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DOES INTERNAL IMMIGRATION ALWAYS LEAD TO URBAN UNEMPLOYMENT IN EMERGING ECONOMIES? : A STRUCTURAL APPROACH BASED ON DATA FROM CHINA*

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Abstract

Immigration restrictions usually arise from the idea that immigrants compete with original residents for jobs. Their effects on urban job creation are often ignored. In this study, we develop an inner-city dual labor market model that incorporates both of those effects, and apply it to empirical studies on China. We find that rural-urban immigration does not contribute to urban unemployment in China. Migrants take away some jobs from residents, but at the same time, they lower equilibrium wages and increase output, which expand the demand for resident workers. This latter positive impact is larger than the former substitution effect in China.

Keywords: dual labor market, wages, labor demand and supply, substitution effect, scale effect
JEL classification: J20, J64, R23, C51, C53

I. *Introduction*

The influence of rural-urban immigration on urban unemployment could be one of the key determinants of policy attitude on whether to restrict or encourage immigration. Previous empirical studies on the influence of migration have typically used reduced-form approaches that have regressed possible factors and obtained different results; structural approaches have

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not received sufficient attention. In order to fill this research gap, we construct a structural model for China's urban labor market and provide insights into the mechanisms of wages, production, and labor supply and demand as suggested by the labor economic theory.

China's case is representative of most developing countries experiencing large-scale rural-urban immigration. By 2007, the inflow of migrant workers to urban areas had risen to 134 million people, which is nearly equal to the 175 million total resident workers. This large number of migrants undoubtedly influences the urban labor market. A few previous studies have addressed this issue, and the findings are mainly based on reduced-form estimation. Although some of these studies found that migrant workers and resident workers are direct substitutes of one another [Xie (2008), Knight and Yueh (2004), Knight and Yueh (2009)], others examined total employment and concluded that they were highly imperfect substitutes or complements [Knight, Song, and Jia (1999), Knight and Yueh (2004), Meng and Zhang (2010)].

Among these studies, Knight and Yueh (2004)[1], and Knight and Yueh (2009), used two attitudinal surveys: a questionnaire administered to enterprise managers in 1995 and a questionnaire administered to urban resident workers in 1999. The survey results showed that in 1995, two-thirds of managers denied that rural workers could be replaced with redundant urban workers, which could be used as evidence in favor of the segmentation of the labor market. In the survey conducted in 1999, over 50% of urban resident workers agreed that "migrants are competitors and should leave when unemployment is high." Based on a simple regression, the researchers concluded that competition between the two groups has been increasing. Xie (2008) also used the 1999 attitudinal survey and claimed that migrants pose a threat to the employment of urban residents. The other studies mainly focused on the amount of employment, data for which came from official yearbooks and enterprise surveys. Knight, Song, and Jia (1999) regressed the migrant employment rate on the non-migrant employment rate and other factors, and obtained a non-significant negative coefficient. Therefore, they concluded that migrant and non-migrant workers are highly imperfect substitutes or even complements. Knight and Yueh (2004)[2] also regressed migrant employment rate on the urban unemployment rate, layoff rate, and other factors, and found conflicting results among different estimation methods. Further, Meng and Zhang (2010) found a significant positive coefficient for migrants on the dependent variable of the resident employment rate.

The studies that regressed the two types of employments found that the reason for this apparent relationship was still unclear. Knight and Yueh (2004) mentioned that a problem with their regression was "the identification of the causal relationship." Although Meng and Zhang (2010) provided possible reasons, such as economic growth and labor demand expansion, they did not attempt to determine causality; therefore, they indicated that further study was required "to provide a conclusive explanation as to why the large scale rural-urban migration has had an insignificant impact on urban natives." Our structural model is intended to address this issue.

The main theoretical background of our model uses substitutes and complements in the Hicks-Allen sense (also called *p*-substitutes and *p*-complements in short)[3], and gross substitutes

[1] Section 3 of Knight and Yueh (2004).

[2] Section 4-7 of Knight and Yueh (2004).

[3] In economic labor theory, *p*-substitutes and *p*-complements are defined as substitutes and complements of inputs for a given level of output.

and complements [Cahuc and Zylberberg (2004)]. There are three production inputs in our model: labor of migrants, labor of residents, and capital. Note that migrant labor and resident labor have been widely recognized as two separate production factors in China [Wang, et al. (2005), Knight, Song, and Jia (1999), Yan (2008)] because of the heterogeneity of the two types of labor [Appleton et al. (2004), Demurger et al. (2009), Knight, Song, and Jia (1999)]. Based on this theory, migrants influence urban employment from two sides. For a given level of output, migrants are either *p*-substitutes or *p*-complements to residents; this is the direct influence of migrants. On the other hand, in an actual economy with endogenous output, migrant labor has a production effect, which could increase the output level and further expand the total labor demand. Thus, the total effect, which is theoretically related to gross substitutes and complements, depends on the sum of the above two effects.

We examined China's urban labor market using our basic model. The estimation results indicated a *p*-substitution relationship between migrant and resident labor in China with a constant level of output. This is consistent with previous findings that rural migrants compete with some urban residents for jobs [Xie (2008), Knight and Yueh (2004), Knight and Yueh (2009)]. However, when considering the whole economy, our simulation results showed that the production effect of migrants exceeds their *p*-substitution effect, which provides a reliable explanation of the apparent relationship between the two types of employments found previously [Knight, Song, and Jia (1999), Knight and Yueh (2004), Meng and Zhang (2010)]. In short, we found that migrants create more jobs for residents than they take away from them; therefore, immigration does not contribute to urban unemployment.

In this paper, Section II describes the background of rural-urban immigration in China. Section III outlines the theoretical framework for analysis and constructs the basic model for empirical study. Section IV explains the data. Section V presents the estimation results. Section VI performs simulations and presents their results. Section VII concludes this paper.

II. *Background*

In recent years, China's rural-urban migration, which began in the mid-1980s, led to a large number of migrant laborers in urban areas. A national household survey reported that there were 108.9 million, 117.9 million, 132.3 million, and 146.9 million rural-urban migrants in China in 2003, 2005, 2007, and 2009, respectively [Cai, Du, and Wang (2010)]. Among the outflows of rural-urban migrants, more than half came from middle and western China. For example, in 2008, 56.9% rural migrants came from the middle and west regions of China, and approximately 43.1% came from east China [calculated by data from Cai et al. (2010)]. Further, rural migrants from east China usually move within the province wherein they reside; in 2008, 79.7% of the migrants from the east rural areas of China moved to cities within the same province. In contrast, most of the rural migrants from middle and western China moved out of their resident provinces (71% of middle-China migrants and 63% of west-China migrants). The destination of this inter-province immigration is generally the east coast of China, which includes regions such as Guangdong, Zhejiang, and Shanghai. These statistics come from the Rural Survey of the China's National Bureau of Statistics (NBS) [Cai et al. (2010)].

