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DYNAMICS OF THE CHINESE URBANIZATION BASED ON NONPARAMETRIC MODELS

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Abstract

This paper provides an estimation model with errors-in-variables observation; it studies the density function of Chinese urbanization development level. The model comes to the conclusions given below: the impacts of GDP, population and rural-urban income gap reduce the probability of observed real urbanization in early stage while increase that of middle stage through the whole process of urbanization in China, which means lots of uncertainties during the early stage of urbanization process; the impact of each factor accelerates the urbanization process with their intensities ranking as GDP, population and rural-urban income gap. The empirical results of 28 provincial cities and separate planning cities reveal that a moderate enlargement of rural-urban income gap will help to accelerate the urbanization process.

1 Introduction

In seeking econometric evidence of urbanization, scholars attempt to highlight the impact of urbanization or urban concentration on economic development. Based on the fact that previous literature assumed that there is an optimal level of urbanization or an optimal level of urban concentration but no research to date had quantitatively examined the assumption, Henderson

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(2003) gave a quantitative estimate between the economic growth and urbanization, found that: there was a best degree of urban concentration, in terms of maximizing productivity growth, the degree varied as with the level of development and country size, over or under-concentration can be very costly in terms of productivity growth; Bertinelli and Strobl (2003) applied semi-parametric estimation techniques to a cross-country panel data for the relationship between urban concentration and economic growth. The investigation showed a U-shaped relationship for urban concentration and appeared to be no systematic relationship between urbanization and economic growth; Bertinelli and Black (2004) aimed at highlighting how the trade-off between optimal and equilibrium city size behaved when introducing dynamic human capital externalities in addition to the classical congestion externalities, showing there are dynamic gains from statically oversized cities and concluding that urbanization is the engine of productivity improvement; Lu and Chen (2004) used the method of linear regression, investigated the provincial panel data between 1987 to 2001 and concluded that the economic policy implanted by the local government was correlative to China's enlarging rural-urban income gap, and urbanization played a notable role in reducing the statistical rural-urban income gap; Xiao-Han Zhong (2006) gave an empirical study of labor stream into city not only improved total economic efficiency but also held positive impact to the salary growth; as to the enlarging rural-urban income gap, Wang and Cai (2006) examined income allocation using the method of cointegration, Granger causality test and error correction model with the annual data since 1978, their study showed that invest structure tendency of prior to heavy industry attributed to the enlarging of urban citizens' income gap, and gave the fact that the urbanization process transferred the high-income part of rural citizens into urban citizen, thus enlarged rural-urban income gap furthermore, which held a restraining effect on the invest structure tendency of prior to heavy industry; Chang and Brada (2006) reexamined the relationship between per capita income and urbanization, presented a fact that China was not under-urbanized before or during the early period of the reform while the urbanization lag did exist in the late period of the reform as the slow pace in eliminating restrictions on rural-urban migration during a period of rapid economic growth, which entails significant economic costs in employment and retards economic growth.

The statistical data is hard to measure exactly because the large numbers of population stream, especially for the large population in China. The urbanization development level is measured by the ratio of urban citizen population to total population. So the observed urbanization level may carry error. Also the statistical data of rural-urban income in China is according to the household register policy, Luan, Lu and Chen (2002) showed if the richer part in rural residents turned into the urban residents during the urbanization, then the urbanization process would enlarge the statistical rural-urban income gap without any change of the income level in all the residents.

Review the existed urbanization researches; two problems show up, First, it is usually assumed the exact observations of urbanization level, which is unsuitable for Chinese cities especially. Second, the linear model is applied extensively, this carries the advantage of obvious explanation of the studied results, but there may be model specification error because there is no obvious evidence assuring urbanization level is linear with GDP, population or rural-urban income gap. Considering the Errors-in-variables observations in Chinese urbanization level, the purpose of this paper is to investigate the urbanization density function of China by employing the nonparametric weighted kernel estimate, compare the density function change of China's urbanization with the impact of GDP, population or rural-urban income gap respectively, and explore the different impact effect in each stage of urbanization process.

This paper is organized as follows; in the following section contains a description of our data and describes the urbanization density function model of Errors-in-variables observations. Section III provides our empirical results of China's urbanization process with the impacts of population, GDP and rural-urban income gap. Section IV gives concluding remarks.

