, as for the three proxies of local governments' budget constraint, the effect of budgetary income is insignificant in both 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 the model of transportation infrastructure investment. According to the coefficient in column (1), a one standard deviation increase of land sales income will lead to 0.14 percentage point increase ($2.398 \times 0.057 \approx 0.137$) 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 the model of 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 the land auctions, they mainly choose to invest in the transportation field, but not for environmental protection. Or, more strongly stated, cities would raise money from land sales and loans to invest 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 of lagged Google index on infrastructure investment is only positive and marginally significant in the sector of transportation infrastructures, but negative (although insignificant) in the sector of 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 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 significant in 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 volume of the two sectors 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 infrastructure and significantly negative 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 totally controlled by local governments. If one prefecture top officer plans to invest on a huge infrastructure development during the following years, he/she may choose to supply more land this year to collect funds. In this case the effect of *RATIO_LANDINC* may be biased due to the inversed causality. Hoping to correct for this problem, in Table 5 we 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 government spending adds to aggregate demand and stimulates growth, spending on transportation infrastructure relative to spending on environmental amenities has a more immediate growth effect 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 China context several papers have shown that infrastructure investment could substantially and immediately boost local 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 economic growths during the same speed. Fan and Zhang (2004) point out that infrastructure investment is also an important driver of 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' 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 are unfortunately 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 following 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

[10] We also try to introduce the 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 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 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 is statistically significant.

IV.b Transportation infrastructure investments raise land sales revenue

The classical framework of Roback (1982) suggests that in equilibrium the city variance in property price is fully determined by city variance in expected economic growth and quality-of-life (QOL). Accordingly, since urban infrastructure investment could lead to either QOL improvement or economic growth (or even both), it could also be expected to finally result in an increase in property prices. As stated earlier, currently in China land sales income is an important off-budget finance source for local governments. This means that growth in property prices (land prices) would directly lead to higher finance revenues for local governments, which could provide strong incentives for local governments to invest on certain types of urban infrastructure that raise land price.

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 is significantly positive in the model, 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 ($1.025 \times 0.055 \approx 0.0564$), 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 suggest that transportation infrastructure investment could substantially raise land prices in the following years and thus higher land sales revenues to the local governments. Together with the earlier findings in Table 3, these suggest a positive feedback cycle between local governments' transportation infrastructure investment and land sales income. The local governments use the land sales income to develop transportation infrastructures, which then helps them get more land sales income in the future. This makes the transportation infrastructure investment "sustainable" for local governments, and thus could provide strong incentives for prefectural officers to invest. 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 the sector of 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 have pointed out that the provincial level GDP growth is the most important key performance indicator in evaluating officers' performance and hence determines their political career (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 sectary in the same or another city), and equals 0 if he/she remains on current position, or moves to another position in the same or lower level, or retired. The "abnormal" changes (death, arrested due to corruption, etc.) are excluded from the sample. We exclude secretary/mayor's first 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 growth performance. We use three proxies: the average GDP growth rate during the secretary/mayor's current tenure until the previous year, the difference between the 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 between the secretary/mayor's own average performance and the average GDP growth rate of his/her predecessor's tenure.

The second is infrastructure spending. To capture that, we use the ratios of the two types of urban infrastructure investment scaled by GDP, average over an official tenure until the previous 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 provinces. Since the determinants of promotion may differ between secretaries and mayors, we run the probit model in each of these two groups, with the results reported in Table 8 and 9, respectively.

Our results suggest that, for both the CCP secretaries and mayors, only the variable measuring 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. Considering the great inter-city variance in China, a direct comparison in GDP growth rate between different cities may be misleading. Instead the performance of the predecessor could be a more suitable benchmark in evaluation an officer's performance. Besides, this GDP 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 leases which 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 officers 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 significant 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.

