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The Impact of Air Pollution on the Willingness to Stay in Cities: Evidence from A Chinese Survey

He Zhang* · Tackseung Jun**

대기 오염이 도시 거주 의도에 미치는 영향: 중국 자료를 중심으로

장하* · 전택승**

Abstract: China's rapid economic growth and accelerated urbanization have significantly increased labor force mobility. The choice of city residence and long-term residence intentions of migrants will have significant consequences on both economic output and societal dynamics. This paper investigates the impact of air quality on the long-term residence intention of migrants. By matching an individual-level survey on willingness to stay in the long run and the city-level air quality, represented by PM2.5, we find that the willingness to stay in the long run increases with better air quality. This implies that public policy to maintain good air quality is crucial in keeping those who moved to the city.

Key Words: air pollution, PM2.5, internal migration

국문요약 중국의 급속한 경제성장과 가속화된 도시화에 따라 노동력의 이동성이 증가하였으며, 이에 따라 이주자의 거주지 선택과 거주 의도는 중국의 경제와 사회에 중요한 영향을 미치게 되었다. 본 연구는 대기오염이 도시간 이동한 사람들이 장기적으로 도시에 머무르려 하는지에 어떤 영향을 주는지 분석한다. 중국 도시간 이동한 사람들에 대한 서베이 자료와 도시 수준의 PM2.5로 대표되는 대기오염자료를 매칭함으로써, 회귀분석을 통해서 도시의 대기질을 좋은 곳으로 이동한 사람들은 해당 도시에 더 오래 남으려는 유인을 가지고 있음을 알 수 있다. 본 연구결과를 통해서 대기질의 유지가 도시의 인구를 지속적으로 유지하는데 중요한 변수임을 알 수 있다.

주제어 대기 오염, PM2.5, 이주

* Ph.D. candidate, Department of Economics, Kyung Hee University (First Author: zhanghe@khu.ac.kr)
** Professor, Department of Economics, Kyung Hee University (Corresponding Author: tj32k@khu.ac.kr)

1. Introduction

Human migration is currently one of the significant challenges facing both developed and developing countries (Davis et al., 2013; Cattaneo et al., 2019; IOM 2021). Internal migration is a result of societal development and interaction, and sometimes is a cause of such changes (Vlassenroot and Huggins, 2004; Burrows et al., 2016). The migration may positively affect the destination cities, providing a labor force, and boosting the economy (Boubtane and Dumont, 2023), but it may induce conflict between existing people and newly-moved people over the resources in the city (Côté, 2022). Therefore, understanding the determinants of internal migration is crucial in developing a migration policy that focuses on maximizing the benefit of migration, while minimizing the costs.

China has observed a substantial increase in migration in recent decades. According to the China Migration Development Report 2018, by the end of 2017, China's migrant population reached 244 million, accounting for 18 percent of the overall population, or around one in every six people. This ratio was only .65% in 1982.

Environment and quality of life have been increasingly discussed as a driver of migration (Piguet, 2010; Black et al,. 2011; Aunan and Wang, 2014; Peng, 2017). Degradation of environmental quality, such as air quality can be an explanation for large migration flows that occurred in recent decades in China (Liu and Song, 2020; Yang 2019; Yang, 2021). This type of migration is largely attributed to the adverse health impact of exposure to air pollutants such as particulate matter (PM2.5) (Lu, 2015; Pui et al., 2014; Murray et al., 2019; Pope et al., 1995; 2002; Woodruff, 2006; Jun and Min, 2019): the exposure to PM2.5 is associated with increased risk of morbidity and mortality due to cardiovascular and respiratory diseases, and people may relocate to places with better air quality to avoid the adverse health consequences. Zhang et al. (2019b) indeed showed that disclosing air quality information raises people's environmental concerns, and when people realize that their environment is hazardous, they will make certain behavioral decisions to avoid harm,

The behavioral responses involve migrating to a place of better air quality. Piguet (2010) showed that people voluntarily or forcibly migrate temporarily or permanently in response to sudden or gradual environmental degradation. Li (2023) showed that an increase in air pollution leads to a decline in net in-migration, which is driven by both a decrease in gross in-migration and an increase in gross out-migration. Aunan and Wang (2014) found that about 60% of the total exposure reduction of PM2.5 can be associated with migration.