General determinants for immigration include income disparity, gender, education, age, marriage, and land allocation [Eleven studies reviewed by Zhao (2005), Knight and Song

(2005), Bodvarsson and Hou (2010), Xing (2010)]. Although immigration determinants indicate that the human capital of rural-urban migrants could be higher than that of most other rural persons, they are still a labor group of low education and skill [Cai et al. (2010)]. A survey of six large cities in 1999 and 2000[4] reported that the number of years of education and work experience of migrants were much shorter than that of urban residents [Xie (2008)]. Education quality and skill training in rural areas have been considerably falling behind urban areas for a long time, which may be a key reason for the gap in their education and work experience. However, most rural migrants are young; the national survey reported that in 2009, 61.6% of migrants were below the age of thirty, and 83.9% of them were below the age of forty [Cai et al. (2010)]. Many of these migrants were used to physical work and could work harder than urban residents [Zhao (2009), Research Office of the State Council (2006)].

These characteristics provide evidence regarding the heterogeneity of migrant and resident labors; the household registration system in China (*hukou*) could be a more pertinent reason [Xu (2006), Liu (2010), Sun and Fan (2011)]. Because rural migrants do not have permanent urban household registration, they often receive lower wages even though they do the same jobs as residents, and they do not have unions to bargain with firms for wage increases [Meng (2010)]. Furthermore, they can neither permanently reside in the cities nor enjoy city social insurance as official residents [Rupelle et al. (2009), Lin and Zhang (2011)]; they do not receive unemployment benefits on losing urban jobs because unemployment benefits are limited to urban residents. Rural migrants are not recognized as involuntarily unemployed persons because they own land-use rights in rural areas and could return to farm work at any time. Even in recent years, discrimination in the labor market based on the household registration system is “not in the trend of diminishing but the trend of expanding” [Tian (2010)].

These heterogeneities of migrant and resident labor provide evidence for our model wherein migrant labor and resident labor are treated as two separate production factors. The evidence of heterogeneity of migrant and resident labor has also been found in other countries, such as the heterogeneity between natives and immigrants in the U.S. [Ottaviana and Peri (2011)]. We addressed that issue of China using a dual labor market approach: a labor market for urban residents with government protection, high social welfare, and relatively high wages, and a labor market for rural migrants with temporary jobs, fewer required skills, and limited social welfare.

Furthermore, both government and previous studies have recognized that rural-urban immigration considerably contributes to urban economic growth [Research Office of the State Council (2006), Gong (2008)]. The most important reason for this is that the employment of rural migrants substantially reduces the labor costs for enterprises, which enlarges the production scale and reinforces international competitiveness [Yan (2008), Zhao (2009)]. We also incorporate this production effect of migrants into our model.

In the subsequent section, we construct a basic model in order to address these issues.

[4] *China’s Urban Labor Market Research Program*, supported by the Ford Foundation, Hansheng Wang; Xie (2008)

III. *Model*

1. Model

In an emerging economy, there are two types of workers in urban areas: urban resident workers and rural migrant workers. Labor supply and demand of urban residents, denoted by D^R and S^R respectively, and those of rural migrants, denoted by D^M and S^M respectively, comprise an inner-city dual labor market.

For the wage of the two labors, we assumed resident wages to be exogenous and rigid, and migrant wages to be endogenous and flexible because of the following reasons: First, a labor market for urban residents with involuntary unemployment is in disequilibrium, and the wage rate,w^R, could be rigid. That wage rigidity can be explained by resident minimum wage policies or protection of unions. In China's case, it mainly reflects the wage system for urban residents, which is still influenced by the planned economy that ended in the 1980s and during which wages were not determined by market, but by government policies. Flexible wages had been advocated by the government; however, such a policy was not implemented during our sample period. Second, rural migrants are often paid market-clearing wages because they lack government protection and union wage bargaining power. In China, a more important reason for this is that rural migrants own land-use rights and can fall back on farm work in their original rural areas, and therefore, do not face involuntary unemployment. Accordingly, in the labor market for urban residents, we assumed that $U^R=S^R-D^R, U^R>0$ with exogenous wages, w^R ; at the same time, we assumed that the labor market of rural migrants is in equilibrium, $D^M=S^M$, and the wage is the market-clearing wage, which is endogenously determined by $D^M=S^M$.

We conducted our analysis into four parts. In the first part, we examined the *p*-substitution and *p*-complementary effects of migrant labor, assuming that wages, output levels, and other factors were constant. In the second part, we extended the output level into an endogenous variable and examined the production effect of immigration. Combining those two effects, we obtained the total effect in the third part and discussed several possible cases. In the last part, we derived the determination equation for migrant labor and obtained the final unemployment equation.

(1) *P*-substitution and *P*-complementary effects of migrants

An important effect of immigration is that migrant labor could possibly substitute for or complement resident labor, given a certain output level. The theoretical background is the conditional demand functions, which focus on how demands vary in the wake of a rise or fall in the prices of these factors [Cahuc and Zylberberg (2004)]. The conditional labor and capital= demand functions are obtained as:

$$\overline{D}^R=\overline{D}^R(\overline{Q}, w^R, w^M, r+\delta), \quad (1)$$

$$\overline{D}^M=\overline{D}^M(\overline{Q}, w^R, w^M, r+\delta), \quad (2)$$

$$\overline{D}^K=\overline{D}^K(\overline{Q}, w^R, w^M, r+\delta), \quad (3)$$

where r is the real interest rate, δ is the depreciation rate, and $(r+\delta)$ is the rental price of capital. Conditional factor demand increases with lower levels of factor prices, w^R, w^M, and $r+\delta$, and decreases by a reduction in the given output level, $\overline{Q}$.

As mentioned earlier, most empirical work on migration influences focused on the changes of the number of workers. Our conditional demand function enables us to look beyond this apparent phenomenon and solve the problem on a theoretical level. In eq. (1), for a given level of output, if $\frac{d\overline{D}^R}{dw^M}$ is positive, rural migrants and urban residents are p-substitutes (or substitutes in the Hicks-Allen sense). If $\frac{d\overline{D}^R}{dw^M}$ is negative, rural migrants and urban residents become p-complement (or complements in the Hicks-Allen sense).

Accordingly, migrants substitute or complement residents, given a certain level of output. However, on the other hand, migrant could also contribute to output and expand the total labor demand, which we will discuss in the next part.

