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Appendix A. Build outward: city leader sets urban boundary in order to maximize welfare of urban residents

We consider a benchmark case where the city leader is a benevolent social planner who sets the urban boundary in order to maximize the welfare of each urban resident. Therefore, the objective function of the city leader is

$$\begin{aligned} &\max_{S} \quad V \equiv \frac{\theta^{\theta}(1-\theta)^{1-\theta}(AG-2tS-\kappa T(S))}{\underline{p}^{1-\theta}} \\ &s.t. \\ &(i) \quad G=\int_0^S 0.5*p^2(r)dr-(1-\kappa)T(S) \\ &(ii) \quad \int_0^S \frac{F(r)}{h(r)}dr=\int_0^S \frac{p(r)}{h(r)}dr=N \end{aligned} \quad . \tag{A.1}$$

In (A.1), *(i)* is the city government's budget constraint, and *(ii)* means that the total housing supply should accommodate the total housing demand, which effectively determines the city population corresponding to the optimal urban boundary, denoted as S_0. Suppose that there exists an interior solution with $V>0$ and that the second-order derivative of *V* is negative, then we know that the first-order condition is satisfied at $S=S_0$:

$$V_S \equiv \Omega*(AG_S-2t-\kappa T_S)=0, \tag{A.2}$$

where $\Omega \equiv \theta^{\theta}(1\text{-}\theta)^{1\text{-}\theta}/\underline{p}^{1-\theta}$; and $V_S<0$ for $S>S_0$. We can solve for S_0 from (A.2). Note that S_0 depends on the city's production amenity *A*, transportation technology associated with *t*, agricultural rents associated with $\underline{p}$, and institutional factors such as κ, etc., which we shall control for in the empirical analysis. Note also that S_0 is independent of the city leader's career incentives.

Appendix B. Proof of Propositions 1 and 2

Proposition 1. *Assume that* $R_{SS}<0$ *and* $V_{SS}<0$. *And assume the parameter space guarantees that* $\Omega \equiv \theta^{\theta}(1\text{-}\theta)^{1\text{-}\theta}/\underline{p}^{1-\theta}<1$[1]. *Then at* S^*, $dS^*/d\lambda>0$, $dY^*/d\lambda>0$, *and*

[1] This condition can easily be satisfied under reasonable parameter space. For example, when $\theta \in [0.7, 0.8]$ and

$dN^* / d\lambda > 0$.

Proof. First, let us show $N_S > 0$ at $S = S^*$ From the individual worker's indirect utility, equilibrium house price per unit floor area at each location, and condition *(ii)* of (5), we know $N = (\underline{p}^2 / 4t) * \left[\left((AG - \kappa T(S)) / (AG - 2tS - \kappa T(S)) \right)^{2/(1-\theta)} - 1 \right] = (\underline{p}^2 / 4t) * \left[\left((V + 2tS) / V \right)^{2/(1-\theta)} - 1 \right]$. Thus, $N_S \propto d(S/V)/dS \propto (V - SV_S)$. This means the sign of N_S is the same as that of $V - SV_S$. Because $V_{SS} < 0$, we know $V - SV_S$ monotonically increases with *S*. Suppose under certain regularity condition, $V - SV_S = 0$ when $S = 0$. Therefore $V - SV_S > 0$ for any $S^* > 0$. So $N_S > 0$ at $S = S^*$.

Second, we show $Y_S > 0$ at $S = S^*$. From the first-order condition (6), we know that $\mu Y_S = E_S - (1-\mu) V_S$ at $S = S^*$. If $S^* > S_0$, then $V_S < 0$. Therefore $Y_S > 0$ at $S = S^*$. If $S^* \le S_0$, then $V_S = \Omega(AG_S - 2t - \kappa T_S) > 0$ at $S = S^*$, which means $AG_S > 0$ at $S = S^*$. Because $N_S > 0$ and $G_S > 0$, also because $Y_S = NAG_S + N_S AG$ by definition, we have $Y_S > 0$ at $S = S^*$.

Thirdly, $dS^* / d\mu = -R_{S\mu} / R_{SS} = -(N_S AG + NAG_S - V_S) / R_{SS}$. From the first-order condition (6), we know that $NAG_S + N_S AG - V_S = (E_S - V_S)/\mu$ at $S = S^*$. If $S^* > S_0$, then $V_S < 0$ at $S = S^*$. Also, because $R_{SS} < 0$, we have $dS^* / d\mu > 0$. If $S^* \le S_0$, then $N_S AG + NAG_S - V_S = N_S AG + A(N - \Omega)G_S + 2\Omega t + \Omega\kappa T_S > 0$, because $N_S > 0$ and $G_S > 0$, and also because $N - \Omega > 0$. Therefore, we have $dS^* / d\mu > 0$.

Finally, we have $dN^* / d\mu = N_S * dS^* / d\mu > 0$ and $dY^* / d\mu = Y_S * dS^* / d\mu > 0$. Because μ is increasing with λ, we have $dS^* / d\lambda > 0$, $dN^* / d\lambda > 0$, and $dY^* / d\lambda > 0$. QED.