However, the impact of air pollution on migration is heterogeneous across different individuals and regions. Peng (2021) showed that air pollution has a more significant impact on migrants with higher education and income levels. Qian (2019) found that the probability of out-migration due to environmental pollution is significantly lower in cities with higher economic openness.

Although the literature has examined the incentive for relocation due to environmental conditions, no research has been conducted on the impact of environmental quality on the incentive to stay in the city in the long term. Here,

we examine whether air quality, measured by the PM2.5 concentration, affects people's willingness to stay in the long run. In particular, we regress the willingness to stay on the air quality of the city that people move in, after controlling various individual and city-level factors that may also influence the willingness to stay.

The paper is organized as follows. In Section 2, we discuss some background information on migration and PM2.5 distribution in China. In Section 3, we present the modeling strategy and dataset we use. In Section 4, we present the main results from the empirical exercise. We conclude with a discussion on policy implications and limitation of our research in Section 5.

2. Background

Here, we discuss a general snapshot of internal migration and the distribution of PM2.5 concentrations in China.

Figure 1 depicts the net migration by city in 2019. In Northern China, Beijing and Tianjin have the highest level of attractiveness. In Southern China, the cities with the highest net migration are Shanghai, Shenzhen, and Guangzhou. In contrast, Zhoukou and Xinyang in Henan Province, which experienced substantial economic growth, had the greatest net out-migration.

Overall, consistent with findings in the literature (Liang et al., 2002; Ma and Tang, 2020), China's population has generally moved from economically backward regions to economically developed regions, from rural to urban areas.

Figure 2 shows the annual mean of PM2.5 in

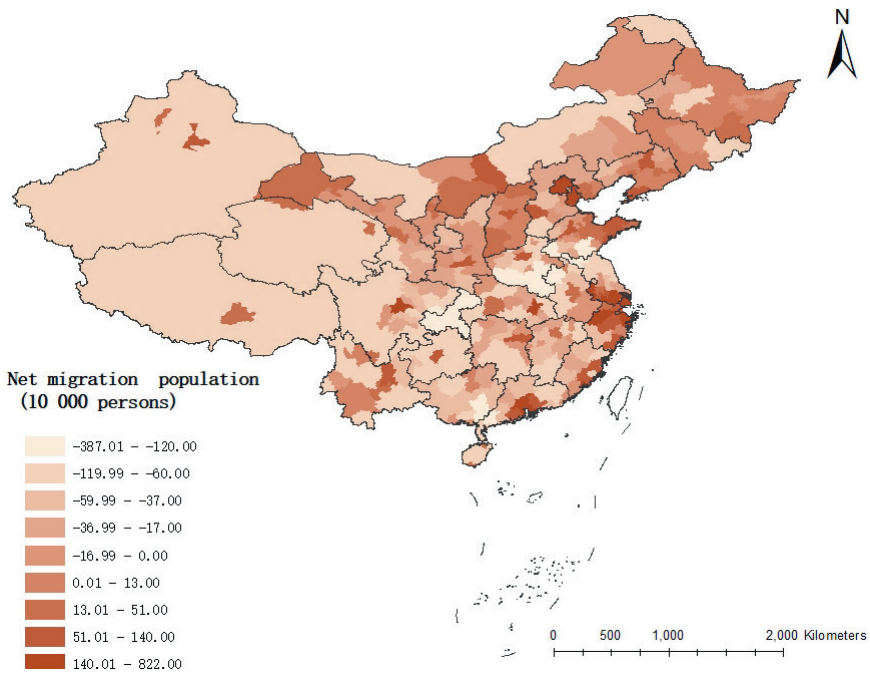

Figure 1. Net migration in China in 2019. This is based on China City Statistical Yearbook

