Article

Determinants of Workplace Choice: How Important Is the City's Ecological Environment in Attracting Jobseekers in China

Bowen Shen ¹ and Shijie Zhang ^{2,*}

¹ School of Economics and Trade, Hunan University, Changsha 410006, China; bowenshen@hnu.edu.cn

² Administrative Bureau of Chinese Academy of Sciences, Chinese Academy of Sciences, Beijing 100086, China

* Correspondence: zhangshijie@kezhuwuyue.com

Abstract: People's demands for a better environment have become increasingly strong, and the construction of ecological civilization has risen to the national level of strategic decision making. This paper studies the relationship between city ecological environment and labor mobility decision-making from the micro-individual perspective by matching the latest online resumes micro-big data with the ecological environment index data of 279 cities in China. By estimating a conditional logit model, we find that job seekers are more willing to move to the city with better ecological environment during the job transaction process. The heterogeneity results suggest that the higher the education level and the older the age is, the more sensitive the female are to the city's ecological environment when switching the workplace. Combined with empirical conclusions, this paper argues that the government in China can open a new way in the competition of labor resources through urban ecological civilization construction and reserve high-quality "fuel" for accelerating economic transformation and achieving high-quality development.

Keywords: eco-environmental carrying capacity; labor mobility; city selection

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1. Introduction

People's demands for a better environment have become increasingly strong, and the construction of ecological civilization has risen to the national level of strategic decision making. In China, the impact of regional environmental quality on the assessment and promotion of government officials has gradually increased [1], all of which indicate that the government is paying more and more attention to ecological environmental governance. However, on the empirical side, we see relatively scarce evidence of how workers are making actual city choices when seeking jobs on the labor market, especially when migration costs and institutional barriers are involved. In this study, we employ a unique sample of online job seekers to identify the importance of cities' environment quality in attracting workers, based on real-world observation of an individual's preferred workplace.

Our unique data uses information from around 500,000 individual resumes filed with a leading recruitment website in China. It is worth noting that our dataset provides detailed information regarding work experience and the planned work choice of job seekers. A standard conditional logit approach that focuses on city attributes is adopted. Moreover, to alleviate the potential estimation bias, our methodology relies heavily on the estimation of the city choice with three dimensional fixed effects related to industries, occupations, and the cities of the last job.

The results show that cities' ecological environment situation indeed plays a prominent role in the locational choice of utility-maximizing workers. We further conduct a set of heterogeneity analyses based on personal attributes and preferences. On educational attainment, individuals with more years of schooling or higher degrees are found to be more attracted by a better environment when selecting job locations. On personal attributes, the younger and female job seekers put more weight on the cities' ecological environment

when intending to switch job, comparing to the younger and male ones, respectively. On the employment status, these on-the-job seekers seem to be more attracted by the level of the environment amenities in candidate cities during the job changing process. On the migration types, the returnees and the migrated job seekers seems pay less attention on the environment quality of the destination cities for their next job.

In summary, the contribution of this paper to the current literature is threefold. First, it adds both to the city environment literature and migration incentives literature by highlighting the importance of cities' environment situation to workers in China. The main results stay robust to include a rich set of control variables and using the historical measures of ecological environment as alternative measurements for cities' environment status. Due to the data limitation, to the best of our knowledge, there are still scarce studies to examine the migration determination at the city level for China, except for [2]. Second, by combining individual-level micro-big data from online resumes with city level data, we obtain credible information on personal attributes and locational preference of job seekers. This unique dataset enables us to conduct unprecedented analyses at the level of individual job seekers, by differentiating the attractiveness of a city's ecological environment among various subgroups of interest. Finally, a worker's willingness to move is likely to be determined before receiving any offers and should hence be less sensitive to potential reverse endogeneity. Thus, analyzing the effects of stated willingness to move rather than observed migration is a critical contribution of this paper.

The remainder of this paper is organized as follows. Section 2 reviews relevant literature on how cities' levels of environment situation and other attributes attract workers. Section 3 describes the conditional logit framework used for empirical estimation. Section 4 describes data and variables. Section 5 presents the main results and conducts heterogeneity analyses. Section 7 concludes the study.

2. Literature Review

Labor migration is likely to be a selected sample in terms of joint observable and unobservable factors, generally including individual and city-level factors. Generally speaking, city-level economic factors are the most important factors to attract labor mobility, such as wage level, unemployment rate and housing price level [3]. In recent years, the role of human capital externalities has been gradually attached importance [2,4,5]. Social factors at the urban level are also important factors in labor mobility. Tiebout (1956) pointed out that public service of the government has a significant effect on migration, namely the theory of "voting with your feet" [6]. A large number of literatures have confirmed the existence of this theory [7–9].

