Traininig for Hukou: Evidence from China*

By Shimeng Liu†, Lishuang Huang‡and Wenquan Liang§

This paper exploits a unique feature of migrants training to get a hukou(household registration in urban city). Based on the China Labor-Force Dynamics Survey(CLDS), we find that the participation rate in training has significantly increased after the hukou reform. The higher the hukou requirements, the larger the participation rate of migrants, with training funds more likely to be self-financed.This phenomenon is attributed to getting bonus points related to the hukou system through training. Besides, migrants with less than a bachelor's degree or less than 40 years old are more likely to train. Training for hukou can improve individual income. However, the income increment for migrants is 62.08% less than the natives, coupled with a low skill mismatch. Despite these skill mismatches and less favorable spillover effects, training facilitates the social integration of migrants into their cities of residence. Our paper highlight the misallocation caused by the Chinese-style training motivation and have general implications for other countries.
JEL: J24; M53; R23
Keywords: Migrants; Skills Training; Social Integration

Training for hukou becomes a pathway for migrants to overcome settlement barriers under the household registration (hukou) system in China. Migrants may face challenges in accessing essential public services, such as healthcare, housing, and education for their children, due to their non-local hukou status (Whalley and Zhang, 2007; Chan and Buckingham, 2008; Zhang et al., 2020). The Chinese government has implemented point-based hukou reform to aid in the integration of migrants into urban areas. However, there is limited causal evidence regarding how migrants obtain a hukou in their situation. Our paper analyzes the hukou reform, a plausibly exogenous policy shock that disrupted an individual's training behavior, and its consequences for labor outcomes. We also shed light on labor mislocation issues caused by Chinese-style training movements.

* The authors thank the National Natural Science Foundation of China (72373051), National Natural Science Foundation of China General Project (72373054) and the Guangdong Provincial Basic and Applied Basic Research Fund Youth Promotion Project (2023A1515030117) as well as Guangdong Provincial Natural Science Foundation of China General Project (2022A1515011096) for funding.

† Associate Professor in Institute for Economic and Social Research(IESR), Jinan University, Guangzhou, China; Ph.D. in Economics from Syracuse University, America; Email: shimeng.liu@foxmail.com

‡ Ph.D. candidate at Jinan University and currently visiting at the University of Mannheim, Germany. Email: lishuanghuanggz@163.com

§ Corresponding author, Associate Professor in Department of Economics at Jinan University, Guangzhou, China. Ph.D. in Economics from Fudan University, China; Email: liangsuwenquan@163.com

Between 2012 and 2018, a total of 130.57 million vocational training of were organized in China, of which 64.99 million were attended by migrant workers. Further analysis shows that the average training rate for migrants is 14.57%, while it is only 7.51% for natives[1]. This difference suggests that migrants may be motivated to educate themselves to obtain an urban hukou. We also discovered through interviews that many migrants obtain vocational or qualification certificates through skill training to increase their hukou points. These certificates include such as "system integration project manager," "network engineer," "intermediate economist," and "information system project manager," which are commonly used by migrants in the Pearl River Delta region of China. Participation in skills training involves a cost-benefit analysis. While there may be short-term costs associated with training, it can lead to long-term benefits(Becker, 1962; Mincer, 1962). For migrants, however, skills training has the added benefit of increasing settlement points, which motivates them to participate in training. Therefore, the difference between migrants and natives may reflect the strength of their motivation to settle. Given the significant social impact of skills training and its crucial role in the integration of migrant communities, it is imperative to thoroughly examine the relevant issues.

Specifically, we aim to investigate whether migrants will participate in skills training to settle down. We try to answer the following questions: how can we identify the strength of the motivation to settle down? Is there a difference in the effect of training aimed at achieving citizenship compared to traditional training for improving performance in the labor market? Will there be a spillover effect on society? The findings have significant policy implications for enhancing the social integration of migrants, decreasing labor market friction, and improving labor mobility.

We answer the questions from theoretical and empirical aspects. Firstly, we expand the theory of Becker (1962) on training behavior. The model introduces the hypothesis based on the expected benefits of training behavior, that is, if training has the additional effect of helping the migrants to settle in the living city, it will strengthen the incentive of the migrants to participate in training. Next, using data from the 2012-2018 China Labor-Force Dynamics Survey, we constructed a difference-in-difference model to study the effect of hukou registration on an individual's probability of participating in training. Our analysis aimed to verify the potential motivation to settle down and the positive role of skills training in moderating the hukou constraints caused by the 2014 hukou reform. Subsequently, we examine the effect of training behavior that includes additional settlement motives on the spillover of the local labor market, as well as its role in the social integration of the migrant population. Finally, we provide policy implications and recommendations based on theoretical and empirical findings.

Conclusion of this paper. We have three findings in this paper. Firstly, after the

[1]The data is sourced from the "Statistical Bulletin on the Development of Human Resources and Social Security" of China.

hukou reform in 2014, the number of people participating in training increased in cities with stricter settlement policies. Migrants are motivated not only by human capital accumulation but also by obtaining skills and professional certificates related to hukou policy. Therefore, the probability of migrants participating in training was about three times higher than natives, whose motivation is mainly to accumulate human capital.

Secondly, we find that in cities with a higher settlement threshold and entry requirements, migrants are more likely to train to get an urban city hukou. Individuals with a bachelor's degree or lower education level are more inclined to settle down and have a greater need for training. This trend is also observed in the age group of 40 and below. Additionally, in cities with higher settlement thresholds, migrants are more likely to self-fund their training rather than rely on government funding. This evidence confirms the motivation of migrants to participate in training and establish permanent residency.

Thirdly, we find a misallocation in the improvement of human capital when migrants train for hukou. Compared with natives, migrants who participate in training experience a 62.08% lower increase in income. In addition, their increase in skill matching and employment probability are 84.36% and 44.98% lower, respectively. From the city's perspective, there are fewer positive spillovers generated for the city by migrants in training. For natives, the training rate increases by 1%, the average individual income level increases by 1.37%, while for migrants the individual income level increases by only 0.42%. However, training has a positive impact on improving the social identity of migrants and promoting social integration, which can largely compensate for the misallocation caused by the hukou policy. We found that participation in training significantly encourages migrants to pay attention to the development of the local city and integrate into the local area. It also helps migrants feel more accepted by locals. This finding suggests that training can improve the goals of reducing labor market friction and increasing social integration.

Contribution to the literature. We contribute a new training motivation of migrants. Related to the dilemma of the migrants' "willingness to settle but without ability", we examine the effect of hukou reform on the training behavior of the migrants. This motivation differs significantly from training for human capital enhancement. The current literature mostly examines the factors influencing training from the perspective of firms and individuals. From the firm's aspect, tax incentives can encourage firms to train their employees (Leuven et al., 2004; Tian et al., 2022) and the minimum wage squeezes firms' marginal profit and reduces employees' investment in on-the-job training (Neumark and Wascher, 2001; Acemoglu and Pischke, 2003). Also, individual characteristics affect training behaviors (Mookherjee and Ray, 2010; Acevedo et al., 2020; Kugler et al., 2022). We find a smaller proportion of migrant workers participate in training compared to urban residents. This paper provides a new perspective on the incentitive for training among migrants, emphasizing the facts of getting a hukou. Recent

research find that rural workers who participate in training are more likely to migrate and stay in the big city for individual development (Dewen et al., 2010; Jiang et al., 2016), which indicates that migrants have a aim of training to settle down in the urban city. We explain the results as migrants can obtain relevant skill bonus points through training to meet the hukou requirements. Additionally, training for hukou reflects an individual's efforts to establish citizenship and can enhance their social integration in their living cities. Participation in training programs can greatly facilitate the integration of migrants into the local community. For instance, language training can aid refugees in their integration into the local area (Foged et al., 2022). Training can also lead to a decrease in urban crime rates, promote social mobility (Bertrand et al., 2021).

We also examines the special motivation effect on the human capital improvements and externalities of training. Traditional human capital theory suggests that education and training are important components of human capital (Becker, 1962; Black and Lynch, 1996). As an important means of human capital accumulation, training can increase labor productivity (Conti, 2005; Konings and Vanormelingen, 2015) and the income level of the labor force (Woodhall, 1987; Sullivan, 2010) and reduce regional poverty rates (Bartik, 2020). Workers with training experience have higher wage growth in later years over the life cycle of human capital accumulation (Kuruscu, 2006). Contrary to existing studies,Contrary to existing studies, we conclude that training behavior aimed at settling down has a smaller impact on individual income and lower skill-match in the job, and generates weaker positive externalities in cities due to hukou registration restrictions. Additionally, this suggests that targeted reforms to hukou registration can boost migrant participation in training, leading to positive effects on labor income.

Overview of this paper. Section I provides relevant background information. Section II introduces the theoretical and empirical models in detail. Section III presents the benchmark results, heterogeneity analysis, and robustness tests on the impact of the hukou reform on individual training. Section IV further examines the effects of training, including labor market performance, spillovers of training, and social integration. Finally, Section V summarizes the evidence and draws conclusions.

I. Background of Hukou Reform

This section introduces the dynamic trends of migrants' willingness to settle down, changes in city household register registration (*Hukou*) policies, and points-based settlement requirements involving vocational and skill certificates. The purpose is to explain that migrants are motivated to train to settle down and get a hukou.

There are various scales of cross-regional population mobility in China. The number of migrant workers has increased from 153.4 million in 2010 to 169.6

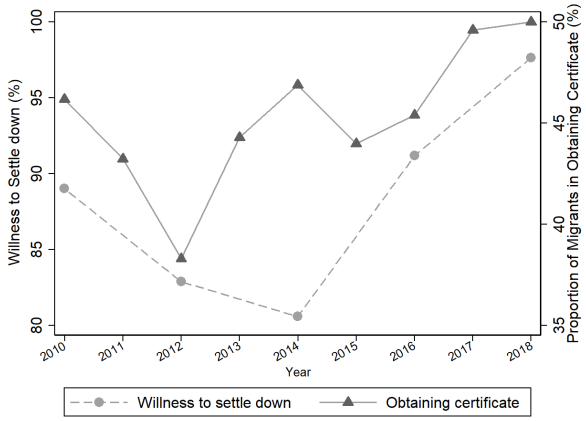

Figure 1. : Proportion of migrant's willingness to settle & Obtain certificates after training: 2010-2018

Source: The data on the proportion of migrants who have obtained training certificates are from the China Labor Statistics Yearbook, and the data on settlement intention are from the Migrant Population Dynamic Survey Data (CMDS) 2010-2018 .

million in 2020[3].Furthermore, according to the 2020 census data, the number of people with separated households has increased by 88.52% compared to 2010, reaching a staggering 492.76 million. Despite the impact of COVID-19, the number of migrant workers has continued to grow in the past two years. Additionally, migrants have expressed a strong desire to settle down and obtain urban Hukou status. Figure 1 shows that from 2010 to 2018, the proportion of migrants willing to settle in cities slightly decreased from 2010 to 2014, then gradually increased, and remained high overall.

Why do migrants tend to settle in big cities? Currently, economic opportunities are the main factor influencing a migrant's decision to stay in a city. According to the 2017 migrant survey data, the reasons for obtaining hukou registration included personal development (20.36%), improving income (16.86%), and accumulating work experience (7.64%), accounting for nearly 45% of respondents. Based on the statistics of China in 2021, Shenzhen, Shanghai, Guangzhou, Beijing and Dongguan are the top five cities with net population inflow. This trend is mainly due to the "sharing, matching, and learning" effect of the agglomeration of large cities, which increases efficiency, productivity, and employment opportunities for the labor force (Duranton and Puga, 2004; Moretti, 2004). In addition, cities provide better public services, thus supporting population mobility and encouraging settlement. In particular, 23.62% of individuals choose to live in cities

[3]The data is sourced from the "Statistical Bulletin on National Economic and Social Development" of China.