Proposition 2. *Assume that* $R_{SS} < 0$ *and* $V_{SS} < 0$. *As long as* $Y_S(S_0) > a$ [2] *there exists a*

$\underline{p} \ge 1$, which is both consistent with data, $\Omega \equiv \theta^\theta (1\text{-}\theta)^{1\text{-}\theta} / \underline{p}^{1-\theta} < 1$.

[2] This condition means that at the margin, the additional output generated by expanding the city beyond the socially

threshold career incentive level $\bar{\lambda}(S_0)$ *such that city leaders choose to expand urban boundary beyond the socially optimal level; that is,* $S^* > S_0$*, if and only if* $\lambda > \bar{\lambda}(S_0)$*. Regarding welfare, for* $\lambda > \bar{\lambda}(S_0)$*,* $dV^*/d\lambda < 0$*; for* $\lambda \le \bar{\lambda}(S_0)$*,* $dV^*/d\lambda \ge 0$*.*

Proof. From (A.2), at $S = S_0$, $AG_S = (2t + \kappa T_S) > 0$; and $V = AG - 2tS - \kappa T(S) > 0$. Also, from the individual worker's indirect utility, equilibrium house price per unit floor area at each location, and condition *(ii)* of (5), we know that

$$N = (\underline{p}^2/4t)*\left[\left((AG-\kappa T(S))/(AG-2ts-\kappa T(S))\right)^{2/(1-\theta)} - 1\right].$$

Therefore, at $S = S_0$,

$$N_S = (\underline{p}^2/2t(1-\theta))*\left[\left(1/(AG-2ts-\kappa T(S))\right)^{2/(1-\theta)}\right]*(AG-\kappa T(S))^{(1+\theta)/(1-\theta)}*(AG_S-\kappa T_S) > 0.$$

So we know $Y_S(S_0) \equiv ANG_S + AGN_S > 0$. Also, $E_S = a$ at $S = S_0$. Therefore $R_S > 0$ at $S = S_0$ if and only if $\mu > a/Y_S(S_0)$. Because $Y_S(S_0) > a$, let us define $0 < \bar{\mu}(S_0) \equiv a/Y_S(S_0) < 1$. Because μ is increasing with λ, we can find a unique $\bar{\lambda}(S_0)$ that corresponds to $\bar{\mu}(S_0)$. The first part of the proposition thus follows.

Regarding welfare, from Proposition 1, we have $dS^*/d\lambda > 0$. Because $V_S < 0$ for $S > S_0$ and $V_S \ge 0$ for $S \le S_0$, we know that *for* $\lambda > \bar{\lambda}(S_0)$, $dV^*/d\lambda < 0$; *for* $\lambda \le \bar{\lambda}(S_0)$, $dV^*/d\lambda \ge 0$.

QED.

Appendix C: Data appendix

Land transaction data: The land transaction data come from the China Index Academy. The original sample includes 36,058 residential land parcels with completed sales. We drop the observations missing key information such as transaction date and location address. The resulting sample has 30,058 residential land transactions completed through public auctions in 200 Chinese

optimal level is greater than the additional administration effort cost incurred on the leader himself. Given the large size of Chinese cities, we expect this inequality holds under reasonable parameter space. It is also consistent with our empirical findings. If $Y_S(S_0) \le a$, then city leaders always choose $S^* \le S_0$.

cities during the period from 2000 through 2011. For each land parcel, we have information on the use type, total area, transaction date, sale price, auction type, address, etc. By taking advantage of the micro-level land data we are able to obtain detailed geographic information on residential land developments. We first geocode each land parcel based on its address and infer the names of the streets that serve as its boundaries. Using this information, we then find the smallest polygon that contains the land parcel on Baidu Map (www.map.baidu.com). The geographic coordinates of the polygon's centroid are used as the coordinates of the land parcel and we use them to calculate the distance to the city center for each land parcel. We use the coordinates of the 1992 light center (i.e., the brightest cell at night in each city's central area) from Baum-Snow et al. (2017) to identify the actual city center. They suggest that despite the enormous increase of light over the past two decades, the light centers have remained unchanged.

A typical Chinese prefecture consists of one city proper and several surrounding rural counties. The address information of our land data confirms that the majority of the land parcels in our sample are located within the administrative city proper. This is even true for those land parcels at the top percentiles in the distribution of the land distance to the city center. Only a few are located in the surrounding rural counties. Even for those cases, the land parcels are adjacent to the city proper. As such, the outward urban expansion we focus on essentially occurs at the edge of the city proper. In addition, our data on land reserve and sale prices at auction show that the land parcels sold at the city edge are sold through competitive bidding, suggesting that there exists competitive market demand for land located near city fringes.

The Chinese government passed a law in 2002 requiring all the land intended for business purposes (including residential, commercial and industrial land) to be sold via public auction. This law was strictly enforced beginning in August 2004. We understand that some land transactions still occur through negotiated sales instead of public auctions. However, we note that most negotiated sales involve industrial land, and it is common for local governments to subsidize industrial land so as to attract more firm investment. Even for residential land sold through negotiations, the sale prices were far below the market value. This suggests that such negotiated sales are not intended to create fiscal revenues for the local government. Since local government revenues are at the heart of this paper's story, our residential land transaction data from public auctions is representative and suitable for the research purposes of this paper.