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 revenues based on tax revenue sharing mechanism and intergovernmental fiscal transfers are far from adequate. At the same time, prefectural officers face a promotion criterion that emphasizes delivering 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 an illustrative case in point. 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 statement on investing in transportation infrastructure raises that type spending; but, the same call for spending on environment does not stimulate that type of spending. This happens in spite of that China's environment is deteriorating and the central government repeatedly emphasizes the importance of environmental protection, and the observed results 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 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 and assigned responsibilities and budget constraint. Clearly, reward incentives guide behaviour: officers will enthusiastically fulfil the part of assigned responsibilities that matches given incentives and ignore those that are not incorporated in the incentive system. Also, the budgetary process can affect behaviour too: officers will carry out activities that raise their available resources and they therefore could spend effort on activities that are in discordance with national objectives.

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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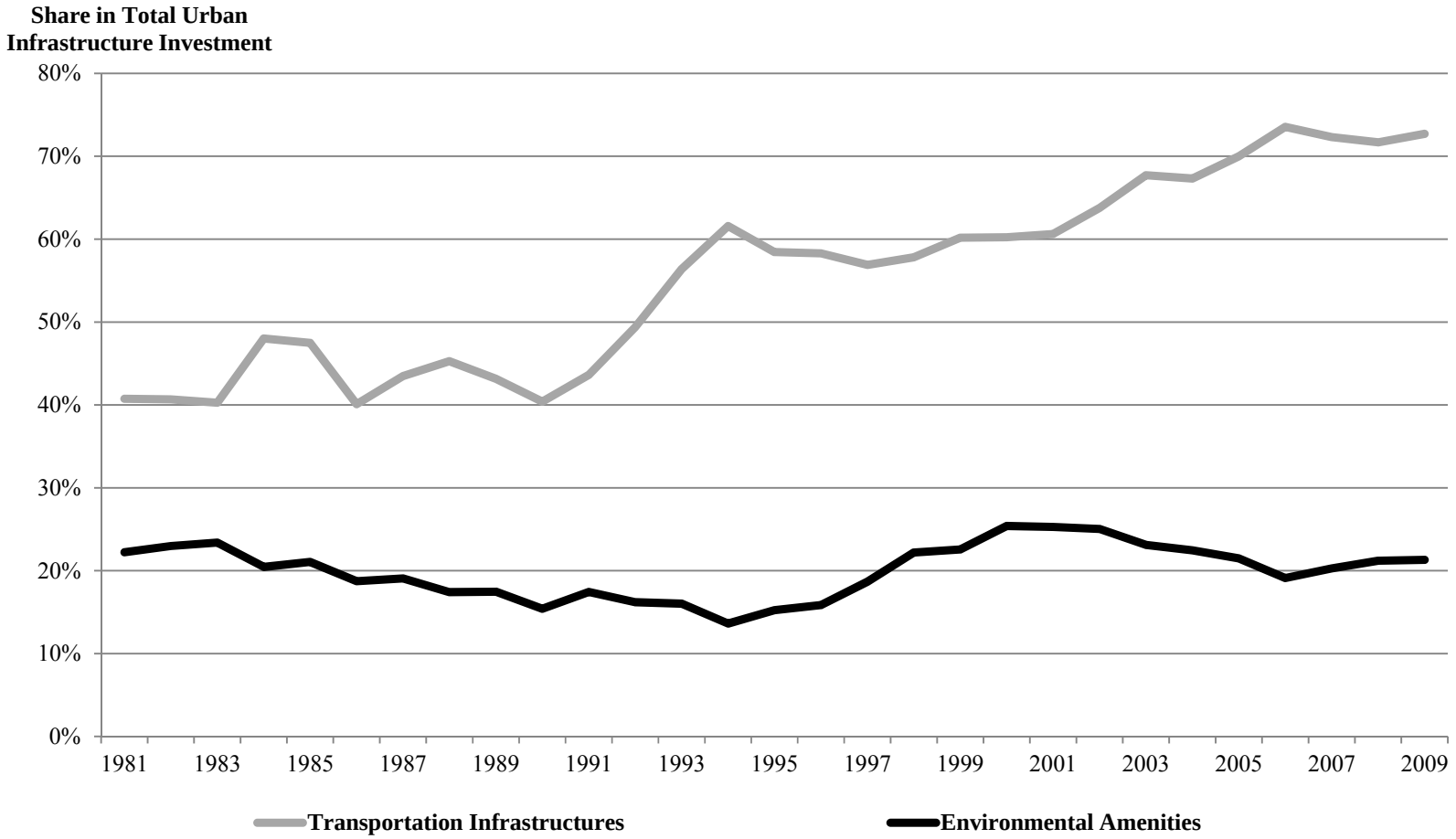