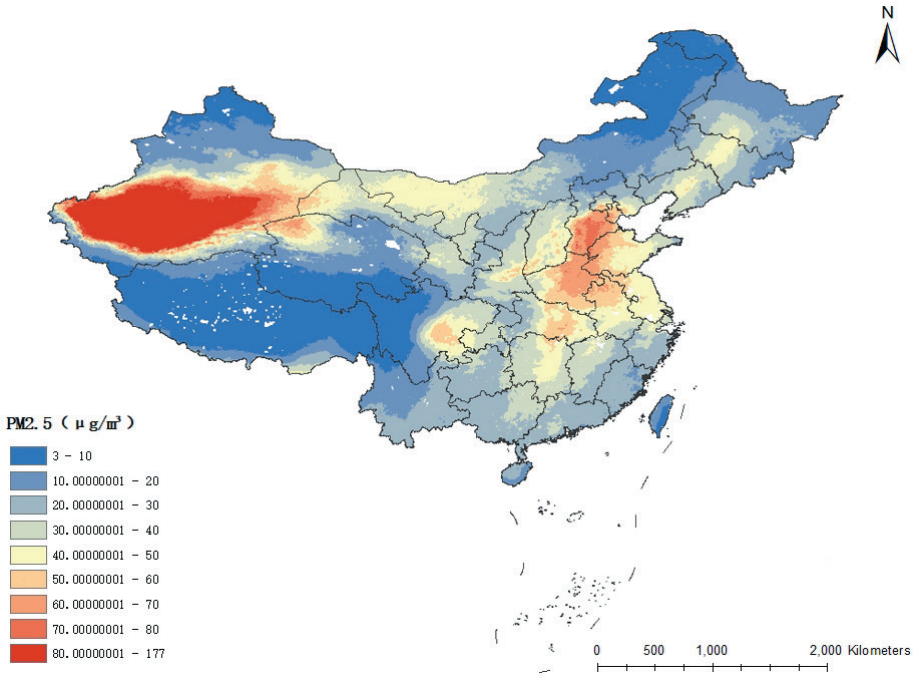

Figure 2. Annual Mean of PM2.5 in 2019. This is constructed from the Center for International Earth Science Information Network (CIESIN)

2019. It reveals that the Xinjiang region has the poorest overall air quality. This is mainly due to a large desert area in the region that is a source of dust, and anthropogenic factors such as the manufacturing industry (Li, 2009; Guo et al., 2017). Adverse air quality in Eastern China is mainly contributed by industrial sources (Sun et al., 2019).

Comparing Figures 1 and 2, the relationship between migration and PM2.5 is complex. In the Xinjiang region, out-migration seems to be associated with its below-average air quality. However, in Eastern China, the relationship between migration and PM2.5 is heterogeneous. Higher PM2.5 concentration is often associated with cities with a net inflow of people. For this reason, one needs to consider various economic and non-economic factors that may compound the relationship between air quality and migration. The picture is complicated as well when we consider how long the new migrants will stay in the city since long-run expectations of stay will depend on individual characteristics and city-specific factors. This relationship between the long-run willingness to stay and air quality is the main research question of this paper.

3. Model and Data

Here we specify the regression specification to test our hypothesis and data set used for the econometric exercise. Our main concern is whether the air quality of the city influences the willingness to stay in the city. In particular, we hypothesize that good air quality will increase the

willingness to stay in the city. To test our hypothesis, we need a measure of willingness to stay in the city and a set of individual and city-level characteristics that may affect willingness to stay.

The information on the willingness to stay is gathered from the China Migrants Dynamic Survey. The survey is conducted every year between 2014 and 2018. The question regarding the intention to stay in the city for an extended period is "whether you want to live in the city for more than five years." This question is only asked to the people who moved into the new city. In other words, for those who relocate to a city, the survey asked whether they are willing to stay in the new city for a long period.

There are 165,579 individuals surveyed in 2014 and 123,086 in 2018, with 809,502 in total between 2014 and 2018. The survey has a rotating sample structure, and an individual is questioned once in the dataset. The sample includes 286 cities in 31 provinces. Hence, all provinces except Hong Kong, Macao, and Taiwan are included in the dataset.

These movers have various reasons for the move. About 72 percent of moves are due to work and job relocation. 18 percent are due to business-related reasons. Therefore, about 90 percent of the moves are associated with economic incentives. We drop the temporary nature of moves such as study and training (.004% of the sample) and moves where individuals may not have the freedom to choose relocation such as joining the army (.42% of the sample). We also drop the responses where moves are due to unspecified reasons (.5% of the sample).

The air quality of the city is obtained from the Center for International Earth Science Information Network (CIESIN) at Columbia University, This dataset is created by inversion of remotely sensed image data (Hammer et al,. 2020). Here we use PM2.5 concentration, which measures fine particles of soot containing dust, heavy metals, and organic chemicals, as a measure of air quality.

We use the gridded data on PM2.5 over time from the CIESIN dataset. We match the geographic extent of the city with corresponding grids from the air quality data from CIESIN by the ArcGIS and take the average of PM2.5 of those grids that belong to the geographic extent of the city. This match is performed each year, taking the annual mean of the PM2.5 over the grids that belong to the city.

