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How do home purchase restrictions affect elite Chinese graduate students' job search behavior?



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ABSTRACT

In this study, we examine how China's home purchase restrictions (HPR) affect recent graduate students' job search behavior. Using administrative records of all graduate students from Tsinghua University in China in the period 2006–2016, we find that HPR significantly discourages migrant students from accepting job offers in Beijing by 6.0 percentage points. Additionally, they are more likely to choose jobs in the public sector (where it is easier to obtain residency status and thus be eligible for home purchase), and the job offers they accept are less relevant to their field of study in graduate school. The HPR has a greater effect on male, PhD, and older students. These results suggest that intervention in the housing market could affect labor-market decisions, even for highly skilled workers.

1. Introduction

Purchasing a home is considered one of the most important decisions for many families. Homeownership offers residential stability (Rohe and Stewart, 1996; Aaronson, 2000) and reduces housing risk by shielding families from future rent increases (Bostic and Lee, 2008; Sinai and Souleles, 2005). Homeownership is perceived to improve child cognitive outcomes and reduces behavioral problems, and thus is important for young people considering starting a family (Green and White, 1997; Haurin et al., 2002). Even for young adults who have just finished graduate school, the home purchasing decision is one of the most important considerations when searching for jobs across cities. In particular, many families in developing countries value homeownership more than in other countries because young men use home purchasing as a strategy to improve their relative status in the marriage market (Glaeser et al., 2017; Wei et al., 2017). In fact, in China's capital, Beijing, the homeownership rate for 28- to 30-year-olds is 54.4% for those with at least a college degree (Appendix Table 1), and the average age of

first-time homebuyers is only 27.¹

In this paper, we study the impact of a set of austere housing market interventions, home purchase restrictions (HPR), on labor-market outcomes in Beijing. Due to dramatic surges in housing prices starting in the early 2000s, the Chinese government decided to take firm action to reduce speculative housing demand and stabilize housing prices by restricting the number of houses that could be purchased. We examine the impact of the HPR implemented in Beijing on elite graduates' job search behavior using unique administrative data based on all graduate students from 2006 to 2016 from Tsinghua University in Beijing, China. In February 2011, the city government of Beijing announced that migrants, that is, those who were not in the city household registration system (also called *Hukou*), could not purchase any houses in Beijing if they did not have five years of continuous work experience in the city, whereas residents of Beijing could still purchase one house per household.² We look at how HPR affects the city that graduates choose to go to after graduation and the quality of the job-major match. In addition, as HPR tightly bundles access to homeownership through *Hukou* status in a

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¹ <http://www.globaltimes.cn/content/568479.html>

² A multi-generation family, in which parents live with adult children, is considered as two separate households in terms of home purchases. If a migrant male marries a Beijing native, they can purchase a home as a local resident, and the husband's name can be put on the title of the house if the wife agrees.

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city and public-sector jobs with easier access to *Hukou* may be more appealing to migrant students, we also examine whether HPR affects graduates' decision to choose public-sector jobs versus private-sector jobs.³

Our main identification strategy is a difference-in-difference (DID) approach with HPR as an unexpected policy shock. Recent migrant graduates face much higher barriers to purchase a home in Beijing and thus comprise the treatment group of the study. If they cannot find a job that grants them Beijing *Hukou* at the time of graduation, they have no other means of obtaining this status during at least the first five years after graduation and are thus unable to purchase their own home (unless they marry a local resident and purchase a home together). The control group includes students with Beijing *Hukou*. These students can still buy one house per household (per person if unmarried) after the policy intervention. The HPR policy only affects the homeownership of the treatment group, not the control group. *Hukou* status distinguishes the treatment and control groups, and the HPR implementation timeline indicates the status before and after the policy change. Unlike many housing policies in China or other countries, the distinction between local and migrant individuals on the first home purchase restriction was unanticipated and there was no discussion of the policy in the news before it was first announced in Beijing.

We find that the implementation of HPR in Beijing significantly reduces the likelihood of a nonlocal graduate student accepting a job offer in Beijing by 6.0 percentage points. Furthermore, after 2010, migrant graduate students in Beijing are 5.8 percentage points more likely to accept job offers in the public sector where it is easier to obtain *Hukou*. On the contrary, migrant graduate students who accept job offers in cities other than Beijing are 3.7 percentage points less likely to work in the public sector. In addition, HPR is found to increase the mismatch between students' fields of study at school and the job industry they enter for those who stay in Beijing, but has no significant effect on the mismatch for graduates who accept job offers in other cities. These results suggest that housing market interventions that distinguish between residents and nonresidents do have spillover effects on labor-market decisions.

This study contributes to the literature in several ways. First, this is one of the first papers to examine the impact of HPR on labor-market decisions of highly skilled workers. Existing studies on HPR in China or cooling measures in other countries mostly focus on its effect on housing prices and sales quantity (Sun et al., 2017; Deng et al., 2018; Jia et al., 2017; Somerville et al., 2020; Du and Zhang, 2015). HPR may succeed in stabilizing housing prices, but could have unintended consequences on household decisions beyond the housing market, which very few studies have explored. Qian et al. (2019) investigate how households reallocate their wealth in response to the HPR, and find that HPR affected households by increasing the opening of new stock accounts by 47%. We explore the effect of HPR on the labor market, as restrictive housing policies might push productive workers out of the city.

Our study is also related to studies on how unexpected housing market interventions affect labor market decisions in China. One unique policy shock is housing reform in China in the late 1990s, which allows state employees to purchase their current rented homes at subsidized prices. Using a DID approach, Wang (2012) finds that the reform led to reduced labor mobility and increased self-employment due to the alleviation of credit constraints. Chen and Hu (2018) note that homeowners

who purchased a home during the housing reform are less likely to engage in self-employment, using more recent data.

Finally, we add to the existing literature on migrant or immigrant graduates' job search behavior. Studies show that H-1B quota assignments in the U.S. affect immigrant graduates' job search. For example, they are more likely to work in academic institutions (Amuedo-Dorantes, Catalina, and Furtado, 2017), or defer entering the labor market (Mayda et al., 2018). Wang and Moffatt (2008) examine the effect of *Hukou* on graduates' choice of location for searching for a job. They find that graduates without urban *Hukou* tend to put more effort into the job search effort and are willing to accept a lower starting salary. This implies that migrant graduates face more intense pressure when they search for a job. Our study provides new evidence that the additional restriction that applies to migrants could push them further away from the city where they might prefer to work.

The remainder of the paper is organized as follows. In Section 2, we provide institutional background on the *Hukou* system in China that the HPR is based upon and the policy details of HPR. We present empirical specifications in Section 3. Data are described in Section 4. We then outline the empirical results in Section 5 and conclude the paper in Section 6.

2. Background

2.1. The *Hukou* system in China

Since *Hukou* status is a key determinant of whether a person is eligible for home purchase after HPR implementation, we start by describing the *Hukou* system and how it has changed over time. *Hukou* is a resident permit issued to households by the Chinese government. Each household has a "*Hukou* certificate" that contains basic demographic information of all household members, including name, date of birth, *Hukou* status, marital status, and relationship to the head of the family. The *Hukou* system in China determines access to many social benefits, such as housing, education, health care, and social security.

The *Hukou* system was first established in 1958 and has undergone four phases of reforms since 1979.⁴ The most recent reform occurred in 2014–16, following the July 2014 State Council "Policies on the Reform of Household Registration System," which requires full liberalization of *Hukou* in small and medium cities, and more transparent requirements in big cities. During the 2006–2016 period of our study, the criteria for obtaining local *Hukou* in first-tier cities — Beijing, Shanghai, Guangzhou, and Shenzhen — have become increasingly stringent, while obtaining *Hukou* in most middle and small cities has become easier.

Typically, students' first job right after school is the most straightforward and the quickest way to obtain *Hukou* in a large city such as Beijing.⁵ Usually, Tsinghua students can easily obtain *Hukou* in many cities upon accepting a job offer there; this is not the situation, however, in large cities such as Beijing or Shanghai. For example, *Hukou* in Shanghai is based on a point system, and one needs to accumulate sufficient points through education, specific skills, work experience, and so

³ The *Hukou* quota varies across sectors. The public sector, including government agencies, state-owned enterprises, and educational and other nonprofit institutions, usually receives a larger quota than the private sector. Foreign-owned companies have a limited *Hukou* quota, even smaller than that for domestic private companies. The uneven distribution of *Hukou* quotas across the private and public sectors can affect migrant students' job choice decisions. Some migrant students prefer to work in lower-paid nonprofit institutions if they can get *Hukou* immediately after graduation.

⁴ Zhang, Wang and Lu (2018) discussed these reforms in detail.

⁵ Alternative ways of obtaining *Hukou* usually include large business investments (e.g., an annual taxable income over 3,000,000 RMB or over 800,000 RMB for three consecutive years in Beijing), a postgraduate degree from a well-recognized university overseas, and marriage to a local resident that has lasted several years. Much more time is needed or several criteria need to be fulfilled to obtain *Hukou* through channels other than the above mentioned.

on, to obtain *Hukou*.⁶ Zhang, Wang and Lu (2018) construct a numerical index to compare the threshold for *Hukou* qualification across cities. The threshold is the highest in Beijing (0.898), followed by Shanghai (0.683), Guangzhou (0.487) and Shenzhen (0.279). As their paper shows, Beijing's *Hukou* is the most difficult to obtain. This is also one of the main reasons this study focuses on the impact of Beijing's HPR policy on Tsinghua graduate students. Even though the HPR is implemented in many cities, it has little effect on Tsinghua graduates because they can easily obtain *Hukou* in cities other than Beijing and are not typically restricted in their home purchases. Nonetheless, we do take into account the *Hukou* reform during our sample period by controlling for *Hukou* strictness level by year fixed effects, which will be explained in Section 3.

