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ABSTRACT

Economic Opportunities and Gender Equity: The Migration and Education Decisions of Young Women from Rural China

We study how the migration decision of young women in rural China is shaped by the return arrangement and opportunities of college education. Women outnumbered men in young rural-urban migrants in the early 2000s, but the surplus of young women has recently disappeared. We propose that the temporary nature of migration and an earlier return time relative to men are the major reasons that women migrate at a younger age. When higher education expansion increased women's chance of permanent migration, women stayed in school longer. Empirical evidence is consistent with this hypothesis. Marriage motives and demand factors are also considered.

JEL Classification: J12, J16, O15, R23

Keywords: migration, gender, education expansion, marriage

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1. Introduction

Since the late 1990s, China has witnessed a tremendous increase in the number of rural-urban migrants. By 2017, 137 million migrants resided in urban areas with their rural household registration (Hukou) unchanged. In this paper, we start with the gender composition of young migrants, which is determined by the gender differential in migration propensity of rural residents. We notice that among migrants aged 16 to 22 in 2005, women outnumbered men by 1.3 million (nearly 30% male migrants of this age range). For older migrants, however, there were more men than women. More interestingly, the surplus of women in the population of young migrants became a deficit in 2010 and 2015. Why was there a surplus of women among young migrants in the early 2000s, and why did this surplus later disappear? Presenting and explaining these patterns are the major tasks of this paper.

A high female ratio among young migrants from rural areas sounds worrisome. First, it may reflect a shorter period of schooling among rural women relative to men. Had they not migrated, individuals in this age range could be in high school or college. Second, migration may alter the sex ratio in local marriage markets. The unbalanced sex ratio, which is mainly attributable to son preference and the family planning policy (Chen et al., 2013; Almond et al., 2013), has caused pressure in the marriage market and numerous social and economic problems such as criminal behaviors (Cameron et al. 2017; Edlund et al. 2013) and high savings rates (Wei and Zhang, 2011). If young women migrate to cities more than men do, it may further increase men's competition for women in rural marriage markets. Third, gender selectivity in migration might affect the labor market outcomes of both genders among migrants and local residents.

The disappearance of surplus women in recent years alleviates but cannot eradicate these concerns. If the surge and disappearance of surplus women are cyclical or caused by fluctuations in the demand for young women, the above concerns will arise repeatedly. Even if the recent disappearance of surplus women is permanent, there will be important lessons to be learned related to deep factors that influence migration decisions.

Using the 2005 1% population census data, we find that the higher migration probability of rural young women is mainly attributable to the behavior of single women, who are more likely to migrate than their male counterparts. Evidence also shows that women are more likely to return to the countryside, especially after marriage. We propose a simple theory of job search and migration, highlighting the fact that women retreat to family and/or return to the countryside earlier than men. The before-marriage phase thus becomes the golden period for a rural woman to exploit the economic opportunities in urban areas. Given their younger return age, women will leave rural areas earlier and outnumber men among young migrants. However, because married men stay in the urban labor market longer, there are more men than women in the overall migrant population. Both the assumptions and predictions of this model are consistent with the empirical evidence. In addition, we show that the gender gap in migration probability is not attributable to the gender gap in educational attainment. Instead, young women leave the countryside earlier than men do when both groups finish a similar amount of schooling, and they use search methods that are significantly different from those used by men.

Because college education is a major channel through which rural residents obtain urban Hukou, by 2010 China's higher education expansion significantly increased rural residents' chances of permanent migration. Empirical evidence indicates that the probability of a continued education increased more rapidly for women than for men. Consequently, the growth in migration propensity for younger women lagged behind their male counterparts, which can largely account for the disappearance of surplus women among young migrants by 2010.

Our research highlights several aspects that are important for understanding the migration behaviors of Chinese rural residents. First, because of the Hukou restriction, migration in China is mostly temporary; this is especially true in earlier years and is particularly prominent among women. One major implication of this feature is that the age at migration will be endogenously determined. Second, separate-residing is a strategy for households to maximize their economic well-being. Studies in the active literature on family migration usually assume the comovement of spouses (and children) and regard separate migration as a marital dissolution. This assumption does not hold in the context of China and many other developing countries, where millions of wives (and children) are left behind in rural areas while husbands work in cities. Third, education and migration decisions are interrelated for young people. The institutional arrangement in China makes this interdependence stronger, as college education serves as a formal channel for Hukou conversion.

China's institutional feature and rapid transition provide a unique environment for us to study how individuals (households) behave under different circumstances. The changing migration pattern will also be of great value for us to evaluate the validity of alternative hypotheses. One hypothesis that is consistent with both the surplus of women in young migrants and its disappearance will be more promising than others that are consistent with only one of these phenomena.

A high female ratio among young migrants and its decline can be equilibrium outcomes shaped by supply and demand forces in the labor markets. It is probable that the urban service sector in a rapidly growing economy generated higher demand for young females or/and that export growth created higher demand for females to perform the assembly tasks that are a feature of export-oriented manufacturing (Pun 2005; Chang 2009). In addition, the demand for young females might come from employers' preference, as documented in Helleseter et al. (2017). The migration of young women might be the supply response to these demands.

We use a supply-demand framework to determine whether supply or demand factors dominate. We find that the relative wages of young female migrants are positively correlated with their relative shares in the migrant population, consistent with the prediction of the model when demand shifts drove the changes. However, this pattern is not restricted to young women. In particular, we do not find a consistently positive correlation between the fraction of women among young migrants and export activities. Thus, the prevalence of women among young migrants is inconsistent with a higher demand for young women in urban labor markets.

Edlund (2005), aiming to explain the urban surplus of women in a set of Western countries, hypothesizes that while rural men migrate to cities for high wages, young rural women migrate not only for high wages but also for a higher likelihood of marrying a high-wage man. We find some supportive evidence for this explanation, showing that rural women are more likely to migrate for marriage and that in recent years, they have married urban men and changed their Hukou status more often. In addition, we show that migrant women are more likely to be present in regions with higher male wages. However, this theory's explanatory power is limited because migrants normally are denied official permanent residency in destination regions. Although the chances of marrying high-wage male migrants or natives exist (or even increase), female migrants are still discriminated against in the marriage markets of their destination regions.

Although the marriage market hypothesis makes the same prediction about the gender gap in the migration probability of young rural residents as our job search hypothesis, its implications for the marriage market are drastically different. While the former hypothesis has a direct impact on the marriage markets, the latter hypothesis does not. Moreover, the marriage hypothesis neglects the temporariness of women's migration, and it cannot predict a male surplus in the whole sample of migrants, nor can it explain the disappearance of surplus women when the chance of permanent migration increases.

The paper is organized as follows. Section 2 summarizes the literature and highlights our contribution. Section 3 introduces our data and documents the fact that young rural women are more likely to migrate than men in the early 2000s. In section 4, we build a model of job search or human capital investment with migration opportunity in which the duration of women's migration is shorter than that of men. We then present supporting evidence in section 5. We explain the disappearance of surplus women in young migrants in section 6. Section 7 considers two alternative explanations: demand shifts and marriage motives. Section 8 concludes.

2. Background and related literature

The discussion of migration is closely related to China's household registration system (i.e., Hukou), which was established in the 1950s to control rural-urban migration by registering household members in designated locations. One's Hukou status is defined by both socioeconomic eligibility (agricultural and non-agricultural Hukou) and registered residential location (local and nonlocal Hukou) (Chan and Buckingham, 2008). Hukou status confers specific local benefits, including access to health care, public education, housing, and jobs. To migrate permanently, one must change one's registration location, which is tightly controlled by the government. College education has been a major channel that one can use to change one's Hukou status.

Although it has become easier for workers and households to transfer their registrations since the 1980s, the number of Hukou changes remains low. Temporary residence permits are granted more often, and it has become possible for rural workers to migrate without a valid permit. For the vast majority of migrants, local public services remain inaccessible or expensive and many migrants (especially women) are expected to return to rural areas. As emphasized by Dustmann and Gorlach (2016), the temporariness of migration is crucial for us to understand the behavior of rural residents, such as the endogenously determined age of migration.

Gender selectivity in migration in China has been examined by numerous studies (Yang 1994; Duan 2008; Zhao 2004). Studies on migration in the 1980s found that migrants were more likely to be women who migrated for marriage (Yang 1994; Duan 2008). Beginning in the late 1980s, urban employment has become the major motive of rural to urban migration, and most studies found more men than women migrants (Zhao 1997; 1999, for example). Zhao (2004) argues that the demand for rural labor is mainly in the construction and manufacturing industries, whose manual labor tasks are less suitable for women. From the supply side, most rural households do not migrate together but send male members to cities either for higher incomes or to smooth consumption; women are usually left behind to take care of other family members. One of our contributions is to point out that while male prevalence is true of migrants as a whole, it does not apply for young rural migrants in the early 2000s, for whom migration probability is significantly higher for women than for men. This relationship is reversed for the group of older ages.

While the surplus of women among young migrants has rarely been examined, the literature provides possible explanations. Consider the supply side reasons first. Age has been proved to influence migration significantly (Sjaastad 1962). Young people are more likely to migrate because they are more able to adapt to a new environment and can harvest higher wages for a longer period. However, very few studies have examined how the age of migration is endogenously determined by the expected duration of migration. In this paper, we show that women have a shorter period of migration because of labor division within households, which leads them to migrate earlier than men do. In this respect, the work of Bodvarsson et al. (2016) resembles our research. They show that the temporariness of China's rural-urban migration induces rural residents to migrate earlier. However, they do not consider gender differences. Also related to this mechanism, de Brauw and Giles (2017) and Zhang (2015) show that increased chances of migration have negatively affected school attainment. We find no sizable gender difference in this respect.

Marriage motives and differential preferences for cities can also generate a higher migration rate among rural young women. Edlund (2005) notes that in many countries, marriage-aged women are more likely than men to choose urban areas than men. She argues that women not only earn high wages in cities but also have a higher likelihood of marrying a high-wage spouse. Because women value the financial stability of marriage more than men (who place more value on female fecundity), young women have a higher payoff than men when they migrate.

The attractiveness of cities as marriage markets is affected by numerous factors, including segregation in the labor markets and discrimination against migrants without a local Hukou. All else being equal, marrying a migrant is less attractive than marrying a local resident. Thus, migrants are discriminated against in the local marriage markets. However, there is the possibility of marriage within the migrant population. Another possible explanation related to family arrangements is that young women are less attached to rural families because they usually leave the family after marriage. Alternatively, young men tend to stay longer in rural areas to accumulate social capital because they are more tied to their rural families.

Next, we turn to the demand side. In the last three decades, income levels increased and the service sector enlarged significantly in urban areas. The increased demand for services in places such as restaurants and hotels has generated a demand for young females in the labor markets. Increased exports may contribute to this demand, as young women might have comparative advantages in performing the assembly tasks that are used in the production of export goods.