Promotion variable: We define a promotion dummy variable which equals one if the city leader was promoted to a higher-level position by the end of his term. Note that the higher-level positions exclude those in the local CPPCC or PC. For city leaders who were arrested or died during office,

or whose office terms had not ended by December 30, 2015, we consider their promotion status as missing. We also experiment with alternative definitions of promotion. For instance, we set the promotion dummy to be zero if the city leader was either arrested or died during his term, or if the city leader had not finished his tenure by the end of 2015. The main results remain similar.

City-leader-level outward expansion measures: We match the residential land transactions in each city with the data on city leaders during our sample period. We are then able to calculate the extent of outward development during each leader's term of office. Among the 974 city leaders in our sample, 602 of them had no residential land transaction records in our data. The majority of these 602 leaders finished their terms of office before 2006 while more than 85% of the transactions in our sample happened during 2007-2011. A simple comparison shows that within a given city, the career-incentive intensities of leaders with land transaction records are not statistically different from those of leaders without. Eight city-leader-level observations are dropped because their terms of office started before 1999. An additional two observations are dropped because their terms' initial city characteristics are missing. The city-leader-level regression sample contains 362 observations.

City-level characteristics: We collect data on city-level characteristics from different data sources. We collect the yearly data on city-level economic characteristics (such as registered population size, GDP per capita, built-up urban land area, employment size by industrial sector, and fixed asset investment) from the *City Statistical Yearbooks 1998-2014*. Data on each city's annual road stock are taken from the *China Urban Construction Statistical Yearbook 1998-2013.* All value variables are converted to constant 2012 price levels using the provincial-level consumer price index reported by the *National Bureau of Statistics of China*.

Bartik variable: Following Bartik (1991), we multiply a city's employment share in each industry sector in the office-start year by the national growth rate in the corresponding sector over the three years just after the city leader takes office and then take the average of the product across all industry sectors. The data on each city's employment by industry sector (SIC digit one) is from the 2005 edition of the *City Statistical Yearbook.* The yearly data on the national employment by industry sector is obtained from the website of the *National Bureau of Statistics of China* (http://data.stats.gov.cn).

Appendix D: Other robustness checks

The effects of other personal characteristics of local leaders

According to the Chinese political economy literature (e.g., Jia, Kudamatsu and Seim, 2015; Chen, Henderson and Cai, 2016), older officials of the Communist Party in China tend to patronize younger ones, while officials of similar age compete with each other for higher positions. Thus, it is possible that city leaders display more loyalty towards provincial leaders who are older than they are and in turn are more favored by those older upper-level superiors. In contrast, a younger provincial leader tends to carry out a more sensible allocation of resources (in terms of granting land quotas) in order to maximize the province's overall economic performance. To address these concerns, we further include the age of the provincial leader (and its squared term) as of the city leader's office-start year. Our main results remain fairly robust as shown in column 1 of Table A5 in the appendix.

A city leader who has greater career-incentive intensity may stay in office for a longer time. Meanwhile, his tenure length may affect the number of land parcels sold during his office term and their distance from the city center, which in turn influences the outward expansion. Column 2 of Table A5 shows that the main results remain robust to inclusion of the city leader's total tenure length and its squared term.

In our previous city-leader analysis, we treat a given city leader's multi-year term as a single observation. In doing so, we assume that all land parcels sold during the leader's tenure follow the land development strategy that was created when he first took office. Note that it is possible for a city leader to draft a new plan upon being re-appointed for an additional term after the first five years. However, among the 362 city-leader observations, while 112 office terms last beyond five years (the normal length of a term), only 29 last more than seven years. Thus, in most cases, the additional years in office beyond the first five years do not allow sufficient time for a leader to start a new development plan. Nevertheless, we conduct several robustness checks regarding this re-appointment issue. First, the main results are robust to including a dummy variable indicating a city leader with tenure greater than five years. Second, our main results remain unchanged if we exclude the 29 city-leader observations that last for more than seven years. Finally, for these 29 observations, we treat the time beyond the first five years as a new term of office. Our main results still stand using this alternative method of defining city-leader observations. Columns 3-5 of Table A5 report these robustness check results.

Relative economic performance

The previous literature has shown evidence that the promotion of local leaders in China

hinges on their economic performance relative to their immediate predecessors and/or their administrative neighbors (e.g., Chen, Li and Zhou, 2005; Landry, Lu and Duan, 2017). The key intuition of our model does not change if we let local leaders' promotions depend on relative performance. Empirically, we address this issue as follows. First, our main regressions control for the GDP per capita and population just before a given leader took office, which helps to capture the economic performance of his immediate predecessor. In addition, as discussed in Section 5.2.2, column 3 of Table 5 shows that the main results are robust to including the immediate predecessor's career-incentive intensity. Second, our main regressions include the province-specific time trends of both the office-start year and the office-end year of the city leader. These trends capture the overall trend of all cities in the same province. Moreover, our main results remain unchanged when we further include the provincial GDP in the city leader's office-start year, which captures the economic performance of all peer cities within the same province as shown in column 6 of Table A5.