2 Errors-in-Variables model

The data sets this paper collected are the cross-city panel data of prefecture-level cities in China for the years 1999-2003. The data sets contain the year-end total population, year-end urban population, per capita annual disposable income of urban households, and per capita annual net disposable income of rural households, and GDP for each city. All the data are available at http://www.newibe.cei.gov.cn/ , China Statistical Yearbook, China Statistical Yearbook of Region Economy and China Urban Statistical Yearbook. In the study, the urbanization of a unique city is defined as the proportion of its urban population to the year-end total population; the rural-urban income gap is the ratio of its per capita annual disposable income of urban households to per capita annual net disposable income of rural households.

Let X_i $(i = 1, \cdots, n)$ to be urbanization observation of city i. Note the fact that neighbor cities depend on each other for the shared resources in economy, so X_i $(i = 1, \cdots, n)$ depends on each other. However, it is hard to get the exact value of X_i $(i = 1, \cdots, n)$. One reason is the statistical standards vary between urban population and total population; another reason is the dynamic feature of population toughens the statistical accuracy.

Now, suppose the real urbanization level x, an observation X_j could have come from somewhere else in the neighborhood of x, that is, $x \in (X_j - h, X_j + h)$, $h > 0$, say x, with the probability of

$$h^{-1}(k(x - X_j)h^{-1}), \tag{2.1}$$

where $k(\cdot)$ stands for the kernel function. It is natural to find that when X_j is the exact x, that is there isn't statistical error in measurement, (2.1) will get the maximum probability of

$$x = \arg\sup_{y} h^{-1}(k(y - X_j)h^{-1}).$$

On the other hand, x is relevant to observation X_j while X_j is relevant to X_i for $i = 1, \cdots, n, i \neq j$, because the neighbor cities can share the resources thus show dependence on each other. The dependence degree between X_i and x is probably weaker than that of X_j and x. So it's reasonable to suppose that x, $x \in (X_j - h, X_j + h)$, can be gained with the probability density of

$$f_h(x) = \frac{1}{n}\sum_{j=1}^{n} h^{-1}k((x - X_j)h^{-1}). \tag{2.2}$$

The kernel choose in (2.2) gives different weight to different X_j according to the distance between X_j and x. Generally, a larger weight is given to a nearer X_j.

Note that equation (2.2) is the same as the Nadaraya-Watson kernel density estimation of X_i $(i = 1, \cdots, n)$. While the formula in this paper shows the new ideas: (a).X_j is an observable surrogate variable of x with errors-in-variables; (b). the surrogate variables X_i $(i = 1, \cdots, n)$ depend on each other. By the large sample statistical theory, $f_k(\cdot)$ is a consistent estimate of the real density function $f(\cdot)$ for X_i $(i = 1, \cdots, n)$. X_i $(i = 1, \cdots, n)$ be strongly mixing dependence.

In (2.2) the probability of observed real urbanization x depends on its surrogate variable X_j, observation X_i for $i = 1, \cdots, n$, given a kernel function $k(\cdot)$ and bandwidth h, and each element is given equal weight of n^{-1}. If relevant element X_i provides no new information to X_j, $i = 1, \cdots, n, i \neq j$, then it is reasonable to give each X_i a equal weight of n^{-1}. Otherwise, if surrogate variable X_j is relevant to another ω_j, an option will be giving the asymmetric and non-average weight ω_j to each element in equation (2.2), that is to define

$$f_{\varpi h}(x) = \sum_{j=1}^{n} \varpi h^{-1}k((x - X_j)h^{-1}). \tag{2.3}$$

as the probability density of observed real urbanization x. In our study, we regard equation (2.2) as the standard kernel density estimate for point x, while equation (2.3) the weighted kernel density estimate for point x.

In order to get the estimated probability density $f_{\varpi h}(x)$ of real urbanization x , we need to select h and $k(\cdot)$. Nowwe can choose the h in $f_k(\cdot)$ via the minimum of equation:

$$\text{IMSE} = \int_{-\infty}^{+\infty} E(f_h(x) - f(x))^2 \, \mathrm{d}x. \tag{2.4}$$

A. Selection of kernel function k

According to the idea of Optimal asymmetric kernels by Karim M. Abadir, Steve Lawford(2004),we choose

$$k(x) = \alpha(x-\lambda_1)(x-\lambda_2)(x-\lambda_3)I \quad (x \in (\lambda_1, \lambda_2)). \tag{2.5}$$

The parameters λ_1, λ_2 and $c = Ex^3$ here, satisfying $\int_{\lambda_1}^{\lambda_2} k(x)\mathrm{d}x = 1$, $\int_{\lambda_1}^{\lambda_2} xk(x)\mathrm{d}x = 0$, $\int_{\lambda_1}^{\lambda_2} x^2k(x)\mathrm{d}x = 1$, $\int_{\lambda_1}^{\lambda_2} x^3k(x)\mathrm{d}x = c$.