In addition to the demand derived from final goods and services, employers are also found to have a preference for young females. Using data from three job boards in China, Helleseter et al. (2017) find a phenomenon of age twist in gender preference: employers prefer females when they recruit young workers and prefer males when they recruit experienced workers. However, those authors have not examined a migrant sample, neither have they discussed the implication of their findings for the migration behavior of rural residents.

This paper also contributes to a growing literature on family migration (Mincer, 1978; Costa and Kahn, 2000; Compton and Pollak, 2007). However, these studies assume comovement of all family members and permanent migration, which are unlikely to occur in China.

3. Data and facts

3.1 Data

We first use a one-fifth random draw from the sample of the 2005 1% population survey conducted by the National Bureau of Statistics of China (NBS) to examine gender selectivity of migration among young rural residents. The raw data contain more than 2.5 million individuals from all provinces, autonomous regions, and municipalities of mainland China. We keep observations aged 16-45 but emphasize the younger group, which is aged 16-25. In this paper, migrants are defined as people who have left their

Hukou location for more than six months. Observations with non-agricultural Hukou are deleted. Migrants whose migration duration is less than six months or who migrated only within the prefecture of Hukou registration and who remain in rural areas are deleted. Nonmigrants are those who have not left their Hukou location. Some young rural residents are still in school. We exclude them from our sample except when we examine the possibility that a different amount of schooling is driving the gender gap in migration propensity.

We also use another two datasets. The first is the 2016 Dynamic Monitoring Survey of Migrant Population, which is used to examine the gender difference in search methods used by migrants when they first moved to cities. The second is the China Household Income Project (CHIP) for 2002, 2007, and 2013. The rural module of the CHIP 2013 is used to examine the gender difference in return migration and compared with the CHIP 2002 to examine the growth of migration propensity for different age groups. The migrant module of the CHIP 2007 is used to examine the gender difference in work experience before rural workers migrate. We will introduce these sources in more detail when they are used.

3.2 The surplus of women in young migrants, 2005

Figure 1 shows the share of women by age among migrants. In 2005, the share of women among migrants declined sharply with age: for those approximately 20 years old, women account for more than 55% of the migrants, whereas for those aged approximately 35, the share is approximately 45%. It is this significant difference in gender composition between different ages that we explore first in this paper.

The gender composition in migrants is determined by the gender difference in migration probability. Figure 2 shows the probability of migration for the rural population by gender, age, and marital status.[1] First, it shows that (1) single women are more likely to migrate than single men, especially at younger ages; and (2) married women are less likely to migrate than married men, especially at older ages. Second, it shows that the migration probability is drastically higher for single than for married

[1] We classify marital status into two categories. The single group includes unmarried, divorced, and widowed individuals; the married group includes married and remarried observations.

observations in people's early and mid-20s.

Because migration probability and female shares vary considerably by marital status, we report the share of the single population by gender and migration status in Figure 3. Naturally, shares of the single population decline sharply with age for all groups. For those aged below 30, male migrants are most likely to be single, followed by male nonmigrants, female migrants, and female nonmigrants. For those aged above 30, the single shares do not differ much across groups, except that male nonmigrants are significantly more likely to be single. Figure 2 and Figure 3 together suggest that the higher proportion of women in the young migrants is mainly attributable to the higher migration probability of unmarried young women.

Next, we use a linear probability model (LPM) for a quantitative estimate of the probability of migration among young women relative to young men. The sample consists of the migrants and nonmigrants, as defined earlier, aged 16-25. The dependent variable *migrant* is a dummy variable that equals one when an individual is a migrant and zero otherwise. The major independent variable *female* is an indicator of gender (female=1/otherwise=0), and the others include dummies for age, education, marital status, and origin region. Because young women are more likely to migrate, the coefficient on *female* is expected to be positive.

Panel A in Table 1 reports the estimation results. The result in column 1 indicates that women's migration probability surpasses that of men by 2.3 percentage points and is 13% higher than that of men (whose migration probability is 17.5%). Controlling for a full set of covariates raises the coefficients of *female* to 0.031. The results by education levels show that women's higher migration propensity is more obvious among residents with higher education levels (columns 3-5).

In panels B and C, we run similar regressions using the unmarried and married samples separately. The first column of panel B shows that the raw difference in migration probability for the unmarried is 6.2 percentage points. Controlling for covariates reduces the gap to 5 percentage points. The results by education levels show that females are more likely to migrate than men by 5.9 and 7.6 percentage points for those with middle school and high school degrees, respectively. Panel C reports the results for the married sample, showing that married women are less likely to migrate than married men by 2 percentage points given their personal characteristics and region of origin.

The results in panels B and C indicate that the higher probability among rural women is mainly the behavioral pattern of those unmarried, who account for 70% of the population aged 16-25. In addition, middle school graduates constitute the majority of this group and contribute the most to the gender gap in migration probability.

For comparison, panel D examines the sample of older ages (26-45). The results show that women are significantly less likely to migrate by 2 to 3 percentage points. Panel E pools all observations together and shows that on average, men are more likely to migrate than women. The results in panels D and E are important for us to evaluate the validity of alternative theories in explaining the surplus of women among young migrants.

4. Explaining the surplus of women: leave earlier, return earlier

4.1 Temporariness of migration and women's family responsibilities

To understand women's migration behavior, it is necessary to know what will happen after they move to cities and how major events such as marriage will change their life trajectories. In China, migration is mostly temporary and women assume more family responsibilities after marriage, which means that women will retreat from the labor markets and return to rural areas earlier. In the following, we show that it is optimal for rural women to migrate earlier when they expect a shorter migration.

First, we use the rural part of CHIP 2013 to show that women migrants are more likely to return to rural areas. The advantage of this dataset is that it collects information not only on current migrants but also on those who have returned. Migrants in this survey are those who have worked outside of the town or neighborhood of their Hukou registration before 2013. Return migrants are defined as those who (1) had migration experience, (2) were staying at home, and (3) did not plan to migrate in the coming year. Using the migrant sample (including returnees), we examine how return behavior is associated with gender (see Table 2). Column one indicates that women are more likely to return than men by 5.5 percentage points, conditional on age, education levels, ethnicity, and Hukou city. Columns 2 and 3 show that the gender differential is larger for older migrants. For return migrants, the survey asked about the major reason for their return. Panel B examines how the reasons for return differ by gender. The regression results show that women are significantly more likely to choose the reason of "taking care of children and the elders or feeding babies". As returnees age, the gender difference decreases, but remains large and statistically significant. Thus, we establish that women are more likely to return to rural areas and are more likely to do so after marriage to assume family responsibilities.[2]

Women not only are more likely to return earlier, which reduces migration duration but also are more loosely attached to the labor markets after marriage even if they stay in urban areas. Table 3 shows how migrants' gender gaps in labor force participation (whether an individual had worked more than one hour in the last week when the 2005 population survey was conducted), weekly working hours, and hourly wage change with marital status. The first two columns in Table 3 show that while the gender gap in the labor participation rate is only approximately 2 percentage points for unmarried migrants, it is 27 percentage points for married migrants. Columns 3 and 4 show that among those working, unmarried women work approximately 0.3 fewer hours per week but married women work approximately 0.8 fewer hours per week than their men counterparts. Finally, columns 5 and 6 show that while unmarried women's hourly wage is 4% less, married women earn 26% less than their men counterparts. These results suggest that we can understand women's shorter migration duration in a broader sense: even if women stay in urban areas after marriage, their income will be significantly lower than their men counterparts.

4.2 A theoretical model

We build a simple three-period model to illustrate how the gender difference in return arrangement affects the searching behavior of young rural residents. In periods

[2] Using a more rigorous hazard model, Démurger and Xu (2015) also find that women are more likely to return. However, their sample is only from a single county in China.

one and two, one chooses the amount of time searching for an urban job and then returns to the city for employment. In period three, individuals marry and women return to rural areas. Job search here should be understood in a general manner as any activity that enhances one's earning capacity in urban areas, such as education and training. No direct costs of searching and migration occur.

Rural wage, w_r, is identical for all individuals. One's urban wage, w_u, depends on his/her searching time, x, which increases the base urban wage w_u^B by $s(x)$ (i.e., $w_u = (1 + s(x))w_u^B$), with $s'(x) \geq 0$ and $s''(x) \leq 0$. We assume that rural jobs are inferior to all urban jobs, $w_r < w_u^B$. Women and men are risk neutral and choose their searching time to maximize their individual lifetime income. One rationale for a woman to maximize her lifetime income is to enhance her bargaining power in her future family. A representative woman's problem is as follows:

$$\max_{x_f} \left(1 + s\left(x_f\right)\right) w_u^B\left(2 - x_f\right) + w_r \tag{1}$$

Using the F.O.C., her optimal amount of searching time satisfies

$$\frac{s'\left(x_f^*\right)}{1+s\left(x_f^*\right)} = \frac{1}{2-x_f^*} \tag{2}$$

Similarly, a man's objective function is $\left(1 + s(x_m)\right)w_u^B(3 - x_m)$, and his optimal amount of searching time satisfies the F.O.C. as follows:

$$\frac{s'(x_m^*)}{1+s(x_m^*)} = \frac{1}{3-x_m^*} \tag{3}$$

Using these two F.O.C.s, we can draw an inference about the gender gap in migration propensity and the gender composition of different age groups, which are summarized in the following propositions.

Propositions: (1) Men's searching time is longer than that of women: $x_m^* > x_f^*$; (2) Women's migration duration is shorter than that of men; (3) Women dominate in the young group, but men dominate in the overall migrant group; (4) The relationship between the gender gap in migration probability and age has an inverted U shape.

To prove proposition (1), we assume that the opposite is true, that is, $x_m^* < x_f^*$. It must be that $\frac{1}{3-x_m^*} < \frac{1}{2-x_f^*}$ or equivalently $\frac{s'(x_m^*)}{1+s(x_m^*)} < \frac{s'\left(x_f^*\right)}{1+s\left(x_f^*\right)}$. $\frac{s'(x)}{1+s(x)}$ is decreasing in x, $x_m^* > x_f^*$. Contradiction. The other propositions can easily be proved using proposition (1).

We provide two examples to illustrate these propositions. First, let $s(x) = \ln(x)$. It is straightforward to show that $x_f^* = 1$ and $1 < x_m^* < 2$. Second, we let $s(x) = x$. In this case, $x_f^* = \frac{1}{2}$ and $x_m^* = 1$. Clearly, propositions (1)-(4) hold.

Next, we extend the model by assuming different abilities for individuals (ε_i), which follow the same distribution, $F(\varepsilon)$, for both men and women. We assume that ability influences urban wages only, reflecting a higher return to unobservable skills in urban than in rural areas. Therefore, individual i will either earn w_r in rural areas or $w_u + \varepsilon_i$ in urban areas. ε_i can also be understood in different ways. It can be an individual's preference for cities relative to rural areas; it can also represent migration cost (higher values represent lower cost). For simplicity, we assume $s(x) = x$ and that one can only choose either $x = \frac{1}{2}$ or $x = 1$, and the urban wage will be $w_u^L = \frac{3}{2} w_u^B$ and $w_u^L = 2w_u^B$, respectively. The properties of this model are essentially the same as proposition I (see appendix).