Start age and start level

Readers may worry that our key results may be driven by the way we predict the *ex-ante* likelihood of promotion of city leaders. To check the robustness of our key results, we re-run our regressions in Table 4, replacing the predicted career-incentive intensity with the city leader's start age and start level. The results are reported in Table A6. The estimates reveal a consistent story: all other things being equal, younger city leaders tend to build their cities further outward. City leaders at the deputy-province level are less likely to adopt an outward pattern of urban land development, possibly because there are relatively fewer upper-level positions available to them and hence they tend to have lower ex-ante promotion chances and lower career-incentive intensities given that they have the same retirement age as prefecture-level leaders. Note that the effect of the dummy indicating province-level or above is subsumed by the city fixed effects.

Log forms of outward expansion measures

Table A7 in the appendix reports the results of the regressions that use the logs of the distance measures as outcome variables. Our main results still stand: a one-standard-deviation increase in career-incentive intensity causes the 90^{th} percentile distance to the city center to increase by 31% (12.5 km) from the sample average.

Appendix E: The effects of career incentives on city's social and economic outcomes

In this section, we empirically investigate the effects of city leaders' career incentives on the economic outcomes of their cities. According to our theoretical model, outward expansion driven by a city leader's career incentives enhances his city's total output and accommodates more population. As such, we expect that a city's total output and total urban population will be greater during times when it is governed by a leader with higher incentives.

We also investigate the impacts of local leaders' career incentives on per-capita retail sales of consumer goods and per-capita disposable income of urban residents. Although they do not perfectly measure individual utility, these two variables to some extent capture individual net income after certain costs associated with expansion are factored out (e.g., commuting costs, pollution-related medical costs, etc.).

Given that a city leader typically stays in office for several years, we expand each city-leader observation in Section 5 to multiple city-year observations. In total, we have 1374 city-year-level observations for this analysis.[3] The advantage of using the city-year-level variables as outcomes is that it allows us to control for the city-specific year trends of these outcome variables. The regression specification is as follows:

$$y_{c,t} = \varphi\lambda_{c,s(t)} + \tilde{\eta}_c + \gamma_t + \delta_{c,t} + X_{c,s(t)}\tilde{\phi} + \varepsilon_{c,t} \quad \text{(E.1)}$$

where $y_{c,t}$ represents various outcome variables in city *c* in year *t*; $\lambda_{c,s(t)}$ represents the career-incentive intensity of leader $s(t)$ in city *c* in year *t* at the start of the office term; $\tilde{\eta}_c$ are the city fixed effects, which capture all time-invariant city attributes; γ_t are the year fixed effects; $\delta_{c,t}$ represents the city-specific year trends and captures time trends specific to each city; $X_{c,s(t)}$ contains the same set of city-leader characteristics used in regression (7) in Section 5 for city *c*'s leader $s(t)$; and $\varepsilon_{c,t}$ is an error term.

We collect data on the disposable income of urban households from the *China Statistical*

[3] For the years when city leaders change, we keep only the city leaders who served for more than six months in each such year and drop the other leaders. Thus, in the regression sample, there is only one city leader in each city in each year. For this exercise, we exclude the observations from four provincial-level cities as their social and economic characteristics are likely to be heavily affected by the will of leaders in the central government. The results are quite similar if we include these four provincial-level cities.

Yearbooks for Regional Economy 2001-2013, and city-level economic characteristics (such as gross industrial output value and retail sales of consumer goods) from the *City Statistical Yearbooks 1998-2014*. Data on each city's total number of urban residents are taken from the *China Urban Construction Statistical Yearbook 2001-2013*. All value variables are converted to constant 2012 price levels using the provincial-level consumer price index reported by the *National Bureau of Statistics of China*.

Table A8 in the appendix reports the regression results. The standard errors are generated by bootstrap replications clustered at the province level. The effects of career-incentive intensity on gross industrial output and urban population size are both positive and significant (see columns 1-2). If the career-incentive intensity of the city leader increases by one standard deviation, the gross industrial output rises by 4.7%. This coincides with the circumstances that existed during our sample period of 2000-2011, when the land-fiscal policies of local governments were mainly aimed at developing the industrial sector. A one-standard-deviation increase in career-incentive intensity also corresponds with an increase of 3.6% in urban population.

We next replace the predicted career-incentive intensity with the city leader's start age and start level. The estimates, reported in columns 5-6, tell a consistent story: all other things being equal, cities with younger leaders (presumably with higher career-incentive intensities) have greater total industrial production and urban population.

The effects of career incentives on the two per-capita variables are both negative and insignificant (see columns 3-4). Also, according to columns 7-8, all other things being equal, younger leaders with higher incentives are associated with lower per-capita retail sales of consumer goods and per-capita disposable income of urban residents. Notice the two per-capita variables do not perfectly measure individual utility. So we take the results of these two variables as only suggestive evidence of welfare loss.

In addition, we examine the effect of career-incentive intensity on transportation infrastructure using regression specification (E.1) and find that career-incentive intensity is positively associated with both total road length and road density (see Table A9 in the appendix).

