Administrative Hierarchy, Government Favoritism and Size Growth of Cities

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Based on the significant difference of China's cities at different (administrative) hierarchical levels in population growth over the past three decades, this study explains the influence of urban development policies (industrial policies and land policies) on the gap in urban population growth from the perspective of government favoritism. Taking 423 cities during 1990–2015 as samples, this paper selects two indicators, setting up national development zones and turning counties into districts, to represent government favoritism and applies the PSM-DID method. The empirical result shows government favoritism in setting up national development zones and turning counties into districts is conducive to urban population growth and helps generate synergy effects of industrial and land policies. Market potential of cities is an important condition for the effect of government favoritism. The result finds that government favors higher-level cities and coastal ones, but overlooks inland medium- and low-level cities, resulting in the shallow U-shaped characteristics of "higher on both ends and lower in the middle" in population growth of cities at different levels. In order to prevent inland medium- and low-level cities from "collapsing" relatively, the government should break its favoritism for high-level cities, transform industrial and land policies from "preference system" to "generalized system of preference", and put greater favor of inland medium- and low-level cities with certain market potential.

Keywords: administrative hierarchy, government favoritism, city size, national development zone, turning counties into districts

1. Introduction

The rapid urbanization in China over the past three decades presented significant features. On the one hand, cities at high (administrative) hierarchical levels represented by provincial capitals expanded fast in population. For instance, population of Anhui's

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largest city Hefei and the second largest city Huainan was 1.1 million and 724000 respectively in 1990 and grew to 3.608 million and 1.33 million by the end of 2015, with the former far outgrowing the latter. Similarly, when Jiangxi's provincial capital Nanchang was compared with Jiujiang and Henan's provincial capital Zhengzhou was compared with Luoyang, the provincial capitals "stood out" in size, and a group of large cities with over 3 million population and even super cities with over 5 million population emerged nationwide. On the other hand, population of many medium- and low-level cities (such as prefecture-level and county-level cities) grew only slowly and even stagnated. In the *Major Tasks for the New Urbanization Construction in 2019*, National Development and Reform Commission (NDRC) proposed a group of shrinking cities, including resource-exhausted cities, industry-transformed ones, geographically remote ones and passively siphoned ones. Wei (2014a) summarized this into polarization with super cities rapidly expanding in size, but medium- and small-sized cities relatively shrinking. At the national level, imbalance and even polarization in size of cities and its growth caused irrational spatial distribution of population and tended to generate multiple economic and social problems in efficiency of resource allocation, economic growth and labor income (Tang, 2016).

In comparison, this study makes possible marginal contribution as follows. (1) It constructs a two factor-driven model to explain the influencing mechanism of government favoritism. This paper expands the model on government influence on urban development through land market constructed by Henderson (1987) to cover both labor market and land market. Compared with the Henderson model, the model in this study is further generalized and more suitable for explaining the role of government in the development of China's cities: government not only provides public goods, but also directly engages in economic activities, shaping the mode of government behaviors with Chinese characteristics and the competition in size of cities. (2) This study quantitatively measures government favoritism, evaluates its effects and points out conditions of the effects. It refers to the study of Davis and Henderson (2003) on conceptually explaining the influence of government favoritism on size of cities, and selects setting up national development zones and turning counties into districts, as indicators to measure the difference of industrial policies and land policies in cities of different levels. It also adopts propensity score matching and differences-in-differences for measurement and testing, not only evaluating the influence of government favoritism on size of cities, but also revealing the conditions of such influence. This helps profoundly understand implementation approaches, effects and conditions of government favoritism and provides effective empirical evidence for policy implementation or adjustment.

The next part will explain the theoretical mechanism of government favoritism influencing size of cities. In the third part, favoritism for cities is measured and its performance in cities of different levels is analyzed. In the fourth part, PSM-DID testing is conducted. The last part is conclusions and policy suggestions.

2. Theoretical Mechanism of Government Favoritism Influencing Size Growth of Cities

2.1. Theoretical Model of Government Influencing Size of Cities

Henderson (1987) constructed the mathematical model of government influencing size of cities by intervening in land market (investing in public facilities). This study expands it and takes into consideration the working mechanism of government affecting labor market and land market simultaneously.

(1) Production. Assume that some economy is an urban system in a limited efficiency scale, and its cities are respectively engaged in specialized production; each city is a single-center one covering production sector, consumption sector and government sector, and produces two types of end products: traded goods and goods for local service. To be specific, the first type of specialized traded goods X uses two production factors, labor and capital, under constant returns to scale, and manufacturers are subject to control of Hicks-neutral mobile factors. The production function is:

$$X = Ag(N)N_0^{\alpha}(K_1^{\tau}K_0)^{1-\alpha} \tag{1}$$

N_0 and K_0 respectively refer to labor input and capital input for production of traded goods; K_1 is investment of private production guided by government (e.g. construction of industrial parks) and can increase marginal efficiency of private capital. A is production efficiency parameter; $g(N) = e^{-\varphi/N}$ means agglomeration effect of cities. N is number of urban residents (residents allocate time to production of X and commuting).