We assume that an individual is exposed to the average PM2.5 concentration in the city. Therefore the city-level PM2.5 data is matched to the individual who moves to the city. This potential mismatch between the actual exposure to PM2.5 concentration to residents and the mean city-wide concentration may cause measurement error issues.

Although mobility and living decisions, which reflect a complex individual and societal interaction and dynamics, may not be linearly related to changes in air quality PM2.5, the relatively large difference in air quality may have a discernible influence on the decision. To properly represent the impact of air quality, we compute the mean PM2.5 of each city during the whole sample period of 2014-2018 and divide the cities into three equal-size bins. The first bin has cities whose mean PM2.5 is among the bottom 33% of all cities, and the second (middle) bin has cities between 33-66%, finally the third bin has the top 66-100%. We hypothesize that willingness to stay

is positively associated with the air quality, and so the likelihood of staying is largest among cities in the first bin, followed by the second bin, and then by the third bin.

As a robustness check, we use PM10 concentration, which on top of PM2.5, includes more coarse pollutants, as an alternative measure of air quality, and create the three bins as we do with PM2.5. The PM10 concentration is based on the China Air Quality Index (CAQI). The CAQI dataset provides the annual city-wide mean PM10 concentration over the sample period, where all the cities in China are covered. The original dataset for the CAQI is obtained from the Air Quality Online Monitoring and Analysis Platform, which offers historical data retrieval and analysis since December 2013. The dataset encompasses PM10 and other weather information for 367 cities, with automatic hourly updates.

To test our hypothesis, we also control the variations among individual and city-level characteristics that influence the decision to stay. The individual characteristics include gender, age, education level, marital status, number of children in the household, a single-member household, monthly income, "hukou" (residence status in China), and employment status. These variables are based on CMDS.

The city-level characteristics include the city's economic and social well-being and amenities. Here, we consider a gross regional product (GRP) that represents the economic output of the city, and the unemployment rate as the economic characteristics of the city. Liu (2000) found that the population's age structure and the unemployment rate are the determinants of population migration in China.

According to Tiebout (1956), people may decide to relocate in search of better public services. Therefore, we consider the following amenities of the city: number of primary and secondary schools, green-covered area, number of licensed doctors, and number of public transportation (bus and trolley bus). The city-level variables are based on the China City Statistical Yearbook, which reports the annual value of the variables.

$$stay_{ijt} = \beta_0 + \gamma_2 pm25bin2_{ij} + \gamma_3 pm25bin3_{ij} + Z_{ijt} + W_{ijt} + \lambda_j + \eta_t + \varepsilon_{ijt}$$

The subscripts i and j denote individuals i living in city j, and t represents time. $stay_{ijt}$ denotes a bi-

Table 1. Description of Variables

Variables	Description
Dependent variable	
stay	Do you plan to live in the local area for a long time in the future (more than 5 years)? 0 for "NO" and 1 for "YES"
Air quality measure	
pm25	long-term fine particulate matter 2.5 (ug/m3)
pm10	long-term particulate matter 10 (ug/m3)
Individual characteristics	
ln(Fincome)	log. of the total monthly income of the family

high_edu	Do you have a bachelor's degree or above? 0 no 1 yes
female	0 male 1 female
no_child	1 no children, and 0 otherwise
alone	1 living alone, 0 otherwise
married	1 married, 0 otherwise
hukou	1 agricultural residence, 0 non-agricultural residence
age	Age
Han	1 the Han people, 0 otherwise
estatus	1 Employees, 2 Employers, 3 Self-employed workers, 4 Others
City-level characteristics	
ln(GRP)	log. of Gross Regional Product (Current Prices in yuan)
unemp_rate	unemployment rate*
ln(Library)	log. of the number of collections in public libraries (10,000 copies)
ln(Se.School)	log. of the number of regular secondary schools
ln(Pr.School)	log. of the number of regular primary schools
ln(Doctor)	log. of the number of licensed (assistant) doctors
ln(Bus)	log. of the number of buses and trolley buses under operation at year-end

* registered unemployment rate = number of registered unemployed/(number of registered employed + number of registered unemployed) × 100