5. Empirical evidence of model predictions

The critical assumption in our model is that female migrants return to the countryside earlier, for which we have shown supporting evidence. Next, we discuss empirical evidence for each theoretical prediction stated in the Propositions.

5.1 Women leave the countryside earlier

How do young women surpass men in rural-to-urban migration? Technically speaking, there are several possibilities. As we are considering a young age group, one possibility is that women leave school earlier than men (i.e., the education channel). The other possibility is that women leave the countryside earlier after finishing the same amount of schooling, which suggests that the gender gap diminishes with age. The third possibility is that the gender gap is independent of age within a certain age range.

(1) Channel one: Education

To evaluate the education channel, we include the observations who are currently in school and generate a variable (*dropout*) to indicate whether one is in school (*dropout*=0) or not (*dropout*=1). Migration is defined in the same way as before. We first look at how gender is associated with dropout risk. Column 1 in panel A of Table 4 shows that women are more likely to be out of school than men by a small amount (1.3 percentage points). Column 2 shows that women are more likely to migrate than men by 3.6 percentage points for a given age, ethnicity, only child status, and Hukou city. Controlling for *dropout* changes the coefficient of *female* slightly by 0.2 percentage points.[3] Although it is significant in affecting migration, *dropout* has negligible power to explain the gender gap in migration. Adding the interaction term *female*X*dropout* (column 4) reduces the coefficient of *female* toward zero, and its own coefficient is large (0.044) and significant, suggesting that it is those who have left school who produce a surplus of women in young migrants.

As we cannot follow the observations over time, it is possible that some women left school earlier than men did, but we cannot observe this difference for those who have already left school. To alleviate this concern, we separate our sample into smaller age groups according to the timing of education. Even for the groups of middle school age (12-15, panel B) and high school age (16-18, panel C), the results are similar in the sense that the amount of schooling cannot explain the gender gap in migration.

There are several reasons for the lack of explanatory power of the education channel. On the one hand, the law of compulsory education requires all individuals to finish middle school. Given that a majority of rural migrants were middle school graduates in 2005, we do not expect a large gender difference in educational attainment. On the other hand, education is beneficial for women to increase their monetary income, probability of migration, and chances of marrying-up, which discourages them from

[3] The education decision can also be endogenously determined by migration opportunities (Zhang, 2015; de Brauw and Giles, 2017). We show in another analysis that migration opportunities have not encouraged women to leave school earlier than men.

leaving school early. Finally, labor regulations such as the minimum age requirement in the labor markets also prevent rural youths from leaving school early.

(2) Channel two: Job search

Given the same amount of schooling, women can still migrate earlier than men do after leaving school, which highlights a transition process (or searching duration) before one enters into the urban labor markets and after he/she leaves school. Young women can outnumber men because of their younger age at migration, or equivalently, a shorter transition period. To examine this possibility, we construct a new variable of migration age as the dependent variable, using information on how long one has left his/her Hukou place and their current age in the 2005 census.[4] The results in Table 5 show that women are significantly younger than men when they left their Hukou place. When we look at the young group (16-25 years old), the difference is approximately 0.4 years. However, this sample excludes those who migrated at older ages and tends to produce a lower estimate. When we consider all observations aged 16-45, the difference increases by 3 times (column 2).

To partial out the effect of schooling, we control for education levels in columns 1 and 2. In columns 3 to 5, we run regressions by education level and keep only those who have graduated when we do so. The results are largely similar. In addition, we consider the unmarried sample separately in panel B, and again, we obtain similar results. Because the census data do not record returned migrants, we use the rural module of CHIP 2002, which includes return migrants, to perform similar exercises. Although the sample becomes smaller, the gender difference in migration age is similar in magnitude, especially when we examine the young group. However, this gender difference in migration age declined sharply between 2002 and 2013, and for migrants with primary and middle school degrees, the gender difference in migration age is no longer significant. This change is consistent with the results in section 6 where the surplus of women among young migrants disappeared in recent years.

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[4] For those who have left their Hukou place for 6 months to 1 year, 1 to 2 year, 2 to 3 years, 3 to 4 years, 4 to 5 years, and 5 to 6 years, we use the middle values (0.75, 1.5, 2.5, 3.5, 4.5, 5.5) to approximate their real migration duration. For those who have left their Hukou place for more than 6 years, we use 6.5 years.

Because women leave the countryside earlier, it is expected that they are less likely to have work experience in rural areas before they migrate. In Table 6, we show that women are less likely than men to have experience as village cadre, in military service, or in nonfarm work by 3 to 5 percentage points. Women not only migrate earlier but also use different search methods for their first job in urban areas. In Table 7, we show that women are less likely to use family-related networks (information from family members, relatives, and village fellows) to find their first urban job. Instead, they are more likely to use information from general sources such as the Internet, friends, newspapers, or social/governmental intermediary agencies.

5.2 Women's migration duration is shorter than that of men

Have early return and family responsibilities led to a shorter productive migration duration for women? We go back to the 2005 census data and use the number of years since one left his/her Hukou registration place by 2005 as a measure of migration duration to examine this gender gap. This measure is not perfect because (1) it is not the actually completed duration, (2) the sample does not include those who have returned, and (3) the time is not accurately recorded but instead is grouped into 7 categories.[5] With these caveats in mind, we run regressions in Table 8 to evaluate how migration durations differ by gender. Column 1 shows that women's migration duration is approximately 0.2 years shorter than that of men. We control for age in column 2 and the coefficient of *female* becomes small and insignificant, suggesting that migration duration does not differ for current migrants of identical age and the gap is caused by the difference of age at migration. As the duration is top-coded at 6 years, we investigate the probability of an individual's migration duration being longer than 5 years using Linear Probability Models. When age is not controlled for, women are less likely to have a long migration duration than men by nearly 5 percentage points (column 3) and the difference largely disappears when age is controlled for (column 4).

5.3 An asymmetric inverted U shape relationship

The gender differences in migration age, work experience before migration, and

[5] See footnote 4.

search methods indicate that the gender gap in migration propensity is unlikely to be independent of age even for a narrow age range. To see the inverted-U-shaped relationship between gender gap in migration probability and age, we run regressions of migration status on the interactions between gender and age dummies. The results are reported in Figure 4, with a solid line for the whole sample and a dashed line for the unmarried. For both samples, the gender gap in migration probability first increases with age, peaks at age 18 and then declines. It is also interesting to examine the difference between the whole sample and the unmarried sample. For the whole sample, the gender gap declines faster than the unmarried sample, and after ages 23-24, the gender gap in migration probability becomes negative. For the unmarried sample, however, the gender gap remains positive. This is because married women are more likely to return to the countryside.

To see the average effect, we examine the gender gap in migration propensity of rural residents of older ages, which is reported in panel D of Table 1. It is reported that for residents aged 26 to 45, rural women's migration propensity is 3.2 percentage points lower than their men counterparts. When a standard set of covariates are controlled for, the difference decreases slightly to 2.3 percentage points. The results by education levels are of similar magnitude. We also report the results for observations of the whole age range of 16-45. Women's migration propensity is 1.8 percentage points lower than that of men. The results by education level suggest that the magnitude of the gap is decreasing in education levels.

5.4 There are more men than women in all migrants

Proposition (3) and its corresponding evidence lead to proposition (4), which posits that the surplus of women will be reversed as migrants age, and there will be more male than female migrants in the urban labor markets. The surplus of men in older migrant groups is clearly shown in Figure 1. Summarizing the data shows that women account for 47.4% of the migrants aged 26 to 45. When we look at the whole age range from 16 to 45, the number becomes 50.3%, which is inconsistent with our prediction. The reason is probably that younger cohorts dominate the migrant population, which is not taken into consideration by our theoretical model.

However, when we keep only employee observations, the share of women among all migrants declines to 47%. Alternatively, we can also use positive income as an indication of labor market participation. Once we drop those without positive income, the female share declines to 44.8%.

Thus, we have shown that our theoretical predictions are all supported by empirical evidence. It is worth mentioning that although numerous alternative explanations can predict a surplus of women among young migrants, none of them predicts all of these empirical regularities. Their weakness lies in their neglect of the temporariness of migration, women's higher propensity of retreat to families, and families' separate residential arrangement.

6. Higher education expansion and the disappearance of surplus women

We have shown that women outnumbered men among young migrants in the early 2000s because women migrants are supposed to return earlier from cities. In this section, we show that when the chances of permanent migration increase, that surplus disappears. When we use data from recent years (2010 census, for example), the fraction of men surpasses that of women in young migrants (see the solid line in Figure 1). We conjecture that the disappearance of surplus women is mainly attributable to China's higher education expansion because college education is a major channel of permanent migration for rural residents under the current Hukou arrangement.

China initiated an expansion of higher education in 1999. By 2010, the number of new college students had reached 6.6 million, over six times the number in 1998. This expansion greatly increased the opportunity for higher education among rural residents, especially for rural women. The upper panel of Figure 5 shows the gender difference in the attainment of high school and college education in rural areas in 2010. Although women lagged behind in educational attainment for older age groups, young women have been catching up with men. There is a clear pattern that women's education attainment grew faster than that of men. To alleviate the concern that rural residents will be reclassified as urban residents once they graduated from college, panel B of

Figure 5 shows the gender difference in college attainment for urban residents, which also indicates a relative increase in women's education levels. However, the increase shows a linear trend for the whole cohort group and the growth in education levels for recent cohorts is relatively modest, with the increase in higher education mostly mirroring a decline in the attainment of high school degrees.

It is important to realize that most college graduates from rural areas will remain in urban areas after graduation. In addition, high school education is primarily preparation for college education. Rural residents attending high school will mostly migrate to cities permanently if they succeed in entering college. However, most studies do not treat college graduates and students in colleges and high schools as rural migrants. As will become clear later, treating these observations as migrants (or not doing so) has major implications for our results.

Next, we use the rural survey of the CHIP 2002 and 2013 to explore the underlying reason for the declining female share among young migrants. This survey not only records migration and education information but also provides individual level data for both the early 2000s and after 2010. Also important for our study, students who are studying outside but are receiving financial support from their rural households are also recorded as household members. Figure 6 reports the growth in the share of migrants in rural residents by age and gender. For those over the age of 24, the increase in migration probability is similar for both genders, but for below the age of 23, women lagged behind significantly. Note that 16-23 is the age range of high school and college education; it is probable that relatively more rural women stay in school rather than migrating to cities. Indeed, when we treat high school and college students as migrants, the gender difference for the younger group largely disappear (see panel B). Next, we run regressions to verify this hypothesis.