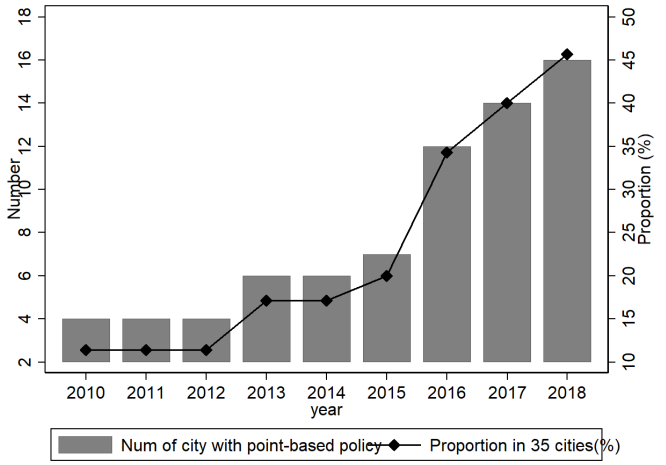

Figure 2. : Cities used the points-based hukou policy: 2010-2018

because of the educational prospects for their children[4]. Education plays a key role in breaking down social barriers and promoting intergenerational upward mobility. However, the unequal distribution of educational resources has widened the educational gap between urban and rural areas (Schnepf, 2007; Dustmann et al., 2012). Driven by traditional family culture, migrants often move in search of better educational opportunities for their children.

Although migrants have a strong desire to become citizens, they face significant obstacles in accessing urban education and medical care without a city hukou. Therefore, governments are actively promoting hukou reform and migrant citizenship. China's National Rural Revitalization Strategic Plan (2018-2022) and the Notice on Carrying out Actions to Improve the Quality of Citizenship of Migrants in County Areas (2023) emphasize the promotion of migrant citizenship and equal access to basic public services. It is worth noting that Zhongshan in Guangdong Province pioneered a point system in 2009 to facilitate migrant workers' acquisition of local hukou registration. In 2010, several cities in Guangdong Province, including Foshan, Shenzhen, Guangzhou, and Zhuhai, introduced points-based settlement policies for migrant workers. Figure 2 illustrates these policies[6]. Since then, the number of cities implementing such policies has significantly increased among the 35 main cities, rising from 4 in 2010 to 16 in 2018. Consequently,

[4]Full statistical results are presented in the appendix.

[6]The data are from Database of Peking law (https://www.pkulaw.net). The list of 35 cities comprises 27 provincial capitals (excluding Hong Kong Special Administrative Region, Macau Special Administrative Region, and Taiwan Province), 4 municipalities directly under the central government (Tianjin, Beijing, Shanghai, and Chongqing), and 4 special economic zones (Shenzhen, Zhuhai, Xiamen, and Shantou).

the reform of the hukou system has created more opportunities for individuals to settle in major cities.

Table 1—: Details of education background, qualifications, skills, and age criteria in cities

City	Education Background	Professional Qualifications	Skills	Age
Guangzhou	Bachelor's degree and above (50) College degree (35) High school (incl. vocational school) (20)	Junior, intermediate, and above professional titles (30; 20) Technician and above (30); Intermediate and advanced vocational qualifications (10; 20); Public institution technical levels three and four (20; 10)	Urgently needed job or certificate (20) People in difficult industries (10)	18-30 years old (30) 31-40 years old (20) 41-45 years old (10)
Shenzhen	College & Intermediate vocational qualifications (100) Non-full-time undergraduate & Junior technical qualifications (90) College & Junior qualifications or senior qualifications (80) Full-time college (70) Non-full-time (60)	First-level vocational qualifications (100) Second-level vocational qualifications (90) Third-level vocational qualifications (70) Fourth-level vocational qualifications (40)	Technician (90) Senior technician (70) Intermediate technician (40)	18-35 years old (5) 35-40 years old (0) 40-45 years old (minus 2 for 1 year increase)
Shanghai	Doctorate (110); Master's degree (100) Bachelor (90); Undergraduate degree (60); College degree (50)	Vocational qualifications levels one to five (140; 100; 60; 30; 15) Advanced and intermediate technical qualifications (140; 100)	Urgently needed major and job(30)	56-60 years old (5) plus 2 points for 1 year decrease
Nanjing	Bachelor's degree and above (80) College or vocational school (70)	Junior technical qualifications (80) Vocational qualifications level four (60) Vocational qualifications level five (40)		40 years old (5) plus 2 points for 1 year decrease

The new hukou policy, which includes the point-based settlement system, includes various dimensions, such as personal quality, urban development orientation, basic social contribution, and indicators for eliminating negative points (Zhang et al., 2019). An individual's educational background, professional qualifications, technical skills, and age are important factors, as shown in Table 1. For example, in Guangzhou, holding a bachelor's degree or higher is worth 50 points, while holding an intermediate professional title or higher is worth 30 points. Thus, the acquisition of a professional qualification certificate becomes crucial for migrants with lower academic qualifications. In addition, certain skills may qualify for additional points. Skilled workers in welding, boiler maintenance, substation maintenance and related fields can earn an additional 20 points[7]. Following the implementation of the point-based settlement policy, individuals possessing vocational or skill certificates can obtain additional points, making it the primary method for migrants to obtain hukou. Additionally, relevant skills and professional titles can serve as separate qualifications for talent recruitment. Figure 3 displays data from 35 cities indicating a year-on-year increase in the number of cities using vocational qualification certificates as a condition for talent introduction, with the percentage exceeding 70% in 2018.

Obtaining vocational and professional technical qualification certificates is a more feasible way to acquire settlement qualifications than obtaining educational qualifications. As most migrants move after completing full-time education, changing their educational background can be difficult. According to the data of migrants in 2016, 85% of the migrant population has a high school education or less, and the average age of first-time migrants is 23 years old. There are no specific requirements for age, education, or work experience for applicants

[7]Source: Guangzhou Municipal Human Resources Administration Occupational Catalog for the Introduction of Technical and Skilled Talents in Guangzhou (2019).

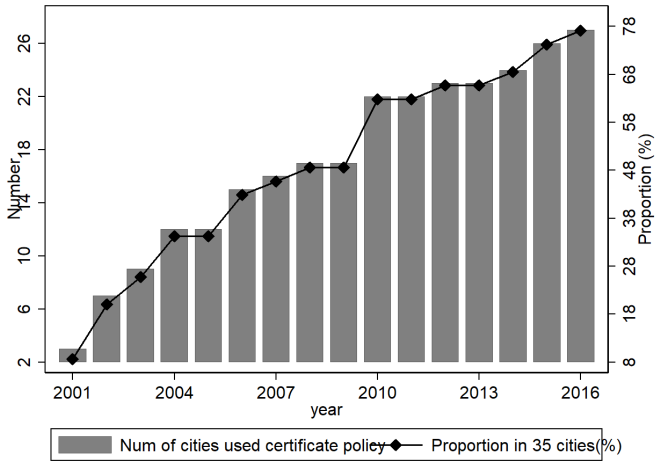

Figure 3. : Cities used qualification certificates as conditions for talent permit: 2010-2018"

to obtain professional and technical qualification certificates. Professional title certificates, such as System Integration Project Manager, Network Engineer, Intermediate Economist, and Information System Project Manager, are popular among migrants. These certificates are available to all applicants regardless of age, education, or work experience, making them a popular choice for many migrants with lower levels of education[8].

However, getting professional and technical qualifications can be challenging, especially for migrants with lower knowledge levels. Typically, they need to participate in training to obtain these certificates. Our surveys of training institutions in the Pearl River Delta region revealed that many migrants obtained the necessary qualification certificates through training. The data suggests that the settlement policy has incentivized migrants to pursue training.

Figure 1 shows a correlation between the proportion of migrants willing to settle and those who have obtained certificates from 2010 to 2018. This trend has persisted since the hukou reform in 2014[9]. In 2018, almost half of the individuals who received training certificates were migrants. Migrants in cities with higher settlement thresholds are more likely to pursue professional titles and technical qualification certificates through training to improve their chances of successful settlement. Figure 4 shows that in cities with higher settlement thresholds, the likelihood of migrants participating in training is higher. We uses theoretical

[8]Please see Appendix B of this article for relevant certificate application requirements.

[9]The data on the proportion of migrants who have obtained training certificates are from the China Labor Statistics Yearbook, and the data on settlement intention are from the Migrant Population Dynamic Survey Data (CMDS) 2010-2018.

models and empirical analysis to support the economic reasoning and causality presented in Figure 5 of Sections II and III.

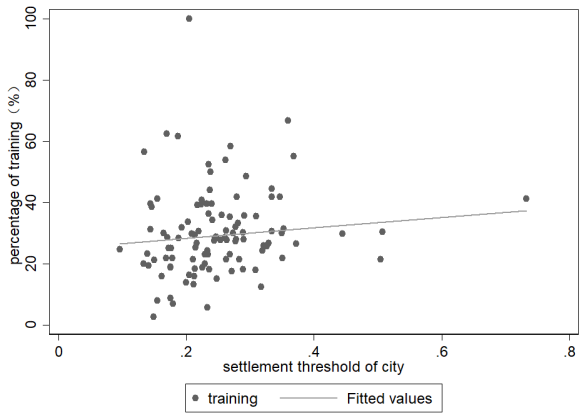

Figure 4. : Proportion of training and settlement threshold of cities

Source: The training variables come from China Migrant Population Dynamic Survey data (2011). The household threshold index comes from Zhang et al. (2019).

II. Theoretical Framework and Empirical Design

A. Theoretical Framework

This section is based on the human capital theory of Becker (1962) to build a simplified model to illustrate how the hukou reform affects labor force participation in training. Becker persited that an individual's decision to engage in training related to the trade-off between current cost and future income. According to the policy background in China, we make two improvements based on Becker (1962). First, the expected remaining length of residence of migrants in the city where they migrate is similar to the life cycle, which will directly affect training decisions. However, unlike Becker's, the duration of living in big cities is variable, contingent upon an individual's inclination and capacity to settle in a metropolitan area. Secondly, we assumes that after participating in training, migrants can increase their probability of obtaining city hukou and enjoy more urban public services. This is based on the unique motivation of migrants in China's institutional background for training to obtain hukou. The specific model is constructed as follows:

We denote E_i as the human capital of an individual in period i, directly influencing the wage level of the current period, with a representing the rate of return per unit of human capital. We assume a uniform rate of return across periods, individual wages is $w_i = aE_i$.

Time allocation for each individual is divided into two parts: working time (t_{wi}) and training time (t_{ei}), where $t_{wi} + t_{ei} = 1$ for $i = 1, ..., n$. The increment in an individual's human capital (ϕ_i) in period i is expressed as a function $f_i(t_{ei})$ of time spent in training, accounting for the depreciation rate of human capital within each period. Time heterogeneity in returns is not considered for simplicity. In period $i + 1$, the individual's human capital (E_{i+1}) can expressed as:

$$E_{i+1} = (1 - d)E_i + \phi_i \tag{1}$$

where d represents the depreciation rate, and n represents the remaining duration of an individual's residence in the city, spanning n periods.

We assumed that individual utility comprises two components: consumption of goods and access to public services in the current period, denoted as $U(c_i,\ g_i)$. Here, c_i represents the quantity of goods consumed in period i, with its price simplified to 1, while g_i signifies the level of public services. With the budget constraint, the discounted value of individual consumption expenditure equals the discounted value of the salary received post-training, expressed as:

$$\sum_{i=1}^{n} C_i(1 + r)^{i-1} = \sum_{i=1}^{n} aE_i t_{wi}(1 + r)^{i-1} \tag{2}$$

The first-order conditions of the consumer's optimization problem are:

$$U_i - \lambda \frac{1}{(1 + r)^{i-1}} = 0, \quad i = 1, \ldots, n \tag{3}$$

$$-\frac{aE_i}{(1 + r)^{i-1}} + \sum_{j=i}^{n} \frac{at_{w(j+1)}}{(1 + \mathrm{r})^j} \frac{\partial E_{j+1}}{\partial t_{ej}} = 0 \tag{4}$$

Here, U_i represents the marginal utility, λ denotes the Lagrange multiplier, j represents the current period, and r signifies the discount rate. These equations govern the optimal consumption and training decisions of the individual, subject to budget constraint and utility maximization.