2.2. Home purchase restriction in China

Our main identification is based upon the implementation of a set of housing market interventions, the home purchase restrictions, which we describe below. Because housing prices continued to grow sharply in many Chinese cities, on April 17, 2010, the State Council of the People's Republic of China issued a public announcement that it had decided to take firm action to control prices.⁷ On April 30, 2010, Beijing was the first city to announce HPR. This was an unanticipated announcement because HPR had never been introduced in China, it had rarely been instituted in other countries, and there had been no pilot program prior to the announcement. The policy goal of the HPR is to stabilize housing prices and prevent potential housing bubbles. Each family was only allowed to purchase one new house, no matter how many houses it already owned. On February 15, 2011, the Beijing government upgraded the HPR and imposed different restrictions for families with Beijing *Hukou* and those without, and, again, this distinction was unexpected. For each family with Beijing *Hukou*, a total of two house purchases were allowed.⁸ For each family without Beijing *Hukou*, only one house purchase was allowed, conditional on five years of continuous deposits to social security (which requires five years' work experience without any period of unemployment).

HPRs have been implemented in many other large cities. By January 2011, nine cities, including Shanghai, Shenzhen, Dalian, and Tianjin, had implemented HPRs. By November 2011, a total of 46 cities had imposed HPRs. Since 2014, China's real estate market began to cool down, and in some medium and small cities there was even a risk of a housing bubble bust. As such, several local governments relaxed their HPRs, and by October 2014, about 40 cities had eased their HPRs or abolished them altogether. By 2016, only six cities in China, including Beijing, still implement HPR. Appendix Fig. 2 shows the number of cities with HPR between January 2010 and December 2016. Although the specific details of the interventions vary across cities, they can be summarized as follows:

⁶ According to the criteria of getting Shanghai *Hukou* in 2015 (<http://www.shchhukou.com/2016/05/05/2015nfnshsypgtgxyjbyshjyfbf/>), the total score required is 72. A PhD degree gets 27 points, and a master's degree gets 24 points. Graduating from a good university gets 15 points. An English certificate gets 8 points, a computer certificate gets 6 points, and credibility gets 5 points. For a company belonging to an important industry, students get 3 points, and an important project gets another 3 points. Tsinghua graduates usually can get all of these (a total of 69 points), and with some additional awards/publications at school, they can easily pass the 72-points bar and obtain Shanghai *Hukou* right after graduation.

⁷ The Appendix Fig. 1 presents changes in housing prices in eight major cities in China between 2006 and 2016.

⁸ On March 30, 2013, another policy intervention was introduced: those who were single and with a Beijing *Hukou* were only allowed to purchase one house instead of two. On October 22, 2013, each family with a Beijing *Hukou* could only purchase one house regardless of marital status. These harsh restrictions were not relaxed until September 30, 2016, when the government announced that families with a Beijing *Hukou* would be allowed to purchase two houses again.

families with local *Hukou* were only allowed to purchase one house if they already owned one, and were not allowed to purchase any more houses if they already owned two or more; families without local *Hukou* could only purchase one house if they had made deposits to social security for at least one to three years.

3. Model

Conceptually, HPR could affect the choice of job location or career decisions through homeownership eligibility channels (HPR restricts some households' eligibility to purchase a home) or price channel (the policy goal of HPR is to reduce housing prices, which makes housing units more affordable, thus increasing housing demand). The main difference is that HPR only affects nonresidents through the homeownership eligibility channel, while HPR affect both residents and nonresidents through the price channel. We use the eligibility channel to construct treatment and control groups as our main source of identification. We further assume that although changes in housing prices could affect residents and nonresidents differently, such differences do not systematically change after policy intervention, and we test this hypothesis in the alternative specification.

We use a DID approach to compare residents and nonresidents before and after the implementation of HPR. The treatment group is students from Tsinghua University who do not have Beijing *Hukou*, and the control group is students from Tsinghua University who have Beijing *Hukou*. The pretreatment period is 2006–2010, and the posttreatment period is 2011–2016. The main regression model specification is as follows:

$$y_{it} = \beta \times Mig_i \times I(t > 2010) + \mathbf{X}_{it} \cdot \boldsymbol{\gamma} + fixed\ effects + \varepsilon_{it} \quad (1)$$

where y_{it} measures three job search outcomes: (a) whether a graduate student i accepts a job offer in Beijing after graduation from Tsinghua University in year t ; (b) whether a graduate student accepts a job offer in the public sector which has easier access to Beijing *Hukou* compared to the private sector; and (c) the job-major match index that measures the match quality of jobs related to students' graduate fields of study.

Mig_i equals 1 if student i is a migrant, which means he or she does not have the Beijing *Hukou* before entering Tsinghua University. $I(t > 2010)$ is a binary variable indicating whether the graduate year is after 2010, the year of HPR implementation. The coefficient of $Mig_i \times I(t > 2010)$ reflects the causal effect of HPR on migrant graduates' job search decision via homeownership eligibility.⁹ \mathbf{X}_{it} controls for students' characteristics, including whether a student is female, whether a student belongs to an ethnic minority, and whether a student is in a master's program (with the omitted category of being in a PhD program).

We control for the following five fixed effects. (1) Home province fixed effects. Students might prefer to return to their hometown after graduation, either because they have better social networks in their hometown than in other cities, or because they are more used to the weather or local culture in their home province. (2) Field \times year fixed effects (where year refers to the year of graduation and same below), which absorb time-varying industry-specific trends due to the possible changes in labor demand in each industry. Migrants may be more likely to work in sectors that started hiring less after 2010 in Beijing, making it appear as though the HPR was driving the relationship when, in fact, it was all about industry. (3) Home region \times year fixed effects, which control for region-specific time-varying trends. We categorize all provinces into the east, west, and central region. Migrants from the western region may be more likely to return to cities in that region after 2010, due to China's western development program. (4) Big city \times year fixed effects. The "big city" variable indicates whether the job is located in

⁹ The dummy variable Mig_i is absorbed by home province fixed effect and $I(t > 2010)$ is absorbed by year fixed effect, which are discussed in the next paragraph.

Shanghai, Shenzhen, Guangzhou, or other large cities besides Beijing. Although a full set of province-year fixed effects cannot be included, because these three cities are the biggest competitors with Beijing for Tsinghua graduates, we control for unobserved year-specific factors (e.g., development in the labor market) that may make these cities more or less attractive to Tsinghua graduates. (5) *Hukou* strictness level \times year fixed effects. As we discussed in Section 2.1, during our study period, the criteria for obtaining local *Hukou* in large cities have become more stringent over time, while the criteria have been relaxed in many medium and small cities. Thus, we include “*Hukou* restriction level by year” fixed effects to control for changes in *Hukou* strictness due to *Hukou* reform. We categorize all cities into three categories following Figure 4 in Zhang et al. (2019): “city with high threshold for *Hukou* registration,” “city with intermediate threshold for *Hukou* registration,” and “city with low threshold for *Hukou* registration.” As the *Hukou* reform gradually took place during our study period, this set of fixed effects controls for changes in the difficulties in obtaining *Hukou* in the workplace after graduation. To deal with the potential problems of serial correlation, we clustered standard errors by the province where the student comes from.¹⁰

We focus on the effect of HPR implemented in Beijing rather than the effect of HPR imposed in any other cities for various reasons. First, as mentioned earlier, graduates from Tsinghua University can easily obtain *Hukou* in virtually every city in China except Beijing and Shanghai. Thus, the HPR in Beijing has a real impact on these graduate students, whereas the HPR in less-developed cities is not a concern for elite students, as they can fairly easily and quickly obtain *Hukou* there. Second, our data are based on Tsinghua graduate students, whose campus is located in Beijing. Between 2006 and 2009, over 70% of the graduate students in Tsinghua University chose to work in Beijing after graduation (Appendix Fig. 3). We thus investigate whether local housing market interventions affect students’ decision to stay in the same city as the university from which they graduated. This has direct policy implications for whether city-specific housing policy attracts or discourages elite students from working in the same city after graduation. Third, Beijing is the first city that introduced HPR. This can be considered an unexpected policy shock because no other Chinese city had ever imposed such restrictions before. Meanwhile, we expected other cities to follow Beijing in implementing HPR because people expect cities with higher housing prices to impose similar interventions sooner or later.

Our DID approach relies on the assumption that HPR drives a nonresident graduate’s willingness of staying in Beijing. We acknowledge that other reasons could affect the likelihood that a nonresident graduate would be willing to stay in Beijing, including changes in labor demand in Beijing or other cities. In the main model, we include “study field by year” dummies to control for time-varying industry-specific trends due to the possible changes in labor demand in each industry. In Section 5.4 we apply additional regression models to address the concern. As owning a house is more important for males than females in China’s marriage market (Wei et al., 2017), we conduct heterogeneous analysis by gender and see if males are more affected by the HPR, which is less likely to be attributable to the labor demand scenario. In addition, we examine whether migrants are more likely to take jobs in the public sector, which also is difficult to explain by labor demand story.

