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China's rural labor market development and its gender implications

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Abstract

Our major objective is to discuss the development of rural labor markets and understand how their emergence has affected women. Using household data, we examine the role of women in labor markets by examining employment trends and analyze how their participation in agriculture has affected farm output. We find that there has been an overall increase in off-farm participation. Most of the increase has been driven by young migrants. Women have participated at rates equaling or surpassing those of their male counterparts. We also find that when women are left in charge of farm work, crop productivity does not fall.

JEL classification: J23; J71; O53
Keywords: Off-farm employment; Migration; Gender discrimination; China

1. Introduction

Since the reforms began in China in the late 1970s, the nation has experienced both rapid economic growth and fundamental structural changes to its economy, changes that have been catalyzed by increased employment off the farm. Rural labor markets have grown dramatically over the past 20 years and their emergence has contributed to the rise in rural incomes (Parish, Zhe, & Li, 1995; Rozelle, 1996; Solinger, 1999; West & Zhao, 2000; World Bank, 2001). The rise of rural labor markets, however, is more important than

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its role of providing rural residents with a means to raise their incomes; labor markets also help drive changes in the structure of the economy and contribute to the nation's modernization (Stark, 1976; Todaro, 1976). According to recent empirical analyses, China's success in modernization over the past two decades is at least partly attributable to improved rural labor markets (de Brauw, Huang, Rozelle, Zhang, & Zhang, 2002; Mohapatra, 2001).

Although scholars recognize the important economic contributions of rural labor market development, they disagree on the role that growing labor markets have played in contributing to the welfare of rural women. Some researchers believe that significant barriers still exist for women in China's rural labor markets. For example, Chan (2001) and Chan and Senser (1997) argue that although women began working more frequently during the 1990s, the process was generally demeaning. Solinger (1999) describes interviews with migrants who, despite having jobs, believe they are disenfranchised and are being treated unfairly. Maurer-Fazio, Rawski, and Zhang (1999) show that as labor markets have liberalized in the 1990s, discrimination towards women, as measured by the male–female wage gap, has increased. While compelling, their work has largely been confined to urban labor markets. Song and Jiggins (2000) suggest that the adverse impacts of labor market trends spillover into agriculture; when women are being left to tend the fields and have inferior access to off-farm employment, they earn less than men for their on-farm work and have lower welfare.

In contrast, others believe that growing rural labor markets are not only spearheading China's drive towards modernization, they have also created significant new opportunities for women. For example, Lohmar, Rozelle and Zhao (2001) and Rozelle, Li, Shen, Hughart, and Giles (1999) show that women entered the off-farm sector at higher rates than men between 1988 and 1995. Meng (2000) shows that as rural labor markets have liberalized, women have been earning the same wages as men, all other things equal. Wan (1993) finds that women are actually satisfied with their work and prefer working in the off-farm sector, despite the fact that many of these jobs are far from home and involve working conditions that would be deplored in developed countries. Finally, although no study to our knowledge has studied crop revenues in households in which women do most or all of the farm work, it seems unlikely that the participation of women in agriculture has had a very large adverse effect on output or incomes. During the 1990s, the cropping sector's productivity has grown rapidly (Jin, Rozelle, Huang, & Hu, 2002), which could not have occurred if a large part of the labor force was working inefficiently.

We believe that fundamental disagreements over the effects of China's rural labor market emergence on women's status exist largely because most previous analyses consider only part of the labor market or focus on only part of the country. Few have attempted to quantify certain key issues, such as the degree to which women have had access to off-farm employment or the effect of the participation of women in the on-farm sector. Perhaps because the questions being asked are broad, the current literature seems inconsistent and contradictory.

The overall goal of this paper is to contribute to the ongoing assessment of women's status as China's rural labor markets are emerging. Specifically, we have three objectives. First, we update trends in off-farm labor participation. Specifically, we will attempt to estimate off-farm participation rates in the migrant labor force, focusing on the partici-

pation of rural women over the reform era (between 1980 and 2000). Second, we analyze the determinants of participation in the migrant labor market to learn whether, all other factors held constant, women are making gains. Finally, to learn more about the role of women in the on-farm sector, we measure how women's participation affects the efficiency of farming. Our test helps us understand whether or not women's participation in agriculture undermines farm income.

To make our study more manageable, we make several assumptions that narrow the scope of our work. In the rest of this study, we assume, as do Thomas, Contreras, and Frankenberg (1997) and Quisumbing and Malluccio (2000), that increased participation in the off-farm labor market and higher wages for those with off-farm jobs are metrics that are positively correlated with women's welfare. These authors argue that as women take jobs, the income generated is directly attributable to their labor, which increases their decision-making power within the household. By the same logic, we assume that if women put all or most of the labor into farming, their welfare will rise (fall) as the farm's efficiency rises (falls). In our multivariate analysis of the determinants of off-farm employment, we focus on migration because it is the most important and fastest growing segment of the off-farm labor force. When we examine the participation of women in agriculture, we restrict our analysis to the effects of women's participation on efficiency, using a supply function approach.

To meet these objectives, the rest of the paper is organized as follows. In the next section, we introduce the data that are used for the analysis, which were collected by the authors in the fall of 2000. Section 3 describes employment trends between 1981 and 2000, focusing mainly on trends for women. Section 4 uses multivariate analysis to explain the determinants of migration, and Section 5 examines how the participation of women in agriculture—either as household heads or as field workers—affects the efficiency of crop production. The final section concludes.