Solving the above equations, we can get the optimal kernel, where $\alpha = 60(\lambda_1+\lambda_2)/(\lambda_2-\lambda_1)^5$, $\lambda_3 = 6/[\alpha(\lambda_2-\lambda_1)^3] + (\lambda_1+\lambda_2)/2$

B. Selection of bandwidth h in $f_{\varpi h}(\cdot)$

In (2.3), the weight ϖ_j is related to j, so the ordinarily selection method of bandwidth h is unsuitable for the estimation, which puts a weight of n^{-1} independent of j.

This study tries to select h through four steps:

(a). Apply the Cross Validation method to the classic model (2.2) on the rule of $IMSE$,select the initial optimal pilot bandwidth h_1;

(b). Search the number of modes m primarily through the plot of $f_{\varpi h_1}(x)$ and select the critical bandwidth $H_{n,m}$, which is defined as the smallest possible value of h producing $f_{H_{n,m}}(x)$ with, at most m modes;

(c). Bootstrap test on the number of modes m ;

As suggested by Silverman (1981), the bootstrap data x^* are generated by

$$x_i^* = \overline{y}^* + (1 + H_{n,m}^2/\sigma^2)^{-1/2}(y_i^* - \overline{y}^* + H_{n,m}\varepsilon), \tag{2.6}$$

where y_i^* are repetitive sample from the original sample, $\overline{y}^*$ its mean, σ^2 its variance and ε is assumed to be distributed as a standard normal and n is the sample size;

Null hypothesis

$H_0 : f_{H_{n,m}}(x)$ has more than m modes.

$H_1 : f_{H_{n,m}}(x)$ has correctly m modes.

Let $H_{n,m}$ be $H_{n,m}(x^*)$ if $f_{H_{n,m}}(x)$, $x^* = (x_1^*, \cdots, x_n^*)$ has more than m modes. Because a "larger" value of bandwidth suggests the smoother feature of the kernel estimate and the $H_{n,m}$ in $f_{h_m}(x)$ of null hypothesis is the smallest possible value of h producing $f_{H_{n,m}}(x)$ with, at most, m modes, so it's reasonable to hold that $H_{n,m}(x^*) < H_{n,m}$, otherwise,$H_{n,m}(x^*) \geq H_{n,m}$.

Estimate $B = \#\{x^* : H_{n,m}(x^*) \geq H_{n,m}\}/\#(x^*)$, where $\#A$ means the number of elements in A. Given $\alpha = 0.05$, we can reject the null if $B \leq \alpha$, say there are exactly m modes of $f_{h_m}(x)$; otherwise $B > \alpha$, we accept H_0, that is $f_{h_m}(x)$ has more than m modes.

(d). The last step of selecting

$$h = \min\{\max(H_{n,m}, \sup_{0<y<1/3} n^{-r}), H_{n,m-1}\} \tag{2.7}$$

The selection of h in last step bases on the theory of A.Futschik and E.Isogai (2006), who proved

$$\sup_{k \in S_n} |f_k(x) - f(x)| \to 0, n \to \infty \tag{2.8}$$

where $S_n = [H_{n,m}, min\{max(H_{n,m}, n^{-r}), H_{n,m-1}\}]$, it is easy to find that (2.8) still holds true if we substitute f_h to $f_{\omega h}$ with the only assumption of non-random feature of ω_j.

Let ω_j be the population (GDP or rural-urban income gap) of city j, X_j be the observation of real urbanization level x, $x \in (X_j - h, X_j + h)$. Surrogate variable X_j shows the observed probabilities of $f_h(x)$ and $f_{\omega h}(x)$. They are respectively the standard kernel density estimation and weighted kernel density estimation, that is, the standard probability and the probability under the impact of population, GDP or rural-urban income gap. Using equation (2.5) and equation (2.7), we can get the kernel function and bandwidth. First, estimate and in equation (2.2) and (2.3); then take the standard kernel density estimate $f_h(x)$ as the benchmark and analyze the impact effect between $f_{\omega h}(x)$ and $f_h(x)$ under each factor, so as to reveal the impact of each factor (population, GDP or rural-urban income gap) on China's urbanization process.