(2) Production effect of immigration

The fact that immigration contribute to production and economic growth has been observed in many emerging economies. As Phan and Coxhead (2010) argued, economic growth and internal migration are complements: growth is a stimulus to migration, and migration facilitates growth. In an empirical study of Taiwan, Burford (1970) also found that migration is an important determinant of economic development. In China, migrants contribute to urban production by their low wage cost [Yan (2008), Zhao (2009)]. To capture the effect of migrants on production, a determination equation for output level is necessary.

In our theoretical model, the contribution of immigration to production can be obtained by firm's profit maximization as follows.

$$\max_{L^R>0,\ L^M>0,\ K>0} \Pi = pQ(L^R, L^M, K) - (w^R L^R + w^M L^M + (r+\delta)K), \quad (4)$$

where $Q(L^R, L^M, K)$ is a differentiable production function, is a given product price.

The maximization problem is solved as,

$$Q^* = Q^*(w^R, w^M, (r+\delta), p). \quad (5)$$

As a result, we obtain the production effect of migrants in China as $\frac{dQ}{dw^M}$, where,

$$Q = Q(w^R, w^M, (r+\delta), p). \quad (6)$$

(3) The total effect of migrants

The total effect of immigration on the employment of residents depends on the above two effects. Substituting eq. (6) into (1) leads to the following total labor demand function of migrants.

$$D^{R^*} = D^{R^*}[w^R, w^M, r+\delta, Q(w^R, w^M, (r+\delta), p)] \quad (7)$$

After several calculations, we obtain the total effect of migrant wage to resident demand, as shown in the following equation.

$$\left(\frac{w^M}{D^{R^*}}\right)\frac{dD^{R^*}}{dw^M}=\left(\frac{w^M}{D^{R^*}}\right)\left(\frac{\partial D^{R^*}}{\partial w^M}\right)+\left(\frac{Q}{D^{R^*}}\right)\left(\frac{dD^{R^*}}{dQ}\right)\left(\frac{w^M}{Q}\right)\left(\frac{\partial Q}{\partial w^M}\right) \tag{8}$$

In eq.(8), the first term on the right-hand side is the elasticity of the conditional demand for urban residents with respect to migrant wage, which represents the direct effect of migrant wage to urban employment (p-substitutes or p-complements); the second term on the right-hand side represents the production effect of migrant wage on demand for residents through a channel of a change of the quantity of production output.

The first term on the right-hand side of eq.(8) could be positive, if the two labors are p-substitutes, or negative, if the two labors are p-complements; the second term is usually negative. Hence, if estimation results of eq. (1) indicates that migrants and residents are complements, the decrease of migrant wage will unambiguously increase the demand for residents. However, if estimation results of eq.(1) indicates a substitution relationship between the two labors, the total effect of immigration become ambiguous. In this study, we use simulations to solve this problem, which is theoretically based on the comparative statics of increase of migrants to urban unemployment changes. The comparative statics will be discussed in the last part of this section.

(4) Determination of migrant wage and models of the dual labor market

As we have discussed previously, migrant wage is determined by the equilibrium of migrant labor market,

$$D^M=S^M. \tag{9}$$

Note that migrant labor supply is the inflows of migrants in urban areas, not their outflows, hence it is determined by migrants' wages, w^M, which attract rural-urban immigration, and other factors, θ, that influence migration inflow in urban areas, such as migration policies, job-search cost, and so on. In our model of China, θ is assumed as a measure of migration acceptance. In addition, the only income of rural migrants in urban areas is wages, so non-wage income is not considered. As a result, the labor supply equation of rural migrants is expressed as follows:

$$S^M=S^M(w^M,\ \theta). \tag{10}$$

Further, total labor demand function of rural migrants is obtained by eq.(2) and eq.(6), as,

$$D^M=D^{M^*}[Q(w^R,\ w^M,\ (r+\delta),\ p),\ w^R,\ w^M,\ r+\delta] \tag{11}$$

Hence, we obtain the determination equation for the wage of rural migrants as follows,

$$w^M=w^{M^*}(\theta,\ w^R,\ (r+\delta),\ p). \tag{12}$$

For the labor market of urban residents, we have assumed that $U^R=S^R-D^R$, $U^R>0$ with exogenous wages, w^R. The labor supply function of residents follows the typical form of an econometric model of labor supply:

$$S^R = S^R(w^R, R). \tag{13}$$

In this expression, w^R is the current wage rate offered by firms, which has a positive effect on labor supply, and R is non-wage income, which has a negative effect on labor supply. Further, total labor demand function of urban residents has been obtained in eq. (7), as $D^{R^*} = D^{R^*}[w^R, w^M, r+\delta, Q^*(w^R, w^M, (r+\delta), p)]$. Accordingly, in the labor demand and supply approach, the unemployment equation is given by:

$$U^R = S^R(w^R, R) - D^{R^*}[w^R, w^M, r+\delta, Q^*(w^R, w^M, (r+\delta), p)],\ U^R > 0. \tag{14}$$

Accordingly, in this part we constructed a model of the dual labor market in urban China, which helped us to capture the effect of immigration on urban residents. Our total model consists of a labor market of urban residents, a labor market of rural migrants, and determination of the output level. Further, the key equation that captures immigration effect is eq. (7), the empirical outcomes of which could be obtained by constructing a structural econometric model consisting of *p-substitution* or *p-complementary* effect of eq.(1), production effect of eq.(6), and migrant wage determination of eq.(2), eq.(6), eq.(9), and eq.(10).

2. Comparative Statics

We examine the comparative statics of immigration's contribution to urban unemployment. Since migrant labor is endogenous and can be directly increased by an immigration-acceptation policy, which is θ in our model, we derive the solution of $\frac{dU^R}{d\theta}$. Based on eq.(14), and eq.(12), the result is as follows:

$$\frac{dU^R}{d\theta} = -\frac{dD^{R^*}}{d\theta} = -\left(\frac{dD^{R^*}}{dw^{M^*}} \cdot \frac{\partial w^{M^*}}{\partial \theta} + \frac{dD^{R^*}}{dQ^*} \cdot \frac{dQ^*}{dw^{M^*}} \cdot \frac{\partial w^{M^*}}{\partial \theta}\right) \tag{15}$$

If the econometric model is not complicated, we may be able to calculate the actual result of $\frac{dU^R}{d\theta}$. There is another way: we perform simulation to examine what happened to D^R when increasing θ by a standard deviation. If $\frac{dD^R}{d\theta}$ is negative, it indicates that immigration leads to a higher urban unemployment rate; if it is nonnegative, we can conclude that immigration does not contribute to urban unemployment, or even reduces the unemployment rate.