Pooling the CHIP 2002 and the CHIP 2013 together, we generate two dummy variables, Age_{16-23} and $Year_{2013}$, to indicate whether an observation belongs to the group aged 16 to 23 and to the sample of 2013. We use their interaction in the regression to capture the differential growths in migration propensity for different age groups. The following regressions are run for men and women separately:

$$migrant = \beta_0 + \beta_1 Age_{16-23} + \beta_2 Year_{2013} + \beta_3 Age_{16-23} * Year_{2013} + \gamma X + \epsilon \qquad (4)$$

$migrant$ is an indicator of migrants. First, we use a conventional definition of migrants as those who are registered in rural households and work in cities for wages. Individuals who are in high school and in college are treated as nonmigrants. The regression results for women and men are reported in the first two columns in Table 9. For women in 2002, young residents were 21 percentage points more likely to migrate than older residents. Between 2002 and 2013, the older group's migration propensity increased significantly by 20 percentage points. However, for those aged 16-23, growth lagged by 19 percentage points. For men, young rural residents also lagged in migration growth by 8 percentage points relative to the older group. Comparing both genders, there is a gender difference of 11 percentage points in the relative growth of migration propensity for the young group, which echoes the difference depicted in Figure 6. In columns 3 and 4, we drop those who are in high school and in college and the coefficients of the interaction terms change, but the gender difference remains at 11 percentage points. Finally, we treat those in high school and in college as migrants, the lag of migration growth for young residents largely disappears and the gender difference is no longer significant. The results in Table 9 strongly indicate that the vanished surplus women are mainly attributable to a larger increase in the opportunity of college education opportunities for women.

How can young women catch up with men? Next, we show that rural women perform better than men academically, using the China Education Panel Survey in the 2013-2014 academic year, a large-scale, nationally representative survey that collects information for 7th- and 9th-grade students.[6] We restrict our analysis to those with rural Hukou locations and study the gender difference in academic performance and educational expectations. The regression results in Table 10 show that although there is no significant gender difference in cognitive ability (column 1), female students score significantly higher in Chinese, math, and English tests and thus rank higher than the

[6] See the website for an introduction: https://ceps.ruc.edu.cn/index.php?r=index/index&hl=en.

male students in their class.

Table 11 shows that female students are more likely to be expected to finish college education by their parents and by themselves, with the gender difference being approximately 7 or 12 percentage points (column 1 and 3 in Table 11). These gender differences are not attributable to factors such as ethnicity, parents' education and occupation, and family backgrounds. However, once academic performance is controlled for, the gender difference in educational expectation either disappears or declines sharply. These results indicate that women in rural areas are more able to take advantage of college expansion to fulfill the educational expectations of both their parents and themselves.

7. Alternative explanations for the surplus of women among young migrants

7.1 Demand for young women in urban areas

We have emphasized a supply-side explanation for the selectivity of migration in the previous sections. However, demand may also play a role if it is gender and age specific. To evaluate the relative weight of supply and demand forces, we first lay out a simple framework here to guide our analysis. The supply of (*S*) and demand for (*D*) women are written in relative terms taking the supply of and demand for men as the reference, and the wages of women (*w*) are also expressed in terms relative to those of men. The relative wages of women are thus the equilibrium outcome of relative supply and demand (point E in Figure 7). The relative wages of women will then change as supply or demand changes, but the consequences of supply and demand shifts are different. When demand increases (from *D* to *D'*), both the relative quantity and the relative wages of women increase; when supply increases (the supply curve *S* moves to *S'*), the equilibrium quantity increases but the relative wage decreases (point E''). This means that when different regions or industries experience differential demand for young women, the correlation between relative wages and relative employment size will be positively correlated; when the difference is induced by supply, it will be negative. We examine the relationship between the gender wage gap and relative amounts of female workers empirically in the following.

First, we consider only the unmarried observations aged 16 to 26 for the following analysis.[7] Because of the labor market segmentation between migrants and local native workers, we consider only the migrant sample. To partial out the wage differential caused by the composition of age and education, we run a regression of log wages (ln$wage$) on age dummies (age_{ki}), education dummies (edu_{li})[8], and their interactions.

$$lnwage_{kli} = \beta_0 + \sum_{k=17}^{25} \beta_k * age_{ki} + \sum_{l=2}^{7} \gamma_l * edu_{li} + \sum_{k=17}^{25} \sum_{l=2}^{7} \delta_{kl} * age_{ki} * edu_{li} + \varepsilon_{kli} \quad (5)$$

We then use the predicted residuals ($\hat{\varepsilon}_{kli}$) to calculate the average wages for men and women and the wage gap between them: $w_g = \overline{\hat{\varepsilon}_{fg}} - \overline{\hat{\varepsilon}_{mg}}$, where the subscripts f and m stand for women and men and the subscript g stands for different groups of region, industry, or province-industry. The relative employment of women ($femalesh_g$) is measured as the share of women within the city, industry, or province-industry cells. We run the following regression using ordinary least squares (OLS) weighted by the relative share of migrants in group g as of the whole migrant sample:

$$w_g = \alpha_0 + \alpha_1 * femalesh_g + \epsilon_g \quad (6)$$

In columns 1 and 2 of Table 12, the relative wages and employment of women are calculated at the city level. The results show that across regions a 10 percentage point increase in the share of women migrants is associated with a 0.025 log point increase in women's relative wages. Controlling for province dummies does not change the results much. In column 3, we consider the variation at the two-digit industry level, and the relative employment and wage of women migrants are positively associated at the 1% significance level. Finally, we consider region and industry variations together. Because of the limitation of the sample size, we consider region at the province instead of the prefecture level. Some industries and provinces are dropped because of insufficient observations to calculate the relative employment or wages at the province-industry level. Again, a positive correlation between employment and wages is found even after we control for the province and industry dummies. In panel B of Table 12,

[7] Including the married observations and extend the age range to 16 to 30 will not change the results much.
[8] There are seven education levels, namely, below primary, primary school, middle school, high school, professional college, college/university, and graduate degrees.

we run regressions without using weights, and the coefficients are similar in magnitude but mostly insignificant. The results in panels A and B in Table 12 suggest that the higher probability of migration for women is consistent with the relative demand from urban areas, and the mobility of women migrants is insufficient to equalize the relative wages across regions and industries.

To see whether the demand is larger for younger women than for older women, we run similar regressions using a sample of married migrants aged 26 to 45. The results in panel C of Table 12 show that the relative wages of women are positively correlated with the share of women among migrants of the same ages. The results indicate that the demand for women is not specific to young women.

Two more pieces of information contradict the hypothesis that exports increased the demand for young women. First, the phenomenon of surplus women among young migrants is as clear in 2000 as in 2005 despite the sharp increase in China's trade activity after its entrance into WTO. Second, we use regional variation to examine the relationship between exports and female employment. Exports are measured as the value of export goods relative to total sales revenue aggregated at the city level, which is calculated using the Chinese Industrial Enterprises Survey Data. In a simple cross-section analysis of the 2005 data, exports are positively associated with the share of women among younger migrants and are uncorrelated with that of the share of women among older migrants (see columns 1-4, Table 13). However, once we consider a fixed effects model, we find no significant impact of trade on the relative employment of young women (see column 5, Table 13).

7.2 Demand for young men in rural areas

The surplus of women among young migrants may be attributable to the fact that young men are reluctant to leave the countryside. One possibility is that they experience a higher demand for labor in rural areas, which makes their opportunity cost of migration higher. However, there is no consistent evidence showing that rural areas have a specific demand for young men, and there was no significant technological change in rural areas that reduced the demand for young men between 2005 and 2010.

It is also possible that men migrate late because they will eventually return to their home community and they want to accumulate social capital before they move. In contrast, a woman migrant will probably "return" to her husband's home community rather than her own. Consider that there is a home bias for a rural man. The longer he remained in a rural area before migration, the more valuable his lifetime income is. The objective function becomes $(1+x_m)^2 w_u^B(3-x_m)$ and the solution is $x_m^* = \frac{5}{3}$. For women, the optimal searching time remains $x_f^* = \frac{1}{2}$. This mechanism only strengthens our propositions. However, the home bias alone (without the search mechanism, men and women's objective functions become $(1+x_m)w_u^B(3-x_m)$ and $w_u^L(2-x_f)+w_r$) cannot generate the inverted-U-shaped gender gap in migration probability. More importantly, the surplus of women in young migrants and its subsequent disappearance strongly suggest that these facts are attributable to the migration decision of women.

7.3 Marriage motives of women migrants

To examine whether marriage motives exist, we first follow Edlund (2005) to see the relationship between gender composition and the wage distribution of men utilizing the variation across regions. If young rural women migrate for marriage and pursue financial security in marriage, they will move to cities with higher male wages conditional on the wage levels of women and industrial structure of the destination regions. Because the marriage market is segmented between rural and urban Hukou and intermarriage across Hukou is rare, we calculate the average wages of migrant men for each city (*lwg_mean_m*). More specifically, we consider migrant observations to show how the probability of being female depends on male migrants' wages conditional on age, education, industry, occupation, province dummies, individual wages (*lnwage*), and the average wages of women (*lwg_mean_f*) at the city level. Clearly, we do not use the regression to infer a causal relationship, but to explore the correlation between women's regional distribution and men's wages.

The results for the sample of the unmarried migrants aged 16-25 are reported in Table 14. The coefficient of the wage level of male migrants is significantly positive, suggesting that female migrants are significantly more likely to be in cities with higher male wages. Column 2 also includes married migrants whose purpose of migration is marriage, and the coefficient on male migrants' wages is larger. In column 3, we consider married and unmarried migrants of age 16-25 together and obtain similar results.

If the positive correlation between men's wages and women's migration intention suggests a marriage motive among young women, the correlation should decrease when we consider the older population. To see this, we consider migrants aged 31-45 in Table 15, in which the average wages of men and women are calculated using observations aged above 30. The results show that wage levels of men have a positive impact on the probability of a migrant being female. The sample of unmarried migrants aged above 30 is small and the coefficients on both male and female wages are insignificant (column 2). When both married and unmarried migrants are considered (column 3), the results do not differ from those of the married sample.

Although smaller than in Table 14, the significant coefficients on male wages in Table 15 cast some doubt on the proposition that this relationship is due to marriage motives among rural young women. In addition, the marriage motive cannot predict a surplus of men in all migrants, nor can it predict an inverted-U-shaped relationship between the migration gap and age.

8. Conclusions

With rapid economic growth, hundreds of millions of rural residents migrate to cities and there is a significant difference in the migration behavior between rural men and women. We notice that in the early 2000s, young women were more likely to migrate to cities than their male counterparts. However, in more recent data (2010 and 2015 census, for example), young rural men surpassed women in the growth of migration propensity.