In formula (4), $\frac{aE_i}{(1+r)^{i-1}}$ represents the current income forgone by engaging in training, while $\sum_{j=i}^{n} \frac{at_{w(j+1)}}{(1+\mathrm{r})^j} \frac{\partial E_{j+1}}{\partial t_{ej}}$ represents the discounted present value of future benefits from participating in training. Assuming optimal working and training times as t_w^* and t_e^* respectively, equilibrium implies that training benefits should reach a steady state. According to equation (1), we have $E_{i+1} = E_i = E^*$. To facilitate an analytical solution, let's assume $\phi_i = f_i\left(t_{ei}\right) = t_{ei}$, yielding the equilibrium training time for individuals as:

$$t_e^* = 1 - \frac{\frac{r}{(1+r)^{i-1}}}{1 - \frac{1}{(1+r)^n}} \tag{5}$$

Based on equation (5), we can find that: $\frac{\partial t_e^*}{\partial i} < 0$ and $\frac{\partial t_e^*}{\partial n} > 0$. The intuitions is as follows: (i) The closer individuals are to leaving the city (with n fixed, larger i), the less time they allocate for training; (ii) As the expected duration of settlement in the city increases (larger n), individuals spend more time on training.

According to the background in section I, individuals increase their likelihood of obtaining hukou by acquiring professional titles and technical qualifications, which also increases their chances of accessing additional public services. The level of accumulated points directly influences the probability of access to public services. In recent years, various local governments have explored the establishment of a basic public service delivery mechanism based on a residence permit system and a points system. For example, the city Guangzhou [12] stipulates that applicants who accumulate a certain number of points can receive additional services and benefits beyond basic public services. These additional benefits include admission for children to public primary schools or government subsidies for enrollment in private schools, applying for government-subsidized rental housing, and other entitlements and public services according to local regulations.

We assume that training can increase the probability of accessing public services. We further hypothesize that the additional public services obtained through training, denoted as $g\left(t_{ei}\right)$, are positively correlated with the duration of training. The expected value of accessing public services is positively related to the time individuals invest in training, expressed as $g'(\cdot) > 0$.Consequently, the individual utility function becomes $U\left(c_i; g\left(t_{ei}\right)\right), i = 1, \cdots, n$. Transforming Equation (4) into:

$$-\frac{aE_i}{(1+r)^{i-1}} + \sum_{j=i}^{n} \frac{at_{w(j+1)}}{(1+\mathrm{r})^j} \frac{\partial E_{j+1}}{\partial t_{ej}} + \underbrace{U_i(\cdot)g'(\cdot)}_{>0} = 0 \tag{6}$$

Based on Equation (6), participation in training have additional benefits (increased probability of accessing public services), leading individuals to allocate more time to training in a steady state compared to what Equation (4) represents. Therefore, our main research hypothesis is that the additional positive effect of skills training on the migrant population obtaining urban household registration will increase the probability of migrants participating in training.

In China, the expected duration of settlement for migrants in urban areas is directly related to their willingness to settle, where a stronger willingness is asso-

[12] see `https://www.gd.gov.cn/zzzq/bmxx/content/post_3539292.html` for details.

ciated with a longer expected settlement time: $n = f(\text{willingness to settle})$, and $f'(\cdot) > 0$. We can find that, individuals spend more time on training as their expected duration of settlement in the city increases. Thus, in the steady state, as the willingness of migrant populations to settle increases, the duration of training also increases. In Appendix A3, we provide evidence that the willingness of migrant populations to settle increases the probability of their participation in training.

B. Empirical Design

This article examines the impact of hukou constraints on migrant participation in skills training, using the quasi-natural experiment of urban differentiated settlement policies in the hukou reform of 2014. We verify that the migrant's motivation to participate in training is affected by the reform, as evidenced by changes in labor force participation in training before and after the reform.

In March 2014, China introduced the National New Urbanization Development Plan (2014-2020), which mandates the adoption of differentiated settlement policies. The plan includes strict measures to control the population size of megacities with more than 5 million inhabitants. Megacities have the option of implementing a point system to establish gradual settlement paths, effectively managing the scale and pace of urban development. The plan also calls for easing settlement restrictions in organized cities and small towns, while systematically liberalizing urban areas with populations between 500,000 and 1 million. In addition, urban settlement restrictions in cities with populations of 1 million to 3 million will be appropriately relaxed, while criteria for urban settlement in larger cities with populations of 3 million to 5 million will be carefully reviewed.

Following Gao et al. (2023),we divided cities into a population of over 5 million as the treatment group and the remaining cities as the control group. After 2014, the population policies of the treatment group cities became stricter, leading to an increase of people adopting the points-base settlement hukou policy. Based on the settlement policies of 35 major cities, over 70% of them used vocational certificates as a requirement for talent recruitment in 2018. The policies related to point settlement have remained relatively stable in the control group cities before and after the study. To verify whether migrants participate more in skills training under the hukou registration constraint, we construct a difference-in-difference model using the impact of the hukou reform.

$$\text{Train}_{ict} = \beta_0 + \beta_1 \text{Treat}_c \times \text{Post}_t + X_{ict} + C_{c,2012} \times f(t) + \gamma_c + \lambda_t + \varepsilon_{ict} \tag{7}$$

Where i represents the individual, where c indexes cities and t indexes years; Train_{ict} is a dummy variable that equals one if individual participates in training and zero otherwise . Post_t is a time dummy variable that equals one if the years after 2014 and zero otherwise. Treat_c indicates the grouping of urban population size. When the urban population is no less than 5 million, the value for Treat_c is

one; otherwise is zero. X_{ict} denotes individual characteristic variables, including the individual's gender, age, and education. Educational and medical resources of the city, will also affect the probability of individuals participating in training. However, using the city control variables directly may lead to the issue of "bad" control variables (Miller, 2023). We follows the approach of Li et al. (2016) by employing the interaction term $C_{c,2012} \times f(t)$ to control for time trends related to city characteristic.

In equation (7), we focus on the interaction term of $Treat_c$ and $Post_t$. The coefficient of interest in equation (7) is β_1, the estimated impact of the hukou reform on an individual's training behavior. We expect the coefficient to be positive, which would suggest a greater increase in the number of training in cities with a population more than 5 million.

As mentioned in Section I, training for migrants serves to enhance skills and income levels, as well as to acquire bonus points that align with settlement policies, such as professional qualifications and vocational certificates. To investigate migrants' motivation for settling and participating in training, this study conducts a comparative analysis of training participation differences between migrants and locals. The analysis includes heterogeneity analysis based on city settlement thresholds, individual education levels, and other dimensions. we examines the labor market outcome of individuals after training, including their wage levels, employment probabilities, and skill matching. The regression equation is as follows:

(8)

$$Y_{ict} = \alpha_0 + \alpha_1 Mig_{ict} + \alpha_2 Train_{ict} + \alpha_3 Train_{ict} \times Mig_{ict} + X_{ict} + C_{c,2012} \times f(t) + \gamma_c + \lambda_t + \varepsilon_{ict}$$

Where Y_{ict} denote variables related to labor market outcome, such as monthly income level, recent work experience, and whether their work skills match with the obtained certificates. The variable Mig_{ict} indicates whether an individual is a migrant, We would also expect the coefficients to increase as the reform advanced. Other variable definitions are consistent with equation(7). The regression analyzes the impact of natives' training participation, denoted by α_3, on labor market performance, represented by α_2. Based on this, this article uses the magnitude in equation $\frac{\alpha_3}{\alpha_2}$ to approximately estimate the proportion of migrants' motivation to settle down in training.

C. Data Source

The article uses data from the 2012-2018 China Labor-force Dynamics Survey (CLDS) to analyze the labor market outcome in mainland of China, We exclude Tibet in all that follows due to limited data. The CLDS contains detailed information on education, work, migration, and social participation. We focus on the labor force participation in training before and after the reform of the household registration system. It also examines labor market performance after training, considering variables such as income level in the past year, employment status,

and job skill qualification matching.

The data is chosen as follows: First, we exclude samples that do not match the city code in minority areas. Second, we remove samples of migrants younger than 16 or older than 65 years old, as well as those whose working status is in school, retired, or doing housework[14].

We define migrants as individuals whose household registration is outside the county when comparing the effects of training between natives and migrants. Migrants may have obtained local hukou through training to increase settlement points, so defining them as natives may not accurately reflect the comparison. Therefore, we define migrants as individuals with local household registration who have migrated.

Table 2 presents descriptive statistics for the CLDS. It shows that 9.63% of laborers participated in training, with 29.95% being migrants. This proportion is consistent with the household registration and current housing address data from the 2015 census, with a difference of 21.16%. The average age of migrants is approximately 43.61 years, with an average of 8.50 years of education. The male proportion is 46.82%, and 86.22% of the sample is married. Additionally, 80.87% of individuals have work experience in the past year, and there is a 63.97% probability of skill certificate matching to jobs.

To examine the settlement intentions and social integration of migrants, we use the China Migrants Dynamic Survey (CMDS) as a second database. The questionnaire includes a question about job training organized by the government, unit, or specialized agency. The response options are coded as '1' for 'yes' and '0' for 'no'. Social integration is measured by assessing migrants' interest in urban development and acceptance by natives, coded as '1' for 'completely disagree' to '4' for 'completely agree'. We also explores the impact of migrants' settlement willingness on their training participation, with detailed results provided in Appendix A3.

The data were processed by removing samples of migrants younger than 16 and older than 60, as well as those with missing education information, resulting in a final sample size of 70,438. Table 2 presents descriptive statistics for the CMDS samples: 27.60% are educated, 47.76% are willing to settle down, with a mean age of approximately 33.81 years, a mean education of 9.10 years, and 59.47% of the sample are male. In addition, 80.16% are married. On average, migrants rated their attention to the city, perceived acceptance by natives, community integration, and perception of being looked down upon by natives as 3.3992, 3.2683, 3.3642, and 2.0196, respectively.

[14]samples missing information about training are excluded.

Table 2—: Descriptive statistics of variables

China Labor-force Dynamics Survey (2012-2018)					
Variable	Observation	Mean	SD	Min	Max
training	65297	0.0963	0.2950	0	1
migrant	65297	0.2995	0.4580	0	1
age	65297	43.6097	13.6823	15	65
education	65297	8.4982	4.4111	0	22
gender	65297	0.4682	0.4990	0	1
marriage	65297	0.8622	0.3447	0	1
ln(income)	41720	9.8117	1.1831	1.6094	15.6073
certificate matches the job	6240	0.6397	0.4801	0	1
work experience	54901	0.8087	0.3933	0	1
China Migrants Dynamic Survey (2011)					
training	70438	0.2760	0.4470	0	1
willingness to settle down	70438	0.4776	0.4995	0	1
age	70438	33.8082	9.0626	16	60
education	70438	9.1038	2.4744	0	19
gender	70438	0.5947	0.4910	0	1
marriage	70438	0.8016	0.3988	0	1
pay attention to city development	70438	3.3992	0.5980	1	4
accepted by natives	70438	3.2683	0.6499	1	4
integrate into the local area	70438	3.3642	0.6649	1	4
not to be looked down upon by natives	70438	2.9804	0.8288	1	4

III. Hukou policy reform and skills training

A. Hukou Reform and training

Table 3 shows the results of estimating(7) for the impact of the 2014 hukou reform on the participation rate of training. The table controls for individual characteristics, the intersection of base period city characteristics and time trends, city-fixed effects, and year-fixed effects. Column 1 presents that cities with stricter settlement policies after 2014 experienced a 2.52 percentage point increase in labor force participation in training, which is statistically significant at the 1% level. Columns 2 and 3 further divide the sample into migrant and natives. China's hukou policy will make it more difficult for migrants to obtain an hukou of urban city with stricter settlement policies. However, natives are not influenced by the reform because they already have local hukou. Column 2 indicates that the probability of natives participating in training only increased by 1.51 percentage points. In comparison, the probability of migrant participation in training has significantly increased by 4.28 percentage points (column 3). Compared to coefficients in columns 2 and 3, it is found that the rate of training is about three times higher than that of natives. This indicates that in cities with stricter settlement policies, migrants are more likely to participate in training after the hukou reform.