Appendix F: The effect of career incentives on building density

Using land-parcel-level data, we investigate the effect of city leaders' career incentives on the city's regulatory residential building density. The regression specification is as follows:

$$F_{i,c,s,t} = \beta^F \lambda_{c,s} + \omega_1 \log(disCBD_i) * \lambda_{c,s} + \omega_2 \log(disCBD_i) + \hat{\eta}_c + X_{c,s}\hat{\phi} + \vartheta_t + \hat{u}_{i,c,s,t}, \quad \text{(F.1)}$$

where $F_{i,c,s,t}$ is the regulatory floor-to-area ratio (FAR) level of land i sold during the office term of city leader *s* in city *c* in year *t*; $\lambda_{c,s}$ is the career-incentive intensity of city leader *s* when he took office in city *c*; $\log(disCBD_i)$ represents the log of the land's distance to the city center; $\hat{\eta}_c$ are city fixed effects, capturing the time-invariant characteristics of city *c* that may affect the regulatory FAR, such as geographic features and climate; $X_{c,s}$ contains the same set of city-leader characteristics used in regression (7) in Section 5 for city *c*'s leader *s*; ϑ_t represents the fixed effects of land transaction year, the fixed effects of land transaction quarter, and the province-specific linear trends of land transaction year, which control for national and regional shocks; and $\hat{u}_{i,c,s,t}$ is the error term. The standard errors are calculated by bootstrap replications.

The regression sample is drawn from the transaction data used in our main analysis. It includes 29,859 residential land transactions with complete information on regulatory FAR upper limits. Notice that in China, the FAR regulation is largely binding (Cai, Wang, and Zhang, 2017).

Table A10 reports the regression results. Column 1 shows that the career incentives of local leaders are negatively associated with the regulatory residential building density in Chinese cities. Furthermore, column 2 of Table A10 shows that the greater the career-incentive intensity of the city leader is, the smaller the magnitude of the gradient of building density against the distance to the city center becomes. The distance gradient itself is negative, consistent with most literature. Hence while career incentives drive outward expansion, the building density flattens out at the same time, which suggests that the spatial layout of cities governed by high-incentive city leaders is less compact than that of cities under low-incentive ones.

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Supplementary Tables and Figures

Figure A1: Map of 200 Chinese Cities in Sample

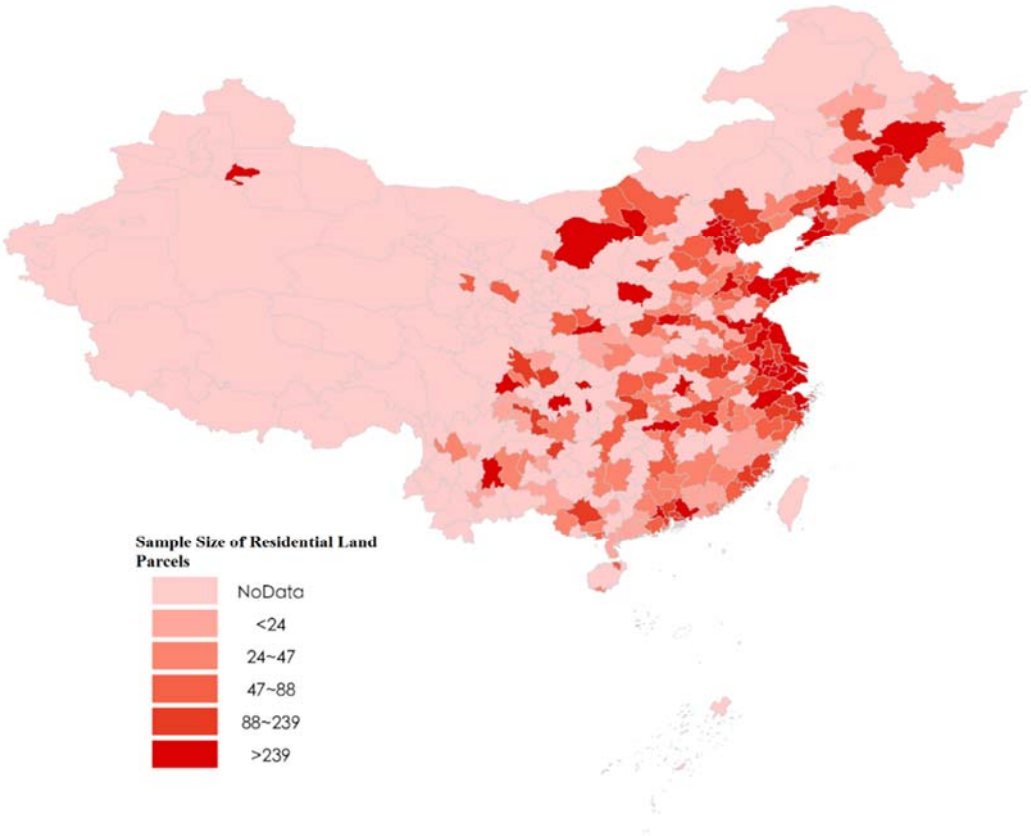
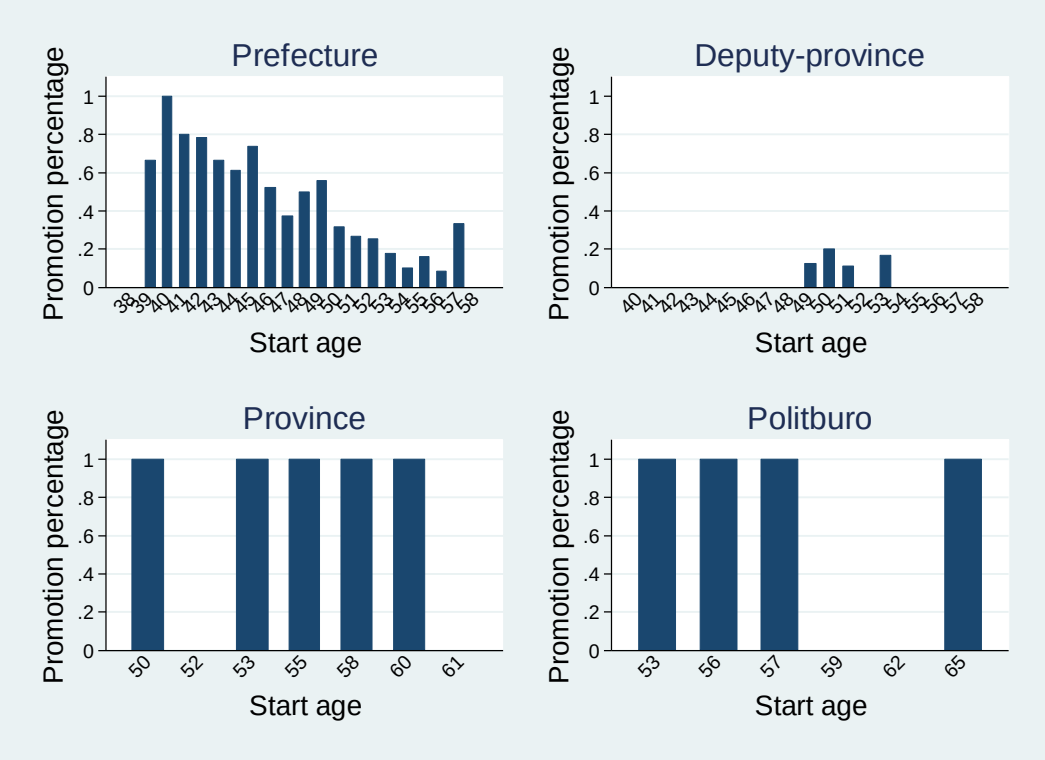