The second type of non-traded goods (housing and other goods for local service) is represented by H and uses two production factors, private capital K_2 and land venue L, under constant returns to scale. The production function is:

$$H = BL^{\beta}K_2^{1-\beta} \tag{2}$$

To be specific,

$$L = (DN^{-\delta}K_3^{\gamma})N_1 \tag{3}$$

N_1 means number of labor force input into non-traded goods under given number of residents N and given government's public investment K_3; δ is relationship between urban land use and population under the influence of topographic features; government's public investment K_3 can improve commuting efficiency, but marginal efficiency of K_3 is negatively correlated with city size N; B and D are both production efficiency parameters.

Here, $N = N_0 + N_1$ reflects quantitative relation of residents' allocation to traded goods and non-traded goods; meanwhile, in $K = K_0 + K_1 + K_2 + K_3$, K_0 and K_2 respectively represent quantity of private investment in traded goods and non-traded goods, and K_1 and K_3 represent quantity of government investment in industrial development and infrastructure.

Assume manufacturers regard input price and output price as given, and according to the principle of profit maximization, value of marginal product equals factor price and equations (1) and (3) lead to price of traded goods X and housing H (non-traded goods) (P_x and P_h) respectively as follows:

$$p_x = c_0 w^{\alpha} r^{1-\alpha} g(N)^{-1} K_1^{\tau(\alpha-1)} \tag{4}$$

$$p_h = c_1 p_l^{\beta} r^{1-\beta} \tag{5}$$

$c_0 = A^{-1}\alpha^{-\alpha}(1-\alpha)^{\alpha-1}$, $c_1 = B^{-1}\beta^{-\beta}(1-\beta)^{\beta-1}$, $p_l = \dfrac{w}{DN^{-\delta}K_3^{\gamma}}$. p_l is land price; w and r are respectively wage rate and capital interest rate. Given that capital interest rate r is nationwide, wage rate can be calculated:

$$w = c_0^{-1/\alpha} p_x^{1/\alpha} r^{\tau(\alpha-1)/\alpha} g(N)^{1/\alpha} \tag{6}$$

(2) Consumption. Residents' utility function is:

$$U = E_0 x_1^{m_1} x_2^{m_2} \quad x_n^{m_n} h^b \tag{7}$$

x_i is traded goods, and the city produces one type of goods and sells them to the outside, and also needs to buy other goods from outside; h is housing consumption. Residents earn income from wage and pay tax at the same rate, and thus resident income y is:

$$y = w - r(K_1 + K_3)/N \tag{8}$$

$r(K_1+K_3)/N$ is per capita local tax collected to raise public capital input.

If urban residents' behaviors are in maximized utility, equation (7) can lead to demand function of housing H:

$$H = \frac{b}{f}(yN)P_h^{-1} \tag{9}$$

$f = \sum_{i=1}^{n} m_i + b$, and the demand equation is substituted into the utility function to get the indirect utility function:

$$U = E(\prod_{i=1}^{n} p_{xi}^{-m_i}) y^f p_h^{-b}, E \equiv E_0 \prod_{i=1}^{n} (m_i / f)^{m_i} \tag{10}$$

(3) Equilibrium solution of a single city. Equations (4) and (5) are substituted into the utility function equation (10), and government optimizes investment K_1 and investment K_3 to maximize resident utility, i.e. $\partial U / \partial K_1 = 0$ and $\partial U / \partial K_3 = 0$. Based on this equation set, we get:

$$K_1 = (m_i \tau (1-\alpha) / f) y r^{-1} N \tag{11}$$

$$K_3 = (\gamma \beta b / f) y r^{-1} N \tag{12}$$

Here, assume the city produces the ith type of traded goods, and in equation (11), m_i is residents' consumption weight on this type of goods in city i. Equations (11) and (12) are substituted into equation (8), and residents' income is calculated as:

$$y = \frac{f}{f + \gamma\beta b + m_i \tau (1-\alpha)} w \tag{13}$$

Equations (4), (5), (11), (12) and (13) are substituted into utility function equation (10), and utility function is presented as:

$$U = c_2 E(\prod_{j \neq i} p_{x_j}^{-m_j}) y^{f + b\beta\gamma + m_i \tau(1-\alpha)} w^{-b\beta - \alpha m_i} r^{-b(1-\beta+\beta\gamma) - m_i(1-\alpha)(1+\tau)} g(N)^{m_i} N^{b\beta(\gamma-\delta) + m_i \tau(1-\alpha)} \tag{14}$$

Specifically,

$$c_2 = c_0^{-m_i} (m_i \tau (1-\alpha) / f)^{m_i \tau (1-\alpha)} c_1^{-b} D^{b\beta} (\gamma\beta b / f)^{b\beta\gamma} \tag{15}$$

$g(N) = e^{-\varphi/N}$ is substituted into utility function equation (14). When $dU / dN = 0$, efficient size of the city is presented as:

$$N = \frac{m_i \varphi}{b\beta(\delta - \gamma) - m_i \tau (1-\alpha)} \tag{16}$$

It is found in equation (16): investment efficiency of government-guided private production (τ) and efficiency of government investment in infrastructure (γ) are both helpful for city size to expand. Besides, growth of urban agglomerative economy (φ), capital output elasticity during production of tradable goods ($1-\alpha$) and residents' consumption weight of tradable goods produced in the city (m_i) promotes the city size to increase; on the other hand, rise of residents' consumption weight of housing (b), urban crowding effect (δ) and labor output elasticity during housing production (β) makes the city size smaller.