The migrants aim to accumulate settlement points under the new hukou policy to increase their chances of settling in and accessing public services. Additionally, natives have shown little motivation to participate in training associated with the hukou policy. However, their participation rate in training has slightly increased following the hukou reform. This phenomenon could be due to labor market competition or cohort effects that motivate individuals to pursue further training, as proposed by Manski (1993). This aligns with the conclusions of Cornelissen et al. (2017), who found that low-skilled groups are more affected by cohort effects.

Column 3 includes migrants who had a local hukou but obtained it after migration. Columns 4 and 5 provide a more detailed analysis of migrants whether have gotten the hukou after migration. In cities with stricter settlement policies after 2014, the probability of migrant workers who obtained a local hukou participating in training increased by 3.73 percent. The probability of migrant workers who have not yet obtained local hukou participating in training increased significantly by 6.05 percentage points, which is statistically significant at the 1% level. Although the policy affects both groups, it has a greater impact on migrants who have not yet obtained local hukou. After the hukou reform, migrants who have not obtained local hukou require more training to secure corresponding opportunities for settling down. Conversely, the motivation to train to settle down weakens among migrants who have obtained hukou and have already settled down. The results also suggest that migrants are motivated to train to settle down.

Table 3—: Hukou reform and skills training: DID estimation

Training	(1) Full sample	(2) Locals	(3) Migrants	(4) Migrants(hukou had ever changed)	(5) Migrants(hukou had not changed
$\text{Treat}_c \times \text{Post}_t$	0.0252***	0.0151**	0.0428**	0.0373*	0.0605***
	(0.009)	(0.007)	(0.017)	(0.021)	(0.022)
Controls	Y	Y	Y	Y	Y
$C_{c,2012} \times f(t)$	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Observations	65,297	45,742	19,555	12,075	7,480
R^2	0.118	0.089	0.173	0.213	0.145

Note: The table presents results based on data from the China Labor-Force Dynamic Survey (CLDS) between 2012 and 2018. The individual characteristic variables considered are age, age squared, gender, education level, and marital status. The city-level control variables include the teacher-student ratio of urban primary and secondary schools in 2012, the number of hospital beds per capita in the city, and urban GDP. The standard errors are clustered to the city level. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

B. Heterogeneity analysis

This section we find some heterogeneity from city and individual aspects.

We investigate the heterogeneity related to city settlement threshold. Using the settlement threshold index of 120 cities calculated by Zhang et al. (2019), which calculates the difference in settlement threshold for each city before and after 2014. The cities are then divided into two groups based on whether their threshold increased or decreased. Cities not included in the 120-city list are considered to have no settlement threshold, which typically applies to small and medium-sized cities.

Table 4 shows that when the settlement threshold increases in cities, the rate in training of migrants also increases significantly by 8.86 percentage points, which is statistically significant at the 1% level. Among cities with increased settlement thresholds, 56.82% have a population of over 5 million, and 61.36% are located on the coast. These cities offer higher wage premiums (Black and Henderson, 1999; Duranton and Puga, 2023), better public services (Artigue et al., 2022; Tiebout, 1956) and more comfortable living environments (Banzhaf and Walsh, 2008). They also require higher levels of human capital (Glaeser and Maré, 2001; Rossi, 2022; Chen et al., 2018). In cities with high settlement thresholds, migrants face greater difficulty in settling and must accumulate hukou points to obtain city hukou. Conversely, the probability of natives participating in training shows no statistical significance. Comparing the different results, it was found that migrants are more likely to engage in training to obtain hukou.

In cities with lower settlement thresholds (columns 3 and 4), there is no statistically significant difference in the probability of participation in training between migrants and natives, particularly in cities with populations below 5 million.

Table 4—: Hukou reform and skills training: city heterogeneity

Training	(1)	(2)	(3)	(4)	(5)	(6)
	Increased threshold		Lower threshold		No threshold	
	Migrants	Locals	Migrants	Locals	Migrants	Locals
$\text{Treat}_c \times \text{Post}_t$	0.0886***	0.0275	0.0266	0.0144	-0.0103	-0.0040
	(0.032)	(0.022)	(0.038)	(0.014)	(0.022)	(0.011)
Controls	Y	Y	Y	Y	Y	Y
$C_{c,2012} \times f(t)$	Y	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	6,799	11,234	5,247	10,687	7,509	23,821
R^2	0.160	0.100	0.182	0.096	0.177	0.075

Note: The results in this table are based on 2012-2018 data from the China Labor-Force Dynamic Survey (CLDS). Individual characteristic variables include individual age, age squared, gender, education level, marital status, etc.; city-level control variables include the teacher-student ratio of urban primary and secondary schools in the base period (2012), the number of hospital beds per capita in the city, and urban GDP. Standard errors are clustered to the city level. *, **, and *** indicate significance at the 10%, 5%, and 1% statistical levels, respectively.

Migrants can now obtain urban hukou more easily by meeting educational and employment requirements, reducing the need for training as a means to obtain urban hukou. Similarly, in cities that do not have a settlement threshold (columns 5 and 6), hukou policy reforms have little effect on training engagement for both demographic groups. Appendix A4 shows that out of the cities without settlement thresholds, 44 are in the eastern region and 94 are in the central and western regions. With 43 cities having populations above 5 million and 95 below this mark, these areas often provide lower public services and experience net population outflows. Migrants display less interest in settling due to the low threshold, which reduces the appeal and necessity of obtaining hukou through training.

Next, we considers the effects of individual characteristics. columns 1 and 2 of Table 5 analyze the educational dimension. Note that big cities always with a high-skill talent preference (Elvery, 2010; Liang and Lu, 2019), The educational bonus points in Table 1 illustrate the eligibility of migrants with a bachelor's degree or higher to obtain a hukou directly in most cities. As a result, the hukou policy is unlikely to significantly affect their training behavior. The sample in this article is divided into two groups based on education level: those with a college degree or lower and those with a bachelor's degree or higher. The results indicate that in cities with stricter hukou policies after 2014, the probability of training increased significantly by 3.39 percentage points for immigrants with a college degree or less, while there was no significant change for migrants with a bachelor's degree or higher. As migrants without a bachelor's degree, they must acquire more settlement points through training to meet the city's requirements. Our survey revealed that migrants with lower levels of education often obtain professional certificates, such as 'System Integration Project Manager', 'Network Engineer', 'Intermediate Economist', and 'Information System Project Manager',

through training. The results indicate that obtaining qualification certificates is crucial for individuals to earn settlement points and achieve citizenship.

Table 5—: Hukou reform and skills training: individual heterogeneity

Training	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Migrants				Locals			
	Bachelor		age		Bachelor		age	
	below	and above	≤ 40	>40	below	and above	≤ 40	>40
$\text{Treat}_c \times \text{Post}_t$	0.0339**	0.0811	0.0542*	0.0241	0.0121	0.0394	0.0244*	0.0069
	(0.015)	(0.064)	(0.029)	(0.015)	(0.007)	(0.055)	(0.014)	(0.007)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
$C_{c,2012} \times f(t)$	Y	Y	Y	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	17,619	1,936	8,140	11,415	43,523	2,219	16,194	29,548
R^2	0.130	0.160	0.176	0.157	0.073	0.186	0.109	0.076

Note: The table presents results based on data from the China Labor Force Dynamic Survey (CLDS) between 2012 and 2018. The individual characteristics analyzed include age, age squared, gender, education level, and marital status. The city-level control variables considered are the teacher-student ratio of urban primary and secondary schools in 2012, the number of hospital beds per capita in the city, and urban GDP. Standard errors are clustered at the city level. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Column 3 and 4 analyze the diverse effects of age. Based on data from the 2018 China Labor Force Dynamics Survey, the migrant population acquires local hukou at a younger age, with an average age of approximately 32.82 years. Conversely, younger age groups can earn more settlement points under the point-based policy, reducing the necessity for participation in training programs. Table 1 displays settlement regulations, including the points system, in various cities such as Guangzhou and Shanghai. However, settlement points decrease with age, especially for those over 40 years old in representative cities such as Shenzhen and Nanjing. Therefore, we divided the sample into two groups: those over 40 years old and those below. The study shows that the rate of training improvement for the migrant population under 40 years old is approximately twice that of the group over 40 years old after the reform of the hukou policy. This may be because younger individuals are expected to have a longer lifespan in urban areas, making it more beneficial for them to obtain hukou through training. Therefore, their motivation to participate in training is stronger, which is consistent with the theoretical model presented in this article.

Columns 5-8 focus on the impact of hukou reform on natives. Columns 5-6 indicate that hukou reform has no significant effect on natives. Local residents who already have hukou no longer need to obtain relevant skills and vocational qualification certificates through training to obtain settlement points. Therefore, the hukou policy will have little impact on the probability of training participation. The data in columns 7 and 8 suggest that household registration reform

will not have an impact on the training participation of natives over 40 years old. However, for natives under 40 years old, the reform resulted in a 2.44 percentage point increase in training participation. This increase represents approximately 45% of the impact on migrants (0.0244/0.0542=0.4502). The data indicates that the reform provides an incentive for migrants to settle down and participate in training.

C. Test of parallel trend and robustness test

Firstly, the validity of the difference-in-difference model relies on the parallel trend assumption. The difference between the treated and control groups is constant over time. To test this identification hypothesis, we employ an event analysis model constructed as follows:

$$\text{Train}_{\text{ict}} = \delta_0 + \sum_{t=2012}^{2018} \delta_t \ \text{Treat}_c \times \ \text{Year}_t + X_{ict} + C_{c,2012} \times f(t) + \gamma_c + \lambda_t + \varepsilon_{ict} \tag{9}$$

The variable $Year_t$ represents the year dummy variable, while the definitions of the other variables are consistent with equation (7). To avoid complete collinearity, we omit the dummy variable for the base year of 2014 in the regression. By observing the coefficients δ_t of policy shocks in different years, we can determine whether there is a difference in the probability of participation in training between the labor force in different group each year. If there was no difference, then the parallel trend assumption required by the difference-in-difference model is fully supported.

Figure 5 plots the estimates of equation (9), a clear pattern emerges from the figure. We take 2014 as the base year. The results suggest no differential trends between the two groups before the reform, which is the key assumption of our identification. Notably, the coefficients in 2016 are significantly greater than zero. The evidence presented in this article confirms that the treatment effect resulting from policy shocks meets the requirement of the Difference-in-difference model used in the baseline regression.