2. Data

The data for our study were collected in a randomly selected, nearly nationally representative sample of 60 villages in six provinces of rural China (henceforth, the China National Rural Survey [CNRS]).[1] To accurately reflect varying income distributions within each province, one county was randomly selected from within each income quintile for the province, as measured by the gross value of industrial output. Two villages were randomly selected within each county. The survey teams used village rosters and our own counts of households to randomly choose 20 households, both those with and without their residency permits (*hukou*) in the village. A total of 1199 households were surveyed.

[1] The provinces are Hebei, Liaoning, Shaanxi, Zhejiang, Hubei, and Sichuan. The data collection effort involved students from the Center for Chinese Agricultural Policy, Renmin University, and China Agricultural University and was led by Loren Brandt of the University of Toronto, Scott Rozelle of the University of California, and Linxiu Zhang of the Center for Chinese Agricultural Policy, Chinese Academy of Sciences. Households were paid 20 yuan and given a gift in compensation for the time that they spent with the survey team.

Several parts of the survey were designed to learn about the household's off-farm labor allocation decisions, including migration decisions. For roughly half of the households surveyed (610 households that were randomly selected from the 1199, or roughly 10 from each village), a 20-year employment history form was completed for each household member and each child of the household head, even when they were no longer considered "household members." For each year between 1981 and 2000, the questionnaire tracked each individual's participation in off-farm employment, the main type of off-farm work performed, the place of residence while working (within or outside the village), the location of off-farm employment, and whether or not each individual was self-employed or wage earning.[2] The questions were asked for both males and females.

Using the employment history data, we separated off-farm jobs into four types: migrant wage earners (henceforth, migrants); self-employed migrants; local wage earners; and local self-employed. Migrants were identified as men or women with off-farm jobs who did not live in the household while working. Local wage earners were individuals that had off-farm employment, were not self-employed, and lived at home while they worked. All respondents that reported being self-employed off the farm were categorized as such. We also asked about the extent of the participation of each member in each year in the household's on-farm activities. A household labor force measure was created by aggregating all individuals in the households above the age 16 who indicated that they were either working in or searching for employment in each year (*size of household labor force*). If a person over 16 indicated they had retired, could not work for health-related reasons, or had full-time enrollment in school, they were not included in the labor force total.

Our data allow us to create other variables over time that can help determine the pattern of shifting off-farm labor over time. Specifically, for each individual in the data set, we know the timing and extent of his/her education (*years of education*), participation in professional or skill-building training (*skill training*), and working experience over the past 20 years (*age*). The survey also collected information on the changing composition of the participation of the entire family in the off-farm labor force during this period (a variable we call *average household experience*). As a consequence, we can use our data to create a 20-year retrospective panel that can be used to track employment and some of its key determinants over time.

The CNRS project team also gathered detailed information on household agricultural production. In addition to the plot-specific, farm inputs and outputs, the survey also asked about the characteristics of the plot (e.g., the nature of the plot tenure, its irrigation status, the quality of the soil and the extent to which the plot was affected by a weather shock in 2000). We also know how much labor each member of the household allocated to on- and off-farm work during the survey year (which we use to create one of our measures of

[2] Enumerators attempted to ask the employment histories from each individual themselves. If a household member or one of the children of the household head was not present, the respondent (which was almost always the household head or spouse of the household head) answered. Extensive pretesting found that the data are fairly accurate. In addition, we conducted a practical test to see whether or not a respondent bias problem exists in the employment history part of our data. We replicated the analysis after excluding observations on individuals we did not interview directly, and found that the results of our analysis did not change.

women-run farms). Descriptive statistics for selected variables used in the analysis are included in Appendix A.

3. The evolution of China's rural labor markets

Consistent with previous findings of other national studies of rural off-farm employment, the CNRS data show the off-farm labor force expanded steadily between 1981 and 2000. The data indicate that the proportion of the rural labor force that found some off-farm employment increased from around 16% in 1981 to 48% by 2000 (Table 1). By assuming that neighboring provinces similar to those surveyed have identical rates of off-farm labor participation, we estimate that off-farm rural employment in China rose from less than 40 million in 1981 to more than 200 million farmers in 2000, a growth in off-farm employment of more than 150 million during the reform era. Although this evidence is not conclusive, the large increase in labor flow seems to indicate that China's rural labor markets are functioning well. Although these estimates are based on a relatively small sample, they demonstrate the consistency of our data with much larger national studies by the China National Statistical Bureau (CNSB, 1996) and our own 1995 national village survey.[3]

By disaggregating China's labor trends, our data also demonstrate that labor markets are providing more than just off-farm income to rural residents and are developing in ways consistent with modernization trends (Chenery & Syrquin, 1975). Trends by employment type clearly show that the target destination of workers over the past 20 years has shifted from rural to urban. In 1981, most rural individuals (nearly 85%) spent all of the time they allocated to labor farming. Individuals who worked off the farm were almost three times as likely to live at home and work within or close to the village (7% were local self-employed; 4.2% were local wage earners) than to work outside of the village and live away from home (less than 1% were self-employed migrants; less than 4% were migrants). By 2000, almost as many off-farm workers were living away from home (more than 85% in cities or suburban villages of major metropolitan areas) as in the village. Migrants comprise both the largest and fastest growing component of the rural labor force.