¹⁰ When the number of groups is fewer than 42, cluster standard errors might underestimate the intragroup correlation (Angrist and Pischke, 2008). We have tried clustering by home province by year (362 groups), double cluster by home province and year, and bootstrap 500 times, and the standard errors are very similar. Results are available upon request. It is worth noting that some other studies based on China also cluster standard errors at the province level (e.g., Chen et al., 2020; Edlund et al., 2013).

4. Data

4.1. Data source and variable construction

Our primary dataset is the administrative data from Tsinghua University Graduates Employment Record 2006–2016. Established in 1911, Tsinghua University is a research university located in Beijing, the capital of China. With its strong research and teaching record, Tsinghua University has consistently ranked first among all mainland Chinese universities on the QS Global University Rankings over the last five years.

The dataset includes every student who graduated from Tsinghua University between 2006 and 2016. The key student record information contains each student’s entrance year, graduation year, school, and field of study, major, degree received (undergraduate, master’s, or PhD), the name of the company, government or institution from which a student accepted a job offer, the industry of the job (from 20 job categories such as transportation, construction, and finance), and the city where the job is located. If a student did not accept any job offer by the time of graduation, the data contain information on whether they went abroad (to study, work or simply migrated with family members), pursued a master’s, PhD or postdoctoral program in China, or became self-employed. In addition, the data contain basic demographic information, including gender, ethnicity, and province of residence (where one has *Hukou* prior to entering college).¹¹

Our main sample only includes master’s and PhD students and excludes undergraduate students. One reason for this is that most undergraduate students from Tsinghua University pursue graduate studies following graduation rather than entering the job market directly. The proportion of undergraduate students accepting a job offer is less than 16%, whereas it is 70% for graduate students (Appendix Table 2). The choice of working versus pursuing graduate studies could be affected by HPRs, and we could, therefore, have a selection problem. For example, students who are more likely to obtain a job with Beijing *Hukou* are more likely to enter the job market. Another important reason is that master’s and PhD students are approaching the age when many people decide to purchase a home. The average age for master’s program graduates is 26.0, and the average age for PhD graduates is 29.7. Undergraduates, who have an average age of 22.5, may be too young to consider purchasing a home and settling down. Appendix Table 1 shows homeownership rates in Beijing by age group and degree using information from the 2000 Census. For those with a college degree and aged between 22 and 24 years old, the homeownership rate is only 17.8%. For those aged between 28 and 30, about half of them own a home.

In addition, we exclude students who already had labor contracts prior to their admission to Tsinghua University (*ding xiang pei yang*). Because their jobs are determined prior to entering the university, and their tuition is usually paid by their employers, they do not search for jobs upon graduation. They account for 9.8% of the sample.

In the analysis of job-major match quality, we construct an indicator of whether a job is a good match for a student’s university field of study.

¹¹ There are alternative data sources such as the Chinese Graduates Employment Survey conducted by Peking University biennially between 2003 and 2017 and the Chinese College Students Survey (CCSS) conducted by China Data Center of Tsinghua University for 6059 students from 19 colleges in May and June 2010 (Li et al., 2012a, 2012b). Our data have several advantages over these national survey data. First, our job information consists of administrative records based on labor contracts and other information such as major and home province information documented by university staff, whereas information in the survey data is self-reported. Second, the national survey data sample is not representative for a given city, so it is not feasible to conduct analysis based on city-level policy changes. Last, most samples in the national survey pertain to undergraduates, whereas we focused on graduates because they are approaching the age in which people make homeownership decisions. We acknowledge that these national surveys usually contain more information regarding wages, family education, and family income, which we do not have.

In the 2015 and 2016 data, graduates who accepted job offers were asked about whether their jobs were relevant to their graduate majors. This question was not asked of those who graduated prior to 2015. We use the 2015 and 2016 sample to construct an “ $m \times n$ ” matrix, where $m = 144$ is the total number of majors in Tsinghua University, and $n = 20$ is the total number of industry categories. For each major-industry pair, we calculate the proportion of graduate students who report that their jobs are relevant to their fields of study. The job-major matching index is constructed as a continuous variable ranging from 0 to 1, where 1 indicates that the graduate school field of study is highly relevant for the job. The larger the proportion, the higher the relevancy of the field of study and industry pair. Then, each individual in our sample can be assigned an index value of how well the field of study matches the job by major and job industry.

Our secondary data include city-level statistics. Most of these come from China City Statistical Yearbooks, including GDP per capita, total population, total expenditure, average wage, and housing price. We also calculate the mechanical population growth quantity for each city, which equals total population growth minus natural population growth, to determine whether it is difficult to obtain *Hukou*. We use the average wage of each industry from China’s National Bureau of Statistics (2013–2016) to construct an indicator of high-income industries.

4.2. Basic patterns of the job search

We start by looking at some basic patterns of students’ job search behavior during the 2006–2016 sample period, with a focus on the changes in job search behavior before and after the implementation of the HPR and differential trends across different groups. Appendix Fig. 3 presents the overall trend of Tsinghua graduate students by degree and by gender. Although graduate students have a strong preference for going to super-large cities, the proportion of recent graduates who accepted job offers in Beijing has been declining over time, from 67.0% in 2006 to 48.6% in 2016. This declining pattern in Beijing is found for both males and females, and for both master’s and PhD students. In addition, both male students and master’s students were relatively less likely to be employed in Beijing.

Although the number of elite students employed in Beijing has been declining, Appendix Fig. 4 shows that these students have a high preference for working in other first-tier cities, such as Shanghai and Shenzhen, and that the proportion of Tsinghua graduate students employed in Shanghai, Shenzhen, and Hangzhou has increased significantly since 2010. This could simply be because these cities have become more attractive for graduates as higher-paying jobs were increasingly available in those cities and not in Beijing, or because of the increasingly stringent *Hukou* constraints in Beijing. Using the China Family Panel Studies 2010, 2012, 2014 and 2016 waves, Appendix Fig. 5 shows that, on the contrary, the average salary still grows faster in Beijing than in Shanghai, Guangzhou, Hangzhou, or Tianjin, for individuals with a college degree or above.¹²

Appendix Fig. 6 shows the proportion of graduate students employed in the public sector, including government, state-owned enterprises, and universities. As discussed earlier, public-sector jobs usually have a large *Hukou* quota and, thus, become more appealing when *Hukou* is bundled with home purchase eligibility. The number of students who accept job offers in public-sector entities, which usually have more *Hukou* quotas, has increased for both master’s and PhD students after the HPR. Such an increase is large in Beijing, but not much in other cities after 2010.

¹² Unfortunately, the CFPS data do not include Shenzhen or Nanjing. We include college graduates as the sample size for master’s students, and the number of PhD graduates is low in the data.

5. Results

5.1. Unconditional trends in the treatment and control groups

To examine the validity of conducting a DID analysis, we examine the unconditional trends in the treatment and control groups. We plot the unconditional mean of the proportion of graduate students working in Beijing, the proportion of graduate students choosing public-sector jobs, and the mean of the job-major matching index. Fig. 1 illustrates that the differences in means of the above three outcomes between the treatment group and control group before treatment year 2011 remain constant, which confirms the underlying identification assumption of a parallel trend. The gaps between the treatment group and the control group in the proportion of graduate students working in Beijing and their jobs relevant to their fields of study increase visibly after the implementation of HPR. This evidence suggests that graduate students’ job search behavior responds to the HPR.

The DID approach relies on the assumption that the treatment itself does not change the composition of the treatment and control group. In our context, if, after the implementation of HPR, some migrant students can obtain *Hukou* or obtain the right to purchase a home right away through other means, the model’s assumption could be invalidated. Marrying a Beijing native is one potential channel. To simplify, we make an assumption that the HPR does not change the likelihood of nonresident graduate students marrying a Beijing resident.

5.2. Main regression results

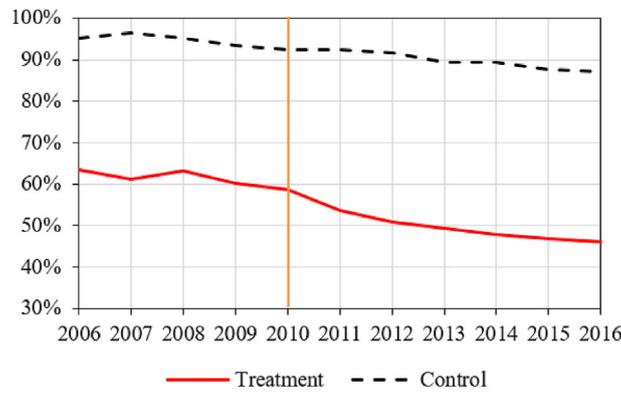
We utilize the DID in regression model (1) to examine the causal impact of HPR on Tsinghua graduate students’ job search behavior (Table 1). The key explanatory variable is $Mig \times I(t > 2010)$, the interaction of the treatment dummy variable of whether the student is a nonresident in Beijing with the time dummy of whether the student graduated after 2010. We present the results for the linear probability models, and the results are robust when we use the Probit or Logit models.

We find that the HPR significantly reduces the likelihood that a nonresident Tsinghua graduate student will stay in Beijing after graduation by 6.0 percentage points (column 1). Column 2 suggests that, after the implementation of the HPR policy, migrant students are 5.8 percentage points more likely to choose jobs in the public sector if they decide to stay in Beijing. On the contrary, if they decide to work in other cities, they are 3.7 percentage points less likely to choose jobs in the private sector (column 3).