The urban ecological environment affects the health level and life quality of labors, but also affects the movement and supply of labor across regions [10]. From the aspect of health and life quality, previous studies have shown that environmental pollution leads to the decline of workers' health and significantly increases the health risks of workers, such as cardiovascular diseases [11], respiratory diseases [12], hospitalization rate [13] and mortality rates [14,15]. Deaton and Stone (2013) found a certain negative relationship between the degree of urban air pollution and residents' happiness [16]. Similarly, using CFPS data and API values at the city-level, Zhang et al. (2017) found that urban air quality had a significant impact on people's mental health and subjective well-being [17].

As mentioned by Moretti and Neidell (2011), the states and cities compete based on income and corporate tax rates, labor, and environmental regulations, which implies that the city-level environment quality should be highly related to the labor supply [12]. Literature on the impact of environmental quality on labor supply mainly focuses on the aspect of labor supply time and production efficiency [18]. Hanna and Oliva (2011) used Mexico's labor supply data and pollution data to conclude that the improvement of environmental pollution significantly improved the level of labor supply and was independent of supply and demand changes in the labor market [19]. Graff and Neidell (2011) drew a consistent conclusion by using ozone concentration data and labor productivity data in

the United States, and the decrease in ozone concentration significantly improved labor productivity [20]. Asadi et al. (2019) show that labor-migration of young men is also affected by positive precipitation shocks, but the impact could be explained by the local unemployment rate [21].

By using city-level data, only a few studies researched migration behavior or intentions in China, especially focus on the urban environment quality. For example, Zhang et al. (2019) discussed the association between the Hukou constraint and labor force return migration behaviors [22]. Su et al. (2021) documented the influence of human capital agglomeration on city choice of high-skilled workers [2]. Therefore, to better understand the trends in migration in the job-changing context and accurately estimate the different economic and social impacts of them, we utilize a newly obtained online-resume data incorporating origin city, destination city, industry, and occupation information.

3. Empirical Model

In order to study the impact of the ecological environment in determining workers' locational choices under the framework of maximizing random utility, this paper uses the conditional Logit model. This model has a solid microeconomic foundation and enables us to identify how an individual makes locational decision in a utility-maximization framework. This model can produce more credible estimates when the set of feasible choices is rather large.

To evaluate how the attributes in city c and the personal characteristics in determining workers' migration intentions in the next job, we use the multi-logit model proposed by McFadden (1974) [23]. The floating population chooses a migration strategy out of 279 mutually exclusive candidate cities. Specifically, let U_{ij} denote utility function associated with the j -th treatment, $j = 0, 1, \dots, J$ for individual i .

The utility an individual i derives by choosing destination j takes the form:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

Let the deterministic component of the utility function for individual i , V_{ij} , be a function of personal and location-specific characteristics,

$$V_{ij} = F(X_i, E_j, C_j, Z_{ij}) \quad (2)$$

where X_i is a vector of individual characteristics such as age, gender, employment status and education; E_j stands for locational ecological environment situation; C_j represents a vector of employment-related city characteristics, such as GDP per capita, population size and unemployment rate; Z_{ij} is a set of variables dependent on both one's origin and city destination, such as the distance between the origin and destination, and its squared term.

A representative worker chooses city j that maximizes his/her random utility function:

$$U_{ij} \geq U_{ik}, \forall k \neq j \quad (3)$$

According to McFadden (1974), if the residual in Equation (1) has a Type 1 extreme value (Weibull) distribution, then the probability that city j is chosen by individual i is the conditional multinomial logit:

$$\text{Prob}(\text{chosen}_{ij} = 1) = \frac{\exp(V_{ij})}{\sum_{k=1}^J \exp(V_{ik})} \quad (4)$$

where $V_{ij} = X_i' \alpha + E_j' \beta + C_j' \gamma + Z_{ij}' \delta$, and, $\text{chosen}_{ij} = \begin{cases} 1 & \text{if city } j \text{ is chosen by migrant } i \\ 0 & \forall k \neq j \end{cases}$.

Taking into account there are 279 candidate cities, it is hard to implement the conditional logit model. Moreover, to improve the estimation precise, we employ a random sampling procedure by constructing a subset of 20 cities that consist of one city that a job-

seeker will choose and a random sample of 19 cities from remaining city alternatives [24,25]. As mentioned by Ben-Akiva and Lerman (1985), consistent estimator can be obtained by taking a random sample of alternatives from the full choice set [26]. Consistency holds provided that first, independence from irrelevant alternatives holds, which is ensured by the MNL model, and second, if an alternative is included in an assigned set, then it has the logical possibility of being an observed choice from that set, which is satisfied because random selection satisfied the “uniform conditioning property” (McFadden, 88–89).

4. Data and Choice of Variables

4.1. Data Sources

The individual level data used in this paper are obtained from Zhaopin.com, a leading Chinese job recruitment website founded in 1994. On this online recruiting platform, the registered job seekers firstly create their accounts by providing detailed information on personal characteristics, education background, work experiences (i.e., number of jobs, firm size, the property of the firm, the wage of pre-job, etc.), and job-search preference (i.e., expected industry, current work city, expected wage, etc.). The registered employers and HR officers could browse these constructed resumes for free. That is, the private information such as email, telephone number, and ID of these employees are only available when the employers pay for this Zhaopin.com. In 2019, Zhaopin.com in China has 170 million registered users, with approximately 4.88 million daily active users, which represents a significant proportion of nationwide job seekers.