We propose that the surplus of women among young migrants in the early 2000s is mainly attributable to the limited opportunity for permanent migration and the earlier return time of women migrants. The fact that women are more likely to return to the countryside after marriage encourages them to migrate earlier. This explanation is also consistent with the recent disappearance of the surplus of women. When higher education expansion increased the opportunity for permanent migration and earnings prospects in cities, rural women choose to stay in high school and go to college more than men do, which can account for the slower growth in the propensity for temporary migration. We also evaluate several alternative explanations, none of which is consistent with all of the empirical evidence.

This paper exploits China's unique growth experience and institutional arrangements and shows how rural women's behavior is influenced by the temporariness of migration, labor division within households, and opportunities for higher education. Studying the interrelationship between these aspects not only contributes to a growing literature on the economics of temporary migration and family migration but also provides insights to understand China's socioeconomic change. It is especially important for us to understand how gender inequality in economic well-being is shaped by culture, the Hukou restriction, and education opportunities. From this perspective, the higher education expansion since the late 1990s is beneficial for narrowing the gender gap among rural residents.

This paper also emphasizes the transition period before rural residents leave the countryside and the gender difference in searching behavior, both of which are worthy of detailed investigation in future research.

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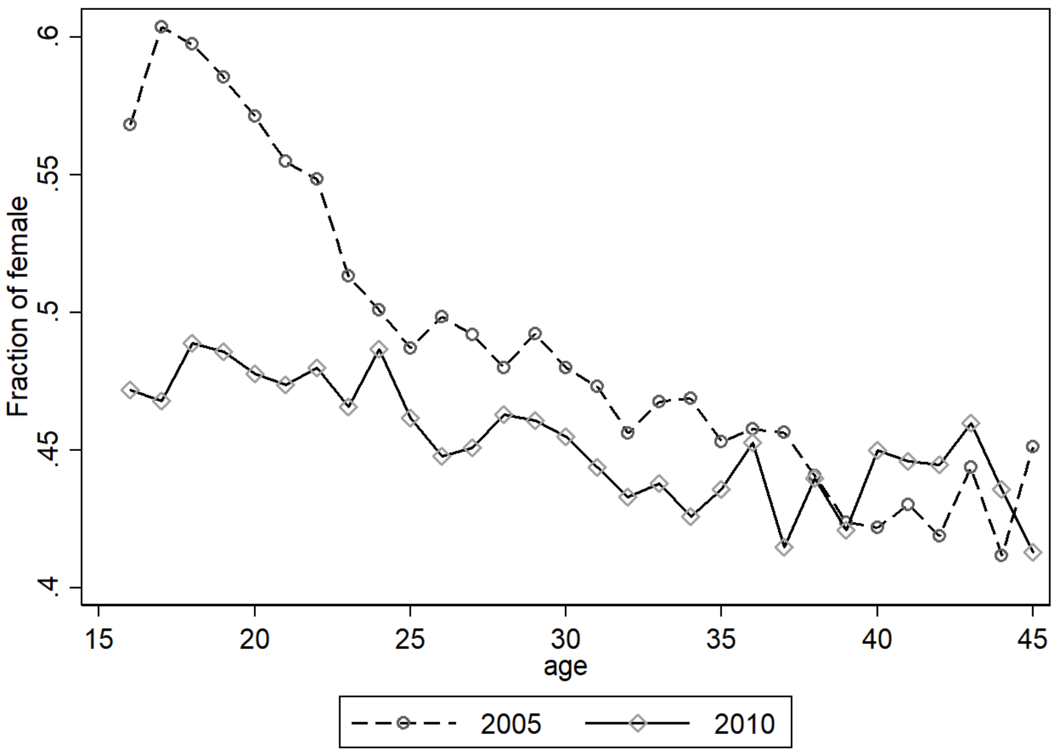


Figure 1 Female share by age in migrants, 2005 and 2010

Notes: (1) Observations with non-agricultural Hukou and those who are in school are deleted. (2) Migrants are those who have left their location of official household registration (Hukou) for more than three months. Migrants who migrated only within the city of their Hukou and who remain in rural areas are deleted. Observations with migration duration less than three months are also excluded from our analysis.

Data source: 2005 1% population survey and 2010 census.

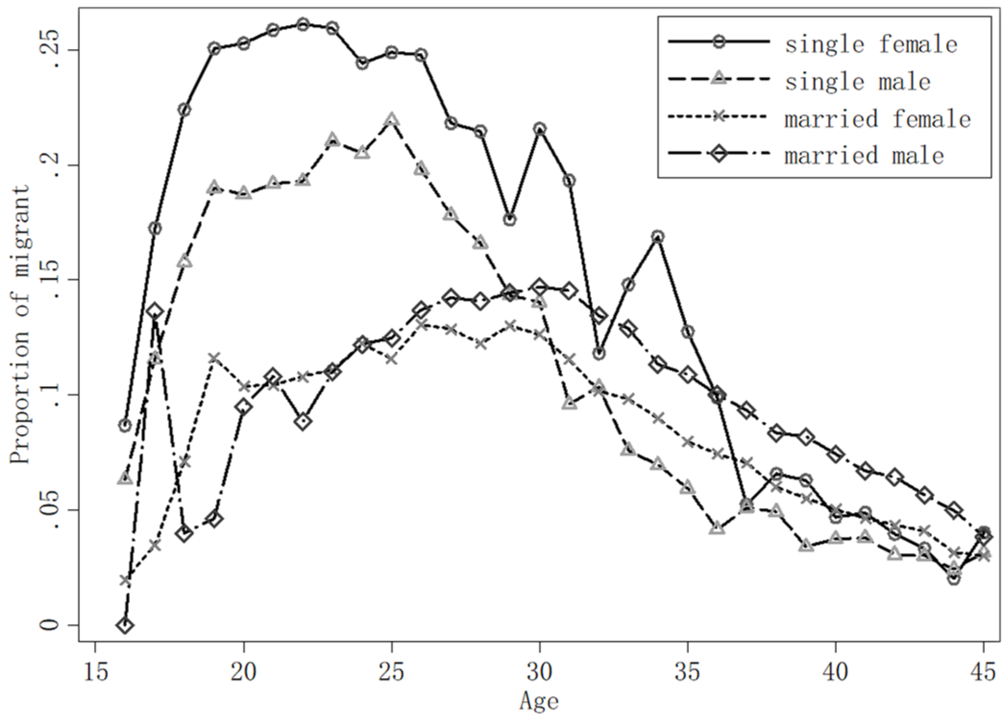


Figure 2 Migration probability by gender and marital status, 2005

Notes: (1) Observations with non-agricultural Hukou and those who are in school are deleted. (2) Migrants are those who have left their location of official household registration (Hukou) for more than three months. Migrants who migrated only within the city of Hukou and who remain in rural areas are deleted. Observations with migration duration of less than three months are also excluded from our analysis. (3) Nonmigrants are those who have not left their Hukou registration place. (4) Single observations are those who are divorced, widowed, or have never been married; married observations include those who remarried.

Data source: 2005 1% population survey.

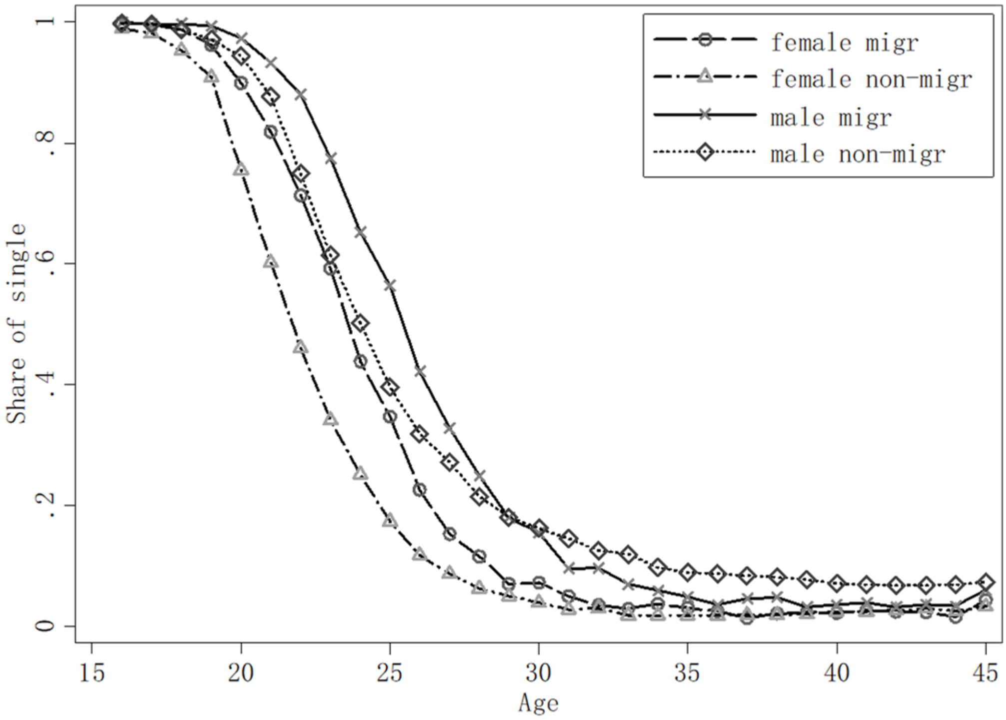


Figure 3 Probability of being single by age, gender, and migration status, 2005

Notes: (1) Observations with non-agricultural Hukou and those who are in school are deleted. (2) Migrants are those who have left their location of official household registration (Hukou) for more than three months. Migrants who migrated only within the city of Hukou and who remain in rural areas are deleted. Observations with migration duration less than three months are also excluded from our analysis. (3) Nonmigrants are those who have not left their Hukou registration place. (4) Single observations are those who are divorced, widowed, or have never been married; married observations include those who remarried.

Data source: 2005 1% population survey.