Table 2 Descriptive statistics of individual and city-level variables

Variable	Obs	Mean	Std. dev.	Min	Max
stay	726,206	.54	.49	0	1
pm25	721,596	34.90	14.14	3.6	68.80
pm10	726,206	83.86	39.67	18	244
ln(Fincome)	725,371	8.62	.57	0	15.60
unemp_rate	670,654	4.27	3.00	0	49.73
ln(GRP)	670,654	8.22	1.05	5.03	10.24
high_edu	726,206	.37	.48	0	1
female	726,206	.46	.49	0	1
no_child	628,473	.11	.32	0	1
alone	726,206	.12	.32	0	1
married	726,206	.82	.38	0	1
hukou	726,206	.80	.39	0	1
age	726,206	35.57	9.53	20	64
Han	726,206	.92	.25	0	1
estatus	618,198	1.76	.95	1	4
ln(Library)	670,654	8.22	1.05	5.03	10.24
ln(Se.School)	721,596	5.47	.73	2.30	7.06
ln(Pr.School)	719,762	6.17	.82	2.89	8.33
ln(Doctor)	717,863	9.61	.88	6.73	11.47
ln(Bus)	716,169	7.81	1.29	3.82	10.56

nary variable where 1 indicates that person i who moved to city j at year t answered "yes" to the question whether he/she is willing to stay in the city for a long period of time, and zero otherwise.

The two latter bins of PM2.5 are denoted by pm25bin2 and pm25bin3 where the first bin is omitted category. According to our hypothesis, both γ_2 and γ_3 are expected to be negative, implying that people in these cities are less willing to stay. It is also interesting to see if γ_3 is larger than γ_2 in magnitude.

The city-level fixed effects, denoted by λ, and fixed year effects, denoted by η, are controlled. Z denotes the set of individual characteristics, and W denotes the set of city-level characteristics. Table 1 presents variable descriptions. Table 2 reports summary statistics of the variables.

4. Results

To construct a parsimonious model, we employ the hierarchical model to select a set of individual and city-level characteristics that have a significant influence on willingness to stay. In particular, we add or subtract a variable one by one in the regression to see if the change has a significant contribution to R2. We find that having no child among individual characteristics and the number of secondary schools and the number of doctors among city-level characteristics do not have significant explanatory power for willingness to stay. Therefore, we drop these variables from explanatory variables.

Table 3 presents the main findings based on various specifications. We perform the Breusch-Pagan test on the presence of heteroskedasticity and find that the model exhibits constant variance. We report the robust standard errors.

The first column shows the linear regression using only the two latter bins of PM2.5. The omitted bin of air pollution is the cities with the cleanest air. The second column adds individual characteristics as exploratory variables to the first specification. The third column further includes city-level characteristics.

The coefficients of the two latter bins of PM2.5 are negative throughout specifications (1) to (3). Compared to the cities in the first bin with the cleanest air quality, people in the cities in the second bin are less likely to say "YES" to the willingness to stay question. In addition, people in the third bin are less willing to stay in their cities than people in the second bin. Note that the difference between the two bins is statistically significant. These results confirm our hypothesis that willingness to stay in the long run will decrease as air quality deteriorates.

The individual characteristics show the expected sign of coefficients. Older people have a greater willingness to stay given other things constant. This is consistent with the observation that older people are generally less mobile (Zhao 1999). On the other hand, people who are living alone are less likely to stay as they may have a smaller cost of moving.

Individuals who have higher income (denoted by ln(Fincome)) and are more educated (denoted by high_edu) are more likely to stay in the long run. This can be explained as follows. The richer and more educated people, when they relocate themselves, find more economically stable jobs and businesses, which makes them expect that they will stay in the long run in the city. On the

other hand, poor and less-educated people typically find jobs in short-term employment sectors such as manufacturing, construction, and social services industries (Shi, 2008), making a shorter horizon of staying in the city.

Female migrants generally work in low-paid, labor-intensive sectors (Fan, 2000), and so may not expect themselves to stay in the long run.

With respect to employment status, those who own their business and self-employed are more likely to stay in the long run compared to the employed (omitted category). This may be due to the fact that the former will have more stakes and capital in the city than the latter, which makes them stay longer.

We find that the hukou status is not a significant determinant of willingness to stay. Although this result may be due to the fact that 80 percent of the sample has a hukou status, and so sample does not have sufficient variability in hukou status, it is still interesting as it determines Chinese citizens' access to housing, education, and public services. Further work with samples of more variations in the hukou status is needed.