We obtained the latest 78,000 resumes as of June 2016 across 52 industries by downloading the newest 30 webpages within each industry (each webpage contains 30 resumes). Raw data from the original HTML forms are then converted into analyzable numerical forms using the JAVA program. Considering our main focus is about the location choice intentions, we restrict our sample to individuals who are 18–65 years of age, with available information regarding the hukou registration cities and the expected working cities. In addition, we excluded the sample expected to have part-time job and internships” (1820 observations), as well as the education category with “Others” (1165 observations). It yields a final sample comprised of 54,924 individual resumes. One caveat is that, according to the design of this online recruiting platform, the job seekers are only required to provide one preferable expected work city.

Considering that the job seekers in 2016 make the decisions on job change based on the previously observable city-level information, we mainly adopt the city-level data from the 2016 City Statistical Yearbook of China, which provides comprehensive city-level details in 2015. Moreover, some city-level social capital measures are from the 2010 Population Census of China, the released latest nationwide census on Chinese citizens’ household and personal information. In addition, based on these resumes’ desired work city, we match these three datasets to form a sample of 279 cities, which covers around 92% of municipal cities in China.

4.2. Variables of City Attributes

The main explanatory variable of interest is the environment quality. Graymore et al. (2010) proposed the concept of eco-environmental carrying capacity and suggested that the environmental quality of the working city could become an important indicator of labor mobility [27]. Using the carrying capacity of ecological environment as the measurement index is better mainly because it comprehensively measures the urban ecological environment from all aspects. Here, we construct an environmental index based on the average value of various indicators, including the industrial waste-water discharge, industrial dust emissions, harmless treatment rate of domestic garbage, and green coverage of the urban built-up areas.

Referring to Egger (2006) and Wang and Zeng (2013), we use the entropy weight method to calculate the ecological environment carrying capacity (EECC index) of each city. Compared with these traditional methods, such as factor analysis and weighting method,

this method considers the disorder degree of information, which is in accordance with the principle of minimum factor limitation [28,29]. The carrying capability is determined by the scarcest resources. We must standardize the indicators. The entropy weight method uses the overall concept to measure the uncertainty contained in each factor. It is a deeper characterization of uncertainty. We use the entropy weight method to assign weights to impact indicators to enhance the objectivity of the results.

For the positive effect index, there are:

$$x_{ij}^* = (\max(x_j) - x_{ij}) / (\max(x_j) - \min(x_j)), (i = 1, 2, \dots, t; j = 1, 2, \dots, p) \quad (5)$$

For the negative effect indicators, there are:

$$x_{ij}^* = (x_{ij} - \min(x_j)) / (\max(x_j) - \min(x_j)), (i = 1, 2, \dots, t; j = 1, 2, \dots, p) \quad (6)$$

where $\max(x_j)$ and $\min(x_j)$ are the maximum and minimum values of the x_j index, respectively. Then we use the entropy weight method to calculate the weight. The principle is mainly assuming that there are m programs and n evaluation indicators. The original indicator data matrix $X = (x_{ij})_{m \times n}$. The specific steps are:

(1) Calculate the proportion of index x_{ij} p_{ij} , $p_{ij} = x_{ij} / \sum_{i=1}^m x_{ij}$, where p_{ij} represents the proportion of calculating the index value of the i th scheme under the j th index.

(2) Calculate the entropy value e_j of the j th index, where $e_j = -k \sum_{i=1}^m p_{ij} \ln p_{ij}$, $k = 1 / \ln m$, $e_j \in (0, 1)$, e_j represents the entropy value of the j -th indicator, and k is the adjustment coefficient.

(3) Calculate the difference coefficient g_i of the j -th indicator, where the calculation formula is $g_i = 1 - e_i$, the greater the value of g_i , the stronger the indicator x_j is in the evaluation.

(4) Calculate the weights of indicators $w_j = g_j / \sum_{j=1}^n g_j$, where the weight of all indicators is 1.

(5) $B_j = \sum w_j x_{ij}$, $i = 1, 2, 3, \dots, n$; $j = 1, 2, 3, \dots, n$, B_j is the bearing capacity index, w_j is the index weight.

(6) Urban EECC index $R_A = \sum_{j=1}^n B_j$.

Based on our calculation the average ecological environment carrying capacity of provincial capital cities and municipalities is 6.04, and the standard deviation is 2.29. The average ecological carrying capacity of non-provincial capital cities is 4.98, and the standard deviation is 0.71. The average ecological environment carrying capacity of provincial capital cities and municipalities are larger than non-provincial capital cities. Furthermore, 70% of the provincial capital cities and municipalities rank in the top 80. The largest and smallest EECC index value is in Urumqi and in Lanzhou, respectively. Among municipalities, Shanghai ranks 7th, Chongqing 13th, Tianjin 24th, and Beijing 31st, all in the forefront of ranking. Beijing has the lowest EECC index among the four municipalities, mainly due to the large difference between the two indicators of industrial wastewater discharge and industrial smoke and dust discharge.