The labor movement contours created from the off-farm employment histories of different age cohorts demonstrate one of most striking and consistent characteristics of China's changing employment patterns: the shift towards off-farm employment is dominated by younger workers (Table 2). Workers in all age cohort categories participated at similar rates in 1990 (ranging narrowly from 20.5% to 33.6%). One decade after the

[3] Our estimates are also consistent with estimates by the State Statistical Bureau [SSB] (1990–2000) in the late 1980s and mid 1990s and Parish et al.'s (1995) study in the early 1990s. For example, using our data set, we estimate that 20% of the rural labor force worked off-farm in 1988. This figure nearly agrees with the SSB estimates for that year, 21%. In 1993, we estimate that 29% of the labor force worked off-farm, which is only 3 percentage points higher than the best guess made by Parish et al.'s national study. The CNRS estimates the off-farm employment rate to be 31% in 1995, which matches the CNSB estimate of the nonfarm labor force (31%) and is consistent with our own 1995 community questionnaire-based estimates of rural off-farm employment (34%; Rozelle et al., 1999).

Table 1
Labor market participation rates (in %) for men and women in rural China, 1981–2000

Employment	1981	1985	1990	1995	2000
Total off-farm employment	16	18	23	32	48
Of which:					
Men	27	31	38	49	63
Women	4	7	10	18	31

Source: Authors' survey.

onset of the reforms, there was no clear progression when moving from the oldest to youngest cohorts. By 2000, however, the rise in the off-farm participation rates of younger workers accelerated relative to older ones, and a distinct ranking appeared as one moved from the youngest to the oldest cohort. In 2000, young workers in the 16- to 20-year-old cohort participated at rates more than three times (75.8%) those of 16- to 20-year-olds in 1990 (23.7%). Those in the 21- to 25-year-old cohort and those in the 26- to 30-year-old cohort doubled the off-farm participation rates of their 1990 cohorts. In contrast, older workers, while still increasing their participation rates significantly (by 17 percentage points), worked off the farm at less than half the rate (only 37.6%) than those in the 16- to 20-year-old cohort.

3.1. Women and off-farm employment

In the same way that emerging rural labor markets may have numerous effects on the fabric of rural and urban economies, the benefits of participation in labor markets by women vary (World Bank, 2001). By some metrics, such as enrollment in primary and secondary schools, indicators of higher welfare for women rise with development, which implies better labor markets. However, by other indicators (such as the relative number of hours of housework performed by women vs. men), there is little improvement. In short, the effect of economic development on women's welfare is complicated and depends on many factors.

According to the CNRS, when considering the rate of off-farm employment among women in rural China, the newly emerging labor markets have begun to have positive

Table 2
Off-farm labor participation rates by gender for selected age cohorts in rural China, 1990 and 2000

Age cohorts	Off-farm labor participation rates (%)					
	1990			2000		
	Total	Men	Women	Total	Men	Women
16–20	23.7	29.9	13.1	75.8	74.7	75.6
21–25	33.6	47.3	13.1	67.2	78.8	53.5
26–30	28.8	47.9	8.8	52.5	72.8	33.7
31–35	26.8	44.4	6.8	47.6	70.5	22.5
36–40	20.5	37.3	3.6	43.3	70.0	20.3
41–50	20.8	33.3	5.2	37.6	61.2	18.7

Source: Authors' survey.

effects on women's relative welfare (Table 1). Although women have participated at rates far below those of men throughout the entire 20-year sample period, participation rates have risen rapidly since the early 1990s. In the 1980s, consistent with the findings from the national community survey-based study reported in Rozelle et al. (1999), off-farm participation rates of men (more than 25% in 1981) far exceeded those of women (less than 5%). Moreover, despite low initial levels of involvement in the off-farm sector, women's participation rates grew more slowly than men's rates during the 1980s. In the 1990s, however, the participation rate of women in the off-farm sector increased faster than that of men.

Although women have been entering all employment types, the most striking increases have come in migration (Fig. 1). Throughout the 1980s, less than 1% of