2.2. Influence of Government Favoritism on the Difference in Population Growth among Cities

If government does not intervene in urban development at all, in equation (16), $\gamma = 0$, $\tau = 0$. Then city size and agglomerative economy of traded goods production (φ) are positively correlated, meaning larger city size under greater combined effect; city size and the ratio between consumption weight of traded goods and residents' consumption weight of housing (m_i/b) are positively correlated as well, indicating larger city size under smaller crowding effect. If only a part of cities are favored by superior government, how will the city size and its growth be affected? Given the existence of central government, tax from residents is used to not only pay public expenditure of local government (K_1 and K_3), but also pay tax to central government. Assume tax rate (t) is the same nationwide and urban residents' income is turned from equation (8) to:

$$y = w(1-t) - r(K_1 + K_3) / N \tag{17}$$

In the case of no government favoritism, the sum of tax collected by all cities equals the sum of public expenditures, and government will select the optimal amount of public expenditures according to this tax and expenditure system to maximize resident utility. At this point, tax rate of all the cities is the same, does not change residents' actual income, and poses no effect on city size in equilibrium. However, when central government favors city i, reducing and exempting tax by a rate of λ for its residents or subsidizing public expenditure of city i by a rate of s_i, residents' income in city i is changed to:

$$y_i = w(1-\lambda t) - r(1-s_i)(K_1 + K_3) / N \tag{18}$$

Equations (11) and (12) are substituted into equation (18), then:

$$y_i = \frac{f}{f + (1-s_i)\gamma\beta b + m_i \tau(1-\alpha)} w(1-\lambda t) \tag{19}$$

When government favoritism exists, the preferential tax rate and subsidy enjoyed by city i will increase actual income of the city's residents. Assume rate of the increase is Δ and also assume resident utility is $\hat{U}_i$ in the new equilibrium, and then resident utility ratio when government favoritism does not exist is:

$$\frac{\hat{U}_i}{U_i} = \frac{[(1+\Delta)y]^{f+b\beta\gamma+m_i\tau(1-\alpha)}}{y^{f+b\beta\gamma+m_i\tau(1-\alpha)}} = (1+\Delta)^{f+b\beta\gamma+m_i\tau(1-\alpha)} > 1 \tag{20}$$

It indicates tax reduction, subsidy or the both measures taken by government increase residents' actual income of the favored city and improve the resident utility level in equilibrium. As government favoritism causes local impact, when labor force flows freely, population will flow from other cities to ones favored by government, resulting in difference in population growth among cities.

3. Difference of Government Favoritism in China's Cities of Different Levels: Identification, Facts and Characteristics

3.1. Identification of Government Favoritism

How to identify and measure government favoritism? Wang and Nian (2015) adopted indirect quantitative indicators and distinguished government favoritism for cities of different levels with dummy variables (1 for high-level cities and 0 for other cities); Chen *et al*. (2017) believed high-level cities were more likely to win national capital support and used bank credit cost as indicator. This study adopts two approval indicators closely related to administrative hierarchical level of cities, if national development zones are set and if counties are turned into districts (cities), to reflect difference in government favoritism.

(1) National development zones reflect difference in industry-oriented policies. Government drives investment of private sector and improves its investment efficiency by taking industry-oriented policies such as building infrastructure in industrial parks, offering preferential tax and subsidizing. In China, industrial parks are an important approach for government to drive urban development through industry. Among them, national development zones (including national economic development zones and national high-tech zones) are most influential: national economic development zones help local cities attract investment, learn advanced technologies overseas and increase export, while national high-tech zones facilitate local cities to industrialize technological achievements and promote industrial development of high technologies. On this account, national development zones promote cities to expand with the engines of industrial development and employment. For instance, Liu and Zhao (2012) showed in their empirical study that national high-tech zones were significantly influential for economic growth and technological advance of local cities. But whichever cities can be approved by central government to set up national development zones depends on not only economic

foundation of the cities themselves, but also choice of central government. The choice usually favors high-level cities and coastal ones, and this is government favoritism.

(2) Turning counties into districts tells difference in land supply policies. Increasing land supply and enhancing infrastructure construction by government help increase labor supply and promote urban development. Turning counties into districts exerts effects in the following areas. First, it compulsorily turns part of rural population into urban population and promotes total urban population to grow mechanically. When other conditions remain constant, increase of labor supply will reduce wage, boost industrial competitiveness and drive urban development. Second, increase of land supply will lower land rental, cut housing price and enhance appeal of the city. Third, from the perspective of land finance, turning counties into districts will increase land supply, and local government adopts the unique investment and financing mode with Chinese characteristics to promote urban development (Zheng *et al*., 2014). Therefore, this study uses if a city gets to turn counties into districts (cities) as a measurement indicator for government intervention in land market, but whether a city can do so or not depends on not only itself, but also approval of central government, which involves government favoritism.

3.2. Facts on Government Favoritism in Cities of Different Levels

Given that government favoritism involves administrative hierarchical level and geographic location of cities, this study categorizes cities into five types at three levels, namely high-level cities, prefecture-level cities (coastal and inland) and county-level cities (coastal and inland).

(1) National development zones. From 1984 to 2015, a total of 14 coastal open cities, 7 special economic zones, 156 national high-tech zones, 219 national economic development zones and 19 state-level new areas were established in China. Regarding the process of setting up national development zones and the general trend of their distribution in cities of different levels, high-level cities and coastal ones were significantly favored at the early stage, while inland cities and medium- and low-level ones were gradually covered recently.