In addition, as shown in the Figure 1, this paper estimates the density of the ecological environment carrying capacity. Furthermore, 82.28% of the urban ecological carrying capacity indexes lie between 4–6. This is related to the unbalanced development among different regions in China. Many of the cities have ecological environment carrying capacities lower than the average value, and only a few cities have deviated from this range due to their own natural environment endowment or others.

The other city-level characteristics mainly include the economic status, human capital level, unemployment rate, average wage, industrial structures, availability of public amenities, and environment situation, etc. Referring to some previous literature, we use GDP per capita, average annual wage, population size, and the unemployment rate to capture the city-level economic situation. Moreover, we also adopt the city population's average years of education to measure the cities' human capital level (Su et al., 2021) [2]. The city's industrial structures directly related to the job opportunities are calculated by

the employment share of the secondary and tertiary industries. Besides, we also use the number of hospital beds per capita to account for public services. Further, the FDI-to-GDP ratio is used to reflect cities' levels of openness, as Su et al. (2021) and Florida et al. (2012) illustrated that the milieu of openness played a significant role in shaping regional talent distribution [2,30].

Figure 1. Distributions of EECC index among different cities.

Except these above city attributes, we also classified the cities of the last job into three categories according to the economic hierarchy, which are used to capture the effects of the public amenities availability related to the barriers of household registration. We classified cities in our sample into three hierarchies, including the first tier to the third or below. As clarified by Zhang et al. (2020), this city classification is not official, but is commonly used by the general public and researchers. The first tier includes Beijing, Shanghai, Guangzhou, and Shenzhen, and the Hukou constraints are highest in those cities. The second tier includes developed provincial capital cities and regional economic centers [22]. The third-tier or below cities are composed of less developed cities with relatively lower Hukou stringency.

Indicated by Table 1, there exists a high level of disparity in economic indicators across cities, especially for the average wage. For example, the average wage in the richest city is around three times more than that in the most impoverished city. The population also distributes highly unequally, and the largest city's population size is over 160 times that of the smallest one. The city level's human capital stock also varies dramatically. The difference in schooling years between the most educated and the less educated cities is more than five years. Similarly, cities differ substantially in their public services and amenity conditions. Overall, there exists a high degree of heterogeneity, along with socioeconomic factors across cities in our sample. These substantial variations justify our use of city-level data instead of data at more aggregate levels (e.g., provincial data). In addition, in our sample, more than 77.6% of job seekers previously worked in the 15 major cities of their last job (e.g., these top twenty cities of the last job listed in Appendix A Table A1). Around 46.2% of these job seekers focus on four mega cities: Beijing, Shanghai, Shenzhen, and Guangzhou, while Beijing alone attracts about 15.2% of workers.

4.3. Variables of Individual Characteristics

The job seekers' individual information includes personal characteristics, e.g., age, sex, education, marital status, and employment status. It also consists of the detailed *Hukou* cities (or registered permanent residence), current cities in the last jobs, and the preferable expected work cities. The descriptive statistics for individual variables are reported in Table 2. The percentage of unemployed job seekers accounts for 66.1%, and the percentage of on-the-job seekers accounts for about 33.9%. In our sample, job seekers generally hold a

relatively higher education level. For example, 42.4% of them have a college degree, but the percentage of high school or below only accounts for 4.9%. Thus, the sample may largely represent the high-educated job seekers, rather than the whole labors in the Society in China. The average age of the job seekers is 29 years old. More than half of the job seekers are males, accounting for 57.3%. In terms of the detailed features of the last job, more than 68% of the job seekers have no management experience (around 68.4%). There are around 32% jobseekers in the 4001–6000 Yuan wage rank in the last job data category.

Table 1. Descriptive statistics of city attributes of the expected city.

Variable	Label	Obs	Mean	SD	Min	Max
Environment index	Ecological carrying capacity in 2015	279	5.09	1.32	0.68	15.99
GDP per capita	Per capital GDP in 2015 (10,000 Yuan)	279	4.93	0.29	0.10	20.02
Population	Total population in 2015 (1 million)	279	4.45	3.18	0.20	33.74
Unemployment rate	Share of the unemployed persons registered in 2015	279	0.06	0.07	0.00	0.31
Human capital	Average schooling years in 2010 census	279	8.94	0.84	6.55	11.71
Public services	Hospital-bed number-per capital	279	0.52	0.41	0.10	3.44
Average wage	Average annual wage in 2015 (10,000 Yuan)	279	7.34	1.941	3.523	11.46
Industry structure	The employees in tertiary industries/The total employees (%)	279	0.52	0.13	0.17	0.86
FDI-GDP ratio	Foreign direct investment as a share of city GDP	279	0.023	0.021	0.00	0.125
Migration distance	City of the expected job and the Hukou city (1000 km)	279	0.27	0.43	0.00	3.68

Note: The data sources include City statistical Yearbook in 2016 of China and 2010 population census. The environment index is a composite index for urban ecological environment carrying capacity, based on a city's industrial wastewater discharge, industrial dust emissions, per capita green area, green coverage of built-up area, and harmless treatment rate of domestic garbage.