Secondly, we show that our baseline estimates are robust to alternative modeling choices regarding changing the grouping of cities. The 2014 hukou reform proposed strict hukou rules of megacities with an urban population of over 5 million, and the establishment and enhancement of the points-based hukou settlement system. In the baseline regression, the treatment group consists of cities with a population of more than 5 million, while the control group consists of the remaining cities. To ensure the results are robust, three different urban division methods are used for the treatment and control groups. Additionally, urban samples with a population of less than 1 million are excluded from the control group. The policy document states that individuals residing in cities with an urban population of 500,000 to 1 million can apply to register for permanent residence as

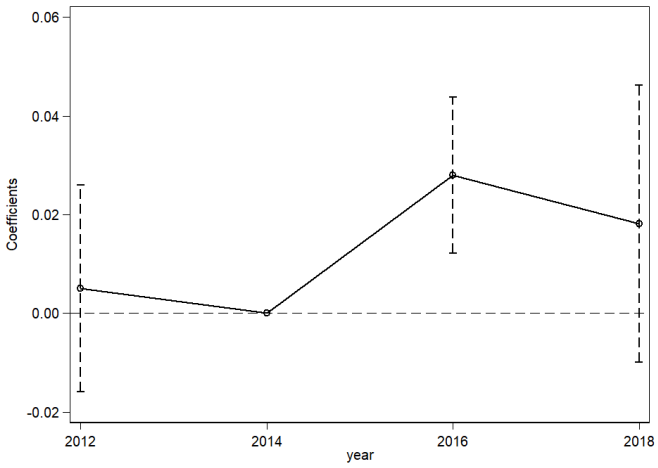

Figure 5. : Parallel Test: Hukou Reform and Training

long as they have legal and stable employment and residence. Consequently, settlement restrictions in cities with less than 1 million people are minimal. Since there are significant differences between cities with a population of less than 1 million and those with a population of more than 5 million, comparing the two types of cities may lead to biased results. To avoid this bias, we exclude samples from cities with a population of less than 1 million in column 1 of Table 6, which indicates that in cities with stricter settlement policies after 2014, the probability of individuals participating in training increased by 2.52 percentage points. This finding is consistent with the baseline regression results presented in Table 3.

Thirdly, we use an urban population of 3 million as the threshold for distinguishing between the treatment and control groups. The proposed reform document for hukou policy suggests that cities with an urban population of 3 to 5 million should moderately control the hukou registration and encourage the government to establish a points-based hukou policy tailored to local conditions. The regression results in column 2 of Table 6 indicate that in cities with stricter settlement policies after 2014, the probability of individuals participating in training increased by 4.11 percentage points. The regression coefficient is slightly larger than the results of the baseline regression, the conclusion holds. Based on column 2, and column 3 of Table 6, samples from cities with a population of less than 1 million were excluded to ensure comparability between the treatment and control groups. The regression results continue to support the conclusions.

Finally, to verify the motivations of migrants to participate in training, we use data from the 2007 China Household Income Survey (CHIPS) [19] to examine

[19]The data is combined from three sub-samples: urban households, rural households, and migrants.

Table 6—: Robustness test: changing the city population size standard

Training	(1) 1 - 5 million vs ≥5 million	(2) < 3 million vs ≥3 million	(3) 1-3 million vs ≥3 million
$Treat_c \times Post_t$	0.0252***	0.0411***	0.0411***
	(0.009)	(0.011)	(0.011)
Controls	Y	Y	Y
$C_{c,2012} \times f(t)$	Y	Y	Y
City FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	64,701	65,297	64,701
R^2	0.118	0.118	0.118

Note: The results in this table are based on data from the China Labor Dynamics Survey (CLDS) from 2012 to 2018. Individual characteristics variables include the individual's age, age squared, gender, education level, marital status, etc. City-level control variables include the student-teacher ratio in primary and secondary schools, the number of hospital beds per capita, and city GDP in the base year (2012). Standard errors are clustered at the city level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

the funding sources of training. If migrants' main motivation for participating in training is to get a city hukou, their training behavior is less related to work. Therefore, the training behavior is more likely to be self-funded rather than government-funded.

In column 1 of Table 7, we use the dummy variable of whether to participate in training self-funded and control the individual characteristic variables, city characteristic variables, and province fixed effects. The estimates of the efficient of the migrant is significantly positive. It suggests that migrants are more likely to self-funded. To ensure that the difference in training funding sources between migrants and natives is caused by the migrant's motivation to settle down, column 2 of Table 7 includes the cross-term between the urban settlement threshold and the migrant. The cross-term coefficient is significantly positive, suggesting that migrants are more likely to participate in training at their own expense in cities with higher settlement thresholds. This finding confirms that in cities with higher settlement thresholds, migrants are more likely to earn settlement points by participating in training.

For comparison, we examine the effect of funding by the government in column 3 and 4. Column 3 indicates that, compared to the natives, migrants are less likely to train funded by the government. Column 4 shows a significant negative coefficient for the cross-term, indicating that in cities with higher settlement thresholds, the probability of migrants receiving government funding for training

The interviewed samples are classified into migrant and natives samples based on the respondent's answers to the question 'Is the current household registration in the local area?' in the questionnaire. The data cleaning process for this study involves retaining only labor force samples of individuals aged 16 years and above who have left school and participated in training-related questions and answers. Samples of individuals over 65 years old are excluded, therefore only samples that have participated in the training are retained

is lower. It is also worth noting the regression coefficient of the main effect of the settlement threshold in the table. In column 2, the regression coefficient for the settlement threshold is significantly negative, while in column 4, it is positive. This indicates that in cities with higher settlement thresholds, the government is more likely to provide training fees for natives. The reason may related to urban technological changes that have caused a shift in the workforce from middle-skilled to high-skilled occupations (Autor and Dorn, 2013; Caunedo et al., 2023). Cities are taking on a more active role in providing effective governance and utilizing government funds to update and upgrade human capital for city development.

Table 7—: Robustness test: city threshold and funding sources of training

Training	(1) Self-funded	(2) Self-funded	(3) Government	(4) Government
Migrant	0.0786***	0.0202	-0.2342***	-0.2059***
	(0.015)	(0.027)	(0.012)	(0.019)
Threshold		-0.0379*		0.0935***
		(0.020)		(0.019)
Threshold		0.0631***		-0.0332**
		(0.023)		(0.016)
Individual controls	Y	Y	Y	Y
City controls	Y	Y	Y	Y
Pro FE	Y	Y	Y	Y
Observations	9,337	9,337	9,337	9,337

Note: The data are sourced from the 2007 China Household Income Survey. The dependent variables are dummy variables indicating whether the training expenses are self-financed or government-funded. Individual characteristics variables include the individual's age, age squared, gender, education level, marital status, etc. City-level control variables include the student-teacher ratio in primary and secondary schools, the number of hospital beds per capita, and city GDP. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

IV. Training Effects on Labor Outcomes

The following section examines whether training behaviors with additional motivation for settling in have different effects on an individual's performance in the labor market. The impact is analyzed from two perspectives: labor market performance and social identity.

A. Skills Training and Labor Market Outcomes

Natives participate in training to improve human capital accumulation, while migrants train to acquire skills or professional certification related to the points-based hukou policy. This different incentive for migrants and natives to train leads to different labor market outcomes. Moreover, it may not be possible to accurately compare the labor market differences between migrants and natives after participating in training, as the costs and benefits of training directly affect

an individual's decision to participate. The costs and benefits of training depend not only on individual characteristics such as age, gender, marital status, years of education and whether is a migrant or not, but also on the location of the city.

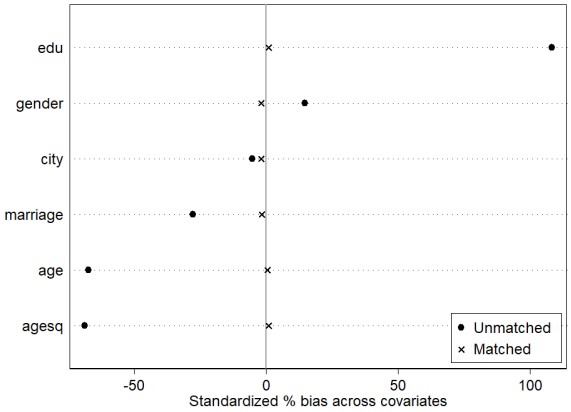

Figure 6. : Changes in standard deviation before and after matching

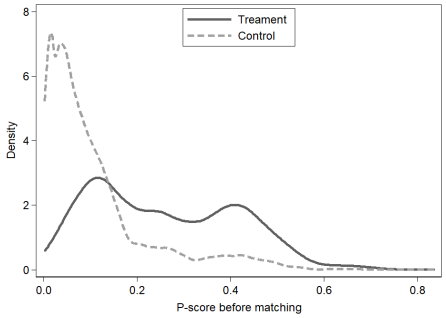

Figure 7. : Before matching

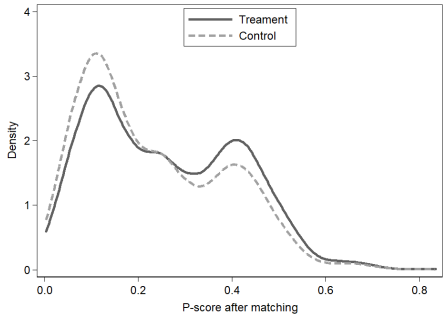

Figure 8. : After matching

To solve this problem, we use the propensity score matching (PSM) method to solve the self-selection bias by using the Logit model. The Logit model includes the labor force's age, gender, marital status, years of education, and city as explanatory variables for the regression. Next, we calculate the propensity score value for each individual's participation in training based on the Logit model. Then, we make a one-to-one nearest-neighbor matching between individuals who have participated in training with those who haven't. Finally, we utilized the matched samples to conduct a least squares regression analysis to estimate the average treatment effect of the training.

Figures 7 and 8 shows the impact of PSM matching on balancing individual characteristics. Figure 7 illustrates a significant reduction in the standardized deviation of the individual characteristics after matching, indicating successful balancing of the individual characteristics of the two groups. Furthermore, Figure 8 shows that the degree of overlap of the propensity score values between the control and treatment groups significantly improved after PSM matching. This indicates that PSM matching can better ensure comparability.

The regression results based on the matched samples are presented in columns

Table 8—: Skills training and labor market outcomes

	(1) Income	(2) Skill matching	(3) Employment	(4) Income
Migrant	0.1716***	0.0060	-0.0068	0.2202***
	(0.026)	(0.019)	(0.009)	(0.014)
Training	0.1461***	0.0831***	0.0747***	0.1769***
	(0.018)	(0.017)	(0.006)	(0.014)
Migrant population × training	-0.0907***	-0.0701***	-0.0336***	
	(0.027)	(0.024)	(0.009)	
Training ratio of migrant				0.4178***
				(0.062)
Proportion of training for locals				1.3662***
				(0.089)
Individual characteristics	Y	Y	Y	Y
$C_{c,2012} \times f(t)$	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
City FE	Y	Y	Y	N
Province FE				Y
Observations	41,720	6,240	54,901	41,484
R^2	0.476	0.215	0.289	0.355

Note: The results in this table are based on data from the China Labor Dynamics Survey (CLDS) from 2012 to 2018. Individual characteristics variables include individual's age, age squared, gender, education level, marital status, etc. City-level control variables include the student-teacher ratio in primary and secondary schools, the number of hospital beds per capita, and city GDP in the base year (2012). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

1-3 of Table 8. We can see that participation in training can increase an individual's income by 14.61 percentage points, skill matching by 8.31 percentage points, and employment probability by 7.47 percentage points. Training and education are important ways of improving human capital, which can reduce the unemployment rate and increase the labor force participation rate (Moreno-Galbis, 2012; Spinnewijn, 2013), reduce skill mismatch and improve the quality of employment (Guvenen et al., 2020; Fredriksson et al., 2018). Additionally, training can increase individual income levels and improve labor market outcomes (Ashenfelter, 1978; Brown and Koettl, 2015), which is consistent with the our results.