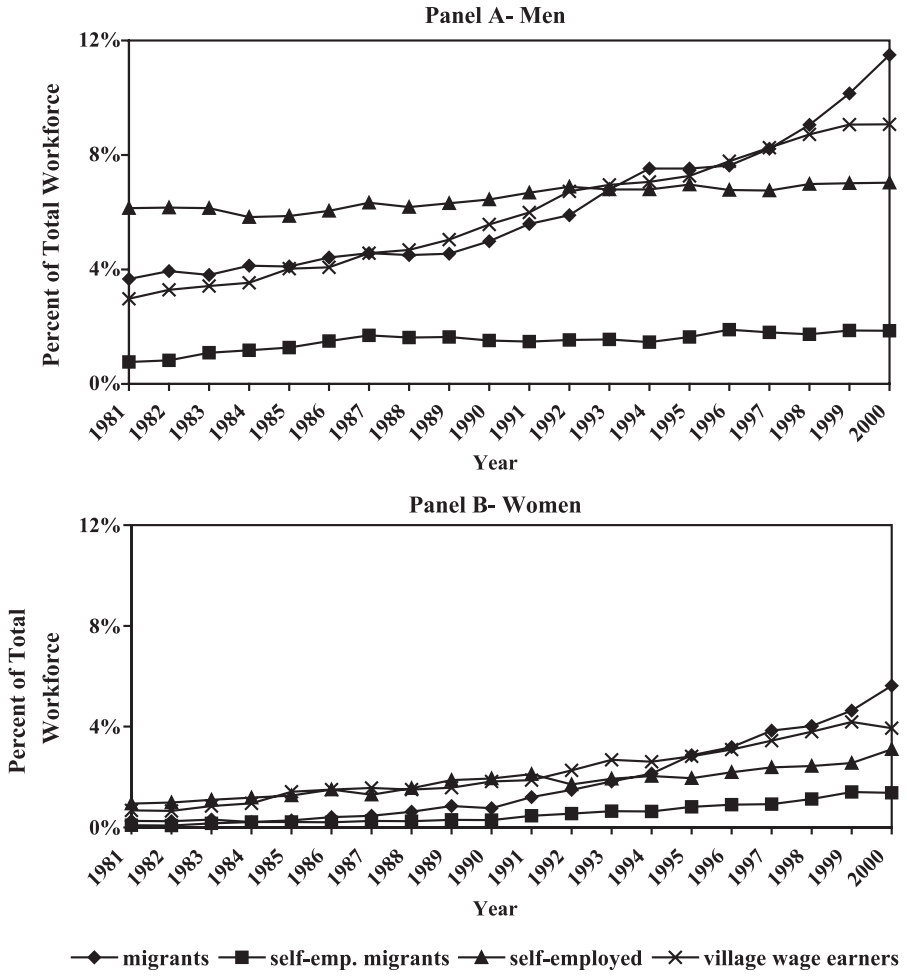

Fig. 1. Increase in migration by gender, 1981–2000.

women left the farm and worked for a wage as a migrant. Since 1990, however, the rate of growth of the migrant labor force has been higher than any other category of job types for both men and women. By 2000, nearly 7% of the female labor force was working as wage-earning migrants. One interpretation of the increase in women's participation in migration is that as labor markets have become more competitive, the scope for managers to exercise discriminatory preferences has declined, therefore opening up new employment opportunities for women. Alternatively, the rise in women's work could have occurred as industries that have a preference for the skills of women have grown.

Perhaps most poignantly, younger women are beginning to specialize by working solely in the off-farm sector. While participation rates among all women are still lower than rates among men (by 32 percentage points—63% for men and 31% for women) in 2000 (Table 1), the gap narrows for younger cohorts and disappears for the youngest cohort (Table 2). Both men and women in the 16- to 20-year-old age groups have similar off-farm participation rates (about 75%). Like men, women in this cohort are increasingly specializing in off-farm labor. Specifically, the majority of young women who work off-farm in 2000 do no work on the farm (59%). The shift in the composition of the off-farm labor force towards young migrants who specialize in off-farm work contrasts sharply with the situation in 1990, when most off-farm workers continued to work on the farm on a part time or at least seasonal basis. These findings are consistent with the argument that the emergence of specialized modes of production in different villages across China's geographical landscape has been facilitated by the emergence of labor markets (Mohapatra, 2001).

With older cohorts, however, the gender gap in off-farm employment participation remains and helps explain the observation that women perform a large fraction of household farm work (Table 2). For example, the difference (in percentage points) between males and females widens to 25.3% for 21- to 25-year-olds; 39.1% for 31- to 35-year-olds; and 48% for 41- to 45-year-olds.[4] Older men who work off-farm typically also work on farm; however, according to our data, women on average during the 1990s accomplish more than 50% of the household farm work.[5] In the fifth section of the paper, we will examine the effect on production of having women heavily involved in farming. If women's participation in farming was found to have a negative impact on production, by our initial assumptions it would be considered a negative consequence for women's welfare.

[4] In addition, women in the age categories between 21 and 25 and between 26 and 30 also have a higher probability of not being in the labor force at all. In our entire sample, 8% of the sample are neither working nor searching for a job; there are more than 10% of women between 21 and 30 that fall into this category. However, in almost all cases, this is explained by the fact that they have children that are 2 years old or younger.

[5] Although our data show that women are putting slightly more than half of the total labor hours into farm work, contrary to the statements of those that call attention to the feminization of China's agriculture, de Brauw (2003) finds no evidence that the proportion of hours put into farming by women are rising. Hence, in this paper, we refrain from calling the active participation of women in farming "feminization" since this would imply that women are taking on an increasing fraction of the farm work, which they are not. Our data, however, are consistent with an agricultural labor force that is getting older (with more work done by both elderly men and women).

4. Multivariate analysis: determinants of participation in the migrant labor force

To explain the determinants of participation in the migrant labor force among individuals in the sample villages and to examine the increased participation of women after considering multivariate effects, we use a fixed-effects conditional logit estimator similar to that developed by McFadden (1974). We assert that in each year, t, an individual, i, from village, v, chooses to participate in migration or not and that this choice maximizes the individual's expected utility, given a vector of individual, household, and community characteristics, $\boldsymbol{X}_{ivt}$. If we define an indicator variable, y_{ivt}, that is 1 when individual i participates in the migrant labor market and is 0 otherwise, we can estimate the effects of the variables contained in $\boldsymbol{X}$ on the individual's labor market participation decision by estimating:

$$\text{Prob}(y_{ivt} = 1) = \exp(\boldsymbol{X}_{ivt}\boldsymbol{\beta})/(1 + \exp(\boldsymbol{X}_{ivt}\boldsymbol{\beta})$$

$$\text{Prob}(y_{ivt} = 0) = 1/(1 + \exp(\boldsymbol{X}_{ivt}\boldsymbol{\beta})) \quad (1)$$

where $\boldsymbol{\beta}$ represents a vector of parameters that corresponds to the effects of the individual and household characteristics on participating in each economic activity.[6]

We use three different approaches to examine the determinants of migration by women during the reform period. For the first two, we specify a dummy variable (*gender*) that is one if an individual is male and zero if female. When we include all observations between 1981 and 2000, we interact the gender indicator variable with an indicator variable for the 1990s (Regression 1 in Table 3). Second, we compare the results from Regression 1 with regressions in which we split the sample into data for the 1980s and the 1990s (Regressions 2 and 3 in Table 3). From these regressions, we can test for increased participation of women in the labor force in two ways—through the interaction term in Regression 1 and by comparing the magnitudes of the coefficients of the gender variable in Regressions 2 and 3. In Regressions 4 and 5, we use the gender variable to divide the sample into male and female subsamples in order to examine how other factors in the model have affected the participation of men and women during the 1980s and 1990s differently (Table 4).