Table 2. Summary statistics of individual variables.

Variables	Mean	SD	Min	Max	Obs
Employment status					
Unemployed	0.661	0.489	0	1	54,113
On-the-job	0.339	0.473	0	1	54,113
Education level					
High school or below	0.133	0.257	0	1	54,113
Junior college	0.399	0.480	0	1	54,113
College degree	0.424	0.500	0	1	54,113
Master's degree or above	0.049	0.244	0	1	54,113
Tenure of last job	2.336	3.349	0	43	54,113
Specific human capital					
Management position in the last job = 1	0.316	0.498	0	1	53,210
Demographics					
Age	28.62	5.81	18	60	54,113
Gender (male =1)	0.63	0.48	0	1	54,113
Marital status					
Married	0.199	0.399	0	1	54,113
Unmarried	0.329	0.470	0	1	54,113
Not displayed	0.472	0.499	0	1	54,113
Wage rank of last job (RMB)					
≤4000	0.325	0.467	0	1	50,720
4001–6000	0.320	0.467	0	1	50,720
6001–8000	0.160	0.367	0	1	50,720
8001–10000	0.084	0.278	0	1	50,720
10,000–15,000	0.070	0.278	0	1	50,720
>15,000	0.042	0.201	0	1	50,720
Migrated (dummy)	0.55	0.497	0	1	49,867
City changers (dummy)	0.25	0.431	0	1	49,867
Returnees (dummy)	0.03	0.162	0	1	49,867

Data source: zhilian.com.

5. Empirical Results

Table 3 presents our baseline results estimated by the conditional logit model. Note that all regressors are normalized to have a mean of zero and standard deviation of one. Thus, the estimated coefficients reflect how one standard deviation increase in the regressors affect the likelihood of a city being selected by job seekers. In Column (1) of Table 3, we include three generic economic factors commonly used in the migration literature: GDP per capita, population, and unemployment rate. Consistent with findings of most studies, our results show that the GDP per capita and population have a positive and significant impact on the attractiveness of cities; meanwhile, higher unemployment rate is associated with lower desirability of cities. In Column (2), we further include distance between an individual's *Hukou* cities and the city he/she is seeking job at, as well as a distance-squared term to capture a non-linear effect of distance. Although some scholars have pointed out the “death of distance”, our results provide evidence for the contrary: the distance variables play a significantly deterrent role, and incorporating distance alone boosts the (pseudo) r squared from 0.41 to 0.82. This suggests that the jobseekers may have less incentive to migrate to other cities far from their *Hukou* cities, concerning the psychological costs of separating from their familiar culture and family ties [31,32]. In Column (3) of Table 3, we further include the most interesting variable of environment index, proxied by the of eco-environmental carrying capacity at the city-level. Our results show that the environment situation plays a prominent role in these workers' city choices. In fact, the estimated effect of the ecological environment is smaller than that of GDP per capita, indicating a statistically significant and economically larger effect related to the economic factors.

Table 3. Conditional logit estimates for the city choices of job seekers, 2016.

	(1)	(2)	(3)	(4)	(5)
GDP Per capita	1.614 *** (0.007)	1.544 *** (0.017)	0.701 *** (0.023)	0.576 *** (0.025)	0.545 *** (0.030)
Population	1.424 *** (0.007)	1.463 *** (0.016)	1.138 *** (0.017)	1.099 *** (0.018)	1.078 *** (0.020)
Unemployment rate	−0.256 *** (0.015)	−0.270 *** (0.025)	−0.198 *** (0.023)	−0.142 *** (0.024)	−0.147 *** (0.024)
Distance		−10.378 *** (0.069)	−9.966 *** (0.069)	−10.061 *** (0.072)	−10.055 *** (0.072)
Distance squared		2.776 *** (0.023)	2.631 *** (0.022)	2.701 *** (0.024)	2.706 *** (0.024)
Environmental index (EECC)			0.235 *** (0.016)	0.205 *** (0.016)	0.164 *** (0.017)
Average wage(log)				0.459 *** (0.262)	0.378 *** (0.044)
Human capital				0.237 * (0.125)	0.179 *** (0.063)
Public service					0.165 *** (0.016)
Tertiary industry emp					0.151 * (0.077)
FDI–GDP ratio					0.096 *** (0.014)
Pseudo_R2	0.412	0.819	0.819	0.809	0.809
N of individuals	49,867	49,867	49,867	49,867	49,867
Observations	997,340	997,340	997,340	997,340	997,340

Note: Standard errors cluster at the city level in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Indicated in Column (4) of Table 3, the environmental index is positive and significant, albeit with a smaller coefficient compared with economic factors and human capital. Column (5) further includes medical services, industry structure, and openness. Our results show that public service plays a positive role. Openness of cities seems to also play a

positive role, while industry structure appears to be unimportant in the locational decisions of high skilled job seekers.