(2) Turning counties into districts (cities). One thing particular of the urbanization in China is land urbanization caused by change of administrative division. Three types of administrative division changes are pertinent to this study. The first is turning counties into cities. It increases power of county-level cities in some areas, expands area of built-up zones, and promotes urban population to mechanically grow intermittently. The second is turning prefectures into cities. After prefectures are removed and prefecture-level cities are established, the prefecture-level cities directly manage districts and counties, and downtown areas have considerably stronger combined effects and radiation. The third is turning counties into districts, where cities at the prefecture level and above use administrative methods to turn their counties (county-

level cities) into districts. By 2015, there were a total of 672 cases of administrative division change such as turning counties into districts in China. They were relatively balanced in spatial distribution in slight favor for coastal areas.

(3) Comparison among cities of different types in national development zones and turning counties into districts. According to Table 1, first, regarding distribution of national development zones, in the sense of the number of national development zones in each city on average (the third column), there are 4.54 in each high-level city, but only 0.21 in each inland county-level city; in the sense of proportion of cities with national development zones in total sample cities (the fifth column), high-level cities account for 100%, but inland county-level cities only account for 18.11%. These indicate as for industry-oriented policies, government clearly favors high-level cities and coastal ones. Second, in terms of distribution of turning counties into districts (cities), in the sense of average number (the fourth column), there are 4.23, 2.00 and 1.51 in high-level cities, coastal cities and inland prefecture-level cities respectively; in the sense of proportion of cities turning counties into districts in total sample cities (the sixth column), the three types of cities account for 94.29%, 81.63%and 80.11% respectively. It should be noted that the high proportion of inland prefecture-level cities in turning counties into districts is particular to some extent. For instance, Lu *et al*. (2017) pointed out a certain part was passively implemented in the process of turning prefectures into cities (prefecture-level cities). Third, in combination of the two indicators (the seventh column), the share of high-level cities both setting up national development zones and turning counties into districts is 94.29%, while the share of other types of cities is 63.27%, 51.38%, 30.90% and 18.10% respectively. It tells that government favors high-level cities, but overlooks medium- and low-level ones. However, under the national strategy of supporting the development of small towns, county-level cities make exceptional cases in land supply and almost all the sample cities have counties turned into cities during the study period.

Table 1. Distribution of National Development Zones and Turning Counties into Districts in Cities of Different Types by the End of 2015

Different city type	Number of sample cities	Average number of national development zones in cities	Average number of turning counties into districts in cities	Share of cities with national development zones (%)	Share of cities turning counties into districts (%)	Share of cities both setting up national development zones and turning counties into districts (%)
High-level city	35	4.54	4.23	100.00	94.29	94.29
Coastal prefecture-level city	49	1.59	2.00	77.55	81.63	63.27
Inland prefecture-level city	181	0.88	1.51	63.54	80.11	51.38
Coastal county-level city	42	0.52	0.94	33.32	95.44	30.9
Inland county-level city	116	0.21	0.98	18.11	97.54	18.1

Note: Number of turning counties into districts in county-level cities means the number of turning counties into cities.

4. Measurement Strategy Based on PSM-DID

4.1. PSM-DID Measurement Model

By referring to Eeckhout (2004), this study investigates inter-city difference in population growth and uses the benchmark regression model as follows:

$$g_{i,t} = \alpha + \beta \ln S_{i,t\text{-}1} + \varepsilon_{i,t} \tag{21}$$

$g_{i,t}$ is standardized population growth rate of city i in period t; $S_{i,t-1}$ is population size of city i at the beginning of the period; $\varepsilon_{i,t}$ is error term. Eeckhout (2004) estimated that $\beta \approx 0$ and the coefficient is insignificant, meaning population growth rate among cities is not different significantly. However, some literature questioned the conclusions of Eeckhout (2004). For example, Chauvin *et al*. (2017) studied China, India, Brazil and the U.S. in 1980–2010 and found the results of China and India do not support the conclusions. Wei *et al*. (2018) held whether the conclusions in Eeckhout (2004) stand or not depends on stages of urbanization and they are not applicable to China during the acceleration stage of urbanization. Therefore, this study makes revision in equation (21) and uses PSM-DID to test the influence of local impact from government favoritism on urban population growth rate.

(1) Differences-in-differences (DID) is usually used to evaluate influencing effect of policies and can admirably overcome the problem of endogeneity in the evaluation. Government favoritism defined in this study covers national development zones and turning counties into districts, and policy effect includes time effect that naturally changes as time goes by and treatment effect under policy impact. Design is made as follows. First, if a city sets up national development zones or not and the change of trend before and after the implementation cover both time effect and policy treatment effect, and thus DID is applicable for evaluation. Second, turning counties into districts brings short-term external impact to city size, but basically does not change natural growth rate of population, and therefore dummy variables are used. Third, this study adopts the measurement model of two-way fixed effect of panel data to evaluate effect of policies implemented stage by stage. Fourth, a variable for distinguishing policy intensity is set, i.e. interaction term of the dummy variable on turning counties into districts and DID. Therefore, the measurement model is as follows:

$$y_{it} = \alpha_0 + \beta_1 City_{it} \times Year_{it} + \beta_2 CXSQ_{it} + \beta_3 CXSQ_{it} \times City_{it} \times Year_{it} + \lambda X_{it} + \mu_i + \nu_t + \varepsilon_{it} \tag{22}$$