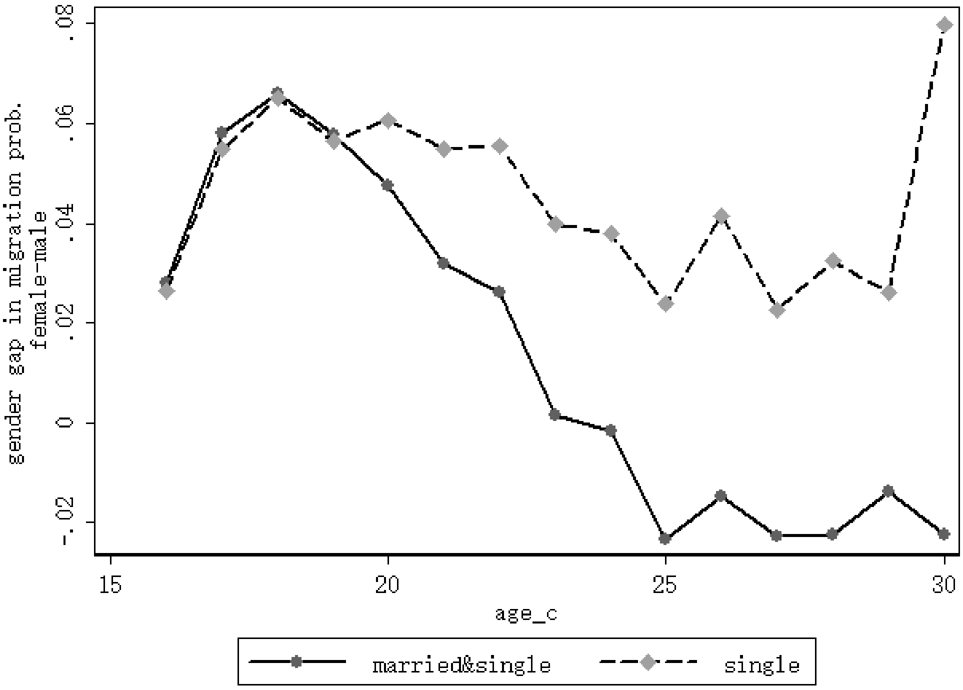


Figure 4 Gender gap in migration probability by age

Notes: (1) Observations with non-agricultural Hukou and those who are in school are deleted. (2) Migrants are those who have left their location of official household registration (Hukou) for more than three months. Migrants who migrated only within the city of Hukou and who remain in rural areas are deleted. Observations with migration duration less than three months are also excluded from our analysis. (3) Using migrant dummy as the dependent variable, we run regressions controlling for interactions between gender and age dummies. The coefficients of the interactions are reported in this figure. (4) Education dummies, Hukou city, age dummies, gender, and a constant term are controlled for. (5) The regressions are run for the whole sample and the single sample separately.

Data source: 2005 1% population survey.

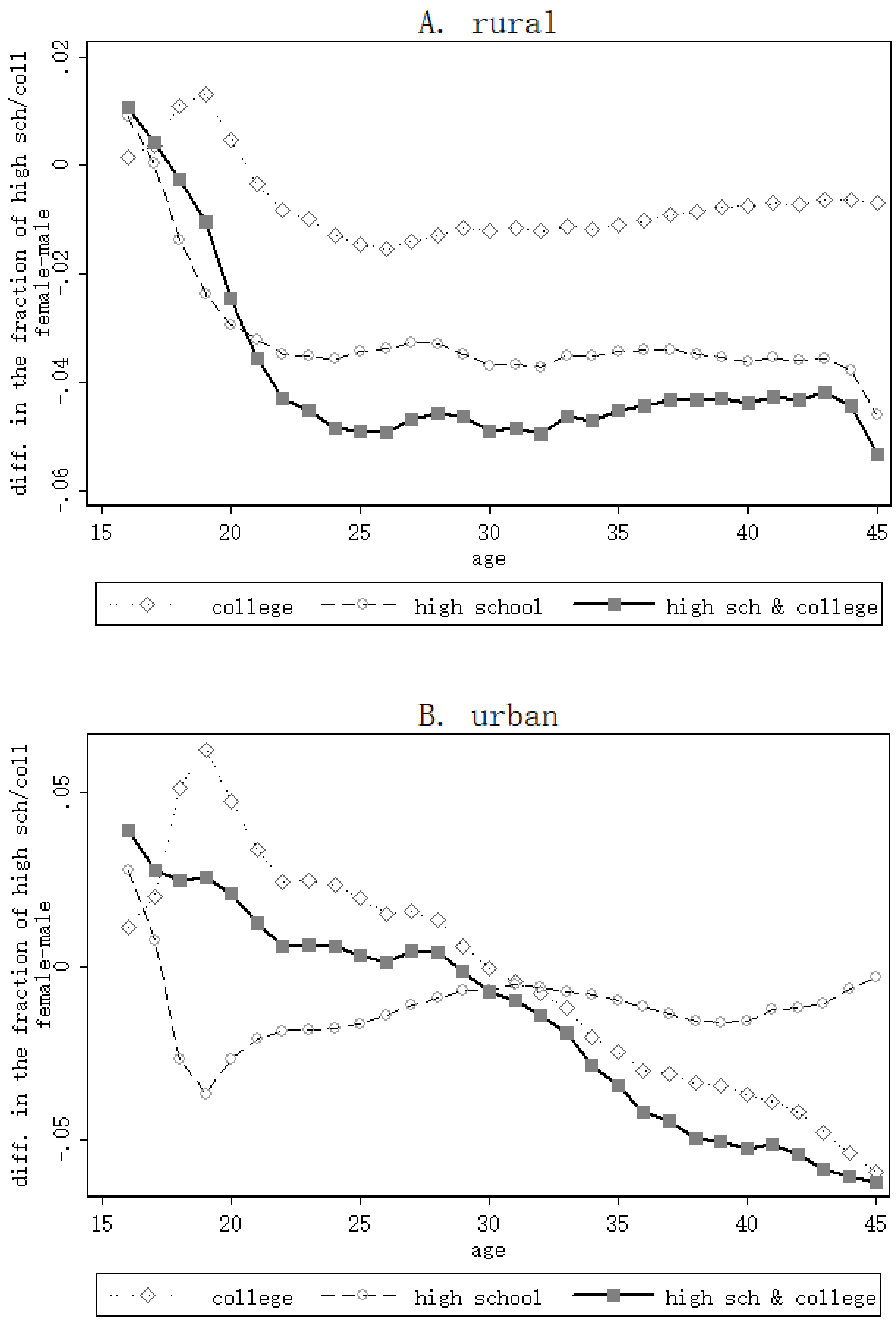
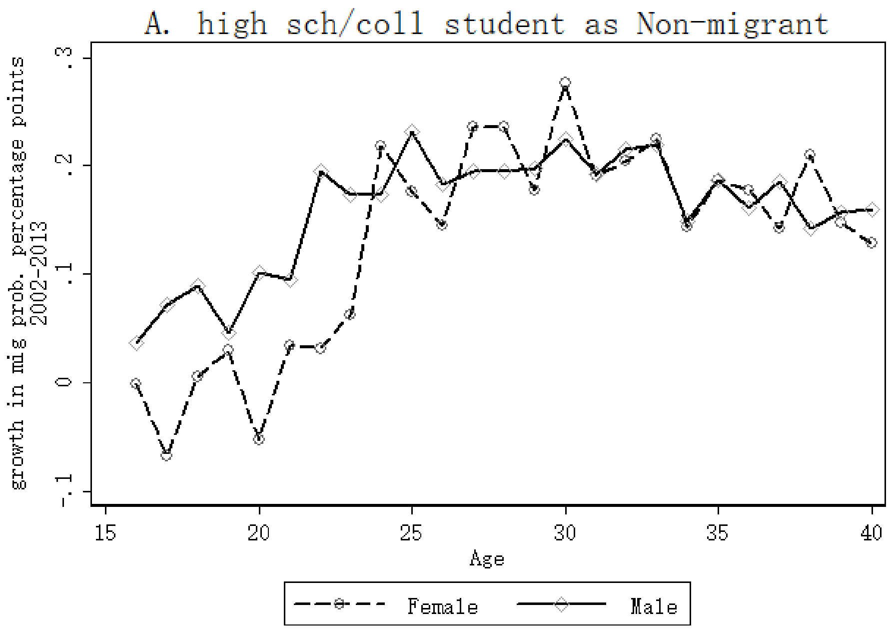


Figure 5 Gender difference in education levels in rural and urban China

Note: Gender difference is calculated using the 2010 census data released by NBS. We first calculate the share of high school and college students/graduates in the population of each age by gender and then calculate the gender difference (female minus male). The dashed and dotted lines represent similar statistics for high school and college degrees, respectively.



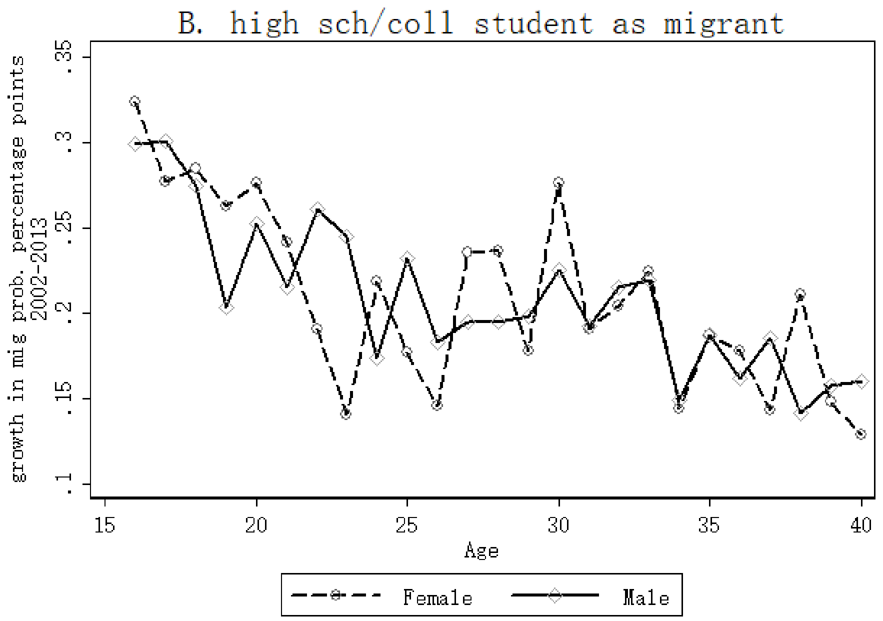


Figure 6 Growth in migration probability by gender

Notes: (1) We use the rural household survey to identify rural migrants. In 2002, migrants are defined as those who have positive earnings from outside employment; in 2013, migrants are those who have worked outside of their township or neighborhood in 2013.
Data sources: Rural surveys of CHIP 2002, 2013.