Regarding the city-level characteristics, the city's greater economic output (in term of GRP) and lower unemployment rate induces an increased willingness to stay. This is consistent with the common observation that people are drawn to places with greater economic opportunity (Chen, 2006; Walmsley et al., 2017). Consistent with Tiebout's theory, a city's amenities, represented by the number of collections in libraries, the number of primary schools, and the number of buses, are positively associated with the willingness to stay.

Since the dependent variable is binary, we use the logit regression specifications in column (4). The results are qualitatively the same as the results in column (3). Using the odd ratio, it is estimated that the odd of answering "YES" to the willing-

Table 3 Regression results using the three equal-sized bins based on PM2.5

	OLS			Logit
	(1)	(2)	(3)	(4)
	Dependent variable: stay			
pm2.5bin2	-.061*** (.020)	-.062*** (.020)	-.063*** (.019	-.266*** (.081)
pm2.5bin3	-.128*** (.031)	-.125*** (.031)	-.120*** (.031)	-.506*** (.131)
ln(GRP)			.256** (.099)	.978*** (.048)
unemp_rate			-.010*** (.003)	-.044*** (.014)
ln(Library)			.006** (.002)	.027*** (.011)
ln(Pr.School)			.025*** (.006)	.109*** (.028)
ln(Bus)			.025*** (.004)	.108*** (.017)

female		-.007*** (.001)	-.006** (.001)	-.028*** (.007)
age		.002*** (.000)	.002*** (.000)	.008*** (.000)
ln(Fincome)		.085*** (.006)	.084** (.006)	.363*** (.030)
married		.006* (.003)	.006* (.003)	.025 (.015)
high_edu		.012*** (.003)	.012*** (.003)	.051*** (.014)
hukou		-.000 (.006)	-.000 (.005)	-.004 (.025)
alone		-.034*** (.006)	-.034*** (.006)	-.137*** (.026)
Han		-.012** (.005)	-.012** (.005)	-.054 (.024)
Employment				
- Own Business		.056*** (.004)	.057** (.004)	.247*** (.018)
- Self-employed		.048*** (.003)	.048*** (.003)	.201*** (.015)
- Others		-.000 (.009)	-.001 (.009)	-.008 (.038)
fixed effects, year	Included	Included	Included	Included
fixed effects, city	Included	Included	Included	Included
Observations	552,579	552,579	552,579	552,579
R-squared	.022	.027	.042	.042

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4. Regression results using the three equal-sized bins based on PM10

	OLS			Logit
	(1)	(2)	(3)	(4)
	Dependent variable: stay			
pm10bin2	-.033*** (.002)	-.034*** (.002)	-.030*** (.002)	-.129*** (.010)
pm10bin3	-.027*** (.002)	-.028*** (.002)	-.032*** (.002)	-.139*** (.012)
ln(GRP)			.257*** (.011)	.965** (.048)
unemp_rate			-.010*** (.000)	-.049*** (.014)
ln(Library)			.006** (.002)	.029*** (.011)

ln(Pr.School)			.027*** (.006)	.118*** (.028)
ln(Bus)			.030*** (.004)	.126*** (.017)
female		-.007*** (.001)	-.006** (.001)	-.028*** (.005)
age		.002*** (.000)	.002*** (.000)	.008*** (.000)
ln(Fincome)		.084*** (.001)	.084** (.001)	.361*** (.005)
married		.006* (.003)	.006* (.003)	.025* (.012)
high_edu		.011*** (.001)	.012*** (.001)	.050*** (.006)
hukou		-.000 (.001)	-.000 (.001)	-.001 (.007)
alone		-.034*** (.003)	-.034*** (.003)	-.136*** (.026)
Han		-.012** (.002)	-.012** (.002)	-.054*** (.011)
Employment				
- Own Business		.057*** (.002)	.057** (.002)	.248*** (.011)
- Self-employed		.048*** (.001)	.048*** (.001)	.203*** (.006)
- Others		-.000 (.005)	-.002 (.003)	-.009 (.022)
fixed effects, year	Included	Included	Included	Included
fixed effects, city	Included	Included	Included	Included
Observations	552,579	552,579	552,579	552,579
R-squared	.021	.039	.041	.031

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

ness to stay question decreases by a factor of .77 in the second bin, and decreases by a factor of .60 in the third bin. Note that the difference in the odds is statistically significant.