IV. *Data*

Using the basic dual labor market model, we studied urban labor markets in China from 2004-2007 where there was rapid economic growth and large-scale urban-rural migration. An econometric model was built to describe China's dual labor market in urban areas.

Three types of migration data have been collected by different routes in China. The first one called Migrant Data I is migrant population in urban areas recorded by Annual Population Changes Census of China. The survey is conducted by the Department of Population and Employment, National Bureau of Statistics of China (NBS) and covers all 31 Chinese provinces. For example, the 2007 census was carried out on 1st, November, 2007 in 1894 randomly selected cities and 3430 towns, and 1.19 million persons filled out questionnaires. The province data of the migrant population are reported by their ratio of the total population. The second type of data, called Migrant Data II, is the outflow of migrant workers reported by the *Rural Household Survey of China* [NBS (2005-2008d)], which also covers the whole country and is conducted every year by the *Department of Rural and Social Economic Survey, NBS*. In 2007 they surveyed 68,000 rural households from all over the country. The outflow of the migrant worker data is provided for the nation level. The third type of data, Migrant Data III, is the rural migrant workers in *urban units* from *China Statistical Yearbook*. *Urban units* are defined as "state-owned enterprises, collective enterprises, foreign enterprises, and other ownership enterprises" in that yearbook. The data are reported at the provincial level.

Among these three types of data, Migrant Data III is directly applied for migrant workers in urban enterprises. Although the total of that third type data does not equal the second one, which is the nation-level data of the outflow of migrant workers, the disparity among regions and years is consistent with Migrant Data I, which is based on the Annual Population Changes Census. We tried to get the data that most closely reflect reality in the following ways:

$$E_{it}^{M}=T_{t}^{M} * \frac{EP_{it}^{M}}{\sum_{i=1}^{29} EP_{it}^{M}} \qquad (i=1,..., 29;\ t=2004,..., 2007). \qquad (16)$$

T_t^M is Migrant Data II in year t at the national level, and EP_{it}^M is Migrant Data III, which are the numbers of rural migrant workers in *urban units* at the provincial level. (Using Migrant Data I instead of Data III leads to almost the same calculation results of E_{it}^M.)

We use urban Gross Regional Product (GRP) as the output data, sourced from NBS (2005-2008a). The total labor supply of urban residents S^R is calculated from the urban registered unemployment rate and the numbers of the unemployed[5]. Total labor demand of urban residents D^R is the difference between the total resident labor supply and the unemployed residents. Those data come from NBS (2005-2008b). The surrogate variable of capital K is industrial electricity. The Data is the "Electricity Consumption per Unit of GRP" sourced from NBS (2005-2008a). We calculate the total industrial electricity by multiplying it by the mount of urban GRP. In our econometric model of China, θ is assumed as a measure of migration acceptance, such as job-search assistance for migrants. Labor exchanges provide most job-search assistance for migrants in China; therefore we chose the provincial number of labor exchanges as the surrogate variable of θ_{it}, which is migration acceptance. Data of labor exchanges are sourced from NBS (2005-2008b). Further, the surrogate variable of non-wage income of urban residents is the taxes on interest earned and the dividend from shares, which are sourced from SAT (2005-2008).

Although there are no direct data for aggregate wages of migrants and residents, we were able to calculate them from currently available data. Sector-wise data of yearly wages and migrant and resident worker numbers are reported in details. We computed the wage rates for the two types of workers as the weighted averages of these sector-wise wage rates, using the shares of two types of workers in each sector as the weights:

[5] Urban registered unemployment statistics only include urban residents.

$$w_{it}^{R}=\frac{\sum_{j=1}^{N} w_{it}^{j} R_{it}^{j}}{\sum_{j=1}^{N} R_{it}^{j}} \quad w_{it}^{M}=\frac{\sum_{j=1}^{N} w_{it}^{j} M_{it}^{j}}{\sum_{j=1}^{N} M_{it}^{j}} \tag{17}$$

$(j=1,..., N;\ i=1,..., 29;\ t=2004,..., 2007)$.

There are N sectors in province i in year j. w_{it}^{R} and w_{it}^{M} are the wages of the residents and migrants at the provincial level; R_{it}^{j} and M_{it}^{j} are the resident and migrant numbers of sector j; w_{it}^{j} is the wages of sector j. All are the data of province i in year t.

The wages, non-wage income, and the GRP data were adjusted at the standard price level of 2007. The calculation process of capital prices, $(r+\delta)$, is located in the Appendix Ⅰ.

The data list is in shown in Appendix Ⅱ.

V. *Estimation*

1. Methods

To provide a general description of the dual labor market in urban China, we estimate equations (1), (2), (3), (10), (13), and (6) constructed earlier. The following two simultaneous estimation systems and one single estimation equation are derived from those equations.

System of factor demand functions:

$$\log D_{it}^{R}=\beta^{RM}\log w_{it}^{M}+\beta^{RR}\log w_{it}^{R}+\beta^{RK}\log(r_{it}+\delta_{it})+\beta^{RQ}\log Q_{it}+a_{i}^{dr}+\varepsilon_{it}^{DR} \tag{1'}$$

$$\log D_{it}^{M}=\beta^{MM}\log w_{it}^{M}+\beta^{RM}\log w_{it}^{R}+\beta^{MK}\log(r_{it}+\delta_{it})+\beta^{MQ}\log Q_{it}+c^{DM}+\varepsilon^{DM} \tag{2'}$$

$$\log D_{it}^{K}=\beta^{MK}\log w_{it}^{M}+\beta^{RK}\log w_{it}^{R}+\beta^{KK}\log(r_{it}+\delta_{it})+\beta^{KQ}\log Q_{it}+a_{i}^{dk}+\varepsilon_{it}^{DK} \tag{3'}$$

System of labor supply functions:

$$\log S_{it}^{M}=\beta^{SM}\log w_{it}^{M}+\beta^{\theta}\log\theta_{it}+a_{i}^{sm}+\varepsilon_{it}^{SM} \tag{10'}$$

$$\log S_{it}^{R}=\beta^{SR}\log w_{it}^{R}+\beta^{SRR}\log R_{it}^{R}+a_{i}^{sr}+\varepsilon_{it}^{SR} \tag{13'}$$

Determination equation of output level:

$$\log Q_{it}=\beta^{QM}\log w'^{M}_{it}+\beta^{QR}\log w'^{R}_{it}+\beta^{QK}\log(r_{it}+\delta_{it})'+\beta^{QP}\log p_{it}+c^{Q}+\varepsilon_{it}^{Q} \tag{6'}$$

In the estimation system, i is the cross section of the regions, and t is the time series of the years. a_{i}^{x} s are fixed effects of the 29 regions. c in these equations are constant terms. ε are error terms. Q is the actual output level. In eq. (6)', w'^{M}_{it} and w'^{R}_{it} are migrant and resident wages per labor productivity, respectively, and $\log(r_{it}+\delta_{it})'$ is capital price per capital productivity[6]. Since the economy of China grew rapidly during the sample period, it is necessary to eliminate the influences of productivity changes on the output level.