Figure A2: Promotion Percentage at End of Office, by Start Level and Start Age



Notes: We observe the promotion outcomes of 735 city leaders. Among the 610 prefecture-level city leaders who were aged between 38 and 58 upon taking office, 242 successfully climbed to a higher hierarchical level. Among the 112 deputy-province-level city leaders who were aged between 40 and 58 upon taking office, only seven of them were promoted. Five of seven province-level city leaders and four of six politburo-level city leaders were promoted.

Table A1: Outward Expansion and Urban Land Area Growth

	Square root of built-up area contiguous to urban settlements at the end of the each period (sq. km)	
	Landsat data	City Statistical Yearbooks
	(1)	(2)
90th percentile distance to city center of land parcels sold during each period, 10 km	0.187***	0.106***
	(0.065)	(0.039)
City fixed effects	Yes	Yes
Period fixed effects	Yes	Yes
Observations	538	534
R-squared	0.974	0.985

Notes: *** p<0.01, ** p<0.05, * p<0.1. Heteroskedasticity-robust standard errors are in parentheses. Landsat data: The Institute of Geographic Science and Natural Resources at the Chinese Academy of Sciences provides detailed land-classification information for all cities nationwide based on the U.S. Landsat TM/ETM images. The dataset covers the years 2000, 2005, 2008, 2010, and 2013. Using this dataset, we calculate the total area of all built-up areas that are contiguous to urban settlements for each year when the data is available. We divide our land sample into four time periods based on the land transaction year: 2000-2005, 2006-2008, 2009-2010, and 2011-2013.

Table A2: Career Incentives and Various Percentiles of Land Distance to City Center

Dependent variable: Percentiles of distribution of land distance to city center (km)										
	90th pct. distance to city center	80th pct. distance to city center	70th pct. Distance to city center	60th pct. distance to city center	50th pct. distance to city center	40th pct. distance to city center	30th pct. distance to city center	20th pct. distance to city center	10th pct. distance to city center	Mean distance to city center
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
City leader's career-incentive intensity	40.087***	25.532**	19.197*	12.356	1.473	-5.749	-7.996	-3.085	-2.798	9.731
	(15.221)	(10.945)	(10.072)	(8.585)	(8.967)	(8.244)	(7.563)	(3.685)	(3.229)	(7.295)
City fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Baseline city-leader level characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	362	362	362	362	362	362	362	362	362	362
R-squared	0.976	0.972	0.978	0.973	0.959	0.959	0.949	0.976	0.969	0.980

Notes: See Table 4 for notes.