Figure 1: Structure of Urban Infrastructure Investments in the National Level

Source: Ministry of Housing and Urban-Rural Devleopment of China, "China Urban Construction Statistics Yearbook".

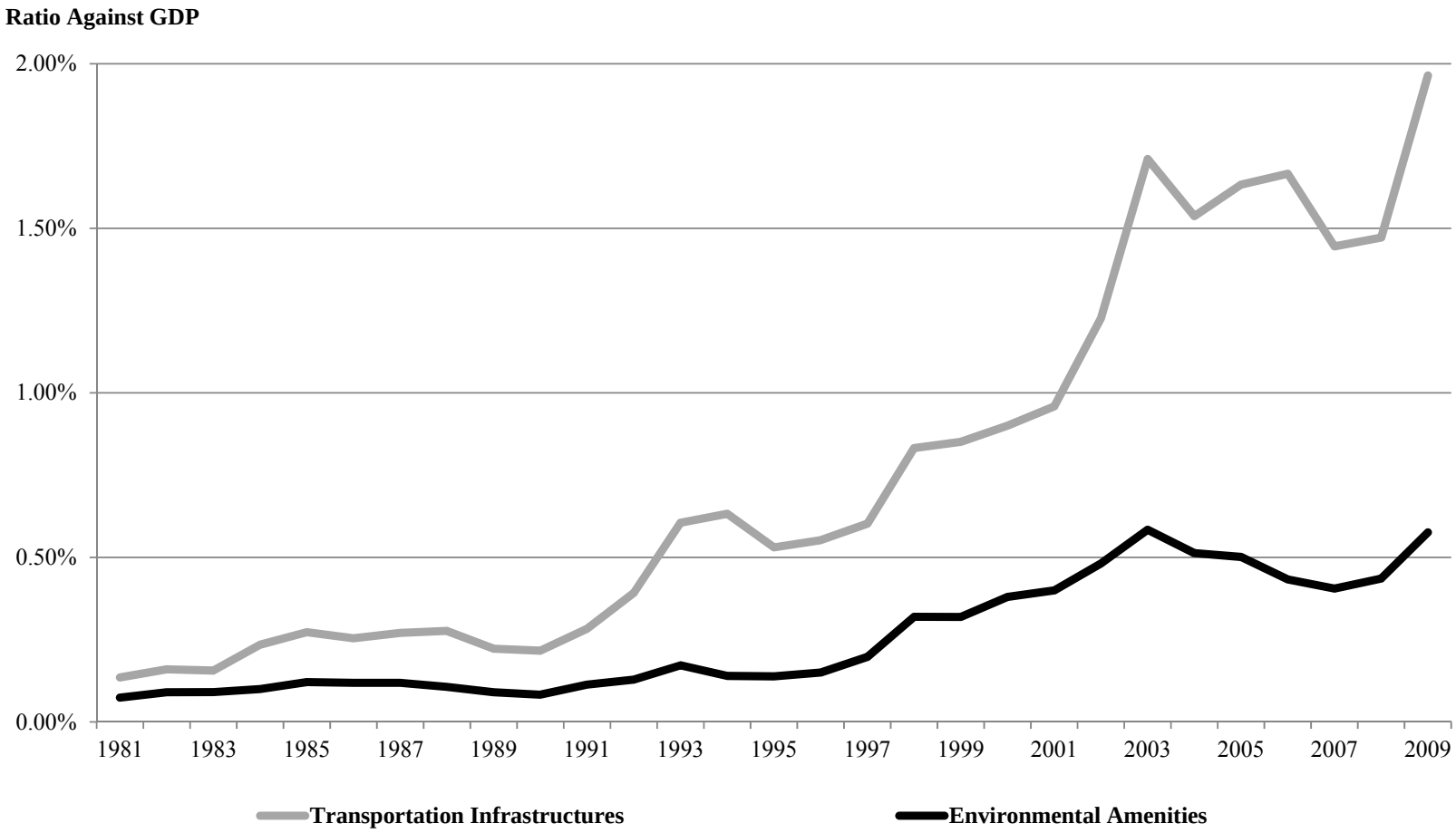


Figure 2: Ratio of Three Sectors of Urban Infrastructure Investments against GDP

Source: Ministry of Housing and Urban-Rural Devleopment of China, "China Urban Construction Statistics Yearbook".