In all of our regression models, we include all individual and household variables, $\boldsymbol{X}_{ivt}$, that we have over the length of the panel that can help explain participation in the migrant labor force. Based in part on our observations in the previous section, and in part by the labor supply literature, we hypothesize that each person's experience (proxied by age) in year t affects their participation rates. We further hypothesize that human capital measures, including years of education and skill training will positively affect participation rates if labor markets are working relatively efficiently. At the household level, we include two variables, one that controls for the size of the household labor force in year t, and the other that controls for the average amount of off-farm experience that an individual's household

[6] In using the conditional logit estimator in our empirical work, we add an error term ε_{ivt} and assume it is independently and identically distributed across observations according to the Weibull distribution.

Table 3
Conditional fixed-effects logit estimators explaining the change in participation of individuals in migration in rural China between the 1980s and 1990s

Explanatory variables	Dependent variable		
	(Regression 1) Migration	(Regression 2) Migration: between 1980 and 1990	(Regression 3) Migration: between 1990 and 2000
Age	0.94 (14.96)**	0.95 (10.38)**	0.92 (30.11)**
Gender (1 = male)	6.12 (16.78)**	11.09 (19.16)**	3.13 (20.73)**
Years of education	1.10 (7.02)**	1.14 (8.40)**	1.17 (17.18)**
Skill training (1 = yes)	2.30 (9.25)**	2.02 (7.46)**	1.53 (7.41)**
Average household experience	1.56 (17.55)**	1.62 (16.91)**	1.16 (15.99)**
Size of household labor force	1.16 (6.86)**	1.29 (10.27)**	1.29 (17.76)**
Age*, 90s dummy	0.99 (3.15)**		
Gender*, 90s dummy	0.57 (4.81)**		
Education*, 90s dummy	1.08 (5.48)**		
Training*, 90s dummy	0.65 (4.14)**		
Experience*, 90s dummy	0.75 (11.66)**		
Labor force*, 90s dummy	1.13 (5.43)**		
Time trend	1.09 (11.85)**		
Year dummies		Included	Included
N	34,257	12,623	21,631
Likelihood ratio index	0.276	0.285	0.267

Coefficients reported are odds ratios; asymptotic *z* statistics in parentheses.
Odds ratios can be interpreted as the additional probability of an event if there is an additional unit of the explanatory variable, ceteris paribus. The *90s dummy* variable is one for all years between 1990 and 2000, and zero otherwise. The odds ratios for the interacted variables should be interpreted as multiplicative. Column (2) only includes data from 1981 to 1990 and column (3) only includes data from 1991 to 2000.

* Indicates significance at the 10% level.

** Indicates significance at the 5% level.

members have in year *t*.[7] Finally, we include a time trend. All variables in all equations are time varying by year for the whole 20-year panel.[8]

In most of our estimations, we use data on 2297 individuals from 610 different households that were employed—in either the on-farm or off-farm sector or both—at some time between 1981 and 2000. For various reasons, the data we use for estimation do not include the full panel of 45,940 observations. First, some individuals enter the labor force during this period and others stop working. Second, we drop one village from the analysis because no migrants left the village for work during the entire sample period. These households could not be included in the migration equation as there was no variation

[7] We were somewhat concerned that the ''household labor participation experience'' variable could be endogenous. In order to address this concern, we dropped the variable from the model and found that the other parameter estimates did not change.

[8] Unfortunately, we only have household-level measures of wealth (proxied by the value of the household's durable goods) and land size that vary over the past 5 years. Because we believed these variables might also affect the individual's decision to migrate, we also ran the basic version of our model with a 5-year panel, including these two explanatory variables. The results are almost identical.

Table 4
Conditional fixed-effects logit estimators explaining the change in participation of individuals in migration in rural China between the 1980s and 1990s

Explanatory variables	Dependent variable (participation in migration)	
	(Regression 4) Women only	(Regression 5) Men only
Age	0.89 (7.89)**	0.95 (12.70)**
Years of education	1.15 (3.30)**	1.11 (7.23)**
Skill training (1 = yes)	1.96 (2.30)**	2.18 (7.95)**
Average household experience	1.68 (7.76)**	1.61 (16.31)**
Size of household labor force	1.23 (3.23)**	1.19 (7.01)**
Age*, 90s dummy	0.97 (1.78)*	0.99 (2.27)**
Education*, 90s dummy	1.15 (3.11)**	1.03 (2.18)**
Training*, 90s dummy	0.59 (1.72)*	0.71 (2.96)**
Experience*, 90s dummy	0.69 (5.47)**	0.72 (11.06)**
Labor force*, 90s dummy	1.09 (1.40)	1.11 (3.62)**
Time trend	1.18 (10.64)**	1.10 (3.62)**
N	16,929	16,625
Likelihood ratio index	0.201	0.378

Coefficients reported are odds ratios; asymptotic *z* statistics in parentheses.
Odds ratios can be interpreted as the additional probability of an event if there is an additional unit of the explanatory variable, ceteris paribus. The *90s dummy* variable is one for all years between 1990 and 2000, and zero otherwise. The odds ratios for the interacted variables should be interpreted as multiplicative.