The labor market outcome of training. The cross-term coefficient in table 8 shows the difference in training effects between migrants and natives. Migrants have an additional incentive to participate in training, not only to improve their labor market outcome but also to obtain the hukou of urban city. Therefore, it is expected that training participation motivated by hukou will lead to a smaller improvement in the labor market for migrants. The results show that participation in training increases the income of migrants by 9.07 percentage points less than that of natives and increases the skill matching of migrants by 7.01 percentage points less than that of natives. It also raises the probability of employment by 3.36 percentage points less for migrants than for natives. These differences are statistically significant at the 1% confidence level. To estimate the strength of motivation to getting hukou, the results in column 1 indicates that training for hukou leads to a 62.08% reduction in the income increase of the migrants (0.0907/0.1461). This suggests a strong motivation for settling down through training. column 2 indicates that the motivation leads to an 84.36% reduction in skill matching improvement (0.0701/0.0831) and a 44.98% reduction in employment probability (0.0336/0.0747). Overall, our results suggest that the impact of the hukou restriction on the motivation of migrant population training should not be underestimated.

Spillover to living cities. The behavior of training influence is not necessarily restricted to individual themselves. It could naturally spillover to local city through the human capital channel (Lucas Jr, 1988; Stoyanov and Zubanov, 2012; Liang and Lu, 2019; Liu and Yang, 2021), which are mainly generated by high-skilled labor (Moretti, 2004). Column 2 in table 8 found that training significantly improves the skill match of the workforce. Therefore, it is expected that as the proportion of cities participating in training increases, the average skill level of the labor force will increase, leading to an increase in the income level of everyone in the city through the spillover mechanism. Column 4 in Table 8 measures the participation of urban migrants and natives in training by using the proportion of individuals from each group who participated in training that year. The data indicates that for each 1% increase in the training proportion of natives, the individual income level in the city increases by 1.37%, while for each 1% increase in the proportion of migrants participating in training, the individual income level only increases by 0.42%. This suggests that the positive spillover of training brought by migrants are lower compared to natives. The disparity between the two spillovers may also indicate the different goals of individuals. Interestingly, the difference between the two is 69.42%, which is comparable to the outcome of the private return for training in column 1 of Table 8.

To summarize, training for hukou can result in a 'mismatch' in the labor market and decreased efficiency. This is reflected in a slight improvement in the performance of migrant workers, as well as a slight increase in the income of other individuals in the city.

B. Skills training and social identity

Participation in training can positively impact the social identity of migrants, compensating for the negative effects of mislocation on the labor market. This demonstrates individuals' willingness to actively integrate into the community. Furthermore, training can provide individuals with additional social relationships, opportunities, and resources to integrate into society. Therefore, we expect that training will positively impact the social integration of migrants. The level of social integration is determined by the migrants' engagement with the city, their acceptance and approval by locals, their active involvement in the local community, and their attitude towards locals.

Table 9's odd columns show that training participation significantly promotes

Table 9—: Skills training and social identity

	Attention to city development		Accepted by locals		Integrate into the locals		Not to be looked down upon by locals	
Training	0.0706***	0.0653***	0.0685***	0.0621***	0.0570***	0.0471***	0.0580***	0.0560***
	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)
Willingness		0.1351***		0.1652***		0.2564***		0.0523***
		(0.005)		(0.005)		(0.005)		(0.006)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
City FE	Y	Y	Y	Y	Y	Y	Y	Y
Hukou Pro FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean Dep.	3.3992		3.2683		3.3642		2.9804	
(sd)	(0.598)		(0.650)		(0.665)		(0.829)	
Observations	70,438	70,438	70,438	70,438	70,438	70,438	70,438	70,438
R^2	0.078	0.089	0.088	0.102	0.073	0.104	0.105	0.106

Note: This data is based on 2011 data from the China Migrant Dynamic Survey (CMDS). Control variables include the individual's age, age squared, education level, gender, and marital status. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels respectively.

migrants' attention to the city's development and their willingness to integrate into the local area. It also makes them feel more accepted and less discriminated against by natives. The coefficient of training accounts for approximately 7% to 11% of the standard deviation of the explained variable, demonstrating its economic significance. To avoid omitted variable bias, we included the willingness to settle variable in the even-numbered columns of Table 9. This variable reflects an individual's positive impact on social integration and training participation. The results show that the coefficients of the training variable remain robust, with only a slight decrease in size. Furthermore, settlement intention has a significant promoting effect on social identity.

Migrants face challenges in social integration when moving to urban areas, even after obtaining a local city hukou. Participating in skills training has been shown to improve individuals' contributions to social security (Attanasio et al., 2015). Furthermore, skill development programs have been linked to reduced urban crime rates and increased social mobility (Bertrand et al., 2021). Our results

indicate that training can help overcome obstacles to social integration, labor mobility. Encouraging migrant populations to participate in training can effectively prompt them to focus on local life, integrate successfully into major cities, reduce labor market friction, and facilitate the mobility of labor in China.

V. Conclusion

Recent literature suggests that inefficient allocation of human capital due to labor market distortions can lead to losses for a country. In economies with distorted labor markets, cities may not optimally determine the utilization of labor inflows. China is an interesting case due to its historically rigid hukou policy, which has restricted the free movement of workers across the country. This paper examines how the hukou system affects migrants' settlement decisions in China and the role of training in this process. It also presents empirical evidence of the impact of the hukou reform on migrants' settlement decisions. Migrants often acquire skills or certifications related to the hukou policy through training programs to achieve their goal of settling down. Exploring skills training behavior motivated by settlement aspirations and its impact on the labor market and social integration of migrants is particularly important.

We examines the motivation for settlement and labor force participation training under hukou constraints and its impact on the citizenization and social integration of migrants. A human capital theory based on Becker (1962) is used in our paper: the positive effect of skills training on settlement points will increase the probability of migrant participation in training. We analyze the impact of the settlement needs of migrants under hukou reform on individual participation in training, labor market performance, and social integration. Using data from the China Labor Force Dynamic Survey between 2012 and 2018, we utilize the hukou reform of 2014 as a quasi-natural experiment. Our empirical results suggest that the 2014 hukou reform led to a significant increase in labor force participation in training in cities with stricter settlement policies. Additionally, the study found that the number of migrants participating in training was three times that of natives. In cities with a high settlement threshold, migrants were more likely to participate in skills training. Migrants with a college degree or below, as well as those aged 40 and below, require training to settle down. Additionally, in cities with higher settlement thresholds, migrant training funds are more likely to be self-funded rather than government-funded. These findings confirm that migrants are motivated to settle down better through training.

We discuss whether training behavior motivated by settling down in the labor market differs from traditional training behavior. Our analysis reveals that participation in training promotes individual performance improvement in the labor market at a micro level. However, the positive impact of migrant population participation in training on labor market performance is lower compared to that of natives. Specifically, the increase in personal income is 62.08% lower, the improvement in skill matching is 84.36% lower, and the probability of employment

is 44.98% lower. At the macro level, the positive impact of training for migrant workers on the income of other laborers in the same city is relatively weak. Although the benefits of labor market training are small, this article also found that it has a strong positive impact on improving the social identity of migrants and promoting social integration. This social effect can significantly mitigate the constraints caused by the hukou policy. This statement aims to expedite the creation of a cohesive national market to facilitate the assimilation of migrant communities in their destination regions and enable seamless labor mobility and employment opportunities. Our result has three policy implications.

Firstly, cities should establish comprehensive conditions and requirements for the settlement of migrants. The conclusion of this paper suggests that mobile populations may choose to participate in settlement training. However, if hukou constraints are not taken into account, this choice may not necessarily maximize social welfare. To promote full labor mobility, local governments should be urged to remove unreasonable settlement restrictions and barriers. Local talent introduction conditions should be set reasonably and flexibly, and qualification certificates for talent introduction should align with the strategic development needs of the city and surrounding areas.

Secondly, local governments should support training institutions in providing courses that are more relevant to market demand. This will improve the impact of human capital and the economic benefits of training. According to this article, training migrant workers with the aim of citizenization will have a reduced role in improving the labor market and will have low positive spillover for the city. The motivation for migrants to participate in training is not solely to improve their labor market performance. Additionally, the actual needs of employment are not fully considered. Therefore, governments can cooperate with enterprises to provide training that meets the actual needs of local industries. This can be combined with policies that support hukou policy to ensure the smooth settlement of migrants. After that, migrants can select training courses that fulfill both their employment and settlement requirements, achieving the dual objectives of enhancing labor market performance and integration. it may be necessary to loosen the link between training and settlement to reduce the mismatch caused by training for settlement and to increase the human capital benefits of training for migrants.

Thirdly, governments should prioritize the positive impact of training on social integration. Despite the vigorous hukou reforms, there is still a gap between migrants and natives in accessing basic public services. Even after successfully obtaining a local hukou, migrants often face differences in social insurance, cultural life, psychological acceptance, and identity compared to locals. Training participation can enhance the social identity of migrants and facilitate social integration. Therefore, in culturally diverse areas with significant socioeconomic disparities and a need for improved social integration, the government can promote the integration of migrant populations into urban society by supporting

local training projects. This statement aims to achieve the triple goals of labor mobility, migrant citizenization, and social integration by enhancing their quality of life and integration.

REFERENCES

Acemoglu, D. and Pischke, J.-S. (2003). Minimum wages and on-the-job training. In *Worker Well-Being and public policy*, volume 22, pages 159–202. Emerald Group Publishing Limited.

Acevedo, P., Cruces, G., Gertler, P., and Martinez, S. (2020). How vocational education made women better off but left men behind. *Labour Economics*, 65:101824.

Angrist, J. and Imbens, G. (1995). Identification and estimation of local average treatment effects.

Artigue, H., Brinkman, J., and Karnasevych, S. (2022). The push of big city prices and the pull of small town amenities.

Ashenfelter, O. (1978). Estimating the effect of training programs on earnings. *The Review of Economics and Statistics*, pages 47–57.

Attanasio, O., Guarín, A., Medina, C., and Meghir, C. (2015). Long term impacts of vouchers for vocational training: Experimental evidence for colombia. Technical report, National Bureau of Economic Research.

Autor, D. H. and Dorn, D. (2013). The growth of low-skill service jobs and the polarization of the us labor market. *American economic review*, 103(5):1553–1597.

Banzhaf, H. S. and Walsh, R. P. (2008). Do people vote with their feet? an empirical test of tiebout's mechanism. *American economic review*, 98(3):843–863.

Bartik, T. J. (2020). Using place-based jobs policies to help distressed communities. *Journal of Economic Perspectives*, 34(3):99–127.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of political economy*, 70(5, Part 2):9–49.

Bertrand, M., Mogstad, M., and Mountjoy, J. (2021). Improving educational pathways to social mobility: evidence from norway's reform 94. *Journal of Labor Economics*, 39(4):965–1010.

Black, D. and Henderson, V. (1999). A theory of urban growth. *Journal of political economy*, 107(2):252–284.

Black, S. E. and Lynch, L. M. (1996). Human-capital investments and productivity. *The American economic review*, 86(2):263–267.

Brown, A. J. and Koettl, J. (2015). Active labor market programs-employment gain or fiscal drain? *IZA Journal of Labor Economics*, 4:1–36.

Caunedo, J., Jaume, D., and Keller, E. (2023). Occupational exposure to capital-embodied technical change. *American Economic Review*, 113(6):1642–1685.

Chan, K. W. and Buckingham, W. (2008). Is china abolishing the hukou system? *The China Quarterly*, 195:582–606.

Chen, B., Liu, D., and Lu, M. (2018). City size, migration and urban inequality in china. *China Economic Review*, 51:42–58.

Chen, Y. and Feng, S. (2013). Access to public schools and the education of migrant children in china. *China Economic Review*, 26:75–88.

Conti, G. (2005). Training, productivity and wages in italy. *Labour economics*, 12(4):557–576.