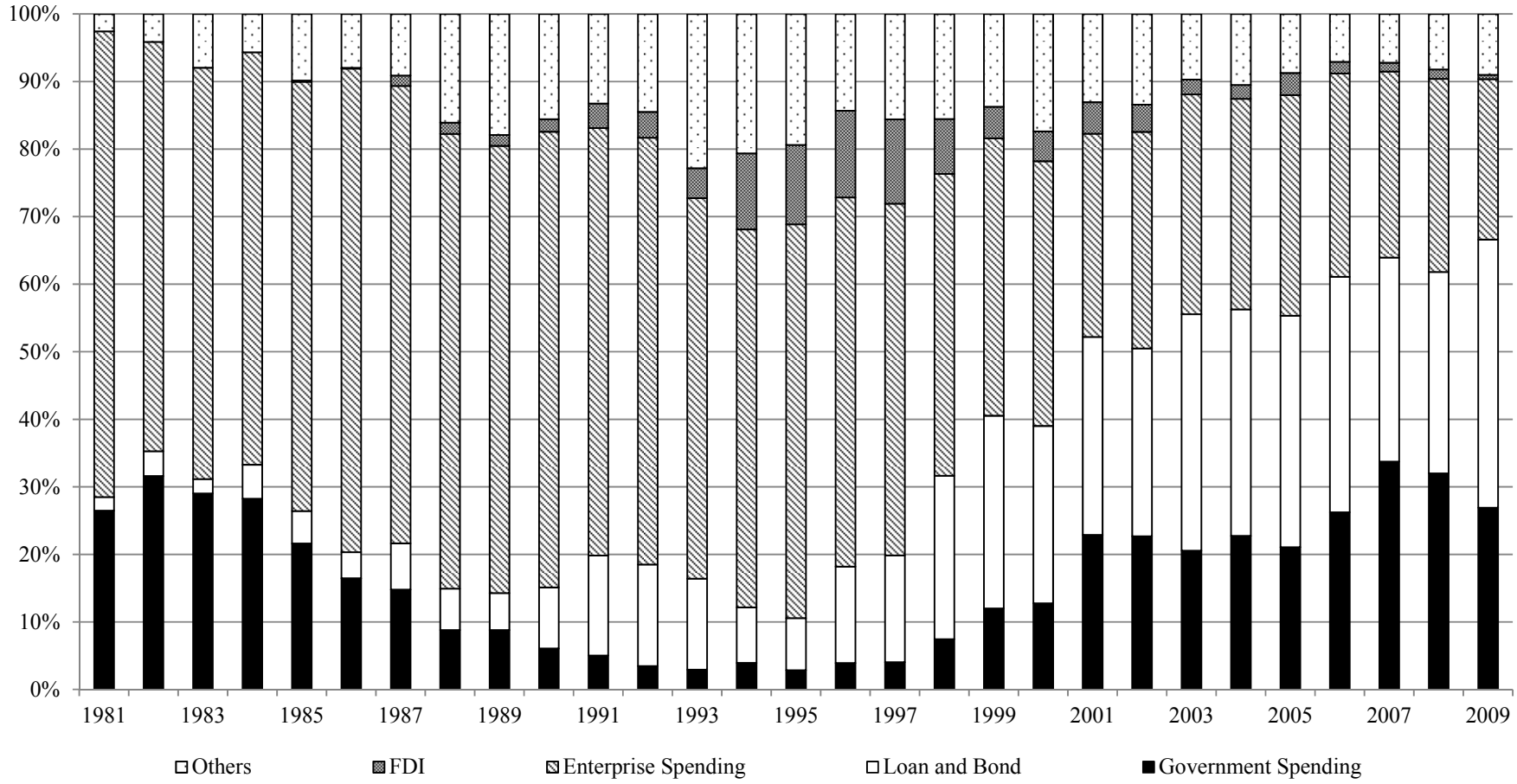


Figure 3: Fund Sources of Fixed Asset Investment on Urban Infrastructure

Source: Ministry of Housing and Urban-Rural Devleopment 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 1" 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)
City Fixed 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)
City Fixed Effect	Yes	Yes	Yes	Yes
Within-group 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)
City Fixed Effect	Yes	Yes	Yes	Yes
Within-group 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)
City Fixed Effect	Yes	Yes	Yes	Yes
Within-group 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 GDP Growth?

(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)*
City Fixed 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 Raise Local 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)**
City Fixed 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				
	(-1.22)	(-1.16)				
Relative GDP Growth Rate Compared with All Other Cities Within the Same Province			-0.0510	-0.0650		
			(-0.63)	(-0.79)		
Relative GDP Growth Rate Compared with Last Officer in the Same Position					0.0543	0.0563
					(1.89)*	(1.78)*
Average of Ratio between Environmental Amenity Investment and GDP during the Tenure		-0.8449		-0.9022		-0.9260
		(-1.99)**		(-2.18)**		(-2.15)**
Average of Ratio between Transportation Infrastructure Investment and GDP during the Tenure		0.0256		0.0030		-0.0436
		(0.23)		(0.03)		(-0.37)
Whether the Officer is Female	0.6284	0.6001	0.6845	0.6672	0.7632	0.7475
	(1.08)	(1.07)	(1.19)	(1.22)	(1.35)	(1.38)