3 Population, GDP, urban-rural income gap and urbanization level

A. Population and urbanization development level

What will the real urbanization development level turn out to be given the impact of population? Will the probability of the real urbanization increase or decrease? The figures below are the comparisons of $f_h(x)$ and $f_{\omega h}(x)$ during period of 1999 to 2003, here ω_j stands for total population of city i.

The Figure 3.1 series stand for the standard kernel density estimate and population weighted kernel density estimate for year 1999-2003. The solid curve stands for the standard estimate and the dashed curve the population weighted curve. Figure 3.1.1 shows the estimate of 1999, figure 3.1.2 the estimate of 2000, and so on. While Figure 3.1.6 shows the lengthways comparison of population weighted kernel density estimates for 1999-2003.

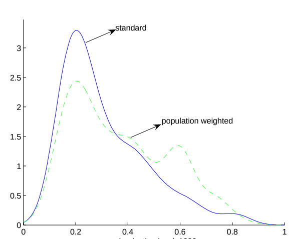


Figure 3.1.1

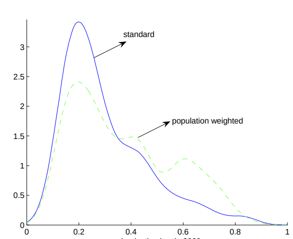


Figure 3.1.2

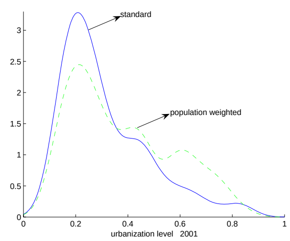


Figure 3.1.3

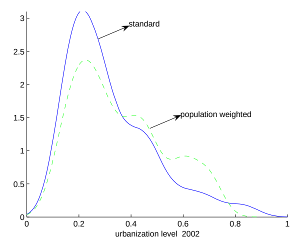


Figure 3.1.4

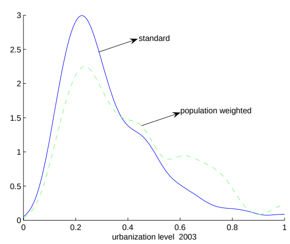


Figure 3.1.5

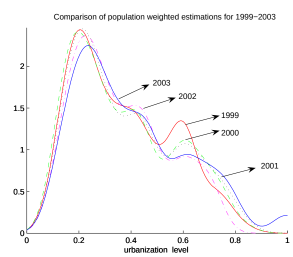


Figure 3.1.6

Table 1 gives the urbanization level where the standard estimation and population weighted estimation show as the intersections. The first point is the urbanization level where standard estimate intersect with the population weighted estimation for each year; the second point is the urbanization level where two estimations are very close for each year.

Table 1. Urbanization levels in accordance with the intersections

Year	**1st point**	**2nd point**
1999	0.354566	0.46271
2000	0.35122	0.49362
2001	0.35553	0.48486
2002	0.36542	0.49709
2003	0.35776	0.521157

The results in figure series 3.1 and table1 suggest the information as below. During the early stage of urbanization process, defined as urbanization level lower than 0.35, population shows a negative impact on the standard estimate, that is, the population impact decreases the observed probability of real urbanization development. During its transition stage, defined as urbanization level varying from 0.35 to 0.5, the population impacts is slightly positive, thus it increases the observed probability of real probability of real urbanization process slightly. During the middle stage defined as urbanization changing from 0.5 to 0.8, the population impact shows a significantly positive trend, that is, the observed probability of real urbanization level increases greatly. In the late stage, as urbanization level being larger than 0.8, the positive impact of population drops and the observed probability of real urbanization process tends to convergence to the standard estimate.

B. GDP and urbanization development level

Similar to the analysis of population impact, the impact analysis of GDP on urbanization level is carried out in the same way. The GDP here refers to the GDP of city i , showing as ω_j in $f_{\omega h}(x)$.

The Figure 3.2 series stand for the standard kernel density estimates and GDP weighted kernel density estimates for year 1999-2003. The solid curve stands for the standard estimate and the dashed curve the GDP weighted curve. Figure 3.2.1 shows the estimate of 1999, figure 3.2.2 the estimate of 2000, and so on. While Figure 3.2.6 displays the lengthways comparison of population weighted kernel density estimates for 1999-2003.