Overall, the estimates in Table 3 provided evidence highlighting the important role of cities' environment in distributing workers across cities. To check whether our findings are sensitive to the specific measurement of human capital we used, in Table 4 we use the percentage of city population with college (or above) degree and the number of higher-learning institutions in cities as alternative human capital measures. The results in column (2) and (3) indicate that the effects of human capital remain positive and statistically significant at the 1% level, albeit with smaller magnitudes compared with that of average educational attainment of city populations.

Table 4. The role of city environment in location choices of labor force.

	(1)	(2)	(3)	(4)
Environmental index	0.166 *** (0.028)			
Environmental index (by factor analysis)		0.103 *** (0.024)		
Environmental index in 2000			0.142 *** (0.033)	
Environmental index in 2000 (by factor analysis)				0.138 *** (0.028)
Human capital	0.237 ** (0.125)	0.179 *** (0.063)	0.198 ** (0.162)	0.194 *** (0.064)
Average wage	0.576 *** (0.025)	1.080 *** (0.020)	0.980 *** (0.021)	0.983 *** (0.021)
Population	1.099 *** (0.018)	1.285 *** (0.017)	0.947 *** (0.022)	0.931 *** (0.021)
Unemployment rate	−0.142 *** (0.024)	−0.095 *** (0.024)	−0.228 *** (0.025)	−0.130 *** (0.024)
Pseudo_R2	0.912	0.908	0.909	0.909
N of Individuals	49,867	49,867	49,867	49,867
Observations	997,340	997,340	997,340	997,340

Note: Standard errors cluster at the city level in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Considering the resume data proving the city preference in the next job, it largely alleviates the potential estimation bias stemming from the reverse causality. However, there may exist omitted variables in the error term that correlate both with cities' average levels of environment quality and the factors linked to the attractiveness of cities. For example, the environment quality may also be correlated with the cities unobservable attributes which may simultaneously affects job seekers' location choices. In addition, the measurement error of the eco-environment carrying capability may also arise the potential estimation bias. Therefore, we use the in eco-environment carrying capability in 2000 (a 16-year lag) as proxies for ecological environment status based on the rationale that these lagged values are correlated with current levels via persistency, but uncorrelated with other contemporaneous factors that influences the attractiveness of cities. Again, taking the measurement error into account, we also construct the lagged environment index by the factor analysis method. Shown in Column (3)–(4) of Table 4, both environment index variables enter with positive and statistically significant coefficients, with magnitudes comparable to those indicated in Column (1)–(2), suggesting that the estimated effects of environment quality are unlikely entirely due to omitted variable bias. Taken together, our results indicate that the eco-environment quality has a consistently positive and significant effect on cities' attractiveness toward workers during the job changing process.

6. Heterogenous Effects

Next, we allow the relative importance of city attributes to differ by individual characteristics. To implement the conditional logit model, we arrange our data in such a way that each individual faces 15 city destinations from which to choose. Assuming that each individual is rational, they will compare the utility derived from each city alternative and choose the city that yields the highest utility level. Note that the individual characteristics, such as age, gender, and education, do not vary within each individual, thus they cannot be directly estimated by running a conditional logit model. However, we can include interaction terms between individual attributes and city attributes in the estimation. The conditional logit model provides the heterogeneous effects of city attributes on the likelihood of a particular city being chosen by individuals of varied personal characteristics.

6.1. Heterogenous Effects by Education Attendance

First, we examine the heterogeneous preference towards various city attributes by individual levels of human capital. While the set of other control variables are identical as model (6) in Table 3, Column (1) of Table 5 uses years of educational attainment as the differentiator for individual human capital, and Column (2) uses a set of dichotomous variables indicating whether an individual has attained a below-Bachelor's degree, Bachelor's degree, or above bachelor's degree, respectively. The estimated coefficients on the interaction term between years of education and cities' average environment quality is positive and statistically significant at the 1% level, indicating that individuals with an additional year of education are more attracted to better environment situation of the cities. Meanwhile, more educated individuals tend to also place more importance on cities' population size, while being less concerned with average wage and unemployment rate.

Table 5. Heterogeneous preferences by workers' levels of human capital.