* Indicates significance at the 10% level.

** Indicates significance at the 5% level.

within the village for the left-hand side of Eq. (1), making the village fixed effect perfectly correlated with the dependent variable for that village. As a result of these limits, we are left with 34,257 observations from 59 villages to explain migration participation in the full model (both men and women) over the whole time period (the 1980s and 1990s).

4.1. Results

In almost all respects, the multivariate regression analyses perform well (Tables 4 and 5). Most of the coefficients of the basic variables in the models have the expected signs and are highly significant. In lieu of reporting the actual coefficient estimates for β in Tables 3 and 4, we report odds ratios, which are $\exp(\beta)$. Odds ratios can be explained more intuitively than raw logit coefficients, as they give the change in probability of migration due to a change in the corresponding right-hand side variable. For example, we find that education increases the individual's participation in off-farm labor markets. For every additional year of education reported, the probability one is in the migrant labor force increases by 10% between 1980 and 1990 (or, a person with an additional year of education is 1.10 times more likely to migrate). For interaction terms, odds ratios are interpreted multiplicatively rather than additively (e.g., Wooldridge, 2002). Therefore, an additional year of education has an even larger effect, 19%, ($1.10 \times 1.08 = 1.19$) on migration between 1990 and 2000. Other coefficients also correspond with our expectations. The coefficient on the age variable implies that the odds of getting a migrant job fall by 6% for every year a person ages.

Table 5
Analysis of the effect of women-headed households on the efficiency of farming, all crops, using village fixed effects

	Dependent variables: ln (gross revenue of all crops)			
	(1)	(2)	(3)	(4)
Household characteristics				
Female-headed	0.120 (3.01)***			
Proportion of hours worked on farm by females		0.031 (0.75)		
Proportion of female household labor			0.001 (2.35)**	
Proportion of female household agricultural labor				0.001 (1.28)
Asset value	− 0.000 (0.47)	− 0.000 (0.71)	− 0.000 (0.49)	− 0.000 (0.73)
Farm size	− 0.001 (0.54)	− 0.001 (0.59)	− 0.001 (0.52)	− 0.001 (0.57)
Household size	0.015 (1.95)*	0.013 (1.71)*	0.009 (1.16)	0.013 (1.63)
Household head characteristics				
Age	0.001 (0.75)	0.001 (0.69)	0.001 (0.85)	0.001 (0.77)
Education (years)	0.004 (1.08)	0.003 (0.97)	0.004 (1.09)	0.003 (1.00)
Plot characteristics				
Irrigated	0.207 (7.74)***	0.204 (7.61)***	0.205 (7.66)***	0.204 (7.64)***
High-quality soil	0.216 (8.95)***	0.221 (9.13)***	0.216 (8.94)***	0.220 (9.08)***
Plain	0.147 (1.24)	0.148 (1.25)	0.147 (1.24)	0.151 (1.28)
Hill	0.097 (0.84)	0.099 (0.85)	0.096 (0.83)	0.101 (0.87)
Terraced	0.064 (0.53)	0.065 (0.53)	0.059 (0.49)	0.067 (0.55)
Distance from home	0.005 (0.44)	0.005 (0.41)	0.003 (0.27)	0.004 (0.38)
Shock from weather, pests, etc.	− 0.011 (17.18)***	− 0.011 (17.19)***	− 0.011 (17.09)***	− 0.011 (17.19)***
Single season	0.576 (26.66)***	0.577 (26.65)***	0.576 (26.63)***	0.576 (26.64)***
Constant	5.375 (40.02)***	5.378 (39.35)***	5.337 (39.08)***	5.361 (39.05)***
N	5327	5323	5327	5323
No. of villages	60	60	60	60
R^2	.18	.18	.18	.18

Absolute value of *t* statistics in parentheses. Estimates were corrected for clustering.
* Indicates significance at the 10% level.
** Indicates significance at the 5% level.
*** Indicates significance at the 1% level.

Most importantly, the results clearly demonstrate that the descriptive findings in Section 3 hold up to multivariate analysis (Table 3). For example, the coefficient on the indicator variable for gender in Regression 1 suggests that male participation in migration during the 1980s (the base period), holding all else constant, was 612% (or 6.12 times) higher than female participation. However, by the 1990s, the relative difference was only 57% as much (or $0.57 \times 6.12 = 3.48$ times; see coefficient on the interaction term in the same regression). When we compare the coefficients on the gender indicator variables in Regressions 2 and 3, we find a similar result. In the 1980s, males were more than 11 times

as likely to participate in migration as females. By the 1990s, males were only 3.13 times as likely.[9] Therefore, the employment access gap is narrowing considerably over time, although men still participate in migrant labor markets at rates far higher than women.

When we split the sample into separate regressions for men and women, we find that many of the same factors affect participation in the migrant labor force, although the magnitudes of the impacts differ (Table 4).[10] For example, younger women and men both work more as do those with more years of formal education and training. However, the differences between the coefficients in the regressions in women's and men's equations show that both the age and education effects are more pronounced for women. Moreover, these effects are increasing over time. The propensity for younger women with higher levels of education to find a migrant job has risen over time. Such findings support calls by academics and policymakers to increase the education opportunities for young women (Nyberg & Rozelle, 1999).