[6] $w'^{M}_{it}=w_{it}^{M}/LP_{it}$, $w'^{R}_{it}=w_{it}^{R}/LP_{it}$, $(r_{it}+\delta_{it})'=(r_{it}+\delta_{it})/CP_{it}$ where LP_{it} is average labor productivity, and CP_{it} is average capital productivity.

TABLE 1. ESTIMATION RESULTS OF THE MODEL

	Supply (3SLS)			Demand (3SLS)		Endogenous Output (2SLS)	
Dep.Var.	$\log D_{it}^{R}$	$\log D_{it}^{M}$	$\log D_{it}^{K}$	$\log S_{it}^{M}$	$\log S_{it}^{R}$		$\log Q_{it}$
Indep.Var.							
$\log w_{it}^{M}$	1.32	−1.38	−0.38	0.26	–	$\log w'^{M}_{it}$	−6.57
	(2.10)**	(−2.01)**	(−1.10)	(2.01)**	–		(−3.00)**
$\log w_{it}^{R}$	−1.29	1.32	0.03	–	0.23	$\log w'^{R}_{it}$	5.45
	(−2.00)**	(2.10)**	(1.03)	–	(3.93)***		(2.69)**
$\log(r_{it}+\delta_{it})$	0.03	−0.38	−0.02	–	–	$\log(r_{it}+\delta_{it})'$	−1.57
	(1.03)	(−1.10)	(−1.10)	–	–		(−3.62)**
$\log Q_{it}$	0.42	1.19	1.29	–	–	$\log p_{it}$	1.10
	(2.04)**	(11.34)***	(5.00)***	–	–		(1.78)*
θ_{it}	–	–	–	0.0002	–		
	–	–	–	(1.88)*	–		
$\log R_{it}^{R}$	–	–	–	–	−0.01		
	–	–	–	–	(−0.17)		
Const..	11.13	5.57	5.39	10.20	11.51	*Const..*	12.84
	(9.82)***	(1.82)***	(3.25)***	(8.16)***	(42.19)***		(6.27)***
Instrumented	$\log w_{it}^{M}$	$\log w_{it}^{M}$	$\log w_{it}^{M}$	$\log w_{it}^{M}$	–	*Instrumented*	$\log w_{it}^{M}$
Instruments	$\log w_{i,t-1}^{M}$	$\log w_{i,t-1}^{M}$	$\log w_{i,t-1}^{M}$	$\log w_{i,t-1}^{M}$	–	*Instruments*	$\log w_{i,t-1}^{M}$
Adj.R.	0.99	0.77	0.99	0.99	0.99	*Adj.R.*	0.21

Notes: T-statistic in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Equation (1)', (2)', (3)', (10)', and (6)' include endogenous variables of w^M and Q. The most proper estimation method could be Three-Stage Least Squares (3SLS) or Two-Stage Least Squares (2SLS). We have examined the relevance and exogeneity of the instrumental variables. Note that migrant acceptance θ — the number of labor exchanges—is exogenous, because, in China, most of the labor exchanges are operated by the government and are mainly manned by the city police. The job search services for rural migrants are free of charge, which are covered by central or local government subsidies [General Office of the State Council (2004)]. The amount of subsidies on rural migrants generally depends on city government's attitude towards immigration. Thus there are no profitable incentives for job agencies to meet migrant labor demand of firms. For confirmation, we also ran the test for endogeneity and found that the null hypothesis of its exogeneity cannot be rejected[7]. It is indicated that it is proper to treat θ as exogenous.

2. Result and Discussion

Our results are reported in TABLE 1. Further for comparison and confirmation, the results of other estimation methods are listed in TABLE 2.

Our main purpose is to examine both the *p-substitution* (or *p*-complement) effect and the product effect of migrant labor to urban unemployment. Based on the estimation results, the

[7] Chi-squared of the Durbin test is 0.000363 (p-value is 0.98) , and F-statistic of Wu-Hausman test is 0.000261(p-value is 0.99).

Table 2. Results of Different Estimation Methods

(1) System of Factor Demand Functions

Equations	Variables	OLS	WLS	SUR	TSLS	WTSLS	GMM	3SLS
$\log D_{it}^R$	$\log w_{it}^M$	1.53	0.41	0.40	1.54	1.34	1.44	1.32
		(4.86)***	(2.05)**	(2.00)**	(3.52)***	(2.13)**	(2.21)**	(2.10)**
	$\log w_{it}^R$	−1.33	−0.28	−0.26	−1.51	−1.31	−1.46	−1.29
		(−0.73)	(−0.97)	(−0.91)	(−0.87)	(−2.01)*	(−2.25)**	(−2.00)**
	$\log(r_{it}+\delta_{it})$	0.02	0.03	0.03	0.03	0.03	0.03	0.03
		(0.09)	(1.07)	(1.05)	(0.14)	(1.03)	(1.26)	(1.03)
	$\log Q_{it}$	0.28	0.23	0.22	0.44	0.43	0.46	0.42
		(0.18)	(1.22)	(1.17)	(0.30)	(2.05)**	(2.38)**	(2.04)**
	Adj.R.	0.99	0.99	0.99	0.99	0.99	0.99	0.99
$\log D_{it}^M$	$\log w_{it}^M$	−1.63	−0.53	−0.52	−1.56	−1.41	−1.52	−1.38
		(−4.59)***	(−1.67)*	(−1.64)*	(−3.51)***	(−2.03)**	(−2.01)**	(−2.01)**
	$\log w_{it}^R$	1.53	0.41	0.40	1.54	1.34	1.44	1.32
		(4.86)***	(2.05)**	(2.00)**	(3.52)***	(2.13)**	(2.21)**	(2.10)**
	$\log(r_{it}+\delta_{it})$	0.05	−0.17	−0.16	−0.09	−0.36	−0.47	−0.38
		(0.34)	(−1.75)**	(−1.67)*	(−0.23)	(−1.05)	(−1.30)	(−1.10)
	$\log Q_{it}$	1.09	1.13	1.13	1.14	1.19	1.19	1.19
		(22.38)***	(16.82)***	(16.80)***	(12.50)***	(11.30)***	(13.40)***	(11.34)***
	Adj.R.	0.78	0.76	0.76	0.78	0.77	0.76	0.77
$\log D_{it}^K$	$\log w_{it}^M$	0.05	−0.17	−0.16	−0.09	−0.36	−0.47	−0.38
		(0.34)	(−1.75)**	(−1.67)*	(−0.23)	(−1.05)	(−1.30)	(−1.10)
	$\log w_{it}^R$	0.02	0.03	0.03	0.03	0.03	0.03	0.03
		(0.09)	(1.07)	(1.05)	(0.14)	(1.03)	(1.26)	(1.03)
	$\log(r_{it}+\delta_{it})$	−0.03	−0.03	−0.03	−0.02	−0.02	−0.01	−0.02
		(−0.14)	(−1.44)	(−1.45)	(−0.13)	(−1.12)	(−0.84)	(−1.10)
	$\log Q_{it}$	0.97	1.12	1.12	1.08	1.28	1.36	1.29
		(2.27)**	(14.17)***	(14.15)***	(2.28)***	(4.95)***	(5.02)***	(5.00)***
	Adj.R.	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Note: Constants are omitted from the lists.