As a robustness check of our results, we repeat the empirical exercises with PM10 concentration. The source of PM10 concentration includes that of PM2.5 and more coarse particles generally from emissions from the combustion of gasoline, oil, diesel fuel, or wood produce, dust from construction sites, landfills, and agriculture, wildfires, and brush burning. The empirical results based on PM10 concentration are reported in Table 4. The results are comparable to the results using PM2.5. The individuals in the cities of the second and third bins are less likely to stay in the long run, compared to the first bin. Using the odd ratio based on the logistic regression (column (4) in Ta-

ble 4), the odd of answering "YES" to the willingness to stay question decreases by a factor of .92 in the second bin, and decreases by a factor of .90 in the third bin.

5. Conclusions

We investigate the factors influencing migrants' city choice, in particular their willingness to live in the city for a long period. To perform empirical exercises, we match the survey on willingness to stay in the city the respondent moved to and the city-level air quality, controlling compound effects from various individual and city-level characteristics. The main finding is that the cities with high concentrations of air pollutants will not hold people in the long run. This is the first kind of research that examines the impact of air quality on the post-migration willing to stay. Although previous studies have examined the relationship between internal migration in China and air pollution concentration, our study is the first of the kind where the impact of air pollution on willingness to stay in a newly moved city.

Note that in 2018, the State Council of China released a three-year action plan to reduce total emissions of major air pollutants and greenhouse gases by 2020. Our results suggest that the statewide objective to improve air quality may significantly influence migration patterns in China. This implies that the policy on improving air quality must be joined and decided with the policy on internal migration.

Our results also show that at the individual level, older people, those with higher incomes and higher levels of education, were more likely to stay for the long term. Female migrants may not expect to stay in the city they migrate to for a long time. In terms of city level, the greater the economic output of the city and the lower the unemployment rate, the higher the propensity of residents to stay. This implies that there is a considerable variation in migration preference across populations, and any welfare-maximizing migration policy should incorporate this difference. This implies that as cities have a heterogeneous composition of their population, the policy to retain their people should also be differentiated.

The heterogeneity of individual response to air pollution concentration on willingness to stay has implications for further research. Since individuals have different socio-economic backgrounds and jobs, they will be exposed to different levels of pollution. Hence, a higher geographical resolution and background information on exposure is needed to more accurately estimate the impact of air pollution concentration on willingness to stay.

Our results should be interpreted with caution. First, we do not have information on the street address of the individual and thus use the city-wide mean PM2.5 concentration. Therefore, there may be a difference between the mean exposure and the actual PM2.5 exposure at the individual level. This will also reduce the variability of PM2.5 exposure at the individual level. Second, the survey has rotating respondents, and thus dataset does not have a panel structure. Although we have controlled various individual characteristics, this may not completely control heterogeneity among individuals. Third, our dependent variable of willingness to stay can be subject to measurement error as the answers to the question may be subject to various circumstances at the time of questioning.

Finally, the binary nature of the response (whether to stay or not) limits the scope of analysis and more detailed policy implications.

However, the findings are still relevant for the current and future policy regarding guiding migration flows in China. In particular, our results imply that even if cities have an influx of people due to a variety of incentives, people may not stay in the city in the long run unless air quality is maintained well. Therefore, good air quality both induces people to move in and makes them stay longer. This implies that public investment to improve air quality should continue, such as reducing industrial pollution, controlling air pollution from motor vehicles, and regulating air quality. Examples of such policy include (Zhang et al., 2019a): (i) the rule that prohibits new coal-fired plants in the three target regions and requires existing coal plants to reduce emissions or be replaced with natural gas. (ii) In large cities such as Beijing, Shanghai, and Guangzhou, control vehicle emissions by restricting the number of cars on the road on any given day.

Furthermore, since incomes and jobs are important for the decision to stay in the long run, instruments for improving air quality should be pro-economy, such as providing subsidies for electric vehicles (Holland et al., 2016), and transforming dirty industry into clean industry, supporting renewable energy source (Boudri et al., 2002; Zhu et al., 2020), and re-educating workers to adapt to the clean industry technology (Constant, et al., 2021). Increasing the city's amenities such as more schools and public transportation can also contribute to keeping the newly-moved to stay in the city in the long run.

China has experienced epic-scale internal migration in the past decades. The huge number of low-cost urban laborers who constitute the bulk of China's "floating population" have reduced prices substantially, giving China a price advantage in the global market (Harney, 2009). The new generation of Chinese seeks not only economic benefits associated with migration but other amenities to improve their well-being. Our study contributes to the understanding of the new types of migration by showing that air quality is a significant contributor to willingness to stay in the migrated cities.

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