Table A3: Outward Development of Immediate Predecessors and Career Incentives of City Leaders

Dependent variable: Percentiles of distribution of land distance to city center, residential land sold by immediate predecessor (km)				
	90th pct. distance to city center	80th pct. distance to city center	50th pct. distance to city center	Mean distance to city center
	(1)	(2)	(3)	(4)
Current city leader's career-incentive intensity	-18.750	-15.956	-5.572	-9.256
	(34.074)	(532.367)	(13.374)	(9.108)
City fixed effects	Y	Y	Y	Y
Baseline city-leader-level characteristics	Y	Y	Y	Y
Observations	313	313	313	313
R-squared	0.986	0.989	0.990	0.993

Notes: *** p<0.01, ** p<0.05, * p<0.1 Standard errors (in parentheses) are calculated on the basis of 1,000 bootstrap replications clustered at the province level. Each regression is weighted by the number of residential land parcels sold by the city leader's immediate predecessor. The baseline city-leader-level characteristics include the dummies of the years when the immediate predecessor took and left office; the province-specific linear trends of the immediate predecessor's office-start and office-end years; the city's population size, GDP per capita, and built-up urban land area (all in logs) in the year just before the immediate predecessor took office; the growth rates of city's population size, GDP per capita, and built-up urban land area over the two years just before the immediate predecessor took office.

Table A4: Cities' Pre-existing Economic Conditions and City Leaders' Personal Characteristics

	log GDP per capita	log city population	log built-up urban land area	Growth rate of GDP per capita	Growth rate of city population	Growth rate of built-up urban land area
	(1)	(2)	(3)	(4)	(5)	(6)
City leader's start age	0.000	-0.002	0.007	0.001	0.001	0.018
	(0.006)	(0.004)	(0.009)	(0.004)	(0.001)	(0.016)
Dummy: Deputy-province	-0.020	-0.001	0.095	-0.030	-0.001	-0.002
	(0.050)	(0.037)	(0.119)	(0.072)	(0.007)	(0.111)
Dummy: Graduate degree	0.021	-0.048	-0.117	0.008	-0.002	0.009
	(0.049)	(0.055)	(0.070)	(0.027)	(0.005)	(0.121)
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Office-start and office-end year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific trends of the office-start and office-end years	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic (Age, level and education coefficients=0)	0.140	0.275	1.187	0.0989	0.301	1.312
p-value (Age, level and education coefficients=0)	0.935	0.843	0.332	0.960	0.824	0.290
Observations	362	362	362	362	362	362
R-squared	0.999	0.999	0.996	0.964	0.999	0.971

Notes: *** p<0.01, ** p<0.05, * p<0.1 Standard errors (in parentheses) are clustered at the province level.

Table A5: Outward Development and Career Incentives of City Leaders: More Robustness Checks

Dependent variable: City-leader-level 90th percentile distance to city center (km)						
	(1)	(2)	(3)	(4)	(5)	(6)
City leader's career-incentive intensity	42.261**	40.192**	38.932**	42.736**	38.154**	41.205**
	(16.706)	(17.321)	(17.357)	(20.411)	(18.414)	(16.890)
Provincial leader's age	-4.114					
	(22.389)					
Provincial leader's age squared	0.043					
	(0.195)					
City leader's tenure length		-1.917				
		(8.887)				
City leader's tenure length squared		0.171				
		(0.563)				
Dummy variable: City leader stayed over 5 years			-6.310			
			(7.343)			
Log (provincial GDP in first year of office)						38.433
						(82.077)
City fixed effects	Y	Y	Y	Y	Y	Y
Baseline city-leader-level characteristics	Y	Y	Y	Y	Y	Y
Observations	362	362	362	333	371	362
R-squared	0.976	0.975	0.975	0.979	0.976	0.975

Notes: See Table 4 for notes. In column 4, we exclude the 29 city leaders who remained in office for more than seven years. In column 5, for the city leaders who stayed in office for more than seven years, we treat the office time beyond the first five years as an independent term of office. Among the 29 city leaders who stayed in office for more than seven years, five did not sell any land in their second terms. Among the remaining 24 city leaders who sold at least one parcel of land in their second terms, 15 did not sell any land in their first terms.

Table A6: Outward Development, Start Age and Start Level

Dependent variable: City-leader-level outward expansion measures (km)								
	90th pct. distance to city center	80th pct. distance to city center	50th pct. distance to city center	Mean distance to city center	90th pct. distance to city center	80th pct. distance to city center	50th pct. distance to city center	Mean distance to city center
	Full sample				Drop 4 provincial-level cities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
City leader's start age	-1.263*	-1.092*	-0.334	-0.393	-1.274*	-1.098*	-0.345	-0.401
	(0.667)	(0.588)	(0.574)	(0.335)	(0.660)	(0.586)	(0.570)	(0.332)
Dummy: Deputy-province	-27.134**	-19.068	-6.884	-8.664	-27.174**	-19.091	-6.926	-8.691
	(12.746)	(13.031)	(9.950)	(5.370)	(12.628)	(12.973)	(9.812)	(5.289)
City fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Baseline city-leader-level characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Observations	362	362	362	362	353	353	353	353
R-squared	0.978	0.975	0.961	0.982	0.975	0.970	0.948	0.977

Notes: *** p<0.01, ** p<0.05, * p<0.1 Standard errors (in parentheses) are clustered at the province level. Each regression is weighted by the number of residential land parcels sold during the office term of each city leader. The baseline city-leader characteristics are the same as those described in the notes of Table 4.