(2) System of Labor Supply Functions

Equations	Variables	OLS	WLS	SUR	TSLS	WTSLS	GMM	3SLS
$\log S_{it}^M$	$\log w_{it}^M$	0.11	0.11	0.10	0.26	0.26	0.26	0.26
		(1.11)	(1.29)	(1.19)	(0.61)*	(2.01)**	(2.39)**	(2.01)**
	θ_{it}	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
		(2.70)	(3.15)***	(3.37)***	(1.51)	(1.88)*	(2.30)***	(1.88)*
	Adj.R.	0.99	0.99	0.99	0.99	0.99	0.99	0.99
$\log S_{it}^R$	$\log w_{it}^R$	0.23	0.23	0.24	0.23	0.23	0.23	0.23
		(3.36)***	(3.93)***	(4.12)***	(3.36)***	(3.93)***	(2.64)**	(3.93)***
	$\log R_{it}^R$	−0.01	−0.01	−0.02	−0.01	−0.01	−0.01	−0.01
		(−0.14)	(−0.17)	(−0.31)	(−0.14)	(−0.17)	(0.13)	(−0.17)
	Adj.R.	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Note: Constants are omitted from the lists.

(3) Determination Equation of Output Level

Equation	Variables	OLS	GMM	TSLS
$\log Q_{it}$	$\log w'^{M}_{it}$	−2.76	−6.57	−6.57
		(−2.92)**	(−3.00)**	(−3.00)**
	$\log w'^{R}_{it}$	1.77	5.45	5.45
		(2.00)**	(2.69)**	(2.69)**
	$\log(r_{it}+\delta_{it})'$	−1.08	−1.57	−1.57
		(−3.69)**	(−3.62)**	(−3.62)**
	$\log p_{it}$	0.45	1.10	1.10
		(1.28)	(1.78)*	(1.78)*
	Const..	11.96	12.84	12.84
		(8.71)***	(6.27)***	(6.27)***
	Adj.R.	0.27	0.21	0.21

Notes: T-statistic in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

econometric model is obtained as follows[8] (***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively; details of estimated are reported in TABLE 1).

$$\log D^{R}_{it}=1.32\log w^{M}_{it}-1.29\log w^{R}_{it}+0.03\log(r_{it}+\delta_{it})+0.42\log Q_{it}+a^{dr}_{i}+\varepsilon^{DR}$$
(2.1)** (-2.0)** (1.0) (2.0)** (1)”

$$\log Q_{it}=-6.57\log w'^{M}_{it}+5.45\log w'^{R}_{it}-1.57\log(r_{it}+\delta_{it})'+1.10\log p_{it}+12.48+\varepsilon^{Q}_{it}$$
(-3.0)** (2.7)** (-3.6)** (1.8) (6.3)*** (6)”

$$\log D^{M}_{it}=-1.38\log w^{M}_{it}+1.32\log w^{R}_{it}-0.38\log(r_{it}+\delta_{it})+1.19\log Q_{it}+5.57+\varepsilon^{DM}$$
(-2.0)** (2.1)** (-1.1) (11.3)*** (1.8)* (2)”

$$\log S^{M}_{it}=0.26\log w^{M}_{it}+0.0002\log\theta_{it}+a^{sm}_{i}+\varepsilon^{SM}_{it}$$
(2.0)** (1.9)* (10)”

$$D^{M}=S^{M} \quad (9)”$$

In the econometric model, eq. (1)” and eq. (6)” are the main equations which specify the two effects of immigrants: the *p-substitution* (or *p-complementary*) effect of immigrants, and the production effect. Further, in eq. (1)” and eq. (6)”, migrant wage, w^{M}, is endogenous. w^{M} is determined by eq. (2)” (with substitution of eq. (6)”), eq. (10)”, and eq. (9)”, as $w^{M}=w^{M^*}(\theta, w^{R}, (r+\delta), R)$ [9], which we have discussed in Section III.

The estimation results show that in eq. (1)”, the coefficients of $\log w^{M}_{it}$ and $\log Q_{it}$ are statistically significant positive, which indicates that migrant labor and resident labor are *p*-substitutes: if migrant wages decrease, firms' demand for migrant labor would increase and that for resident labor would decrease, given other factors. Hence the first effect of immigration on resident employment is negative. However, on the other hand, in eq. (6)”, $\log w^{M}_{it}$ has a significant negative coefficient, which indicates that a lower level of migrant wage, which

[8] The result in Table 1 provides a complete description of the dual labor market in urban China. However, for the purpose of migrant influence, only the estimates listed in the following econometric model are necessary.

[9] Average labor productivity, LP_{it}, and average capital productivity, CP_{it}, are also included in the empirical form, for we have taken their influences on the actual production into account.

results from rural-urban immigration, contributes to the output level. Because the increase of output level expands the labor demand of urban residents, as shown in eq. (1)", the product effect of rural-urban immigration is positive.

In addition, all the other estimates are also consistent with the theoretical model. A higher level of resident wage, w^R_{it}, reduces the labor demand for resident (eq.(1)"), and an increase in migrant wage, w^M_{it}, leads to a lower level of migrant labor demand (eq. (2)"). Furthermore, higher capital price has a negative effect on output (eq.(6)"). Finally, a higher level of migration acceptance, θ_{it}, has a significant positive effect on immigration, which is indicated in eq.(10)".

In this section, we obtained the two effects of immigration on resident labor demand: a negative substitution effect, and a positive production effect. What is the total effect of immigration? We will use simulations to examine it in the subsequent section.