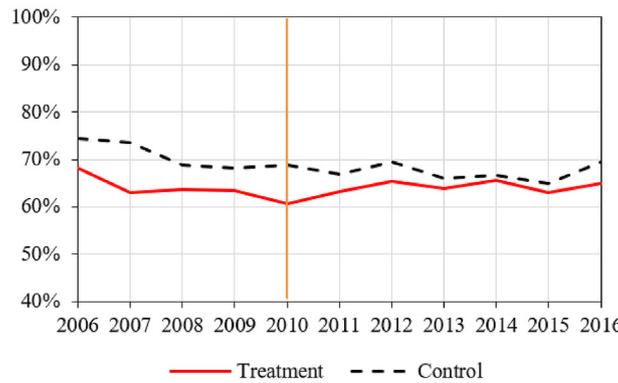
We then consider sector choice and city choice as a joint decision in columns 4 and 5. For all migrant graduate students, the likelihood of choosing the private sector in Beijing (as opposed to all other jobs in all other cities) is 6.2 percentage points lower after the implementation of HPR, but the likelihood of choosing the public sector in Beijing does not experience a significant increase. This indicates that the findings in column 2 are a structural switch—fewer Tsinghua graduates stay in Beijing, and those who do stay switch from the private to the public sector, while the total number of Tsinghua graduates working in the public sector in Beijing remains unchanged.

Columns 6 and 7 show that after HPR, the quality of job-major match declines in Beijing but not in other cities. Therefore, all columns are consistent with the story that, after HPR, migrant students are willing to choose a job where there is a higher probability of obtaining *Hukou* in Beijing, even at the expense of a reduced job-major match.

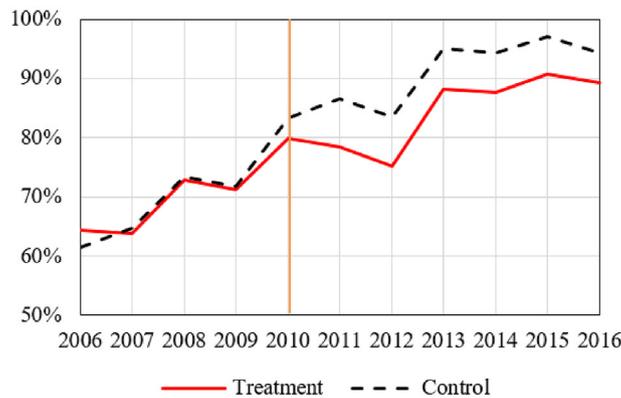
Table 2 further shows that migrant students are more likely to choose low-income jobs in the public sector in Beijing, which suggests that they prefer to obtain *Hukou* at the cost of sacrificing income; this effect is not found in other cities. We construct an indicator of “high-income” job if the job belongs to the following five top-paying industries: (a) finance; (b) information transmission, software, and information technology services; (c) scientific research and technology services; (d) electricity,



(a). Unconditional proportion of graduate students' acceptance of a job offer in Beijing.



(b). Unconditional proportion of graduate students' choice of a public-sector job conditional on their staying in Beijing.



(c). Unconditional mean of job-major matching index.

Fig. 1. Unconditional trends in recent Tsinghua University graduate students with Beijing *Hukou* (control group) and without Beijing *Hukou* (treatment group).

heat, gas, and water production and supply; and (e) culture, sports, and entertainment.¹³ We find that HPR reduces migrant students' likelihood of choosing high-income jobs in the private sector by 3.5 percentage points and increases migrant students' likelihood of choosing low-income jobs in the public sector by 5.4 percentage points. We do not find HPR to have a significant effect on public-sector jobs in high-income industries. Our interpretation is that such jobs are very attractive, and people want to choose these jobs regardless of the HPR. Meanwhile, we do not see a significant trend in cities other than Beijing. This evidence

suggests that migrant students accept job offers from the public sector when there is a higher likelihood of obtaining *Hukou* in Beijing, even at the cost of a lower salary.¹⁴

5.3. The dynamics of labor-market decisions

Table 1 provides the average impact of HPR on job market decisions. In this section, we examine the dynamic evolution of HPR on job market

¹³ The average income of each industry comes from China's National Bureau of Statistics (2013–2016).

¹⁴ We did not rule out the possibility that as income risks become higher over time, students prefer more stable jobs, which are concentrated in the public sector.

Table 1
The impact of HPR on recent graduates' job search behavior.

	Working in Beijing	Working in the public sector		Working in the public sector in Beijing	Working in the private sector in Beijing	Job-major matching index	
	(1)	Among those working in Beijing	Among those working in other cities	(4)	(5)	Beijing	Other cities
<i>Mig</i> × <i>I</i> (<i>t</i> > 2010)	−0.060*** (0.018)	0.058*** (0.017)	−0.037** (0.018)	0.002 (0.022)	−0.062*** (0.010)	−0.068*** (0.008)	−0.003 (0.012)
<i>Female</i>	0.001 (0.002)	0.016** (0.007)	−0.002 (0.010)	0.010** (0.004)	−0.009 (0.005)	0.004 (0.005)	0.005 (0.004)
<i>Minority</i>	0.008** (0.003)	0.009 (0.009)	0.057* (0.031)	0.012 (0.007)	−0.003 (0.006)	0.009 (0.008)	0.006 (0.010)
<i>Master's</i>	0.001 (0.002)	−0.082*** (0.011)	−0.397*** (0.016)	−0.050*** (0.006)	0.051*** (0.005)	−0.091*** (0.004)	−0.076*** (0.005)
Fixed effects	Y	Y	Y	Y	Y	Y	Y
Constant	0.584*** (0.002)	0.794*** (0.010)	0.710*** (0.017)	0.454*** (0.007)	0.130*** (0.006)	0.851*** (0.004)	0.889*** (0.009)
Observations	27,787	16,164	11,613	27,787	27,787	16,164	11,613
R ²	0.933	0.087	0.250	0.563	0.150	0.475	0.456
Mean	0.58	0.77	0.41	0.45	0.14	0.76	0.76

Note: (a) *Mig* × *I* (*t* > 2010) is the interaction term for whether a student is a nonresident of Beijing multiplied by whether he or she graduated after 2010; (b) each column reports results from the linear probability model controlling for field × year dummies, home province dummies, home region × year dummies, big city × year dummies, and *Hukou* strictness level × year dummies; (c) robust standard errors are reported in parentheses, which are clustered at the home province level. **p* < 0.10, ***p* < 0.05, ****p* < 0.01; (d) the mean in the last row represents the mean of the dependent variable for each column.

Table 2
The impact of HPR on labor-market decisions by income level.

	High income & public	High income & private	Low income & public	Low income & private
	(1)	(2)	(3)	(4)
Jobs in Beijing				
<i>Mig</i> × <i>I</i> (<i>t</i> > 2010)	0.004 (0.011)	−0.035*** (0.009)	0.054*** (0.019)	−0.023** (0.010)
<i>N</i>	16,174	16,174	16,174	16,174
R ²	0.111	0.079	0.125	0.077
Mean of Dev.	0.44	0.10	0.33	0.13
	(5)	(6)	(7)	(8)
Jobs in other cities				
<i>Mig</i> × <i>I</i> (<i>t</i> > 2010)	0.020 (0.012)	0.010 (0.020)	−0.017 (0.016)	0.007 (0.020)
<i>N</i>	11,617	11,617	11,617	11,617
R ²	0.161	0.252	0.235	0.114
Mean of Dev.	0.09	0.37	0.32	0.22

Note: (a) *Mig* × *I* (*t* > 2010) is the interaction term for whether a student is a nonresident of Beijing multiplied by whether they graduated after 2010; (b) each column reports the results from the linear probability model controlling for gender, minority, whether the student is a master's student, field × year dummies, home province dummies, home region × year dummies, big city × year dummies, and *Hukou* strictness level × year dummies; (c) robust standard errors are reported in parentheses, which are clustered at the home province level. **p* < 0.10, ***p* < 0.05, ****p* < 0.01.

decisions from five years before the policy intervention to six years after. This also provides evidence of a short-run response within one to two years of HPR enforcement, rather than a six-year average.

We conduct event studies to examine the dynamic effects of HPR on labor market outcomes and estimate the following distributed lag model:

$$y_{it} = \sum_{s=-4}^5 \beta_s \times Mig_i \times I(t=2011+s) + \mathbf{X}_{it} \cdot \boldsymbol{\gamma} + \text{fixed effects} + \varepsilon_{it} \quad (2)$$

Following Agarwal and Qian (2014), the results can be interpreted as an event study. The coefficient β_s ($s = -4, \dots, -1$) captures the differences in trends of labor market outcomes between the treatment group

(migrant students) and the control group (local students) in the pre-treatment years. The coefficients β_s ($s = 0, \dots, 5$) measure the additional marginal response of the announcement year, one year, two years, ..., six years after the implementation of HPR. This model specification allows us to examine how the effect of housing market interventions on labor-market outcomes evolves over time.

Fig. 2 plots the paths of the coefficients estimated from equation (2), and the brackets depict the corresponding 95% confidence intervals. We find that prior to the enforcement of HPR, there is no significant difference between the treatment and the control groups in terms of whether a student accepts a job offer in Beijing, whether a student chooses a public job or private-sector job, or whether a student accepts a job-major match or mismatch, at the 5% significance level. This supports the validity of using the DID approach. After the policy intervention, we further note significant differences between the treatment and control groups regarding whether students are employed in Beijing and job-major match quality, whereas we find few differences regarding whether students choose public-sector jobs.