y_{it} is population growth rate of city i in period t relative to growth of sample cities (nationwide) and calculated by dividing the share of population of city i in total population of sample cities at the period beginning by the share at the period end. $City_{it}$

is the dummy variable on if the city is intervened by government, and $City_{it}$=1 if it sets up national development zones and $City_{it}$=0 if not. $Year_{it}$ is time dummy variable describing the city subject to policy intervention, and $Year_{it}$=1 if national development zones are set at some time point and $Year_{it}$=0 if not. $CXSQ_{it}$ is the dummy variable on if the city turns counties into districts and is represented with 1 or 0. X_{it} is a set of control variables affecting city size. μ_i is individual fixed effect; v_t is time fixed effect; ε_{it} is random error term. In the equations, progression coefficients β_1, β_2 and β_3 are focuses of attention: If β_1 is significantly positive, setting up national development zones helps city size grow; If β_2 is significantly positive, turning counties into districts (*CXSQ*) is helpful for city size to grow; If β_3 is significantly positive, both setting up national development zones and turning counties into districts by a city can produce synergic effects between labor market and land market and promote city size to expand.

(2) Propensity score matching (PSM). DID can well solve the problem of endogeneity in policy evaluation, but heterogeneous cities do not share consistent time effect. Therefore, this study adopts PSM and selects a group of cities that are similar to treatment group in characteristics as control group to eliminate selection bias of samples. As for the specific procedure, first, propensity score is calculated and a regression model is constructed. The dependent variable is a dummy variable and set 1 for treatment group and 0 for control group. Independent variables are several indicators for evaluating similarity of the two groups and they are used to calculate the probability of taking some city as treatment group, i.e. pscore. Second, according to pscore, for each city identified as treatment group, a city closest in pscore is found as control group.

(3) PSM-DID. PSM helps avoid selection bias of samples, but is unlikely to overcome the problem of endogeneity caused by variable omission; DID is helpful for solving the endogeneity problem and evaluating the policy treatment effect, but cannot well address bias of samples (Dong and Zhu, 2016). This study combines PSM and DID, using PSM to find matching group and using DID to evaluate the difference between treatment group and control group after the matching.

In this way, explained variable is relative population growth rate after matching, and key explanatory variable is the same as equation (22). Control variable X_{it} selects initial size, industrial structure and market potential. First, Initial size (logarithm is taken and marked as ln$S$) reflects a city's combined effect or crowding effect from the perspective of production. Excessively small size generates insufficient combined effect, while excessively large size brings strong crowding effect. In the sense of growth rate, cities of large size usually slow down (Davis and Henderson, 2003). This study also refers to Zhang *et al*. (2018) and uses cross term $\ln S\times f(t)$ of the logarithmic value of initial size and time trend to control non-linear change. $f(t)$ is cubic polynomial of year (study period) variable t and leads to $\ln S\times t$, $\ln S\times t^2$ and $\ln S\times t^3$. Second, Industrial structure. Generally speaking, manufacturing is a city's export sector, while services are local input sector, and urban development is affected by the export sector and its multiplier effect on services (O'sullivan, 2013). By referring to Au and Henderson (2006), this study uses industrial structure (*S*/*M*), ratio between GDP of the tertiary industry and that of the secondary industry in districts, to reflect economic structural characteristics. Third, Market potential (logarithm is taken and marked as ln*MP*) reflects from the demand end the influence of potential sales of goods on urban development. In reference to Liang *et al*. (2015) in $MP_{it} = GDP_{it} d_{ii}^{-1} + \Sigma^{n}_{j(j \neq i)} GDP_{jt}\, d_{it}^{-1}$, MP_{it} means market potential of city i at time t, and consists of two parts, $GDP_{it}\, d_{ii}^{-1}$ and $\Sigma^{n}_{j(j \neq i)} GDP_{jt}\, d_{ij}^{-1}$, to respectively represent market potential inside and outside the city. To be specific, city radius is $d_{ii} = (2/3)\sqrt{S_i / \pi}$ and S_i is the area of districts; d_{ij} is distance between city i and city j; *GDP* uses the GDP indicator of districts.

4.2. Sample Selection and Data Source

(1) Sample selection and treatment. First, influence of national development zone policies is evaluated. As high-level cities and a handful of coastal large cities have set up multiple types of national development zones prior to the study period (1990), DID evaluation is not applicable. Many prefecture-level cities and county-level ones set up development zones during the study period (1990–2015) and thus are suitable for policy evaluation. Therefore, the evaluation mainly targets samples of prefecture-level and county-level cities. Second, given the limited annual growth rate of city size, the study considers five years as a study period and there are five study periods in total. Third, city samples that established national development zones before 1990 are deleted to avoid any lagged impact of policies implemented in the past on city size during the study period. Besides, cities that set up national development zones after 2015 are deleted as well to avoid expected impact of following policies. Eventually, a total of 1,895 samples from 379 cities across five study periods are obtained.

(2) Data source. This study uses urban population data released by Population Division of UN Department of Economic and Social Affairs (abbreviated as UN population data), and covers cities with 300,000 and higher urban population and their annual data since 1990 as of the end of 2015. Moreover, for measurement of market potential, data on *GDP* and district area (S_i) is both sourced from *China City Statistical Yearbook* (1991–2016), and distance between cities d_{ij} is calculated with longitude and latitude in Google map.