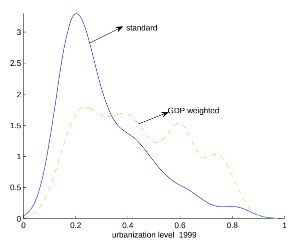


Figure 3.2.1

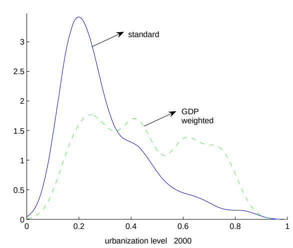
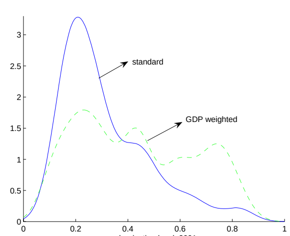


Figure 3.2.2



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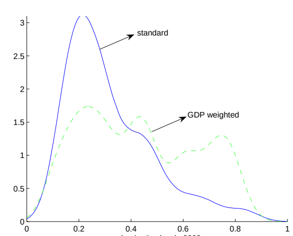

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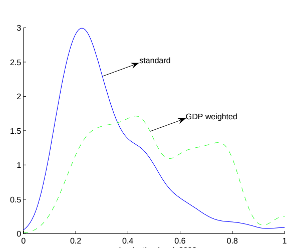

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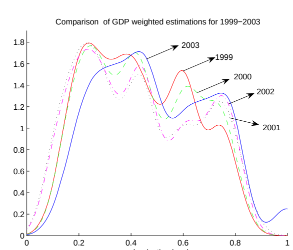

Figure 3.2.6

Like Table 1, Table 2 gives the urbanization levels where the standard estimation and GDP weighted estimation show as the intersections. The first point is the urbanization level where standard estimate intersect with the GDP weighted estimation for each year; the second point is the urbanization level where two estimations are very close for each year.

The results in figure series 3.2 and table 2 suggest information as below. During the early stage of urbanization process, defined as urbanization level lower than 0.35, GDP shows a negative impact on the standard estimate, that is, the GDP impact decreases the observed probability of real urbanization level. During its transition stage, defined as urbanization level varying from 0.35 to 0.5, the GDP impacts is slightly positive, thus it increases the observed probability of real urbanization process slightly. During the middle period defined as urbanization level changing from 0.5 to 0.8, the GDP impact shows an apparently positive trend, that is, the observed probability of real urbanization process increases greatly. In the late stage, as urbanization level being larger than 0.8, the positive impact of GDP drops and the observed probability of real urbanization development tends to convergence to the standard estimate.

Table 2. Urbanization levels in accordance with the intersections

Year	1st point	2nd point
1999	0.338193	0.462717
2000	0.341452	0.49701
2001	0.347858	0.50522
2002	0.355602	0.516086
2003	0.357763	0.521157

C. Urbanization development and rural-urban income gap

To gain the overview of the impact of rural-urban income gap on urbanization level, Figure 3.3 series show the standard kernel density estimates $f_h(x)$ and rural-urban income gap weighted kernel density estimates $f_{\omega h}(x)$ for year 2000-2003. The solid curve stands for the standard estimate while the dashed curve stands for the rural-urban income gap weighted estimate. Figure 3.3.1 shows the estimate of 2000, figure 3.3.2 the estimate of 2000, and so on.

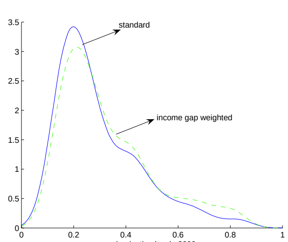

Figure 3.3.1

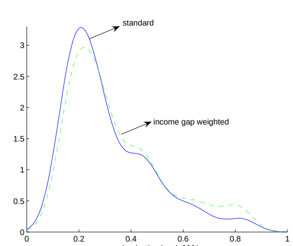

Figure 3.3.2

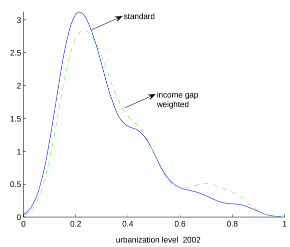

Figure 3.3.3

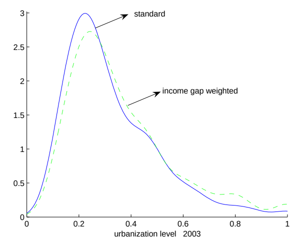

Figure 3.3.4

Take a glance at figure series 3.3, we find some common information. The standard density estimate and the weighted density estimate for each year show a intersection around the level 0.25-0.3 and a overlapping area. The figures in Table 3 are the observed urbanization levels related to the intersections and the critical points of overlapping for both estimates.