VI. *Simulation*

We do simulations with the econometric model to examine the total effect of immigration on labor demand of residents. The theoretical background is the comparative statics that we discussed previously. In our model the direct calculation of differentiation is quite complicated so we choose simulations.

As we have discussed, it is not proper to simply increase the number of migrants directly for this purpose because migrant labor supply is endogenous. Instead, we increase the exogenous variable θ_{it}, which is the index for city policy of migrant acceptance, by one standard deviation, which leads to a direct increase in migrant labor supply and, further, a lower level of migrant wage and a higher level of migrant demand and employment. The simulation examines what happens to the demand for residents, when immigration is increased[10].

The simulation result shows that, for all the observations, resident labor demand does not decrease but increases slightly when immigration is encouraged by increasing θ_{it}. The summary of the results are shown in TABLE 3.

The detailed results show that the labor demand and the supply of the rural migrants increased 13.4%; migrant wage declined 2.0% (the rigid resident wages remained unchanged as an exogenous variable). However, firms did not reduce their total demand for resident workers; on the contrary, resident demand slightly expanded by 0.8%. This interesting result can be explained by the growth of output, which increased 8.6%. Since both resident and migrant labors are *p*-substitutes, when migrant wage decreases, firms substitute migrants for residents. However, the decrease in migrant wages simultaneously raises the output level, which leads to a higher demand for both types of labor. These results suggest that the positive effect could be larger than the negative effect concerning resident demand, because the total demand for urban residents shows a substantial increase. Above all, the simulation results indicate that migration does not reduce the labor demand of urban residents.

Note that economic growth is not the sole reason for this result. If the p-substitute effect is extremely large, or the production effect is not sufficient, immigration could still reduce the

[10] We run deterministic simulations, in which the equations of our econometric model are solved for each observation in the data sample, using an iterative algorithm to compute values for the endogenous variables.

TABLE 3. SIMULATIONS RESULTS

	log D^R	log D^M	log S^M	log D^K	log Q	log w^M
Baseline	15.406 (0.61)	14.734 (1.16)	14.734 (1.16)	11.173 (0.75)	8.595 (1.15)	9.710 (0.29)
Scenario	15.414 (0.61)	14.860 (1.16)	14.860 (1.16)	11.286 (0.75)	8.677 (1.08)	9.690 (0.29)
	D^R	D^M	S^M	D^K	Q	w^M
$X^{Simu}-X^{Base}$	39407	336444	336444	8516	462	−326
$\frac{X^{Simu}-X^{Base}}{X^{Base}}$	0.8%	13.4%	13.4%	12.0%	8.6%	−2.0%

Notes:
(1) All the values are the means of the observations, and their standard deviations are in parentheses.
(2) X stands for each variable in the columns. For instance, $X^{Simu}-X^{Base}$ in the column of logD^R is the difference between the scenario solution of D^R and its baseline solution.

demand for urban resident labor and lead to urban unemployment even with economic growth. Immigration influence depends on the comparative size of *p-substitution* and production effects in the actual situation.

In summary, as the estimation and simulation results indicate, in China although migrants and residents are *p*-substitutes for a given level of output, considering the whole economy, migration expansion does not reduce the demand for residents; low cost of migrant work could contribute to economic growth and enlarge the total demand for labor.

VII. *Conclusions*

This paper provided the framework of a structural approach to examine influences of rural-urban immigration on urban areas in developing countries. An inner-city dual labor market model was constructed that led to the following findings. First, the influence of migration on urban resident employment is a combination of both the simple *p*-substitution or *p*-complementary effect and the production effect. The total effect can be derived from a dual labor market model by the resident labor demand function, the determination equation of output level, and the equilibrium of migrant labor demand and supply functions. Second, depending on the actual situation, rural-urban immigration could either increase or decrease unemployment rate of urban residents.

We examined China's labor market using the above model and estimated an econometric model of China's dual labor market in urban areas. We did not find evidence that migration contributes to urban unemployment. Simulation results illustrated a significant positive effect of migrant employment on resident labor demand.

The resident labor demand estimation equation indicates that a decrease of migrant wages leads to a lower level of resident demand with other factors fixed, so the labors of resident and migrant are *p*-substitutes. However, when considering endogenous output level and the whole dual labor market with our model, we found that migrant employment increases the labor demand of urban residents because lower cost of migrants' work could contribute to economic growth that leads to a higher level of total labor demand.

Although our study might be the first to address this issue with structural models, actually, some Chinese city governments seem to have realized the contribution of migration and eased restrictions in recent years. In 2007, many large cities began to stop charging migration fees. In 2009, Guangdong, Hunan, and other provinces held free recruitment meetings for rural migrants to encourage them to work in cities. Excessively strict migration restrictions don't provide good protection from unemployment for residents, and it could even cost the city the chance to improve employment and develop its economy.

We hope that this study contributes to an increased awareness of China's labor market. Moreover, for empirical studies on immigration in China and other developing countries, using structural econometric models might be the first try. Further empirical studies on developing countries with a structural approach would benefit their economic growth.

APPENDIX I. Calculation and Confirmation of Capital Data

The data of capital prices, $(r+\delta)$, are calculated by the following steps.

First, we calculate the GRP deflators(%) and inflation rates. The data of the nominal Gross Regional Product (GRP^{*}_{it}) and the real GRP index (GRP^{index}_{it}) are available from NBS (2005-2008a). The real GRP index is defined as

$$GRP^{index}_{it}=\frac{GRP^{re}_{it}}{GRP^{re}_{i,t-1}},$$

where GRP^{re}_{it} is the real GRP of region i in year t.

The GRP deflator is defined as:

$$GRP^{deflator}_{it}=\frac{GRP^{*}_{it}}{GRP^{re}_{it}}*100,$$

where we assume that the price in year $(t-1)$ is 1 and $GRP^{*}_{i,t-1}=GRP^{re}_{i,t-1}$.

Using GRP^{*}_{it} and GRP^{index}_{it}, the GRP deflator(%) is calculated as:

$$GRP^{deflator}_{it}=\frac{GRP^{*}_{it}}{\frac{GRP^{*}_{i,t-1}}{GRP^{index}_{it}}}*100.$$

As a result, we have the following inflation rates, g^{p}_{it}:

$$g^{p}_{it}=(\frac{GRP^{deflator}_{it}}{100}-1)*100\%.$$

The second step is for depreciation rate δ_{it}.

Although only the data of depreciation amount D^{*}_{it} and fixed investment I^{*}_{it} of the current prices are available, they enable us to get an approximate value of the depreciation rate:

$$\begin{aligned} KF_{it}&=KF_{i,t-1}-D_{i,t-1}+I_{it}\\ KF_{i,t-1}&=KF_{i,t-2}-D_{i,t-2}+I_{i,t-1}\\ &\vdots\\ KF_{i1}&=KF_{i0}-D_{i0}+I_{i1}, \end{aligned}$$

where KF_{it} is the capital stock of province i in year t, $D_{i,t}$ is the amount of depreciation of province i in year t, and I_{it} is the capital investment of province i in year t.