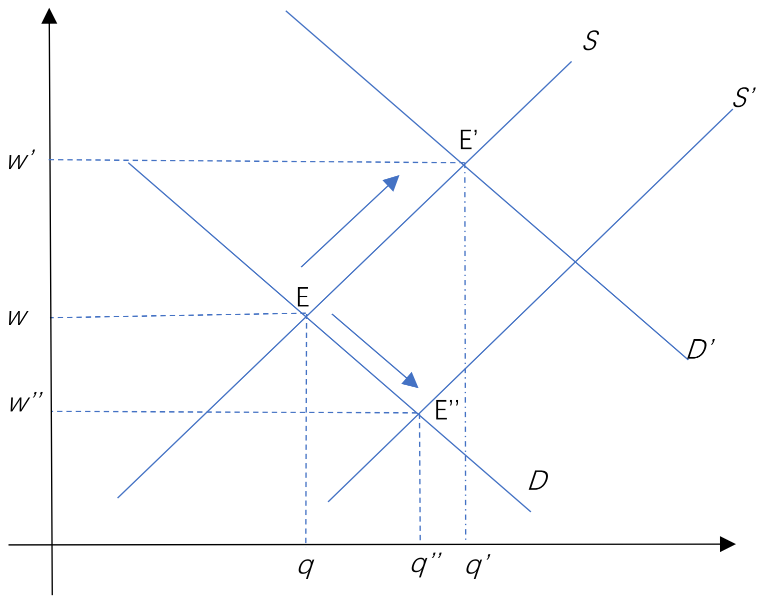


Figure 7 A simple framework of relative supply of and demand for women

Table 1 Gender and migration probability (Dependent variable: migrant (yes=1/no=0), Linear Probability Model)

	(1)	(2)	(3)	(4)	(5)
	all education levels		by education level		
			Primary & below	Junior middle	High sch & above
A: Married & unmarried (age: 16-25)					
female	0.023***	0.031***	-0.007***	0.037***	0.061***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)
single		0.088***	0.018***	0.105***	0.119***
		(0.002)	(0.003)	(0.003)	(0.010)
Obs.	157,173	157,173	34,371	105,662	17,140
Adj. R2	0.001	0.197	0.102	0.148	0.206
B: Unmarried sample (age: 16-25)					
female	0.062***	0.050***	0.000	0.059***	0.076***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.008)
Obs.	111,836	111,836	21,382	76,715	13,739
Adj. R2	0.006	0.2	0.11	0.149	0.207
C: Married sample (age: 16-25)					
female	-0.021***	-0.021***	-0.020***	-0.020***	-0.008
	(0.003)	(0.003)	(0.004)	(0.004)	(0.015)
Obs.	45,337	45,337	12,989	28,947	3,401
Adj. R2	0.001	0.148	0.104	0.108	0.18
D: Married & unmarried (age: 26-45)					
female	-0.032***	-0.023***	-0.025***	-0.023***	-0.032***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)
single		0.014***	-0.023***	0.021***	0.125***
		(0.002)	(0.002)	(0.002)	(0.007)
Obs.	503,701	503,701	192,919	272,578	38,204
Adj. R2	0.003	0.107	0.083	0.094	0.193
E: Married & unmarried (age: 16-45)					
female	-0.018***	-0.006***	-0.021***	-0.005***	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)
single		0.054***	-0.010***	0.064***	0.124***
		(0.001)	(0.002)	(0.002)	(0.006)
Obs.	660,874	660,874	227,290	378,240	55,344
Adj. R2	0.001	0.141	0.082	0.119	0.230
Controls	No	Yes	Yes	Yes	Yes

Notes: Observations in these regressions are aged 16-25, are not in school, all have agricultural Hukou, and migrants are defined as those who have left their Hukou registration place for over three months. Those who migrated within their Hukou city and remained in rural areas are deleted. Dummies for each age, education level, and Hukou city are used when they are controlled for. Robust standard errors clustered at the city level are in parentheses. *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data source: 2005 1% population survey.

Table 2 Gender and return migration

	(1)	(2)	(3)
	Age: 16-45	16-25	26-45
A: d.v.=return migrant (yes=1/no=0)			
female	0.055***	0.051**	0.061**
	(0.009)	(0.013)	(0.012)
Obs	6,212	1,947	4,265
Adj. R2	0.121	0.177	0.126
B: d.v.=return to take care of children/elders or lactation			
female	0.144***	0.221**	0.131**
	(0.025)	(0.074)	(0.028)
Obs	886	165	721
Adj. R2	0.370	0.692	0.407

Notes: (1) We control for age, experience, experience squared, Hukou city, education levels, and ethnicity. (2) Standard errors are clustered at the province level. *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data source: Rural module of CHIP 2013.

Table 3 Gender and labor market participation

	(1)	(2)	(3)	(4)	(5)	(6)
	work dummy		weekly working hours		Ln (hourly wage)	
	single	married	single	married	single	married
female	-0.024***	-0.272***	-0.319	-0.783***	-0.037***	-0.304***
	(0.004)	(0.007)	(0.194)	(0.146)	(0.008)	(0.008)
Obs.	32,613	58,677	30,534	47,932	30,398	47,036
Adj. R2	0.041	0.172	0.051	0.035	0.218	0.206

Note: (1) Education levels, age, Hukou city, and a constant term are controlled for in all regressions. (2) Standard errors are heteroskedasticity robust and clustered at the city level. (3) *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data source: 2005 population survey.

Table 4 Gender, schooling status, and migration propensity

	(1)	(2)	(3)	(4)
Dependent variable =	dropout (not in school=1)	migrant		
A: sample aged 16-25				
female	0.013***	0.036***	0.034***	0.003**
	(0.004)	(0.003)	(0.003)	(0.002)
dropout			0.149***	0.083***
			(0.009)	(0.008)
*female*X*dropout*				0.044***
				(0.004)
Obs.	183,517	183,517	183,517	183,517
Adj. R2	0.315	0.159	0.185	0.185
B: sample aged 13-15				
female	0.000	0.003**	0.003**	0.002
	(0.004)	(0.001)	(0.001)	(0.001)
dropout			0.032***	0.016**
			(0.004)	(0.008)
*female*X*dropout*				0.009*
				(0.005)
Obs.	39,226	39,226	39,226	39,226
Adj. R2	0.076	0.041	0.048	0.048
C: sample aged 16-18				
female	0.009*	0.025***	0.023***	0.000
	(0.005)	(0.003)	(0.002)	(0.001)
dropout			0.132***	0.060***
			(0.008)	(0.008)
*female*X*dropout*				0.049***
				(0.005)
Obs.	89,522	89,522	89,522	89,522
Adj. R2	0.162	0.102	0.153	0.155
D: sample aged 19-22				
female	0.013***	0.048***	0.046***	0.011***
	(0.004)	(0.005)	(0.004)	(0.004)
dropout			0.187***	0.129***
			(0.012)	(0.013)
*female*X*dropout*				0.039***
				(0.006)
Obs.	68,225	68,225	68,225	68,225
Adj. R2	0.099	0.164	0.186	0.186

Notes: (1) *dropout* is a dummy for schooling status, with dropout=1 representing observations not in school. (2) Heteroskedasticity robust standard errors are in parenthesis. (3) Age, numbers of brothers and sisters, ethnicity, and Hukou city are controlled for. (4) *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively. Data source: 2005 1% population survey.

Table 5 Migration age and gender

	(1)	(2)	(3)	(4)	(5)
Dependent variable=migration age					
	Age: 16-25	Age: 16-45			
	All education	All education.	Primary	Middle	High School
A: Census05					
female	-0.406***	-1.628***	-1.615***	-1.673***	-1.874***
	(0.036)	(0.044)	(0.102)	(0.053)	(0.093)
Obs.	32,623	80,842	11,610	49,702	13,372
Adj. R2	0.144	0.483	0.320	0.485	0.438
B: Census05 unmarried					
female	-0.447***	-1.295***	-3.366***	-1.240***	-1.036***
	(0.039)	(0.051)	(0.360)	(0.061)	(0.089)
Obs.	26,511	30,559	1,638	19,616	6,530
Adj. R2	0.058	0.070	0.142	0.057	0.056
C: CHIP 2002					
female	-0.509***	-1.001***	-1.238**	-0.943***	-0.909
	(0.107)	(0.233)	(0.545)	(0.299)	(0.591)
Obs.	1,413	2,955	447	1,883	505
Adj. R2	0.185	0.467	0.463	0.459	0.461
D: CHIP 2013					
female	-0.247**	-0.329**	-0.446	-0.257	-1.089***
	(0.111)	(0.152)	(0.580)	(0.215)	(0.349)
Obs.	1,829	5,958	791	3,570	828
Adj. R2	0.200	0.234	0.178	0.235	0.341

Note: (1) We control for ethnicity, marital status, Hukou city, and education levels when we use the 2005 census data, and we control for ethnicity, political status, education levels, and Hukou county when we use the CHIP 2002 and CHIP 2013 rural surveys. (2) For the CHIP 2002, we use the age of the first-time off-farm job as the age of migration, and our observations are restricted to migrants (who have earned income from working outside). (3) The results for different education levels are obtained by focusing on individuals with identical education levels and having graduated. (4) Heteroskedasticity robust standard errors are in parenthesis. The results for the CHIP data are clustered at the county level. (5) *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data source: 2005 Census (1% population survey) and the rural module of CHIP 2002 and 2013.

Table 6 The gender difference in work experience before migration

	Have cadre/military/nonfarm job experience before migration (yes=1/no=0)	
	(1) age: 16-25	(2) age: 16-45
female	-0.029*	-0.046***
	(0.015)	(0.010)
Obs.	2,636	6,651
Adj. R2	0.016	0.025

Note: (1) We also control for age, education levels, and Hukou province. (2) Robust standard errors are clustered at the province level. (3) *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data source: Migrant module of CHIP 2007

Table 7 Gender difference in the channel of finding the first urban job (dependent variable: *family/village network*)

	(1)	(2)	(3)
	unrestricted sample	unmarried	unmarried & excluding self-employed/unspecified
A: age group: 16-45			
female	-0.010***	-0.043***	-0.060***
	(0.003)	(0.007)	(0.009)
Obs.	93,269	19,480	16,156
Adj. R2	0.046	0.078	0.102
B: age group: 16-25			
female	-0.047***	-0.053***	-0.071***
	(0.007)	(0.009)	(0.011)
Obs.	21,682	14,000	11,782
Adj. R2	0.062	0.073	0.094

Note: (1) *family/village network* is a dummy indicating the use of family network which includes family members, relatives, and village fellows. Other channels (*family/village network* =0) include friends, The Internet, enterprise advertisements, newspapers, social and governmental intermediary agencies, self-employed persons, and unspecified channels. (2) We also control for birth year, ethnicity, birth province, and education levels. (3) Standard errors are clustered at the province level. (4) *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data source: 2016 Dynamic Monitoring Survey of Migrant Population

Table 8 Gender difference in migration duration

	(1)	(2)	(3)	(4)
	years left Hukou registration (top coded at 6)		left Hukou place for more than 5 years	
female	-0.211***	-0.008	-0.046***	-0.009***
	(0.020)	(0.017)	(0.004)	(0.003)
Obs.	91,290	91,290	91,290	91,290
Adj. R2	0.040	0.154	0.034	0.123
control for age	no	yes	no	yes

Note: (1) Education level, Hukou city, and a constant term are controlled for in all regressions. (2) Standard errors are heteroskedasticity robust and clustered at the Hukou city level. (3) *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data Source: 2005 Census.

Table 9 Education expansion and women migration

	(1)	(2)	(3)	(4)	(5)	(6)
	In high school and college as NON-migrants		In high school and college dropped		In high school and college as MIGRANTS	
	Female	Male	Female	Male	Female	Male
*Age16_23*Year2013*	-0.189***	-0.080***	-0.073***	0.036*	0.003	0.042*
	(0.024)	(0.022)	(0.028)	(0.021)	(0.025)	(0.024)
Age16_23	0.207***	0.090***	0.116***	0.019	0.167***	0.081***
	(0.024)	(0.021)	(0.025)	(0.024)	(0.025)	(0.022)
Year2013	0.197***	0.151***	0.187***	0.134***	0.111***	0.077*
	(0.032)	(0.034)	(0.036)	(0.039)	(0.035)	(0.040)
Obs	14,431	15,644	12,523	13,461	14,431	15,644
Adj. R2	0.177	0.208	0.217	0.208	0.270	0.203

Notes: We control for age, age squared, education dummies and region dummies. Standard errors are clustered at the city level.