Cornelissen, T., Dustmann, C., and Schönberg, U. (2017). Peer effects in the workplace. *American Economic Review*, 107(2):425–456.

Dewen, W., Fang, C., and Guoqing, Z. (2010). Factors influencing migrant workers' employment and earnings—the role of education and training. *Social sciences in China*, 31(3):123–145.

Duranton, G. and Puga, D. (2004). Micro-foundations of urban agglomeration economies. In *Handbook of regional and urban economics*, volume 4, pages 2063–2117. Elsevier.

Duranton, G. and Puga, D. (2023). Urban growth and its aggregate implications. *Econometrica*, 91(6):2219–2259.

Dustmann, C., Frattini, T., and Lanzara, G. (2012). Educational achievement of second-generation immigrants: an international comparison. *Economic Policy*, 27(69):143–185.

Elvery, J. A. (2010). City size and skill intensity. *Regional Science and Urban Economics*, 40(6):367–379.

Foged, M., Hasager, L., Peri, G., Arendt, J. N., and Bolvig, I. (2022). Language training and refugees' integration. *Review of Economics and Statistics*, pages 1–41.

Fredriksson, P., Hensvik, L., and Skans, O. N. (2018). Mismatch of talent: Evidence on match quality, entry wages, and job mobility. *American Economic Review*, 108(11):3303–3338.

Freeman, R., Liang, W., Song, R., and Timmins, C. (2019). Willingness to pay for clean air in china. *Journal of Environmental Economics and Management*, 94:188–216.

Gao, X., Liang, W., Mobarak, A. M., and Song, R. (2023). Migration restrictions can create gender inequality: The story of china's left-behind children. Technical report, National Bureau of Economic Research.

Glaeser, E. L. and Maré, D. C. (2001). Cities and skills. *Journal of labor economics*, 19(2):316–342.

Guvenen, F., Kuruscu, B., Tanaka, S., and Wiczer, D. (2020). Multidimensional skill mismatch. *American Economic Journal: Macroeconomics*, 12(1):210–244.

Hu, F., Xu, Z., and Chen, Y. (2011). Circular migration, or permanent stay? evidence from china's rural–urban migration. *China Economic Review*, 22(1):64–74.

Jiang, J., Zhang, G., Qi, D., and Zhou, M. (2016). Can on-the-job training stabilize employment among rural migrant workers? *China Agricultural Economic Review*, 8(3):498–515.

Khanna, G., Liang, W., Mobarak, A. M., and Song, R. (2021). The productivity consequences of pollution-induced migration in china. Technical report, National Bureau of Economic Research.

Konings, J. and Vanormelingen, S. (2015). The impact of training on productivity and wages: firm-level evidence. *Review of Economics and Statistics*, 97(2):485–497.

Kugler, A., Kugler, M., Saavedra, J. E., and Herrera-Prada, L. O. (2022). Long-term educational consequences of vocational training in colombia: Impacts on young trainees and their relatives. *Journal of Human Resources*, 57(1):178–216.

Kuruscu, B. (2006). Training and lifetime income. *American Economic Review*, 96(3):832–846.

Leuven, E., Oosterbeek, H., and Van Ophem, H. (2004). Explaining international differences in male skill wage differentials by differences in demand and supply of skill. *The Economic Journal*, 114(495):466–486.

Li, P., Lu, Y., and Wang, J. (2016). Does flattening government improve economic performance? evidence from china. *Journal of development economics*, 123:18–37.

Liang, W. and Lu, M. (2019). Growth led by human capital in big cities: Exploring complementarities and spatial agglomeration of the workforce with various skills. *China Economic Review*, 57:101113.

Liu, S. and Yang, X. (2021). Human capital externalities or consumption spillovers? the effect of high-skill human capital across low-skill labor markets. *Regional Science and Urban Economics*, 87:103620.

Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of monetary economics*, 22(1):3–42.

Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *The review of economic studies*, 60(3):531–542.

Miller, D. L. (2023). An introductory guide to event study models. *Journal of Economic Perspectives*, 37(2):203–230.

Mincer, J. (1962). On-the-job training: Costs, returns, and some implications. *Journal of political Economy*, 70(5, Part 2):50–79.

Mookherjee, D. and Ray, D. (2010). Inequality and markets: some implications of occupational diversity. *American Economic Journal: Microeconomics*, 2(4):38–76.

Moreno-Galbis, E. (2012). The impact of tfp growth on the unemployment rate: Does on-the-job training matter? *European Economic Review*, 56(8):1692–1713.

Moretti, E. (2004). Human capital externalities in cities. *Handbook of Regional and Urban Economics*, 4:2243–2291.

Neumark, D. and Wascher, W. (2001). Minimum wages and training revisited. *Journal of Labor Economics*, 19(3):563–595.

Rossi, F. (2022). The relative efficiency of skilled labor across countries: Measurement and interpretation. *American Economic Review*, 112(1):235–266.

Schnepf, S. V. (2007). Immigrants' educational disadvantage: an examination across ten countries and three surveys. *Journal of population economics*, 20:527–545.

Spinnewijn, J. (2013). Training and search during unemployment. *Journal of Public Economics*, 99:49–65.

Stoyanov, A. and Zubanov, N. (2012). Productivity spillovers across firms through worker mobility. *American Economic Journal: Applied Economics*, 4(2):168–198.

Sullivan, P. (2010). Empirical evidence on occupation and industry specific human capital. *Labour economics*, 17(3):567–580.

Tian, B., Lin, C., Zhang, W., and Feng, C. (2022). Tax incentives, on-the-job training, and human capital accumulation: Evidence from china. *China Economic Review*, 75:101850.

Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of political economy*, 64(5):416–424.

Whalley, J. and Zhang, S. (2007). A numerical simulation analysis of (hukou) labour mobility restrictions in china. *Journal of Development Economics*, 83(2):392–410.

Woodhall, M. (1987). Human capital concepts. In *Economics of education*, pages 21–24. Elsevier.

Zhang, J., Huang, J., Wang, J., and Guo, L. (2020). Return migration and hukou registration constraints in chinese cities. *China Economic Review*, 63:101498.

Zhang, J., Wang, R., and Lu, C. (2019). A quantitative analysis of hukou reform in chinese cities: 2000–2016. *Growth and Change*, 50(1):201–221.

Appendix

A1. The situation of China's skills training

The Chinese government is closely monitoring and launching relevant skills training projects to promote the reform process of migrant citizenship. The 'National Rural Revitalization Strategic Plan (2018-2022)' proposes improving the employment and unemployment registration and management system, providing government-subsidized vocational skills training services to the agricultural migrant population, and ensuring eligible unsettled migrant workers have equal access to basic public services in cities and towns. Figures A1 and A2 depict the national training situation since 2011. From 2011 to 2021, an average of 20.94 million subsidized vocational skills training programs were conducted nationwide. Migrant workers and the unemployed received an average of 9.54 million and 2.68 million annual training sessions, respectively, accounting for 45.55% and 12.78% of the total training. This underscores the significance of skills training in enhancing labor employment and job skills, which are crucial for urban development and construction. However, state-issued skills training plans have not adequately considered the motivations of migrants to settle down or how to assist them in finding jobs that align with their skill sets. Therefore, it is crucial to address skills training and increase settlement opportunities for migrants.

A2. Motivations and ways to realize the settlement of migrant

Based on the 2017 migrant monitoring data, this appendix presents the reasons for migrants' willingness to settle down. Table A1 displays that the main reasons for settling are economic opportunities (44.86%), family (44.13%), and public services (11.01%). Large cities are more efficient and productive, providing greater economic opportunities for the labor force, increasing personal income,

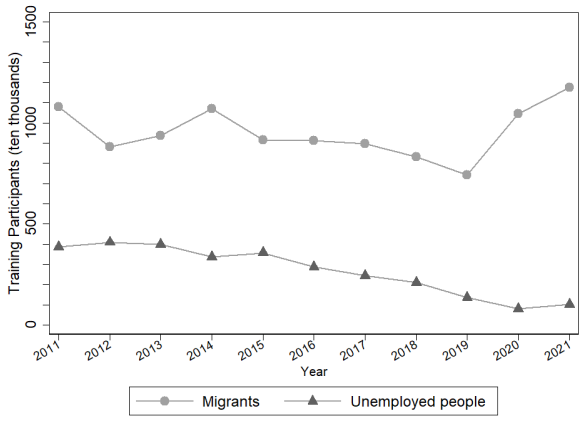

Figure A1. : Number of skills training for migrants and unemployed people

and attracting migrants to settle there. Among the reasons for settling down, personal development space and income level improvement accounted for 20.36% and 16.86%, respectively. Furthermore, many migrants settle in the local area to provide better educational opportunities for their children, which accounts for 23.62% of cases. The uneven distribution of educational resources under the 'urban-rural dual' structure widens the educational gap between urban and rural areas. Education is an important tool for promoting upward mobility and breaking down social barriers. Migrant workers often prioritize obtaining high-quality education for their children, which has become a core reason for their migration and settlement in urban areas. In addition, access to improved urban public services, such as transportation, medical technology, and efficient government management, is a crucial factor for migrants when choosing where to settle.

After analyzing the primary reasons for migrants' willingness to settle down and conducting a survey on training institutions in the Pearl River Delta region of China, we conducted on-site research on how migrants obtain hukou and settle down. It was found that obtaining urban city hukou through skills training is a common method. The migrant population can obtain vocational qualification certificates listed in the 'National Vocational Qualification Catalog' or receive training for point-based occupations to increase their settlement points. According to the survey results, the most popular certificates among migrants in the 'National Vocational Qualification Catalog' are 'System Integration Project Manager', 'Network Engineer', 'Intermediate Economist', and 'Information System Project Manager', among others. Table A2 shows that the positions of 'System Integration Project Manager', 'Network Engineer', and 'Information System Project Manager' do not have any specific requirements for applicants' age, education, or work experience. Therefore, these positions have become popular among migrants. However, many migrants encounter difficulties in obtaining cer-

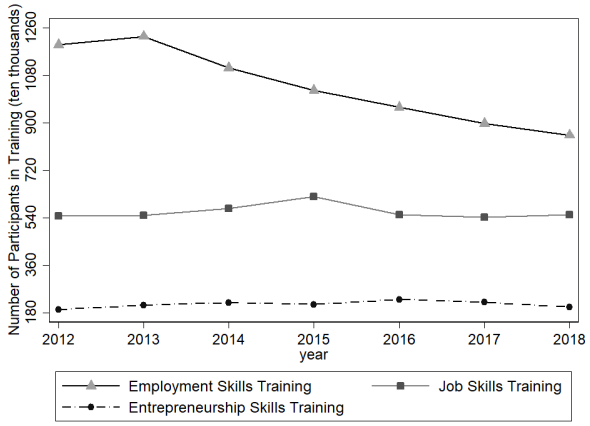

Figure A2. : Variety of skill training programs

Table A1—: Reasons of migrants willingness to settle down in 2017

Reasons for staying in the living city		Num	Percent
Economic Opportunities (44.86%)	better personal development	27038	20.36%
	higher income	22396	16.86%
	working experience	10142	7.64%
Family deveploment (44.13%)	better educational opportunities for children	31369	23.62%
	family reunion	15655	11.79%
	connect to local social networks	5660	4.26%
	marry with local citizens	5910	4.45%
Public services (11.01%)	more convenient transportation	12978	9.77%
	better medical technology	988	0.74%
	better government management	668	0.50%
	Total	132804	100%

tificates due to insufficient knowledge and a mismatch between their certificates and job skills. As a result, migrants may need to participate in training programs to obtain the necessary certificates. Once obtained, they must pay one month's insurance in the city where they reside. After obtaining the local hukou, migrants can access public services such as purchasing a house, education for their children, and urban medical care related to their household registration. Professional qualifications and titles can be used to introduce their talents and increase their chances of settling in the place of migration by earning settlement points.