4.3. Characteristics of Size Growth of Cities

Table 2 presents population and its growth in cities of different levels in 1990–2015 by using population data of 423 cities in the UN population data. It is found that first, in terms of growth rate of urban population in 1990–2015, sample cities grew by 1.58 times; growth of high-level cities and county-level cities was higher than the national average, while growth of prefecture-level cities was lower than the national average.

To be specific, the rate of coastal prefecture-level cities and coastal county-level cities was significantly higher than the national average, while that of inland prefecture-cities was only 1.13 times, much lower than the national average. Second, significantly particular of Table 2, prefecture-level cities, especially inland prefecture-level ones, had the lowest population growth, and the share of their population in total sample population significantly declined, showing a trend of relatively "collapsing".

Table 2. Population and Growth Rate of Cities at Different Levels in 1990–2015 Unit: 10000 people

Type of city	Population (unit: 10000 people)						Growth rate (%)
	1990	1995	2000	2005	2010	2015	2015/1990
High-level cities	8059.03	10333.80	12773.93	15548.90	18078.07	21334.00	164.72
Prefecture-level cities	9521.76	11167.40	13710.80	16397.80	19201.64	22441.00	135.68
Coastal	2333.22	3029.70	4081.73	5015.80	6144.40	7143.60	206.17
Inland	7188.54	8137.70	9629.07	11382.00	13057.24	15297.40	112.80
County-level cities	2327.47	3160.00	4329.69	5206.10	6316.41	7684.80	230.18
Coastal	500.50	732.80	1047.70	1249.30	1470.62	1757.20	251.09
Inland	1826.97	2427.20	3281.99	3956.80	4845.79	5927.60	224.45
Total sample cities	19908.27	24661.20	30814.42	37152.80	43596.12	51459.80	158.48

Note: 423 city samples in the UN population data (population⩾300000 by the end of 2015).

Figure 1 and Figure 2 show the mixed regression diagram of data in 1990–2015 in five periods to study the relationship among actual growth of urban population, relative growth and initial size. The result in Figure 1 reveals that logarithmic value of city size is in the range of 6.0–7.0 (population between 0.4 million and 1.1 million), and in another word, average growth of medium-sized cities (prefecture-level cities) is the lowest. In Figure 2, the regression result using relative growth is similar (Figure 2 takes 0 as axis and approaches $\beta \approx 0$ in the mean reversion model in Eeckhout (2004)). In general, urban population growth and initial size are in a shallow U-shaped relationship: high-level cities have a large initial size, but still a relatively high growth; county-level cities (small initial size) have a high population growth; prefecture-level cities are the lowest in population growth.

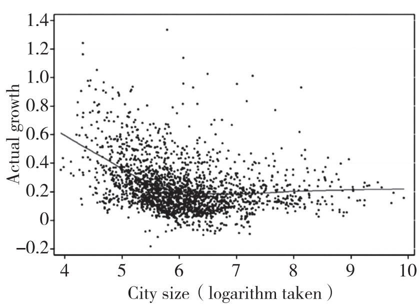

Figure 1. City Size and Actual Growth in 1990–2015

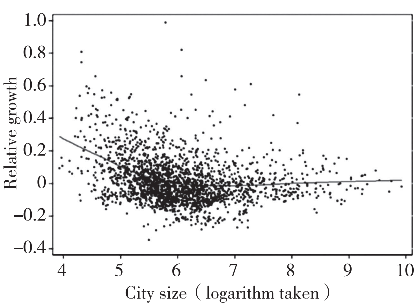

Figure 2. City Size and Relative Growth in 1990–2015

5. Regression Result and Explanation

5.1. PSM Result

Through PSM, this study draws the kernel density function curve before and after PSM. Figure 3 shows before the matching, treatment group and control group are in non-equilibrium, and the probability density distribution of propensity score of the two groups differs widely. Therefore, there exists selection bias between treatment group and control group. As displayed in Figure 4, after the matching, the kernel density curve of the two groups is quite similar, and their retained probability density distribution is noticeably closer to equilibrium than before the matching, indicating main characteristics of the two groups of sample cities after the matching are close and selection bias of the samples is under control.

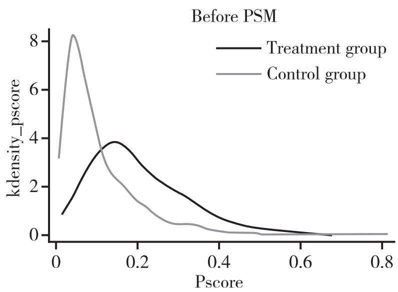

Figure 3. Kernel Density of Propensity Score Before Matching

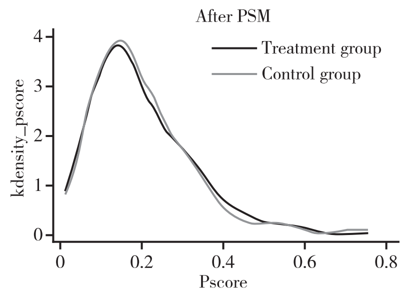

Figure 4. Kernel Density of Propensity Score After Matching

5.2. PSM-DID Benchmark Regression Result and Explanation

(1) Influence of the key variable on national development zones. It is found in the left part of Table 3 that first, model 1 presents the regression result of controlling market potential, industrial structure and initial size as well as time fixed effect and city fixed effect. Coefficient β_1 of $City_{it} \times Year_{it}$ is significantly positive (0.0645) and significant at the 1% confidence level, indicating with the influence of other factors being ruled out, national development zones drive the urban population growth for five study periods to be 6.5% higher than the national average. Given that national development zones are mainly distributed in coastal cities, it means coastal cities adopt economy-oriented policies and government investment to increase labor demand and attract inflow of external population, and rely on the industry-driven development mode to promote the rapid growth of city size. Second, model 2 adds the dummy variable of turning counties into districts (*CXSQ*) into model 1 and finds in the regression result that coefficient β_2 of turning counties into districts is 0.0159, which is statistically insignificant. This is possibly because in the measurement equation, DID and *CXSQ* are both set as dummy variables