Table 3. Urbanization levels in accordance with the intersection and the overlapped area

Year	1st intersection	1st critical point for overlapped area	2nd critical point for overlapped area
2000	0.266890406	0.482729863	0.523553252
2001	0.276111167	0.468483689	0.529407847
2002	0.27502	0.44807	0.48583
2003	0.282002661	0.461594203	0.5

The results in figure series 3.3 and table3 suggest whether the rural-urban income gap will increase the observed probability of urbanization process.

During the early stage of urbanization process, defined as lower than 0.26, rural-urban income gap shows a negative impact on the standard estimate, that is, the rural-urban income gap impact decreases the observed probability of real urbanization process. During its transition period, defined as urbanization varying from 0.26 to 0.6, the rural-urban income gap impacts is slightly positive, thus it increases the observed probability of real urbanization process slightly. During the middle period defined as urbanization changing from 0.6 to 0.8, the rural-urban income gap impact shows an apparently positive trend, that is, the observed probability of real urbanization process increases greatly. In the late period of urbanization being larger than 0.8, the positive impact of rural-urban income gap drops and the observed probability of real urbanization process tends to convergence to the standard estimate.

D. Comparison analysis

Figure series 3.4 below are the intensity comparisons of urbanization process under impacts of GDP, population and rural-urban income gap for each year. Figure 3.4.1 shows impact comparison for each factor in 2000, figure 3.4.2 in 2001, figure 3.4.3 in 2002 and figure 3.4.4 in 2003.

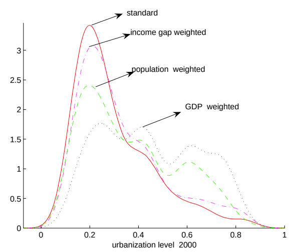

Figure 3.4.1

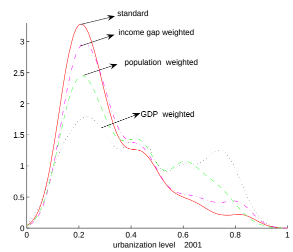

Figure 3.4.2

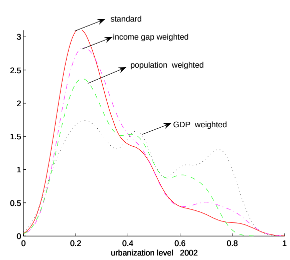

Figure 3.4.3

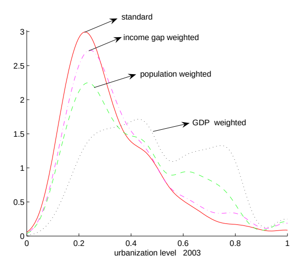

Figure 3.4.4

The comparison figures reflect some interesting information. Given the urbanization lower than 0.35, each factor (GDP, population or rural-urban income gap) shows a negative impact on the standard density estimate of urbanization level; when the urbanization changes from 0.35 to 0.55, each factor plays an adjusting and adapting role on the standard estimate of urbanization, reflecting a slightly positive impact; when the urbanization changes from 0.55 to 0.8, each shows an obvious positive impact on the standard estimate, the impact intensities are ranked as GDP, population and rural-urban income gap; the impact intensity of each factor drops if the urbanization level being larger than 0.8.

No matter the impacts are negative or positive, their strengths always rank as: GDP, population and rural-urban income gap.

Observed from the longitudinal change in years in figure 3.4.5, the impact of rural-urban income gap on the urbanization level shows a rightward moving trend, reflecting a moderate rural-urban income gap in urbanization process is necessary.

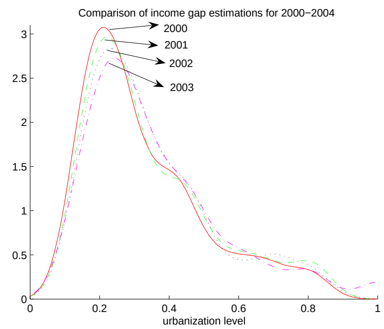

Figure 3.4.5: longitudinal comparison for rural-urban income gap weighted kernel densities

E. Comparison of provincial capitals and Separate Planning Cities

The provincial capitals and separate planning cities in China are the most developed cities. Their urbanization will provide us some reflection for China's urbanization. Thus we study the urbanization in these cities in this section.