5. The participation of women in farming and relative efficiency

Although the youngest cohort of women, 16- to 20-year-olds, have caught up with their male counterparts in access to off-farm employment and are not being discriminated against in any greater degree than before in terms of wage earnings, during the reforms older women have tended to remain on the farm. When assessing the impact of the reforms on women, one must address questions about whether or not their participation in agriculture has led to lower earnings. Internationally, women-headed households and women-cultivated plots have produced lower yields and revenues (World Bank, 2001). Women are less efficient producers for a variety of reasons (Quisumbing, 1994; Saito, Mekonnen, & Spurling, 1994). If true in China, then part of the gains that women have gained in the off-farm sector have been offset by the lower incomes that they receive in farming.

In order to answer the question of whether women-headed households are more, less, or equally efficient in cropping, we use a fixed-effects regression approach. Specifically, total cropping revenue and enterprise revenue for rice, wheat, and maize for each of the household's plots is regressed on the plot, household and village characteristics that are thought to determine plot-specific income.[11] The basic model is:

$$y_{hv} = \alpha + \mu_v + D_{hv}\gamma + \boldsymbol{X}_{hv}\boldsymbol{\beta} + \varepsilon_{hv} \tag{2}$$

where y_{hv} denotes total income per capita or from one of the three specific sources for household h in village v. The variable, $\boldsymbol{X}_{hv}$, is a vector of plot and household characteristics including the plot irrigation status, is irrigated, its quality, its topography, the distance from

[9] When we use a sample that includes only the final 5 years of data (with two additional control variables), the difference between males and females falls to 2.79.

[10] The same patterns appear when using the sample that includes only the last 5 years of data and when the specification includes two additional control variables.

[11] In essence, we loosely follow Yotopoulos and Lau (1973), who examine economic efficiency by examining the profit function. Like Yotopolous and Lau, since we have cross-sectional data, we cannot include prices directly; the prices, which vary by village, are captured by the village dummy variables.

the household and the size of the agronomic shock (which vary by plot) and value of the household's assets, the size of the farm, the number of household members, and the age and education of the household head (which vary by household). To control for differences in growing conditions, prices, and other unobservable factors across villages, we also include a village-level fixed effect, μ_v.

In addition to $\boldsymbol{X}_{hv}$, we include a measure of the level of participation of women in farming, D_{hv}, in order to test whether or not women's participation on the farm affects farm efficiency.[12] Since there is no a priori variable that best measures whether a farm is run by women or not, we employ four alternative variables, one in each regression, to attempt to capture the effects of women's management in our model (henceforth, we refer to this variable as the *women-run farms* variable). Specifically, we use an indicator variable that is one if the household head is female and zero otherwise; a variable that measures the proportion of the household's total labor force that is female (measured as the number of people); a variable that measures the proportion of the household's agricultural labor force that is female (also measured as the number of people); and a variable that measures the proportion of agricultural hours of the household worked by females (measured as the number of hours). The coefficient on the women-run farm variable, γ, will provide the test for our hypothesis: holding all other things equal, if $\gamma = 0$, then women-run farms are equally efficient in generating farm income when compared to male-run farms; the alternative hypothesis is that women-run farms are less efficient. Since we are interested primarily in whether or not women-run farms are less efficient, we use a one-sided hypothesis test.

Using more than 5000 plot-level observations for the analysis, we find results that are somewhat at odds with the results from other countries in other parts of the world (World Bank, 2001). The coefficients on all four of the women-run farm variables are either insignificant or positive (Table 5). According to our data, when all of the other variables in our model are held constant, women-run farms are not less efficient than those of men, implying that women-run farms earn at least as much revenue on their plots as farms run by men. In terms of our hypothesis testing framework, at a 1% level of statistical significance, we cannot reject the null hypothesis that women-run farms are equally efficient as men-run ones at generating revenue.

Hence, according to our findings, although women during the course of rural China's recent development have both taken great responsibilities and provided a large fraction of the labor on the farm, the earnings in these farms have not suffered. The most direct interpretation of this result is, of course, that women are at least as good at farming as men. However, using the results from Table 5, we are unable to reject alternative interpretations. It could be that since female-headed households are frequently, but not always, households in which the husband permanently works outside of the village, these households face fewer capital constraints and therefore are able to produce more. It could also be that farms run by women are not random. Rather, households that have farms by women are households in which the women are particularly capable farmers.

[12] Ideally, we would like to be able to include an indicator variable that is 1 when a woman is primarily in charge of the farm and zero otherwise. Unfortunately, from our data, it is impossible to tell in which households women make all or most of the important farming decisions. Therefore, we test a number of different variables that could indicate that a farm is run by women (or a farm in which a large fraction of the labor is provided by women), in order to capture several different possible definitions of "women-run farms."