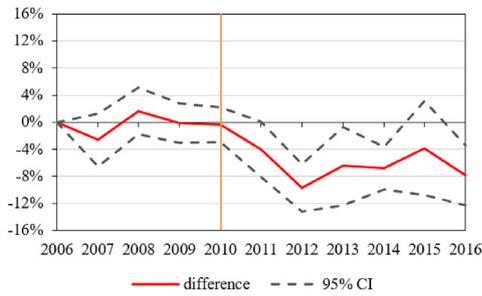
To compare, we plot the dynamic evolution of labor-market outcomes for Tsinghua graduates employed in other cities besides Beijing in Appendix Fig. 7. Appendix Fig. 7a shows that after the enforcement of HPR, there is no significant increase in the proportion of students choosing public-sector jobs, among students working in other cities, compared to Fig. 2b. Appendix Fig. 7d shows that the job-major matching has not deteriorated in other cities, in contrast to Fig. 2e.

5.4. Robustness checks

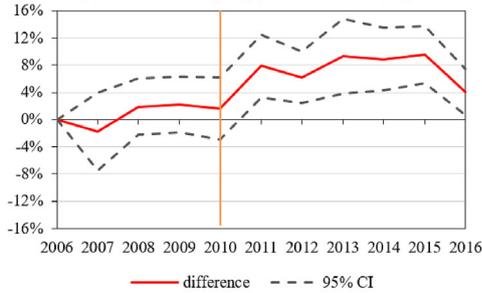
We conduct several robustness checks, which also partly address the empirical challenges faced by the DID approach. First, our assumption about the housing price channel — that the change in housing prices affect local and migrant students in Beijing in the same way — could be a strong assumption, because local students might come from families with higher incomes and their job choices may be less sensitive to housing price changes compared to migrant students. In equation (3) we include the interaction between housing prices (or housing price change) in Beijing and whether a student is a migrant *Mig_i*.

$$y_{it} = \beta_1 \times Mig_i \times I(t > 2010) + \beta_2 \times Mig_i \times HP_t + \mathbf{X}_{it} \cdot \boldsymbol{\gamma} + \text{fixed effects} + \varepsilon_{it} \quad (3)$$

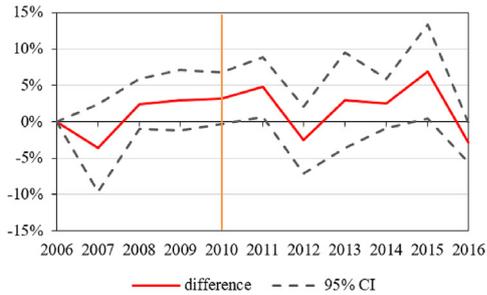
where β_2 represents the differential effects of housing prices (or price change) in Beijing on recent graduate job search decisions between res-



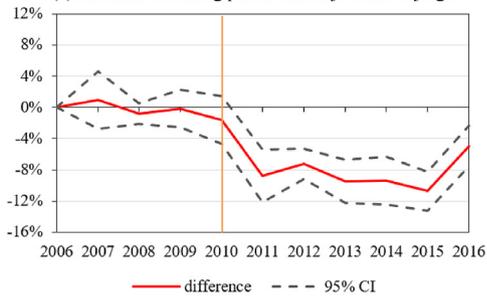
(a). Students accepting job offers in Beijing.



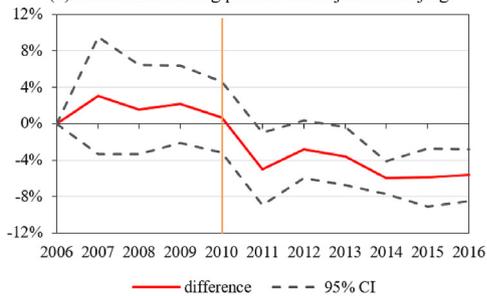
(b). Students choosing public-sector jobs among students working in Beijing.



(c). Students choosing public-sector jobs in Beijing.



(d). Students choosing private-sector jobs in Beijing.



(e). Job-major matching index among those employed in Beijing.

Fig. 2. The dynamic evolution of labor-market outcomes in Beijing. Note: These figures plot the entire paths of coefficients along with their corresponding 95% confidence intervals of job market decisions as estimated from equation (2).

idents and nonresidents. Other variables are the same as in equation (1).

Another challenge to the DID approach is that labor-market policies, such as changes in total *Hukou* quota for recent graduates or changes in the distribution of quotas between public and private sectors, could affect labor demand for local and migrant students differently. For example, a shortage of *Hukou* quotas would not affect local workers at all. In contrast, because migrant workers may be less stable, as they are unable to obtain permanent residency in the city (which is bundled with various social, educational, and medical benefits), they might look for jobs in their hometown or other cities besides Beijing. As a result of the expected higher turnover rate of migrant workers, companies may prefer to hire more local students instead. In equation (4), we control for *Hukou* quota and interact with the treatment indicator to test whether there is a differential effect of the *Hukou* quota on job search decisions of local and migrant students.¹⁵

$$y_{it} = \beta_1 \times Mig_i \times I(t > 2010) + \beta_2 \times Mig_i \times Quota_t + \beta_3 \times Mig_i \times I(t > 2010) \times Quota_t + \mathbf{X}_{it} \cdot \boldsymbol{\gamma} + fixed\ effects + \varepsilon_{it} \quad (4)$$

where β_3 tests whether *Hukou* quota changes in Beijing affects migrant students' job decisions differently from local students after HPR.

Table 3 suggests that the differential effect of housing prices on local and migrant graduates' labor-market outcomes do not change systematically after the HPR implementation. Panel A finds the interaction between migrant graduates and housing prices in Beijing is insignificant, except for a reduced likelihood of working in the private sector in Beijing. Panel B controls for changes in housing prices instead of the price level, and the interaction term is only marginally significant for sector choice in Beijing and insignificant for other outcomes. This robustness check suggests that controlling for housing prices, how HPR affects migrants' job decisions does not change significantly.

Then we test if treatment effects vary with the *Hukou* quota (which varies across years). In years where there are plenty of *Hukou* quotas and getting a Beijing *Hukou* is fairly easy for Tsinghua graduates, the HPR would not have much of a differential effect on labor-market outcomes between local and migrant graduates. Panel C of Table 3 includes the interaction term of the number of Beijing *Hukou* quotas for recent graduates each year and the treatment dummy, and another interaction term of the above two variables together with the HPR implementation dummy. We find that the *Hukou* quota itself has a direct impact on migrant students' job search outcomes, but it does not significantly change the treatment effect of the HPR.

We conduct a series of additional robustness checks. First, the sample of graduate students may be self-selected and correlated with the HPR. For example, if, after the implementation of the HPR, undergraduate students with a lower-ability delay entering the job market because it is difficult for them to find a job with a Beijing *Hukou*, then the pool of master's students are self-selected with more lower-ability students. To address this potential selection bias, we drop the sample years 2014–2016. Because students usually make decisions about whether to pursue a higher degree two years before they enter the program, retaining the sample period 2006–2013 ensures the decisions were made before HPR implementation in 2011. By restricting our sample to a shorter period after HPR, we also rule out the possibility that market conditions change differentially between the treatment and control groups long after enforcement of the HPR. The results are provided in Appendix Table 3, and they are similar to our main findings.

Appendix Table 4 shows several regression results on different samples. Panel A runs the main regression by adding undergraduate students to the analysis sample, and we find similar effects, although the effect on the public sector becomes insignificant. Panel B includes postdoctoral

¹⁵ Information about the quota of Beijing *Hukou* is only available for all students in Beijing each year, including undergraduates, who are not included in our sample.

Table 3
The impact of HPR with housing prices or Hukou quota on labor-market decisions.

	Working in Beijing	Working in the public sector among those working in Beijing	Working in the public sector in Beijing	Working in the private sector in Beijing	Job-major matching index in Beijing
	(1)	(2)	(3)	(4)	(5)
Panel A					
<i>Mig</i> × <i>I</i> (<i>t</i> > 2010)	−0.059*** (0.017)	0.043 (0.028)	−0.014 (0.029)	−0.044*** (0.016)	−0.070*** (0.017)
<i>Mig</i> × ln (<i>BJ_HP</i>)	−0.003 (0.020)	0.025 (0.026)	0.028 (0.021)	−0.031* (0.017)	0.004 (0.017)
<i>R</i> ²	0.933	0.088	0.563	0.150	0.475
Panel B					
<i>Mig</i> × <i>I</i> (<i>t</i> > 2010)	−0.069*** (0.020)	0.048*** (0.015)	−0.014 (0.021)	−0.055*** (0.009)	−0.065*** (0.006)
<i>Mig</i> × Δ <i>BJ_HP</i>	−0.068 (0.047)	−0.078 (0.052)	−0.125** (0.051)	0.057 (0.036)	0.020 (0.034)
<i>R</i> ²	0.933	0.088	0.563	0.150	0.475
Panel C					
<i>Mig</i> × <i>I</i> (<i>t</i> > 2010)	−0.073*** (0.018)	0.010 (0.025)	−0.060* (0.029)	−0.013 (0.015)	−0.072*** (0.014)
<i>Mig</i> × <i>Quota</i>	−0.029* (0.016)	−0.101*** (0.036)	−0.133*** (0.030)	0.104*** (0.025)	−0.074*** (0.024)
<i>Mig</i> × <i>I</i> (<i>t</i> > 2010) × <i>Quota</i>	0.056 (0.043)	0.072 (0.080)	0.127 (0.079)	−0.070 (0.051)	0.067 (0.047)
<i>R</i> ²	0.933	0.088	0.563	0.150	0.475
Controls	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y
Observations	27,791	16,174	27,791	27,791	16,174