Whether the Officer is Minority	-0.1993	-0.2153	-0.2369	-0.2616	-0.4022	-0.4589
	(-0.56)	(-0.63)	(-0.70)	(-0.81)	(-1.19)	(-1.43)
Whether the Officer is Local	0.2057	0.2589	0.1713	0.2369	-0.0273	0.0109
	(0.64)	(0.77)	(0.53)	(0.70)	(-0.09)	(0.03)
The Age He/She Took Current Position	-0.1279	-0.1231	-0.1280	-0.1226	-0.1270	-0.1207
	(-4.12)***	(-3.78)***	(-4.22)***	(-3.85)***	(-3.65)***	(-3.31)***
Whether the Officer Has Master/PhD Degree	-0.2258	-0.2298	-0.2540	-0.2508	-0.3179	-0.3184
	(-0.71)	(-0.70)	(-0.80)	(-0.78)	(-0.88)	(-0.87)
Whether the Officer Has Worked in Central Government	-0.1331	-0.0620	-0.1566	-0.0596	0.0481	0.1924
	(-0.33)	(-0.17)	(-0.38)	(-0.16)	(0.11)	(0.51)
Whether the Officer Has Worked in Provincial Government	-0.0339	-0.0465	-0.0558	-0.0653	0.0160	0.0195
	(-0.16)	(-0.22)	(-0.26)	(-0.30)	(0.08)	(0.10)
Whether the Officer Has Worked in Universities	-0.1277	0.0499	-0.2404	-0.0433	0.0197	0.2333
	(-0.30)	(0.12)	(-0.54)	(-0.10)	(0.04)	(0.52)
Whether the Officer Has Worked as SOE Executives	-1.4130	-1.5280	-1.4468	-1.5622	-1.5614	-1.6652
	(-3.72)***	(-3.48)***	(-3.85)***	(-3.57)***	(-4.31)***	(-4.06)***
Whether the Officer Has Worked in CCYL	0.1491	0.1605	0.1656	0.1688	0.3143	0.3272
	(0.81)	(0.80)	(0.91)	(0.84)	(1.65)*	(1.54)
Whether the Officer Has Worked in Other Provinces	0.7488	0.6846	0.7634	0.6905	0.7350	0.6530
	(2.61)***	(2.38)**	(2.67)***	(2.40)**	(2.50)**	(2.23)**
Whether the Officer Has Worked/Studied Abroad	-0.0284	0.0715	-0.0875	0.0261	-0.0369	0.1000
	(-0.06)	(0.16)	(-0.18)	(0.06)	(-0.08)	(0.22)
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
	(0.49)	(0.34)	(0.57)	(0.37)	(0.29)	(0.06)

City Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.32	0.33	0.32	0.33	0.33	0.34
Number of observations	1552	1529	1552	1529	1528	1529

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

(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 CCP secretary gets promotion within the year)

Independent Variables	(1)	(2)	(3)	(1)	(2)	(3)
Average GDP Growth Rate during the Tenure	-0.0122	-0.0080				
	(-0.47)	(-0.31)				
Relative GDP Growth Rate Compared with All Other Cities Within the Same Province			-0.0163	-0.0185		
			(-0.52)	(-0.65)		
Relative GDP Growth Rate Compared with Last Officer in the Same Position					0.0893	0.0943
					(3.85)***	(3.88)***
Average of Ratio between Environmental Amenity Investment and GDP during the Tenure		-0.4012		-0.4069		-0.5400
		(-1.75)*		(-1.81)*		(-1.84)*
Average of Ratio between Transportation Infrastructure Investment and GDP during the Tenure		-0.0618		-0.0658		-0.1162
		(-0.98)		(-1.08)		(-1.38)
Whether the Officer is Female	-0.4199	-0.4275	-0.4278	-0.4328	-0.4764	-0.4700
	(-1.76)*	(-1.82)*	(-1.82)*	(-1.88)*	(-1.56)	(-1.59)
Whether the Officer is Minority	-0.0977	-0.1197	-0.1056	-0.1256	-0.2292	-0.2929
	(-0.49)	(-0.56)	(-0.53)	(-0.58)	(-1.21)	(-1.46)
Whether the Officer is Local	-0.2777	-0.3114	-0.2647	-0.3038	-0.3809	-0.4649
	(-1.12)	(-1.27)	(-1.10)	(-1.27)	(-1.61)	(-2.02)**
The Age He/She Took Current Position	-0.0401	-0.0393	-0.0405	-0.0391	-0.0341	-0.0304
	(-2.14)**	(-2.16)**	(-2.25)**	(-2.24)**	(-1.72)*	(-1.61)
Whether the Officer Has Master/PhD Degree	-0.0555	-0.0404	-0.0604	-0.0422	0.0278	0.0684
	(-0.36)	(-0.26)	(-0.40)	(-0.27)	(0.16)	(0.40)
Whether the Officer Has Worked in Central Government	0.4202	0.4040	0.4125	0.4033	0.4103	0.3954
	(1.16)	(1.09)	(1.16)	(1.11)	(1.16)	(1.08)
Whether the Officer Has Worked in Provincial Government	0.2185	0.2510	0.2168	0.2519	0.1734	0.2055
	(1.73)*	(2.01)**	(1.70)*	(1.99)**	(1.30)	(1.55)
Whether the Officer Has Worked in Universities	0.3128	0.3456	0.3010	0.3362	0.4313	0.4827
	(0.86)	(0.88)	(0.81)	(0.84)	(1.18)	(1.21)
Whether the Officer Has Worked as SOE Executives	-0.2055	-0.1868	-0.2189	-0.1957	-0.2916	-0.2455
	(-0.67)	(-0.56)	(-0.74)	(-0.61)	(-0.88)	(-0.67)
Whether the Officer Has Worked in CCYL	0.0644	0.0608	0.0674	0.0601	0.0078	0.0266
	(0.24)	(0.21)	(0.24)	(0.21)	(0.03)	(0.09)
Whether the Officer Has Worked in Other Provinces	-0.6255	-0.6188	-0.6300	-0.6188	-0.6950	-0.6895
	(-2.31)**	(-2.39)**	(-2.30)**	(-2.36)**	(-2.36)**	(-2.49)**
Whether the Officer Has Worked/Studied Abroad	-0.0648	-0.0416	-0.0651	-0.0396	-0.0114	0.0319
	(-0.30)	(-0.19)	(-0.30)	(-0.18)	(-0.05)	(0.13)
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
	(-1.70)*	(-1.54)	(-1.66)*	(-1.50)	(-2.21)**	(-1.79)*

City Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^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 cities are clustered by province.