This leads to:

$$KF_{it}=KF_{i0}-(D_{i0}+\cdots+D_{i,t-1})+(I_{i1}+\cdots+I_{it}).$$

The data cover 1993 to 2007, and the capital stock of $KF_{i,2007}$, $KF_{i,2006}$, $KF_{i,2005}$, and $KF_{i,2004}$ is directly needed for this study:

$$KF_{it}=KF_{i,1993}-(D_{i,1993}+\cdots+D_{i,t-1})+(I_{i,1994}+\cdots+I_{it}),$$

where t=2004, 2005, 2006, and 2007. Further, $KF_{i,1993}$ can be ignored because its value is small compared to $(I_{i1}+\cdots+I_{it})$.
As a result, $KF_{it}\approx-(D_{i,1993}+\cdots+D_{i,t-1})+(I_{i,1994}+\cdots+I_{it})$.
We calculate RHS as follows.
Assume the price in 2007 is 1, we have:

$$D_{i,07}=D^*_{i,07}$$
$$D_{i,06}=D^*_{i,06}(1+g^p_{i,07})$$
$$D_{i,05}=D^*_{i,05}*(1+g^p_{i,07})*(1+g^p_{i,06})$$
$$D_{i,04}=D^*_{i,04}*(1+g^p_{i,07})*(1+g^p_{i,06})*(1+g^p_{i,05}).$$
$$\vdots$$

This is the same as I_{it}.
Finally, the depreciation rate is obtained as

$$\delta_{it}=\frac{D_{it}}{KF_{it}},$$

where t=2004, 2005, 2006, and 2007.
In the last step, real interest rate r_{it} is easily obtained by

$$r_{it}=r^*_{it}-g^p_{it},$$

where r^*_{it} is the nominal interest rate and g^p_{it} is the inflation rates calculated above.
The data of r^*_{it} are the averages of all the nominal interest rates in year t, including 3-month, 6-month, 1-year rate, and so on.

To test the reliability of our estimated data, we calculated the input of capital-labor ratio $\frac{K_{it}}{L_{it}}$ with them. Capital input K_{it} is calculated as $K_{it}=KF_{it}*(r_{it}+\delta_{it})$, labor input L_{it} is obtained by $L_{it}=w^R_{it}*E^R_{it}+w^M_{it}*E^M_{it}$, where w^R_{it} and w^M_{it} are the calculated wages of residents and migrants, respectively. $\frac{K_{it}}{L_{it}}$, which is derived from the estimated data, is described as Fig.1. In official GDP and GRP statistics, there are direct capital input and labor input data. Capital-labor ratio $\frac{K^{GRP}_{it}}{L^{GRP}_{it}}$ is shown as Fig.2.

Fig.1 and Fig.2 show no noticeable disparity of mean, median, and standard deviations between our calculated data and official GDP data.

Furthermore, since we use the data of regional industrial electricity as the surrogate variable of capital input D^K_{it}, we also tested the calculated capital stock data by regression with the regional industrial electricity data, as $KF_{it}=\alpha D^K_{it}+\chi$. The adjusted R-squared of the panel least squares is 0.84, and the t-statistic of the coefficient α is 21.6. The result indicates a strictly close relationship between surrogate variables and calculated capital stock. Accordingly, the calculated data are reliable for estimation.

FIG. 1. K_{it}/L_{it} BY CALCULATED DATA

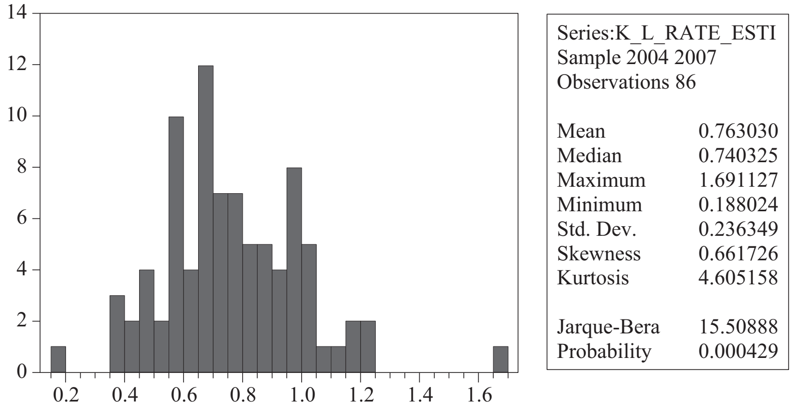
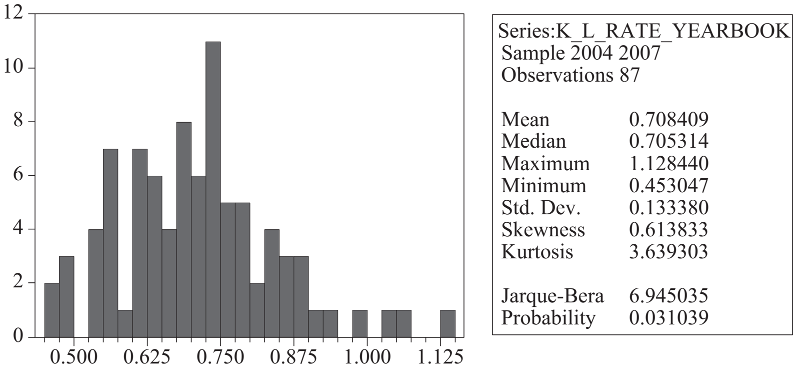


FIG. 2. $K_{it}^{GRP}/L_{it}^{GRP}$ BY GRP DATA



APPENDIX II. The Main Data List

	D^R (person)	S^R (person)	E^M (person)	D^K (kw/h)	w^R (*yuan*)	w^M (*yuan*)	$(r+\delta)$ (%)	Q (billion *yuan*)
Mean	5813887	6459616	4478602	86532.35	22380.76	16836.89	10.32	731.26
Med	5527525	6219784	2619352	59320.32	20246.93	15587.61	10.23	532.19
Max	13763024	14480000	20322882	321408.60	51472.66	39456.13	16.67	2938.89
Min	862397	923664	97494	5418.78	12981.99	10609.20	1.95	54.28
S. D.	3320567	3640403	4853612	67900.48	7509.34	5030.34	2.72	630.25
Obs.	86	86	86	86	86	86	86	86

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