and the influencing effect of *CXSQ* is reflected in the DID result. Third, model 3 adds the interaction term of turning counties into districts and national development zones into model 2 and the regression result shows coefficient β_3 of the interaction term is 0.0762, which is significantly positive and statistically valid. This tells that both turning counties into districts and setting up national development zones in cities, especially the interaction of two, i.e. industry-land collaboration in driving development, can significantly promote growth of city size, which supports the judgment of the theoretical model in this study.

(2) Influence of the key variable on turning counties into districts. Previously, PSM-DID is used to estimate the policy effect of setting up national development zones, while turning counties into districts is represented with a dummy variable. Here, the two variables are replaced in equation (22), with the effect of turning counties into districts being estimated with PSM-DID and national development zones (KFQ_{it}) taken as a dummy variable. Turning counties into districts, national development zones and regression coefficient of interaction between the two are focuses of attention. It is found in the regression result in the right half of Table 3 that first, model (1) controls market potential, industrial structure, initial size, time fixed effect and city fixed effect, and coefficient of policy treatment ($CXSQ_{it}\times Year_{it}$) in the regression result is significantly positive (0.0413), meaning with influence of other variables being controlled, turning counties into districts promotes urban population growth for five study periods to be 4.1% higher than the national average. Second, according to the regression result in model (2), coefficient (KFQ_{it}) of the dummy variable on national development zones is significantly positive, showing growth of city size driven by industry is effective. The possible reason is that if national development zones are established after counties are turned into districts, the increased labor supply is helpful for lowering enterprises' production cost, improving industrial competitiveness and thus attracting more external population. Third, as shown by the regression result in model (3), coefficient ($CXSQ_{it}\times KFQ_{it}\times Year_{it}$) of the interaction term between turning counties into districts and national development zones is significantly positive, reflecting that industry-land collaboration will significantly drive growth of city size. Coefficient of national development zones is insignificant, probably because its effect is reflected in the DID coefficient of turning counties into districts, which is symmetrical and consistent with the regression result of model 3 in the left part of Table 3.

(3) Influence of control variables. In the regression result of Table 3, validity of all the control variables is symmetrically similar. To be specific, first, market potential and growth of city size are significantly correlated positively. In the measurement, the average proportion of market potential outside city exceeds 0.95, and it can be inferred accordingly that city clusters have relatively high market potential and higher urban population growth and are main places of population concentration, while relatively isolated and remote cities are small in market potential and low in population growth. Second, coefficient of industrial structure is significant and positive at the 5% confidence level, indicating the multiplier effect of export sector (manufacturing) on local services

will promote city size to grow. This is similar to results of Au and Henderson (2006). Third, about initial size of a city and its changing trend as time goes by, on the one hand, population growth and initial size are negatively correlated, which is consistent with the view in Davis and Henderson (2003), meaning in the process of city size stabilizing, large cities slow down, but medium- and small-sized ones speed up. On the other hand, Table 2 and the shallow U-shaped characteristic in Figure 1 and Figure 2 jointly tell one thing particular of China. The negative correlation between population growth and initial size is not caused by slowdown in growth of large cities, but the fact that small cities grow rapidly, medium-sized cities grow slowly, and small and medium-sized cities occupy a large share in the samples. Besides, the changing trend of initial size as time goes by is not apparent, and coefficients of $\ln S_{it}\times t$, $\ln S_{it}\times t^2$ and $\ln S_{it}\times t^3$ are not significant.

To sum up, government favoritism helps promote city size to grow, either with industry-oriented policies of setting up national development zones or with land policies of turning counties into districts. If the industry-land synergy effect is put into play, it will be much more helpful for growth of city size.

Table 3. PSM-DID Benchmark Regression Result of Effects of National Development Zones and Turning Counties into Districts