(2) z statistics in parentheses.

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

Table A-1: City Level Variables

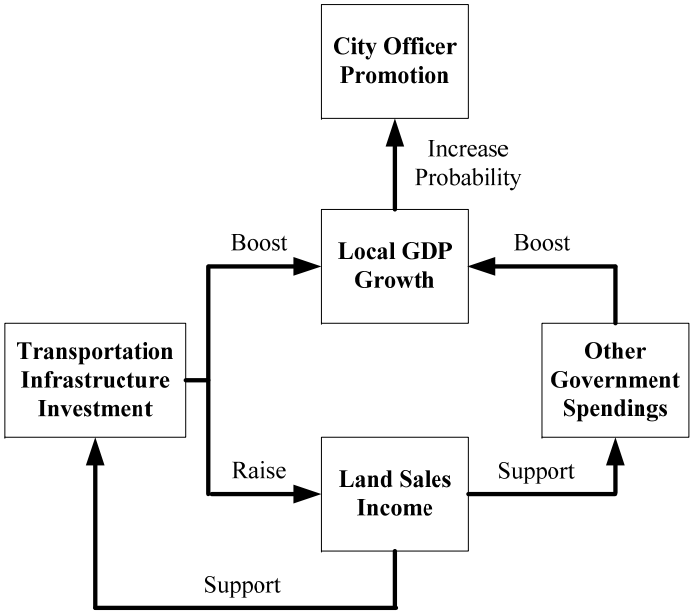
Variable	Definition	Source	Mean	Std. Dev
Environmental Amenity Investment	Annual investment on urban infrastructures in the categories of "Drainage Works (including sewage purification)", "Environmental Sanitation (including solid waste treatment)", and "Gardening and Greening"; normalized by local GDP 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 sectary 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 sectary 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 sectary 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.

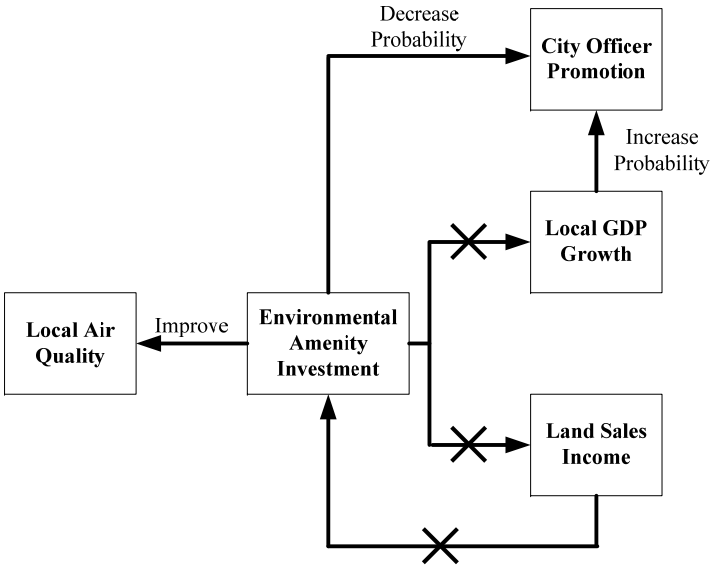
Table A-2: City Officer Variables

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 in the 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

A. For the transportation infrastructures:



B. For the environmental amenities:


Decrease
Probability
City Officer
Promotion
Increase
Probability
Local GDP
Growth
Local Air
Quality
Improve
Environmental
Amenity
Investment
Land Sales
Income