Note: (a) *Mig* × ln (*BJ_HP*) represents the interaction term for whether a student is a nonresident of Beijing multiplied by the logarithm of housing prices in Beijing. *Mig* × Δ*BJ_HP* represents the interaction term for whether a student is a nonresident of Beijing multiplied by the growth rate of housing prices in Beijing between the current year and the year before. *Mig* × *Quota* refers to the interaction of whether a student is a nonresident multiplied by Beijing’s *Hukou* quota. *Mig* × *I* (*t* > 2010) × *Quota* is the interaction term for the DID indicator multiplied by Beijing’s *Hukou* quota; (b) each column reports the results from the linear probability model with controls for gender, minority, whether the student is a master’s student, field × year dummies, home province dummies, home region × year dummies, big city × year dummies, and *Hukou* strictness level × year dummies; (c) robust standard errors are reported in parentheses, which are clustered at the home province level. **p* < 0.10, ***p* < 0.05, ****p* < 0.01.

research as one of the job choices for PhD graduates (instead of dropping it as in the main analysis sample). Postdoctoral researchers earn a much higher salary than PhD students, and most universities provide them with local *Hukou*. Therefore, this may be an appealing job choice for PhD students. We find that HPR still significantly reduces the probability that nonresident students will choose to be employed in Beijing, although the effect is smaller than in the main results (−0.034 versus −0.060).

Panel C excludes the marginal sample of 2011 to account for the measurement error in the treatment status. Although most students from graduation year 2011 signed their labor contracts at the end of 2010, which was before HPR implementation, some students might have signed their contracts after February 2011, when HPR was implemented, and thus do not qualify for inclusion in the pretreatment period. We exclude this marginal sample and still find similar results. In Panel D, we restrict the regression analysis to 2008–2016 to isolate the impact of the worldwide Great Recession, and Panel E restricts the sample period to 2008–2014 because HPR was abolished in several cities, although not in Beijing. The results are also qualitatively the same.

Panel F further imposes an age limitation of 27 for master’s students and 35 for PhD students, which are the age cut-offs for recent graduates applying for a Beijing *Hukou*.¹⁶ Again, we uncover similar results, where the HPR significantly reduces the likelihood of graduate students staying in Beijing and reduces job-major match quality.

5.5. Heterogeneity analysis and potential mechanisms

In this section, we provide an analysis across various subgroups and explore potential mechanisms that HPR could affect the first job choice.

¹⁶ Since 2013, the city government of Beijing has imposed an upper age limit on whether recent graduates can obtain *Hukou*. The age limit is 24 for undergraduates, 27 for master’s graduates, and 35 for PhD graduates.

We also explore two potential reasons for which graduates would value homeownership: to gain a comparative advantage in the marriage market and to invest in the housing market. As owning a home indicates a high socioeconomic status in the male marriage market, we expect HPR has a stronger effect on males than females. In addition, we examine the housing investment channel by looking at whether migrant graduates are more likely to leave Beijing if home province housing prices grow faster.

Our analysis is based on the following regression model:

$$y_{it} = \beta_1 \times Mig_i \times I(t > 2010) + \beta_2 \times Z_{it} \times Mig_i + \beta_3 \times Z_{it} \times I(t > 2010) + \beta_4 \times Z_{it} \times Mig_i \times I(t > 2010) + \mathbf{X}_{it} \cdot \boldsymbol{\gamma} + fixed\ effects + \varepsilon_{it} \tag{5}$$

where *Z*_{*it*} is a vector of graduates’ characteristics, and definitions of other variables are the same as those of the main specification.

In Panels A–C of Table 4, we examine heterogeneous effects by age, degree, and gender. We hypothesize that older students who are closer to approaching the age of marriage might consider homeownership more seriously. We also examine whether the effect differs by degree, to further test the age hypothesis as PhD students are usually older than master’s students.¹⁷ If there is a differential effect by degree, this would also have policy implications, that HPR affects some students greater than others. We find that age significantly affects the decision to work in Beijing and that gender and degree also affect the job-major match quality. Male and PhD students are more likely to get a job relevant to their field of study if they choose to stay in Beijing. This is consistent with the hypothesis of gaining a comparative advantage on the marriage market through purchasing a home, as it is common that men purchase a home before marriage in China.

¹⁷ On the other hand, PhD student could be less sensitive as their job markets tend to be less flexible. Therefore, it is an empirical question on whether PhD student is more sensitive or not.

Table 4
Heterogeneity analysis.

	Working in Beijing	Working in the public sector among those working in Beijing	Working in the public sector in Beijing	Working in the private sector in Beijing	Job-major matching index in Beijing
	(1)	(2)	(3)	(4)	(5)
Panel A: Age					
$Mig \times I(t > 2010) \times \ln(Age)$	-0.327*** (0.100)	0.238*** (0.084)	0.116 (0.095)	-0.343*** (0.062)	-0.067 (0.084)
Observations	17,845	9653	17,845	17,845	9653
R ²	0.932	0.106	0.592	0.164	0.415
Panel B: Degree					
$Mig \times I(t > 2010) \times PhD$	-0.027* (0.013)	0.016 (0.017)	-0.021 (0.015)	-0.006 (0.010)	-0.035*** (0.009)
Observations	27,791	16,174	27,791	27,791	16,174
R ²	0.933	0.089	0.563	0.150	0.475
Panel C: Gender					
$Mig \times I(t > 2010) \times Female$	0.032** (0.011)	-0.017 (0.013)	0.017 (0.010)	0.014 (0.009)	0.017* (0.009)
Observations	27,791	16,174	27,791	27,791	16,174
R ²	0.933	0.088	0.563	0.151	0.475
Panel D: Home housing price growth					
$Mig \times I(t > 2010) \times \ln(Home_HPG)$	0.383* (0.212)	0.310* (0.163)	0.215 (0.233)	0.232*** (0.065)	0.026** (0.011)
Observations	25,158	14,895	25,158	25,158	14,895
R ²	0.939	0.085	0.560	0.148	0.474

Note: (a) each column reports the results from the linear probability model with controls for gender, minority, whether the student is a master's student, field \times year dummies, home province dummies, and home region \times year dummies, big city \times year dummies, and *Hukou* strictness level \times year dummies; (b) robust standard errors are reported in parentheses, which are clustered at the home province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel D controls for home province annual housing price growth rate and finds that migrant students who experience faster housing price appreciation in their home provinces are more likely to work in Beijing, more likely to choose public-sector jobs in Beijing, and more likely to get jobs of greater relevance to their field of study. Our interpretation is that, because investment in housing in their home provinces also becomes profitable, they do not need to own a home in Beijing if it is primarily for investment purposes.

We also examine the heterogeneity in first job decisions by field of study and destination city.¹⁸ Panel B and Panel D in Appendix Table 5 suggest that after HPR was implemented in Beijing, elite graduate students from science- and engineering-related fields became more likely to go to Shenzhen, where there is a higher demand for technicians and IT workers.

5.6. Further discussion

We acknowledge some limitations of the paper. First, due to a lack of individual information on wages, we do not know whether the salaries of these graduates are enough to make home purchase decisions. Neither do we know whether some individuals have sacrificed salary in order to obtain *Hukou* in other large cities.

Second, we cannot fully exclude alternative explanations for the patterns found, for example, that well-developed cities, such as Shenzhen or Shanghai, provide a greater number of higher-paying jobs or become more attractive in other aspects after 2010, or that local graduates are more reluctant to move away from Beijing. Although we show in Section 4.2 and Appendix Fig. 5 that the average salaries grow faster in Beijing than in Shanghai, Guangzhou, Hangzhou, or Tianjin, for individuals with a college degree or above, we do not have direct evidence to argue against the fact that some cities become more attractive to migrant graduates from Tsinghua. Our analysis finds that male graduates are more affected by the HPR than female graduates, and migrants are more likely to take jobs in the public sector after 2010, both of which are more

¹⁸ We only focus on eight destination cities because 58.8% of Tsinghua graduate students choose to work in these cities, among those who work outside of Beijing.

consistent with the housing restriction story than with the labor demand story. In addition, we include "home region by year" fixed effects to partly control for local labor demand shocks from their home provinces, we include "big city by year" fixed effects to control for time-variant attractiveness from other big cities (Shanghai, Guangzhou, and Shenzhen), we include "Hukou strictness level by year" fixed effects to control for changes in other cities' Hukou threshold due to Hukou reform during our study period, and we include "field of study by year" fixed effects to control for time-varying industry-specific trends due to changes in labor demands in each industry.

Third, we only estimate the effects of HPR on the first job after graduation rather than analyze the long-term labor-market effect. Some students might accept a job offer with a lower match quality just to obtain *Hukou* in Beijing and then search for a better job after obtaining *Hukou*. If this is the case, our estimated effect is an upper bound of the actual effect in the long run. Unfortunately, we do not observe the long-term labor-market outcomes following the first job.