Table A7: Log Forms of Outward Expansion Measures

Dependent variable: City-leader-level outward expansion measures in logs								
	Log 90th pct. distance to city center	Log 80th pct. distance to city center	Log 50th pct. distance to city center	Log mean distance to city center	Log 90th pct. distance to city center	Log 80th pct. distance to city center	Log 50th pct. distance to city center	Log mean distance to city center
	Full sample				Drop 4 provincial-level cities			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
City leader's career-incentive intensity	1.321*	1.007*	0.175	0.706	1.322*	1.009*	0.179	0.708
	(0.682)	(0.602)	(0.626)	(0.518)	(0.741)	(0.581)	(0.621)	(0.539)
City fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Baseline city-leader-level characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Observations	362	362	362	362	353	353	353	353
R-squared	0.963	0.967	0.964	0.973	0.959	0.962	0.958	0.969

Notes: See Table 4 for notes.

Table A8: City's Social and Economic Outcomes and Career Incentives of City Leaders

	Log gross industrial output value	Log urban population size	Log per-capita retail sales of consumer goods	Log per-capita disposable income of urban residents	Log gross industrial output value	Log urban population size	Log per-capita retail sales of consumer goods	Log per-capita disposable income of urban residents
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
City leader's career-incentive intensity	0.199*	0.154*	-0.114	-0.045				
	(0.120)	(0.092)	(0.097)	(0.041)				
City leader's start age					-0.010**	-0.004*	0.005*	0.002
					(0.004)	(0.002)	(0.002)	(0.002)
Dummy: Deputy-province					-0.059	-0.055**	0.018	0.020
					(0.051)	(0.022)	(0.025)	(0.019)
City fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
City-specific linear year trends	Y	Y	Y	Y	Y	Y	Y	Y
Baseline city-leader-level characteristics	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,371	1,134	1,285	1,353	1,371	1,134	1,285	1,353
R-squared	0.996	0.994	0.992	0.992	0.996	0.994	0.992	0.992

Notes: *** p<0.01, ** p<0.05, * p<0.1 For the regressions in columns 1-4, standard errors (in parentheses) are calculated by bootstrap replications clustered at the province level. For the regressions in columns 5-8, standard errors (in parentheses) are clustered at the city level. Each regression is weighted by the number of residential land parcels sold during the office term of each city leader. The baseline city-leader characteristics are the same as those described in the notes of Table 4. In columns 3 and 7, we additionally control for the city's annual consumption from foreign and domestic tourism (both in logs). For the years when city leaders change, we keep only the city leaders who served for more than six months in each such year and drop the other leaders. Thus, in the regression sample, there is only one city leader in each city in each year. For this exercise, we exclude the observations from four provincial-level cities as their social and economic characteristics are likely to be heavily affected by the will of leaders in the central government. The results are quite similar if we include these four provincial-level cities.

Table A9: Transportation Infrastructure and Career Incentives of City Leaders

	Total road stock	Road density within urban built-up land area
	(1)	(2)
City leader's career-incentive intensity	925.960*	55.501**
	(488.383)	(27.898)
City fixed effects	Y	Y
Year fixed effects	Y	Y
City-specific linear year trends	Y	Y
Baseline city-leader-level characteristics	Y	Y
Observations	1,374	1,374
R-squared	0.980	0.958

Notes: Each city's annual road stock is measured by its total road length in km. Each city's annual road density within its urban built-up land area is measured by its total road length divided by the square root of the city's built-up land area in that year. See Table A8 for notes. We obtain data on each city's total road length From the *China Urban Construction Statistical Yearbook 1998-2011*.

Table A10: Residential Building Density and Career Incentives of City Leaders

Dependent variable: Land-parcel-level regulatory floor-to-area ratio upper limit		
	(1)	(2)
City leader's career-incentive intensity	-0.326**	-0.846***
	(0.136)	(0.164)
City leader's career-incentive intensity * Log (land distance to city center)		0.223***
		(0.035)
Log (land distance to city center)	-0.251***	-0.319***
	(0.008)	(0.015)
City fixed effects	Y	Y
Transaction year dummies	Y	Y
Transaction season dummies	Y	Y
Provincial trend of transaction year	Y	Y
Baseline city-leader-level characteristics	Y	Y
Observations	29,859	29,859
R-squared	0.285	0.286

Notes: *** p<0.01, ** p<0.05, * p<0.1 Standard errors (in parentheses) are calculated by bootstrap replications. The baseline city-leader characteristics are the same as those described in the notes of Table 4. In addition, in both regressions we control for the fixed effects of land transaction years, the fixed effects of land transaction season and the province-specific linear trends of land transaction year.