PSM-DID benchmark regression result of the effect of national development zones				PSM-DID benchmark regression result of the effect of turning counties into districts			
Variable	Model 1	Model 2	Model 3	Variable	Model (1)	Model (2)	Model (3)
$City_{it}\times Year_{it}$	0.0645***	0.0651***	0.0555***	$CXSQ_{it}\times Year_{it}$	0.0413***	0.0410***	0.0386***
(β_1)	(2.97)	(2.99)	(2.50)		(3.14)	(3.13)	(2.94)
$CXSQ_{it}$		0.0159	−0.0011	KFQ_{it}		0.0306**	0.0073
(β_2)		(0.91)	(−0.05)			(2.36)	(0.41)
$CXSQ_{it}\times City_{it}$			0.0762**	$CXSQ_{it}\times KFQ_{it}$			0.0257**
$\times Year_{it}$ (β_3)			(1.83)	$\times Year_{it}$			(1.85)
Market potential	0.2099***	0.2042***	0.2169***	Market potential	0.0237***	0.0231***	0.0228***
($\ln MP_{it}$)	(4.97)	(4.78)	(5.04)	($\ln MP_{it}$)	(3.13)	(3.08)	(3.04)
Industrial	0.0762**	0.0772**	0.0747**	Industrial	0.0604***	0.0581***	0.0526***
structure (S_{it}/M_{it})	(1.83)	(1.85)	(1.80)	structure (S_{it}/M_{it})	(3.06)	(2.96)	(2.65)
Initial size	−0.1965***	−0.1886***	−0.1902***	Initial size	−0.3531***	−0.3513***	−0.3521***
($\ln S_{it}$)	(−3.71)	(−3.52)	(−3.57)	($\ln S_{it}$)	(−11.17)	(−11.18)	(−11.24)
$\ln S_{it}\times t$	−0.0165	−0.0172	−0.0145	$\ln S_{it}\times t$	−0.0007	0.0019	0.0021
	(−0.83)	(−0.86)	(−0.73)		(−0.05)	(0.15)	(0.17)
$\ln S_{it}\times t^2$	0.0029	0.0036	0.0029	$\ln S_{it}\times t^2$	0.0040	0.0033	0.0034
	(0.42)	(0.51)	(0.41)		(0.85)	(0.70)	(0.72)
$\ln S_{it}\times t^3$	−0.0005	−0.0006	−0.0006	$\ln S_{it}\times t^3$	−0.0005	−0.0005	−0.0005
	(−0.66)	(−0.77)	(−0.75)		(−0.96)	(−0.90)	(−0.93)
Constant term	1.2838***	1.2500***	1.1897***	Constant term	2.8076***	2.7883***	2.7946***
	(3.74)	(3.62)	(3.45)		(17.67)	(17.63)	(17.73)
Time fixed effect	Control	Control	Control	Time fixed effect	Control	Control	Control
City fixed effect	Control	Control	Control	City fixed effect	Control	Control	Control
N	419	419	419	N	704	704	704
R^2	0.27	0.27	0.29	R^2	0.35	0.36	0.36

Note: ***, ** and * respectively mean significance at the confidence level of 1%, 5% and 10%; value in parentheses is t value. It is the same hereinafter.

6. Conclusions and Policy Suggestions

During the urbanization in Europe, the U. S. and other developed countries, urban development is mainly driven by market mechanism. Though city sizes differ widely, population growth among cities is not significantly different. In the urbanization of developing countries, government tends to pool resources to cities as political center, but overlooks medium and small-sized ones on the periphery. This will accelerate the development of cities favored by the government, but damage the development of peripheral medium and small ones with unequal policies. On this account, this study quantitatively measures the characteristics of government favoritism with national development zones and turning counties into districts in China as indicators, and uses PSM-DID to evaluate the policy effect of government favoritism. Main conclusions are as follows.

(1) Government favoritism is an important reason for the gap in population growth of cities at different levels. Both the deduction and argumentation with theoretical models and tests based on PSM-DID support the hypothesis. Enjoying high level of government favoritism, high-level cities are almost entirely supported by the policies of setting up national development zones and turning counties into districts, and show relatively high population growth. The majority of county-level cities will rapidly grow in population once being favored by the policies because of their small population base. Coastal prefecture-level cities benefit from industry-oriented policies of national development zones and grow relatively fast in city size, while their inland counterparts enjoy low level of government favoritism and their passively adjusted land-driven mode has a limited effect on growth of city size.

(2) Government favoritism driven by a single industry and that driven by land show varied effects, but the effect of the two in synergy and complementation is consistently significant. The regression results show both setting up national development zones and turning counties into districts are helpful for city size to grow, and the two in synergy play a more significant role. The regression results also reveal that high-level cities enjoy government favoritism in industrial policies and land policies, and the industry-land synergy drives the growth of city size, while medium- and low-level cities merely enjoy local effect since they are driven only by a single industry or land. Therefore, use of both industrial policies and land policies is an effective measure for government to intervene in urban development.

(3) Market location of a city is a major condition determining the effect of government favoritism. Empirical results indicate that market location reflected by market potential significantly affects urban population growth and is highly synchronized with validity of the government favoritism effect. For inland prefecture (county)-level cities with poor market potential and at a disadvantageous economic and geographic location, especially isolated ones far from city clusters, the influence of

government favoritism is insignificant.

On such basis, this study proposes the following policy suggestions.

(1) The previous "preference system" should be replaced by a "generalized system of preference" to offer all cities access to equal development opportunities. In order to promote the coordinated development of the urban system, government should break its favoritism for high-level cities, prevent medium- and low-level cities, especially inland ones, from continuing to "collapse", take dual measures of setting up national development zones and turning counties into districts, and enhance the synergy effect of being driven by both industry and land.

(2) At the current stage, cities at different levels should adopt varied development policies with different focus. For high-level cities, especially super cities and a few mega-cities, government should prevent the cities from excessively expanding and drive high-quality urban development with innovation. For the majority of high-level cities, government should actively promote the collaboration of national development zones and turning counties into districts and effectively combine reasonable land use and industrial development.

(3) A series of combined policies should be taken to improve the market location of inland cities, prevent the cities from shrinking in size, and promote the coordinated development of the urban system. Given the insufficient market potential of inland prefecture (county)-level cities, it is difficult to promote the urban development even if government offers support in economic policies and land policies simultaneously. In order to improve the development conditions of inland cities, government should take a series of combined policies.

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