6. Conclusion

In response to the surge of housing prices in large cities starting in the early 2000s, the Chinese government implemented several housing market interventions, among which the harshest involved restricting urban households' home purchase eligibility to suppress potential speculative housing demand. In some cities, nonresidents are not even allowed to own their first home without having undergone a minimum number of years of employment in the city. Such housing market interventions could have consequences on individual job location choices bundled with other job characteristics.

We use the unique administrative records of all graduate students from Tsinghua University from 2006 to 2016 to study whether and how the implementation of HPRs affect students' employment decisions about their first jobs, particularly location choice, choice of public versus private sectors, and the quality of the match between the job and their field of study. Our results are consistent with the conceptual model of the job search decision: the HPR implemented in Beijing significantly reduces the likelihood that a migrant student will accept a job offer in Beijing by 6.0 percentage points. Conditional on working in Beijing, nonresident students are 5.8 percentage points more likely to choose a job in the

public sector. On the contrary, migrant graduate students who accept job offers in cities other than Beijing are 3.7 percentage points less likely to work in the public sector. In addition, HPR is found to increase the mismatch between students' fields of study at school and the job industry they enter for those who stay in Beijing, but no significant increase in the mismatch was found for graduates who accept job offers in other cities. We find that the effect of HPR on job decisions mainly comes through the channel where HPR restricts nonresidents' eligibility to purchase a home, rather than through the affordability channel (HPR might reduce housing prices in the short term). The HPR has a greater effect on recent PhD graduates, male graduates and older graduates. These results suggest that housing market interventions, bundled with the benefits of the *Hukou* system, do have a spillover effect on job market decisions.

Although our empirical results are only based on a very specific segment of the population, we expect that HPR also has similar unintended consequences for labor-market decisions of the broader population. In fact, it is much easier for Tsinghua graduates to obtain Beijing *Hukou* than graduates of other universities or the general labor force in Beijing. Therefore, our estimate can be regarded as a lower bound of the effect of HPR if we consider all universities or the entire labor force in

Beijing. If a policy intervention restricts certain social benefits people can obtain by living in a city, such as owning a home, it can make the jobs in the city less attractive and cause distortions in the labor market.

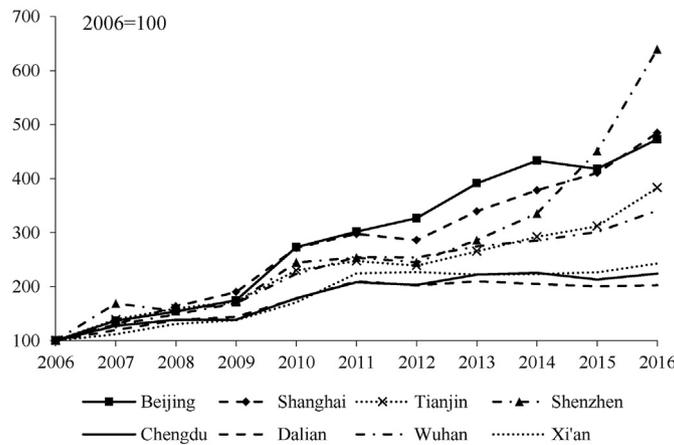
Author statement

Weizeng Sun: Conceptualization, Methodology, Software. Sisi Zhang: Data curation, Writing – original draft preparation. Chengtao Lin: Resources. Siqi Zheng: Writing- Reviewing and Editing.

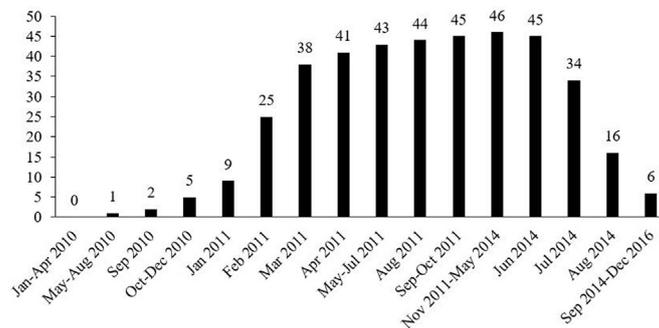
Declaration of competing interest

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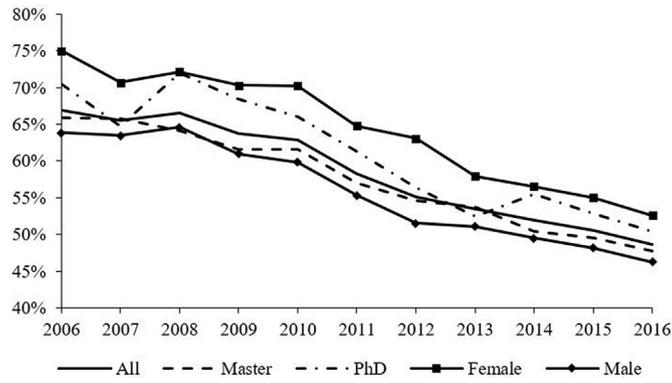
Appendix



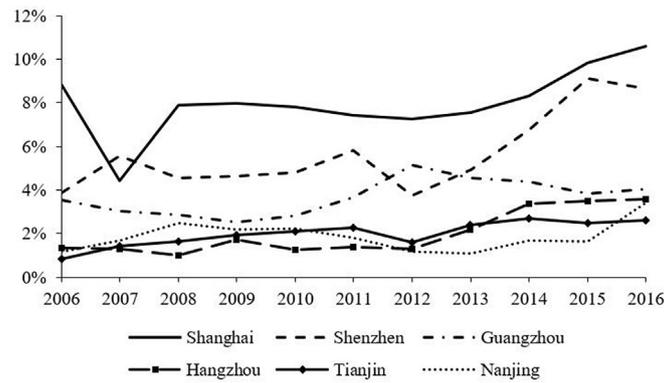
Appendix Fig. 1. Housing Price Index of eight major Chinese cities (2006–2016).
Source: <http://www.cre.tsinghua.edu.cn/publish/cre/9252/index.html>



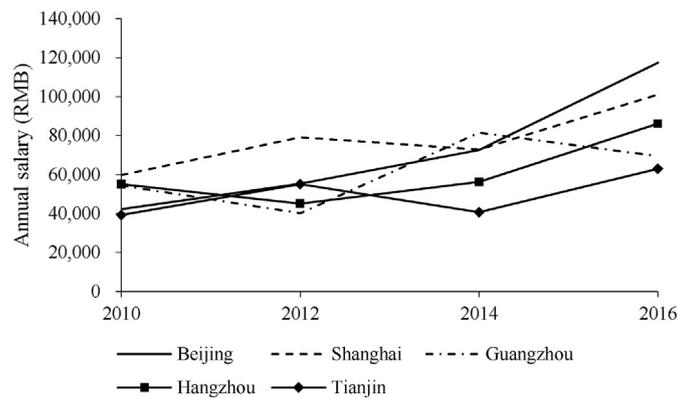
Appendix Fig. 2. Number of cities that implemented HPR, Jan 2010–Dec 2016. Note: This figure shows the number of cities that implemented HPR within each time period.



Appendix Fig. 3. Percent of Tsinghua graduates employed in Beijing, by degree or gender. *Note:* This figure shows the percent of Tsinghua graduate students who accept a job offer in Beijing, overall, by degree or by gender, in each of the years 2006–2016.



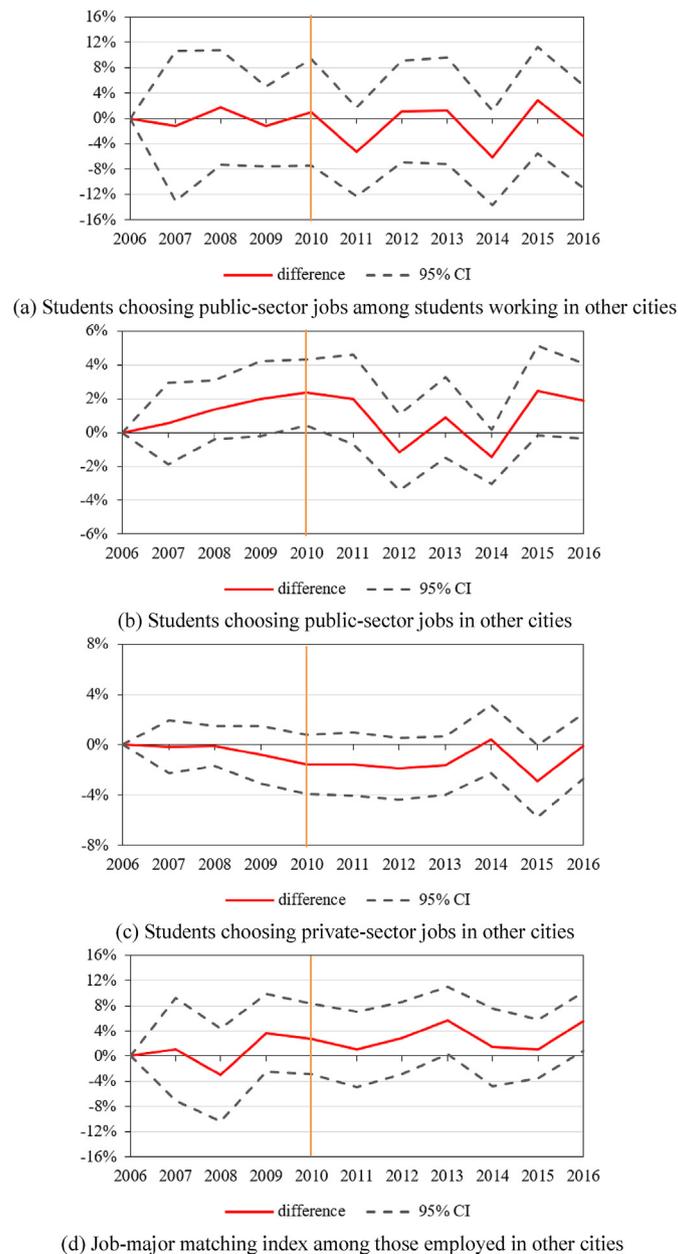
Appendix Fig. 4. Top six employment location choices of Tsinghua graduates, 2006–2016. *Note:* This figure shows the proportion of Tsinghua graduate students who accept job offers in Shanghai, Shenzhen, Guangzhou, Hangzhou, Tianjin and Nanjing, in each of the years 2006–2016. These are the top six cities where Tsinghua graduates find employment.