<i>By an Additional Year of Education</i>		<i>By Levels of Education (Omitted Group: Below BA)</i>	
	(1)		(2)
Education (years) # Environmental index	0.027 ** (0.012)	BA # Environmental index	0.103 *** (0.033)
Education (years) # Human capital	−0.015 (0.013)	Above BA # Environmental index	0.138 ** (0.052)
Education (years) # Average wage	−0.043 ** (0.021)	BA # Human capital	0.248 *** (0.042)
Education (years) # Population	−0.001 (0.006)	Above BA # Human capital	0.704 *** (0.093)
Education (years) # Unemployment rate	−0.064 *** (0.015)	BA # Average wage	0.088 * (0.050)
		Above BA # Average wage	0.451 *** (0.124)
		BA # Population	0.070 ** (0.035)
		Above BA # Population	0.522 *** (0.086)
		BA # Unemployment rate	0.011 (0.049)
		Above BA # Unemployment rate	0.007 (0.082)
Pseudo_R2	0.873		0.884
Individuals	49,867		49,867
Observations	748,005		748,005

Note: Standard errors cluster at the city level in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Furthermore, when a set of dummy indicators is used, our results reveal some non-linearity of preference by individuals' human capital levels. People who have obtained

more advanced degrees place more importance on cities' ecological environment quality. Specifically, individuals with a bachelor's degree are significantly more attracted to the cities' environment situation, compared with those with a below-bachelor's degree (the reference group in the regressions). Moreover, job seekers with a master's degree (or above) are a little bit more strongly attracted to the environment, with estimated coefficient relatively larger than that of bachelor's degree holders (0.14 vs. 0.10). In addition, the more educated jobseekers are increasingly more attracted by the stock of human capital of cities. In contrast, better-educated job seekers do not seem to exhibit discernable differences in their preferences toward unemployment rate, likely because they are more competitive, thus unemployment is less of a concern for this highly educated group.

6.2. Heterogeneous Effects by Personal Characteristics

In Table 6, we examine the heterogeneities among individual's locational choice by introducing a set of dummy variables that differentiate the job seekers: male versus female, young versus older (older refers to those above 30 years of age since our sample consists of mainly young workers), the unemployed and the on-the-job seekers (with unemployed ones as reference group). Table 5 reports the estimated coefficients on the interaction terms between the individual differentiators and city attributes as indicated. All regressions include a full set of city attributes as well as provincial fixed effects. Column (1) of Table 5 indicates that male workers, compared with their female counterparts, tend to gravitate towards cities with more population and higher levels of human capital, meanwhile are less attracted by cities' environment. In contrast, as shown in Column (2), young workers appear to value cities' environment more, while concerning themselves less about other city attributes. As indicated in Column (3), compared with unemployed job seekers, the job hoppers are more attracted to cities' environment, but not necessarily higher income or lower unemployment rate. Thus, our results reveal that cities' environment does play a substantial role in the location choices of female and on-the-jobseekers.

Table 6. Heterogeneous preferences towards environment status by gender, age, and job status.

	Male vs. Female (Female = 0)	Young vs. Older (≥30 Year Old = 0)	By Current Job Status (Unemployed = 0)
	(1)	(2)	(3)
# Environmental index	−0.027 ** (0.012)	0.053 *** (0.013)	0.073 *** (0.019)
# Human capital	−0.015 (0.013)	−0.016 (0.015)	0.025 (0.023)
# GDP Per capita	−0.043 ** (0.021)	0.099 *** (0.023)	0.003 (0.036)
# Population	−0.001 (0.006)	−0.036 *** (0.007)	0.021 * (0.011)
# Unemployment rate	−0.064 *** (0.015)	−0.047 *** (0.016)	−0.060 ** (0.025)
Pseudo_R2	0.612	0.612	0.612
Individuals	49,867	49,867	49,867
Observations	748,005	748,005	748,005

Note: Standard errors cluster at the city level in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.3. Heterogeneous Effect by Migration Types

Our data contains rich information on individual qualifications that allows us to further study different migration directions. Theorists hypothesized that different migration intension of job seekers may be differently attracted by the city-level attributes, especially under the job transaction process. For example, migrants are mainly fueled by investing and capitalizing one's human capital [33]. The return migrants may pay more attention to the family ties, social connects, and high life quality [34].

Here, we further examine the heterogeneous effects of city environment amenities by different migration types. Specifically, “Migrated” is a dummy indicator equal to 1 if one’s current city is different than his/her Hukou registration city; “City changers” is a dummy variable equal to 1 for those looking for jobs in a different city instead of in their current residence city; “Up-level movement” is a dummy variable indicating whether one is looking for jobs in a city that is higher in administrative hierarchy than his/her current city; for example, moving to a first-tier city from a second/third-tier cities, or to a second-tier city from a third-tier city; “Returnees” is a dummy variable equal to 1 for those whose current residence city is different from their hukou registration city (thus migrated), but are seeking jobs in their Hukou registration city.

Our results in Table 7 show that people who have migrated or tend to migrate to a different city place higher priority on cities’ human capital and employment status. In contrast, the environment quality has reverse impact on the job seekers choice on this city. It implies that the intension of these migrated job seekers may focus on finding good position and improve their human capital accumulation. Similarly, the returnees (return migrants) also pay less attention to both environment and human capital of the destination cities. Differently, the “city changers” are positively and significantly attracted by the cities’ environment quality, followed by “up-level movers” who intend to move to cities ranking higher in hierarchical levels than his/her current city. Overall, these results indicate that the jobseekers sort themselves into cities with different environment situation by different migration types.