Data: 2002 and 2013 CHIP.

Table 10 Gender difference in cognitive ability, test scores, and ranking

	(1)	(2)	(3)	(4)	(5)
	Dependent variable= Cognitive ability	Chinese	Math	English	Ranking
female	-0.019	5.811***	0.799***	5.923***	0.266***
	(0.018)	(0.246)	(0.291)	(0.280)	(0.030)
Adj. R2	0.175	0.105	0.010	0.104	0.049

Notes: (1) Observations are restricted to those with rural Hukou, and the sample size is 8717. (2) Ethnicity, father's education, mother's education, father's occupation, mother's occupation, family income, grade (7^{th} or 9^{th}), and school fixed effects are controlled for in all regressions. (3) Test scores for Chinese, math, and English are standardized. Ranking refers to rankings within class ranging from 1 (the lowest) to 5 (the highest). (4) Robust standard errors clustered at the school level are in parentheses.

Data source: CEPS.

Table 11 Gender difference in educational expectation, LPM

	(1)	(2)	(3)	(4)
	Parents' expectation (college=1/below=0)		Students' expectation (college=1/below=0)	
Female	0.065***	0.006	0.116***	0.037***
	(0.011)	(0.011)	(0.012)	(0.012)
Ranking & test scores	no	yes	no	yes
Adj. R2	0.050	0.163	0.069	0.219

Notes: (1) Observations are restricted to those with rural Hukou, and the sample size is 8717. (2) Ethnicity, father's education, mother's education, father's occupation, mother's occupation, family income, grade (7^{th} or 9^{th}), and school fixed effects are controlled for in all regressions. (3) Test scores for Chinese, math, and English are standardized. Ranking refers to rankings within class ranging from 1 (the lowest) to 5 (the highest). Dummies for ranking are used when they are controlled for. (4) Robust standard errors clustered at the school level are in parenthesis.

Data source: CEPS.

Table 12 Relative wage and relative share of females

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: wages of women relative to men within					
	city		industry	province and industry		
A: unmarried 16-25 (weighted)						
femalesh	0.253***	0.243*	0.335***	0.231***	0.232***	0.087
	(0.082)	(0.129)	(0.048)	(0.045)	(0.044)	(0.086)
Obs.	197	197	85	485	485	485
Adj_R2	0.024	0.168	0.365	0.050	0.122	0.144
B: married 26-45 (weighted)						
femalesh	-0.162	0.176	0.236***	0.326***	0.312***	0.411***
	(0.321)	(0.299)	(0.065)	(0.039)	(0.038)	(0.095)
Obs.	281	281	90	950	950	950
Adj_R2	-0.001	0.270	0.119	0.068	0.112	0.135
Province	No	Yes	No	No	Yes	Yes
Industry	No	No	No	No	No	Yes

Notes: We first run a regression of log wages on age dummies, education dummies, and their interactions and then use the predicted residuals to calculate the average wages for men and women and the wage gap between them. The average is taken at the city (columns 1 and 2), industry (column 3), or province-industry level (columns 4-6). The relative employment of women (*femalesh*) is measured as the share of women within the city, industry, or province-industry cells. Ordinary least square (OLS) regressions are weighted by the relative share of migrants in different groups among the whole migrant sample. Robust standard errors clustered at the city level are in parentheses. *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Table 13 Exports and the prevalence of women among migrants

	(1)	(2)	(3)	(4)	(5)
	Female share of migrants				
	aged 16-25, 2005		aged 26-45, 2005		aged 16-25, 2000-2005 fixed effects
Export share	0.197*	0.199	-0.017	0.037	-0.066
	(0.110)	(0.149)	(0.058)	(0.078)	(0.346)
SOE share	0.038	-0.108	0.026	-0.014	-0.029
	(0.087)	(0.150)	(0.045)	(0.078)	(0.091)
Ln average wage	-0.144***	-0.076	-0.042	-0.081**	
	(0.052)	(0.072)	(0.027)	(0.037)	
College share	0.079	-0.160	-0.129	-0.084	0.027
	(0.217)	(0.276)	(0.111)	(0.141)	(0.307)
Average age	0.009	0.012	0.001	-0.003	0.011
	(0.008)	(0.013)	(0.004)	(0.007)	(0.011)
Share non-ag Hukou	-0.047	-0.051	0.002	0.011	-0.170
	(0.071)	(0.080)	(0.069)	(0.075)	(0.107)
Education_migrants	0.160**	0.204*	0.071*	0.080	0.055
	(0.077)	(0.110)	(0.041)	(0.057)	(0.091)
Province	No	Yes	No	Yes	
Obs	298	298	317	317	550
Adj. R2	0.017	-0.004	0.020	0.027	.

Notes: Export and SOE shares are calculated using the Chinese industrial survey data, with the former being the total export in a region divided by the total sales revenue and latter being the share of SOE enterprises in the sample in each region. Average wage levels, college share, average age, and share of non-agricultural Hukou are calculated using the 2000 census and the 2005 1% population survey. The sample is restricted to those aged 16-60 who live in urban areas and are not in school. Education of migrants is the share of those with high school degrees (or above) among migrants (aged 16-25 for columns 1 and 2 and aged 26-45 for columns 3 and 4). The constant term is controlled for. The population in each city is used as the weight in all the regressions. Standard errors clustered at the city level are in parentheses. *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Table 14 Male wage and the regional distribution of young (16-25) female migrants

	(1)	(2)	(3)
	unmarried migrants (N=24,542)	+ migrants for purpose of marriage (N=24,807)	married and unmarried migrants (N=29,000)
lnwage	-0.049**	-0.055**	-0.083***
	(0.022)	(0.022)	(0.024)
lwg_mean_f	-0.011	-0.033	-0.028
	(0.086)	(0.077)	(0.065)
lwg_mean_m	0.181**	0.204***	0.206***
	(0.078)	(0.070)	(0.059)
Age&Education	Yes	Yes	Yes
Industry&Occup	Yes	Yes	Yes
Province	Yes	Yes	Yes
Adj. R2	0.202	0.199	0.194

Notes: Robust standard errors clustered at the city level are in parentheses. *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data Source: 2005 Census.

Table 15 Male wage and the distribution of female migrants of older age (31-45)

	(1)	(2)	(3)
	married migrants (N=27,497)	unmarried migrants (N=1,339)	married & unmarried (N=28,836)
lnwage	-0.212***	-0.091***	-0.207***
	(0.014)	(0.033)	(0.014)
lwg_mean_f	0.064***	-0.044	0.054**
	(0.024)	(0.080)	(0.023)
lwg_mean_m	0.073***	0.045	0.080***
	(0.026)	(0.089)	(0.025)
Age&Education	Yes	Yes	Yes
Industry&Occup	Yes	Yes	Yes
Province	Yes	Yes	Yes
Adj. R2	0.282	0.273	0.275

Notes: Robust standard errors clustered at the city level are in parentheses. *, **, and *** represent the significance level at 10%, 5%, and 1%, respectively.

Data Source: 2005 Census.

Appendix:

A model with individual heterogeneity

We first consider the migration decision of a man of ability ε_i with a given amount of searching efforts and then study his searching decisions. If $x = \frac{1}{2}$, he will migrate to cities as long as

$$\frac{5}{2}(w_u^L + \varepsilon_i) > \frac{5}{2}w_r \Leftrightarrow \varepsilon_i > w_r - w_u^L$$

Given he chooses $x = 1$, he will migrate to a city if

$$2(w_u^H + \varepsilon_i) > 2w_r \Leftrightarrow \varepsilon_i > w_r - w_u^H$$

The two cutoffs ($w_r - w_u^H$ and $w_r - w_u^L$) partition the distribution of individuals to three parts. For those with low ability $\varepsilon_i \in (-\infty, w_r - w_u^H]$, the optimal choice is to stay in their rural areas. They will withdraw from searching after $\frac{1}{2}$ period and stay put their entire lives, as more searching has no return. For those with ability $\varepsilon_i \in (w_r - w_u^H, w_r - w_u^L]$, those whose searching time is 1 will migrate and those with minimum searching time ($\frac{1}{2}$) will stay. An individual will choose $x = 1$ if

$$2(w_u^H + \varepsilon_i) > \frac{5}{2}w_r \Leftrightarrow \varepsilon_i > \frac{5}{4}w_r - w_u^H$$

Finally, individuals with ability $\varepsilon_i \in (w_r - w_u^L, +\infty]$ will migrate to cities. In this case, an individual chooses $x = 1$ if

$$2(w_u^H + \varepsilon_i) > \frac{5}{2}(w_u^L + \varepsilon_i) \Leftrightarrow \varepsilon_i < 4w_u^H - 5w_u^L$$

It is straightforward to show that to have some individuals choosing $x = 1$, it must satisfy $w_r - w_u^L < 4w_u^H - 5w_u^L$ or $\frac{5}{4}w_r - w_u^H < w_r - w_u^L$, which is exactly the same as in the case of an average man $\frac{w_r}{4} < w_u^H - w_u^L$.

Giving the above analysis, the number of men choosing $x = 1$ and then moving to cities, migrating to cities from period $\frac{1}{2}$, and the total number of men who would go to cities are

$$\int_{\frac{5}{4}w_r-w_u^H}^{4w_u^H-5w_u^L} dF(\varepsilon),\ \int_{4w_u^H-5w_u^L}^{+\infty} dF(\varepsilon), \text{ and } \int_{\frac{5}{4}w_r-w_u^H}^{+\infty} dF(\varepsilon)$$

Using the same logic, we can show that the number of women choosing $x = 1$ and then moving to cities, migrating to cities from period $\frac{1}{2}$, and the total number of women who would go to cities are

$$\int_{\frac{3}{2}w_r-w_u^H}^{2w_u^H-3w_u^L} dF(\varepsilon),\ \int_{2w_u^H-3w_u^L}^{+\infty} dF(\varepsilon),\ \int_{\frac{3}{2}w_r-w_u^H}^{+\infty} dF(\varepsilon)$$

We can see that men search longer than women and will migrate later, but more men than women will migrate. Several empirical predictions emerge:

[1]. Women's migration duration is significantly lower than that of men. This is because of family arrangements and Hukou discrimination against rural migrants, particularly in public services (such as schooling).

[2]. Women start migration earlier (and thus are less likely to search longer)

[3]. Women are more likely to migrate than men at younger ages, but there are more male than female migrants in the urban labor markets.

[4]. The gender gap in migration probability is of inverted U shape.

Note that while the second proposition can be deduced from either the marriage or the pecuniary motive, the marriage motive is not part of the predictions of propositions one and three.