To list the relative impacts of each factor (population, GDP, rural-urban income gap) to the urbanization level of the provincial capitals and separate planning cities. The relative impact here refers to the relative difference between weighted kernel density and the standard kernel density for a given urbanization level in a city. It is gained by formula $(f_{\omega h}(x) - f_h(x))/f_h(x)$ given weight as population, GDP, or rural-urban income gap.

There are four cities belong to the early stage of urbanization process: Chongqing , Nanning, Fuzhou and Changsha. The relative impact of GDP on urbanization in Chongqing shows an intensity of 50 percent, being the highest among the other cities' relative impacts of each factor. The relative impact of rural-urban income gap on urbanization in Nanning shows an intensity of only 1.7 percent.

As to the transition stage in China's urbanization, there are 11 provincial capitals and separate planning cities: Hefei, Shijiazhuang, Chengdu, Kunming, Hangzhou, Nanchang, Changchun, Xi'an, Huhehaote, Ha'erbin and Guiyang. The relative impacts of each factor haven't reached 26 percent among cities of Hefei, Shijiazhuang, Chengdu, Kunming and Hangzhou. And the relative impacts of GDP reach 30 percent among Nanchang, Changchun, Xi'an, Huhehaote, Ha'erbin and Guiyang, while the relative impact of population and rural-urban income gap are lower than 8 percent.

Concerning the middle stage of China's urbanization, there are 13 provincial capitals and separate planning cities: Jinan, Xining, Lanzhou, Tianjin, Yinchuan, Wuhan, Shenyang, Taiyuan, Guangzhou, Nanjing, Beijing, Shanghai and Wulumuqi. All the relative impacts of GDP and population on the urbanization exceed 100 percent except for Jinan, Xining and Lanzhou. For example, the relative impact of GDP in Beijing, Shanghai and Wulumuqi have reached 500 percent, while the relative impacts of rural-urban income gap on them (except for Beijing, Shanghai and Wulumuqi) haven't reach 30 percent yet with a minimum of 0.5 percent on cities Jinan and Xining.

To sum up, for the cities at the early stage or transition stage of urbanization, the motives of improving growth of GDP, moderate loosening the control of urban population size and enlarging the rural-urban income gap will accelerate their urbanization process. As to the cities at the middle stage of urbanization except Beijing, Shanghai and Wulumuqi, a moderate increase in rural-urban income gap will benefit their urbanization process in the long run.

4 Concluding remarks

Ray M. Northam, the American urban geographer, puts forward the "s" curve theory for urbanization in 1975. according to the theory, the urbanization can be divided into 3 stages: the early stage, embodied as the urbanization level lower than 30 percent, signs with low urbanization level and slow development in urbanization; the middle stage, embodied as the urbanization level varying from 30 percent to 60 percent, signs with an accelerated urbanization; the late stage, embodied as the urbanization level larger than 60 percent, signs with a slow down in urbanization; the whole curve is shown as a leveled S curve from both ends.

Compared with Ray M.Northam's "S" curve model of urbanization process, China's urbanization process shows its own feature, that is, the urbanization process can be divided into four stages. The early stage of China's urbanization level lags behind about 5 percent compared with the international urbanization level, and China's urbanization level contains a transition stage before the accelerated middle stage, which lags behind about 20 percent according to the international level; the 20 percent lag is still on relative to the international level for the late stage of China's urbanization level.

This paper provides an estimation model with errors-in-variables observation; it studies the density function of Chinese urbanization development level. The model comes to the conclusions as below : during the Chinese urbanization process, the impacts of GDP, population and rural-urban income gap reduce the probability of observed real urbanization in early stage while increase that of middle stage, which means too much uncertainty in early stage of urbanization process; the impact of each factor accelerates the urbanization process with their impact strengths ranked as GDP, population and rural-urban income gap. The results we gained from the study imply that the motives of improving GDP growth, accelerating population migration and narrowing rather than enlarging rural-urban income gap will push the urbanization process in China greatly. Also, the empirical results of 28 provincial cities and separate planning cities reveal that a moderate enlargement of rural-urban income gap will help to accelerate the urbanization process.

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