Table 7. Heterogeneous preference towards ecological environment by mobility types.

	(1)	(2)	(4)	(3)
	Migrated	City Changers	Up–Level Movers	Returnees
# Environmental index	−0.155 *** (0.033)	0.101 *** (0.027)	0.297 *** (0.037)	−0.382 *** (0.081)
# Human capital	0.537 *** (0.041)	0.977 *** (0.046)	0.637 *** (0.048)	−0.268 *** (0.041)
# Average wage(log)	0.063 (0.049)	0.600 *** (0.058)	1.429 *** (0.063)	−0.817 *** (0.101)
# Population	0.135 *** (0.034)	1.101 *** (0.042)	0.905 *** (0.040)	0.236 *** (0.075)
# Unemployment rate	−0.452 *** (0.060)	−0.597 *** (0.084)	−0.899 *** (0.076)	0.109 (0.096)
Pseudo_R2	0.914	0.923	0.926	0.913
Individuals	49,867	49,867	49,867	49,867
Observations	748,005	748,005	748,005	748,005

Notes: 1. “Migrated” equals 1 if one’s current city is different than his/her Hukou registration city; “City changers” refers to those who are looking for jobs in a different city than their current residence city; “Up-level movement” is a dummy variable indicator; whether one is looking for jobs in a city that is higher in administrative hierarchy than the current city, for example, moving to a first-tier city from a second/third-tier cities, or to a second-tier city from a third-tier city; “Returnees” are defined as those whose current residence city is different from their hukou registration city and are seeking jobs in their Hukou registration city. 2. Standard errors cluster at the city level in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

7. Conclusions and Remarks

As the economic development level of China and the income level of labors have increased, labors may pay more attention to life quality, and their migration decisions may be increasingly affected by city environment quality. In this study, we examine the important role of city’s environment quality in the locational choices of job seekers in China. We adopt a conditional logit modeling strategy to produce credible estimates within a utility maximization framework. We find that although human capital, wages, unemployment rate, and population size have significant impacts on the location decisions of job seekers, the ecological environment status of the city also play a substantial role in attracting workers from the job changing perspective.

Our results confirm that workers are not randomly assigned to cities; rather, they are self-selected to cities of various attributes. We find that there is a high level of heterogeneity among job seekers, and more capable, female workers, and the employed workers tend to pay more attention on cities' environment quality when choosing the work location for the next job. Moreover, the attractiveness of the cities of the environment quality is also related to the migration patterns. Only the "city changers" and the "up-level movers" who intend to move to cities ranking higher in hierarchical levels than his/her current city are positively and significantly attracted by the cities' environment quality. In contrast, the environment quality of the destination cities seems to be unnecessary for the job seekers who intend to return to the Hukou cities and these migrated job seekers.

We acknowledge a few limitations of this study. First, this study relies on a cross-sectional dataset, thus we are unable to determine whether the tendency for people to city environment quality has been lessened or intensified over time. Second, we rely on a conditional logit model, which is unable to purge the endogeneity concerns associated with omitted variables. Nevertheless, we have attempted to alleviate the endogeneity issues utilizing a number of econometric techniques. Finally, considering the sample from these online jobseekers, the estimates may not well reflect the city preferences of whole job seekers in China, especially for the low-educated ones. Furthermore, we will solve this problem when the national and representative data are available. Overall, we find that cities ecological environment quality tends to be significantly and positively associated with individual's city choice during the job transaction process, especially for those with higher levels of human capital.

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Appendix A

Table A1. Distribution of city choices of the job seekers.

City	Ranking	Share (Percent)	Cumulative	No of Individuals
<i>Beijing</i>	1	16.08	16.08	5391
<i>Shanghai</i>	2	8.33	24.41	2792
<i>Shenzhen</i>	3	6.07	30.48	2036
<i>Guangzhou</i>	4	5.53	36.01	1853
<i>Chengdu</i>	5	4.2	40.21	1409
<i>Tianjin</i>	6	4.08	44.29	1369
<i>Nanjing</i>	7	2.85	47.14	954
<i>Xi'an</i>	8	2.83	49.97	950
<i>Hangzhou</i>	9	2.79	52.76	934
<i>Wuhan</i>	10	2.53	55.29	849
<i>Zhengzhou</i>	11	2.34	57.63	786
<i>Chongqing</i>	12	2.2	59.83	739
<i>Shenyang</i>	13	2.1	61.93	703

Table A1. Cont.

City	Ranking	Share (Percent)	Cumulative	No of Individuals
Suzhou	14	1.79	63.72	599
Qingdao	15	1.69	65.41	567
Changsha	16	1.59	67	533
Dalian	17	1.35	68.35	453
Jinan	18	1.31	69.66	440
Changchun	19	1.15	70.81	384
Harbin	20	1.07	71.88	360

Data source: author's calculation based on resume data from zhilian.com.

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