Table A2—: Description of vocational certificates

Vocational certificate	Certificate level	Age	Education	Qualifications
Network Engineer	intermediate	no require	no require	no require
System Integration Manager	intermediate			
Information Systems Manager	senior			
Intermediate Economist	intermediate		high school or above	need working experience

Note: To meet the requirements of Intermediate Economist, candidates must have a high school diploma and primary economic, professional, and technical qualifications, as well as at least 10 years of work experience. Alternatively, candidates may have a college degree and at least 6 years of work experience, a bachelor's degree and at least 4 years of work experience, a second bachelor's degree or a graduate degree and at least 2 years of work experience, or a master's degree and at least 1 year of work experience.

A3. Migrants' willingness to settle down and skills training

The article's regression results indicate that, after the hukou reform, migrants participate in training more than natives. This effect is particularly noticeable in cities with higher settlement thresholds and for groups with college degrees or lower. The article proposes that the points settlement policy implemented after the hukou reform is one of the main reasons for this outcome. Skilled and vocational qualification certificates are highly valued for settlement. The migrants can increase their settlement bonus points through short-term training.To encourage migrants to receive training and settle down, this appendix analyzes the impact of migrants' willingness to settle down on their probability of participating in training, using data from the 2011 China Migrant Population Dynamic Survey (CMDS). The regression coefficient for willingness to settle is 3.47, which is statistically significant at the 1% level. This suggests that migrants with a stronger willingness to settle are more likely to participate in training. Column 2 accounts for the fixed effects of the province of residence of migrants to capture the impact of province of residence on training behavior. The results show a positive and significant coefficient of settlement intention, with a slight decrease of 3.33 percentage points.

Table A3 presents the regression results of OLS using two different instrumental variables and the instrumental variable regression method to alleviate the endogeneity problem caused by omitted variables and potential reverse causality. The instrumental variables used are all city-level variables, and the regression controls for province-level fixed effects in columns 3 to 6. Columns 3 and 4 use the average settlement intention in the city from the same province of household registration as an instrumental variable. Column 3 shows a significant correlation coefficient of 0.5840 at the 1% level between the average settlement intention in the city and the individual settlement intention from the same household registration province. The first stage's F value is 442, and the instrumental variable satisfies the require-

Table A3—: Migrants' willingness to settle down and skills training

Training	(1) OLS	(2) OLS	(3) First Stage	(4) Second Stage	(5) First Stage	(6) Second Stage
Willingness	0.0347***	0.0333***		0.0876***		0.2083***
	(0.004)	(0.004)		(0.018)		(0.075)
IV_1			0.5840***			
			(0.011)			
IV_2					-0.0339***	
					(0.003)	
Controls	Y	Y	Y	Y	Y	Y
City FE	Y	Y	N	N	N	N
Hukou Pro FE	N	Y	Y	Y	Y	Y
F-value			442.011		11.059	
Observations	70,438	70,438	69,423	69,423	61,827	61,827
R^2	0.092	0.095	0.141	0.053	0.106	0.020

Note: This table is base on the data of 2011 China Migrants Dynamic Survey (CMDS) and includes individual characteristics such as age, age squared, education level, gender, and marital status. City-level data on industrial smoke and dust emissions are also included. To minimize the impact of outliers, a 0.1% shrinkage is applied. Statistical significance is denoted by *, **, and *** for the 10%, 5%, and 1% levels, respectively.

ments well. The results of the second stage, presented in column 4, indicate that migrants' willingness to settle down can increase their participation in training by 8.76 percentage points.This finding highlights that migrants who have a stronger desire to settle down are more likely to participate in training. After applying instrumental variable regression, the estimated impact of settlement intention on training improvement is approximately twice that of OLS (the coefficient in column 2 of Table A3 is 0.0333).

To ensure the exogeneity assumption of instrumental variables and avoid reflection problems, column 5-6 utilize an alternative instrumental variable: urban industrial smoke and dust emissions. The results are presented in the last two columns. Column 5 shows that emissions of urban industrial dust significantly decrease individuals' willingness to settle. The finding is in line with previous research that suggests pollution can increase migration tendencies (Freeman et al., 2019; Khanna et al., 2021; Chen and Feng, 2013). The F-value in the first stage is lower than the F value of the average settlement willingness, which supports the expectations of this article. However, the F-value is slightly higher than 10, indicating a low possibility of weak instrumental variables. Column 6 shows that an individual's willingness to settle increases the probability of participating in training by 20.83 percentage points, which is statistically significant at the 1% level. The increase in individual training achieved by willingness to settle is approximately twice that of using the average willingness to settle as an instrumental variable. These results reflect the local average treatment effect (Angrist and Imbens, 1995).Therefore, the two instrumental variables may capture the training motivations of different migrants, resulting in differences in the size of the regres-

Table A4—: Willingness to settle down and skills training: heterogeneity

Training	(1) Low skill	(2) High skills	(3) $\leq$ 5 years	(4) $>$ 5 years	(5) With children	(6) Children left behind
Willingness	0.0914***	-0.0072	0.0280	0.1766***	0.1182***	0.0142
	(0.018)	(0.160)	(0.023)	(0.029)	(0.026)	(0.055)
Controls	Y	Y	Y	Y	Y	Y
Pro FE	Y	Y	Y	Y	Y	Y
Hukou Pro FE	Y	Y	Y	Y	Y	Y
Mean Dep.	0.2680	0.4857	0.2839	0.2593	0.2426	0.2958
Mean Indep.	0.4762	0.5154	0.4525	0.5313	0.4879	0.4427
Observations	66,881	2,542	47,264	22,159	26,408	12,631
R 2	0.046	0.062	0.059	0.033	0.038	0.064

Note: This table presents data from the 2011 China Migrants Dynamic Survey (CMDS). This table presents the estimation results of IV, which represents the average willingness of other individuals to settle in the same province as the household registration. The table's columns (5) and (6) indicate the location of children based on the position of the youngest child aged 15 or under. If there are multiple children under 15 years old, the location is determined based on the top child. Statistical significance levels are indicated by *, **, and ***, representing 10%, 5%, and 1%, respectively.

sion coefficients in columns 4 and 6.

Table A4 uses migrant monitoring data to analyze heterogeneity. The samples are divided into groups based on skill level. The samples are divided into low-skilled, which includes those with a college degree or below, and high-skilled, which includes those with a bachelor's degree or higher. According to the data in columns one and two, low-skilled migrants are more likely to participate in training if they are willing to settle down, while high-skilled migrants are not significantly impacted. Columns 3 and 4 are divided into two groups based on flow duration. Individuals who have been mobile for longer periods may be more inclined to settle down, which could influence their willingness to participate in training. The results suggest that those who have been mobile for five years or more are more likely to participate in training to settle down. However, for individuals who have lived in the city for less than five years, participating in such training does not have a significant impact. Two possible reasons for this are suggested. Firstly, the longer an individual lives in the city, the more they adapt to local living habits, accumulate work experience and expand their local social network. This can increase their motivation to settle down. Individuals who have been mobile for five years or more are likely to be familiar with the city's settlement rules. When their desire to settle increases, they may seek training to facilitate the process.

Columns 5 and 6 consider not only the skill level and length of mobility but also the impact of whether children move with the individual. Cities face challenges in providing equal public services to their migrant populations. Moreover, due to a lack of local household registration, many migrant children in China are unable to attend public schools (Hu et al., 2011). The reason is that many migrants move to the cities for the education of their children. We divide the

sample into two groups in columns 5 and 6: children who moved with their parents and children who stayed in their hometown. When children move with their parents, their willingness to settle down significantly increases their probability of participating in training. Children who stay in their hometown are more likely to receive education locally and therefore have weaker motivation for training to settle down. It is worth noting that migrant children are typically of compulsory education age. Without urban household registration, individuals may encounter obstacles when enrolling in public schools or may be subject to higher tuition fees. Consequently, parents may resort to various methods, such as obtaining relevant certificates through training, to acquire local household registration. For families with left-behind children, there is less urgency to settle down.

A robustness test was conducted on the migrant data, and the results are presented in Table A5. The explanatory variable was changed to 'residence intention'. We used data from the China Migrants Dynamic Survey conducted in 2010, 2013, and 2014. The core explanatory variable 'willingness to settle down' was replaced with 'willingness to stay'. Column 1 shows that as a migrant's intention to stay increases by one percentage point, there is a significant 1.84 percentage point increase in the probability of the migrant participating in training. The sample size was increased to include more participants. However, respondents who answered 'unclear' to the question about their willingness to settle down were excluded from the baseline regression in this article. To examine the impact of willingness to settle down on training, this article assigns a value of 0 to samples that answered 'no' or 'unclear' about their willingness to settle down. To examine the impact of willingness to settle down on training, this article assigns a value of 0 to samples that answered 'no' or 'unclear' about their willingness to settle down. This ensures that individuals with unclear intentions, who may have a weaker inclination to settle down, are not included in the analysis. The data in column 2 shows that an individual's willingness to settle results in a 3.25 percentage point increase in training probability, which is consistent with the benchmark result in column 2 of Table A3. The proportion of respondents who answered 'unclear' is minimal. It is recommended to include family-level control variables.

As described in Appendix A2, migrants choose to settle down based on factors such as children's education and economic opportunities for the labor force. Therefore, column 3 includes relevant control variables, including the incoming flow of migrants. The regression sample only consisted of married individuals. The study examined the impact of settlement intention on the probability of training participation while controlling for relevant variables. The data shows a 2.46 percentage point increase in training participation, which is slightly lower than the baseline regression results in Table A3, but still statistically significant at the 1% level. The findings suggest that migrants who are more willing to settle down are more likely to participate in training, supporting the theoretical model presented in the article.

Table A5—: Willingness to settle down and skills training: robustness test

Training	(1) Replace explanatory variables	(2) Expand the sample	(3) Add control variables
Willingness to long live	0.0184***		
	(0.003)		
Willingness to settle down		0.0325***	0.0246***
		(0.003)	(0.004)
Controls	Y	Y	Y
City FE	Y	Y	Y
Year FE	Y	N	N
Hukou Pro FE	Y	Y	Y
Observations	98,004	94,899	56,384
R^2	0.127	0.092	0.117

Note: Column 1 of this table is based on the China Labor Force Dynamics Survey (CMDS) conducted in 2010, 2013, and 2014. The individual characteristics analyzed include age, age squared, education level, gender, and marital status. Column 2 of the table is based on 2011 data from the China Labor Force Dynamics Survey (CMDS). The individual characteristics analyzed include age, age squared, gender, education level, and marital status. The table's third column is based on the 2011 data from the China Labor Force Dynamic Survey (CMDS). The regression sample only includes married individuals. The variables for individual characteristics include age, age squared, gender, education level, marital status, and market arrival. Additionally, the length of migration, number of children born, and nature of the work unit are considered. Statistical significance is indicated by *, **, and *** for the 10%, 5%, and 1% levels, respectively.

Table A6—: Details in city thresholds and city population sizes

Area	(1) Hukou threshold is increased		(2) Hukou threshold is lower		(3) No Hukou threshold	
	≥5 million	<5 million	≥5 million	<5 million	≥5 million	<5 million
East	16	11	10	10	11	33
Central	5	2	8	13	22	30
West	4	6	4	13	10	32
Total	25	19	22	36	43	95

A4. Urban settlement threshold and urban population size grouping

Table A6 supplements the city grouping based on the settlement threshold in our paper. The majority of cities with no settlement threshold are located in the central and western regions. Out of the 138 cities with no settlement threshold, 95 have a population of 5 million or less. The majority of cities with increased settlement thresholds have a population of 5 million or more. Among the groups with reduced settlement thresholds, the majority of cities have a population of less than 5 million. However, there is no significant difference in the overall number of cities between the two groups.