Appendix Fig. 5. Average annual salary by city, college degree, and above. *Note:* This figure shows the average annual salary in RMB in Beijing, Shanghai, Guangzhou, Hangzhou, and Tianjin, for all individuals with a college degree or above. *Source:* Authors' calculations from China Family Panel Studies (CFPS) 2010, 2012, 2014, and 2016.



Appendix Fig. 6. The proportion of graduate students choosing public-sector jobs, 2006–2016. *Note:* This figure shows the proportion of Tsinghua graduate students who accept job offers in the public sector, by whether they are employed in Beijing, and whether they have a master’s or PhD degree.



Appendix Fig. 7. The dynamic evolution of labor-market outcomes in cities other than Beijing. *Note:* These figures plot the entire paths of coefficients along with their corresponding 95% confidence intervals of job market decisions as estimated from equation (2).

Appendix Table 1
Homeownership Rates in Beijing, among College Graduates 22–34 Years Old, 2010.

Age	College degree	Master degree or above
22–24	17.8%	15.7%
25–27	35.3%	27.3%
28–30	54.4%	46.4%
31–34	68.2%	70.9%
Total, 22–34	47.0%	44.4%

Source: Authors' calculation from Census 2010 in the city of Beijing.

Appendix Table 2
Choice After Graduation, by Degree (2006–2016).

	Employed	Self-employed	Looking for job	Pursuing master/PhD/postdoc in China	Studying abroad	Preparing for master/PhD/postdoc	Undecided
Undergraduate	15.8%	8.8%	0.4%	49.6%	23.5%	1.3%	0.6%
Master	73.7%	11.5%	0.5%	1.9%	11.1%	0.2%	1.1%
Doctor	71.8%	5.0%	0.5%	12.7%	8.6%	0.2%	1.2%

Note: The sample includes all students from Tsinghua University who graduated between 2006 and 2016.

Appendix Table 3
Regression Results Restricting the sample period to 2006–2013.

	Working in Beijing	Working in the public sector among those working in Beijing	Working in the public sector in Beijing	Working in the private sector in Beijing	Job-major matching index in Beijing
	(1)	(2)	(3)	(4)	(5)
$Mig \times I(t > 2010)$	-0.065*** (0.017)	0.055** (0.023)	-0.005 (0.025)	-0.060*** (0.012)	-0.055*** (0.012)
Controls	Y	Y	Y	Y	Y
Fixed effects	Y	Y	Y	Y	Y
Constant	0.614*** (0.002)	0.792*** (0.012)	0.481*** (0.007)	0.133*** (0.008)	0.812*** (0.005)
Observations	19,695	12,098	19,695	19,695	12,098
R ²	0.939	0.076	0.547	0.140	0.475

Note: (a) $Mig \times I(t > 2010)$ is the interaction term for whether a student is a nonresident of Beijing multiplied by whether they graduated after 2010; (b) each column reports the results from the linear probability model with controls for gender, minority, whether the student is a master's student, field \times year dummies, home province dummies, and home region \times year dummies, (Shanghai, Shenzhen, Guangzhou, all other destination cities besides Beijing) \times year dummies, *Hukou* strictness level \times year dummies; (c) robust standard errors are reported in parentheses, which are clustered at the home province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 4
Additional Robustness Checks.

	Working in Beijing	Working in the public sector among those working in Beijing	Working in the public sector in Beijing	Working in the private sector in Beijing	Job-major matching index in Beijing
	(1)	(2)	(3)	(4)	(5)
Panel A: Inclusion of undergraduate students					
$Mig \times I(t > 2010)$	-0.055*** (0.018)	0.004 (0.016)	-0.011 (0.008)	-0.043** (0.021)	-0.088*** (0.007)
Observations	32,755	18,001	32,755	32,755	18,001
R ²	0.932	0.079	0.566	0.156	0.421
Panel B: Consideration of postdoctoral positions as a job choice for PhD graduates					
$Mig \times I(t > 2010)$	-0.034*** (0.013)				
Observations	28,895				
R ²	0.934				
Panel C: Exclusion of the marginal samples (2011)					
$Mig \times I(t > 2010)$	-0.065*** (0.021)	0.059*** (0.018)	-0.003 (0.025)	-0.062*** (0.010)	-0.068*** (0.010)
Observations	25,468	14,820	25,468	27,791	14,820
R ²	0.932	0.087	0.563	0.150	0.475
Panel D: 2008–2016					
$Mig \times I(t > 2010)$	-0.067*** (0.017)	0.036** (0.017)	-0.026 (0.023)	-0.041*** (0.010)	-0.073*** (0.010)
Observations	22,599	12,734	22,599	22,599	12,734
R ²	0.929	0.100	0.574	0.159	0.425
Panel E: 2008–2014					
$Mig \times I(t > 2010)$	-0.071*** (0.015)	0.036* (0.019)	-0.030 (0.023)	-0.041*** (0.011)	-0.066*** (0.013)
Observations	17,120	10,017	17,120	17,120	10,017

(continued on next column)

Appendix Table 4 (continued)

	Working in Beijing	Working in the public sector among those working in Beijing	Working in the public sector in Beijing	Working in the private sector in Beijing	Job-major matching index in Beijing
	(1)	(2)	(3)	(4)	(5)
R^2	0.936	0.092	0.569	0.151	0.425
Panel F: Age limitation for recent graduates applying for Hukou					
$Mig \times I(t > 2010)$	-0.044** (0.017)	0.023 (0.016)	-0.018 (0.022)	-0.026*** (0.009)	-0.066*** (0.008)
Observations	26,581	15,575	26,581	26,581	15,575
R^2	0.936	0.086	0.569	0.146	0.476

Note: (a) $Mig \times I(t > 2010)$ is the interaction term for whether a student is a nonresident of Beijing multiplied by whether he or she graduated after 2010; (b) each column reports the results from the linear probability model with controls for gender, minority, whether the student is a master's student, field \times year dummies, home province dummies, and home region \times year dummies, big city \times year dummies, and Hukou strictness level \times year dummies; (c) robust standard errors are reported in parentheses, which are clustered at the home province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 5

Where Do Elite Graduate Students Go? A Destination City Analysis.

Working city	Shanghai	Shenzhen	Guangzhou	Hangzhou	Tianjin	Nanjing	Chengdu	Wuhan
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: All								
$Mig \times I(t > 2010)$	0.002 (0.009)	0.015* (0.008)	0.008** (0.004)	0.006 (0.005)	-0.003 (0.003)	0.002 (0.004)	-0.002 (0.001)	-0.004 (0.003)
Observations	27,793	27,793	27,793	27,793	27,793	27,793	27,793	27,793
R^2	0.151	0.087	0.090	0.172	0.066	0.433	0.187	0.149
Panel B: Science & engineering								
$Mig \times I(t > 2010)$	0.011 (0.012)	0.017* (0.009)	0.010* (0.006)	0.008 (0.007)	-0.001 (0.004)	0.000 (0.004)	-0.004 (0.003)	-0.005 (0.004)
Observations	18,919	18,919	18,919	18,919	18,919	18,919	18,919	18,919
R^2	0.169	0.094	0.101	0.186	0.072	0.462	0.190	0.168
Panel C: Arts								
$Mig \times I(t > 2010)$	-0.005 (0.007)	0.014 (0.012)	0.007 (0.005)	0.004* (0.003)	-0.009 (0.005)	0.005 (0.003)	0.002 (0.002)	-0.003 (0.002)
Observations	8874	8874	8874	8874	8874	8874	8874	8874
R^2	0.101	0.080	0.074	0.153	0.063	0.412	0.191	0.103
Panel D: STEM								
$Mig \times I(t > 2010)$	0.014 (0.012)	0.017* (0.009)	0.013** (0.006)	0.009 (0.007)	-0.001 (0.004)	0.001 (0.004)	-0.003 (0.002)	-0.005 (0.004)
Observations	19,098	19,098	19,098	19,098	19,098	19,098	19,098	19,098
R^2	0.170	0.094	0.102	0.189	0.073	0.460	0.191	0.166

Note: (a) $Mig \times I(t > 2010)$ is the interaction term for whether a student is a nonresident of Beijing multiplied by whether he or she graduated after 2010; (b) each column reports the results from the linear probability model with controls for gender, minority, whether the student is a master's student, field \times year dummies, home province dummies, and home region \times year dummies, and Hukou strictness level \times year dummies; (c) robust standard errors are reported in parentheses, which are clustered at the home province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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