Table 6
Analysis of the effect of women-headed households on the efficiency of farming for all crops, rice, wheat, and maize, using village fixed effects and controls for ability

	Dependent variables: Total or enterprise revenue (in natural logs)			
	(1) All crops	(2) Rice	(3) Wheat	(4) Maize
Household characteristics				
Female-headed	0.117 (2.90)***	0.068 (2.68)***	0.033 (0.77)	0.207 (3.51)***
Asset value	− 0.000 (0.42)	0.000 (1.80)*	0.000 (0.43)	− 0.000 (1.04)
Farm size	− 0.001 (0.54)	0.001 (0.80)	− 0.003 (1.82)*	0.000 (0.07)
Household size	0.012 (1.58)	0.010 (1.93)*	0.004 (0.47)	0.011 (1.09)
Household head characteristics				
Age	0.001 (0.91)	0.002 (2.82)***	0.002 (1.74)*	− 0.001 (0.71)
Education (years)	0.004 (1.18)	0.002 (1.01)	0.011 (3.01)***	0.015 (3.20)***
Mother's education level, head (if female) or spouse of head	0.003 (0.48)	0.003 (1.03)	− 0.013 (1.78)*	− 0.001 (0.20)
Plot characteristics				
Irrigated	0.210 (7.75)***	− 0.015 (0.62)	0.127 (3.22)***	0.156 (4.43)***
High-quality soil	0.217 (8.86)***	0.130 (8.26)***	0.129 (4.47)***	0.102 (3.14)***
Plain	0.152 (1.28)	− 0.018 (0.33)	0.062 (0.43)	1.255 (4.26)***
Hill	0.099 (0.86)	− 0.015 (0.30)	0.043 (0.32)	1.274 (4.32)***
Terraced	0.072 (0.59)	− 0.045 (0.81)	0.000 (0.00)	1.278 (4.19)***
Distance from home	0.004 (0.37)	− 0.002 (0.21)	0.025 (1.82)*	− 0.028 (1.32)
Shock from weather, pests, etc.	− 0.011 (17.20)***	− 0.008 (13.83)***	− 0.008 (10.36)***	− 0.013 (17.89)***
Single season	0.576 (26.37)***	0.257 (11.80)***	0.091 (1.64)	− 0.086 (2.02)**
Constant	5.367 (39.59)***	6.264 (87.50)***	5.606 (35.05)***	4.972 (16.40)***
Observations	5220	1630	1009	1083
No. of villages	60	37	43	47
R^2	.18	.22	.16	.31

Absolute value of *t* statistics in parentheses. Estimates were corrected for clustering.
* Indicates significance at the 10% level.
** Indicates significance at the 5% level.
*** Indicates significance at the 1% level.

Although "ability" is difficult to control for, in Table 6 we run a series of equations for total crop revenue (as in Table 5) and for crop-specific revenue (for rice, wheat, and maize) which have the same specification as in Table 5, except that we add one variable: the education of mother of the household head (if female) or the spouse of the household head. As before, when we add the variable and control for ability, our analysis suggests that cropping revenue earned by women-headed households is not lower than cropping revenue in other households. Our results are robust whether we are explaining total crop revenue or the revenue earned on rice, wheat, or maize plots.[13]

[13] We also used an alternative measure of ability (grades of the household head, if female, or spouse of the household head during the final year that the individual was in school). Regardless of the dependent variable, we find that women-run farms are no less efficient than male-run ones.

6. Summary and conclusions

In this paper, we have sought to understand the effect of China's labor market development on the welfare of women. To do so, the first part of the paper documents the rapid emergence of China's labor markets during the reform period. Specifically, we show that the rapid rise in employment that began in the 1980s and early 1990s has continued even during the late 1990s, a time when some feared that macroeconomic conditions might keep rural residents on the farm or drive them back to the farm. In our disaggregation of labor market trends, we also show that labor markets are clearly acting in a way consistent with an economy that is in transition from one being dominated by agriculture to one being characterized by the rising presence of other forms of production. Our analysis illustrates that labor markets have allowed migration to become the most important form of off-farm activity and has become increasingly dominated by younger workers who are showing signs of specializing in off-farm work.

Assuming that participation in off-farm labor markets is a sign of increased welfare, our analysis shows that because women have had greater access to off-farm employment, they have become better off. Although women still lag behind men, access to off-farm jobs has increased more quickly for women than men. By 2000, over 30% of women had jobs off the farm, up from only 10% in 1990. The brightest outlook, however, is shown to exist for the youngest cohort. In the case of 16–20-year-old women, the level of participation is high (more than 75%) and equal to that of men.

Although China's rural labor market development has improved the welfare of women according to our criteria, women have not achieved parity with men. Women play an important role in farming in China, both in running the farm as a household head and in allocating labor to agriculture. In the rest of the world when this happens, the revenue produced on the farm has been shown to lower on their farms than those of men. According to our results, however, the efficiency of cropping does not suffer when women run the farm. From this perspective, also, the development of China's rural economy cannot be said to have hurt women. Unfortunately, due to space limitations, the source of the higher farming efficiency of women-headed households is not explained in this paper. Further work is needed to pinpoint the sources of these measured gains.

In summary, then, the type of growth that China has been experiencing has led to fast growing labor markets in which women have been able to participate. Policies that facilitate the perpetuation of this growth should be continued (e.g., higher spending on rural education). The government should also take an active role in ensuring that women become even more active in off-farm labor markets so they can close the gaps that still remain and make sure that the gaps do not rewiden in the future.

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Appendix A

Table A1
Descriptive statistics for selected variables

Variable	Mean	Standard deviation
Gender (1 = male)	0.490	0.5
Years of education	6.01	3.66
Male	6.81	3.47
Female	5.23	3.68
Skill training (1 = yes)	0.185	0.389
Male	0.26	0.44
Female	0.11	0.31
Total land area, 2000 (mu)	8.91	11.10
Value of durables, 2000 (yuan)	4970	34900
Household labor force	3.75	1.94
% of female-headed households	6.00	–
% of households with *female-dominated* in agriculture[a]	12.57	–

Source: Authors' survey.

[a] "Female-dominated" households here refer to households whose female labors performed more than 75% of hours spending in the agriculture.

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