LABOR MARKET LIBERALIZATION, EMPLOYMENT AND GENDER IN RURAL CHINA

Linxiu Zhang[1], Alan de Brauw[2], and Scott Rozelle[3]*

[1]Center for Chinese Agricultural Policy, Institute of Geographical Sciences and
Natural Resources Research, Chinese Academy of Sciences.
[2]Williams Colleges
[3]Rozelle a professor in the Department of Agricultural and Resource Economics,
University of California, Davis, CA 95616.

ABSTRACT

The major objective of this paper is to discuss the development of rural labor markets in China during the past two decades and understand how it has affected women. Using household survey data that we collected in 2001, we examine the role of women in labor markets by examining employment and migration trends and changes in wages. According to the data of our nearly national representative sample, we find that there has been a sharp overall increase in off-farm participation, most of the increase has been driven by young migrants, and women, especially those in the youngest cohorts, have participated at rates equaling or surpassing those of their male counterparts. We also find that the wages of women have not been adversely affected by the emergence of liberalized labor markets and that when women, mostly middle-aged and older ones, are left in charge of farm work, the productivity of crop production does not fall.

Keywords: China, labor market liberalization, employment, wages, gender

Since the economic and political reforms began in China in the late 1970s, the nation has experienced rapid economic growth. The expansion of the rural economy has driven a large part of this growth (Putterman, 1992; Perkins, 1994). Rural labor markets have changed dramatically over the past twenty years and their emergence has contributed to the success of the rural economy (Solinger, 1999; West and Zhao, 2000; World Bank, 2001). Many observers of China agree that the success of rural labor in raising incomes and productivity can account for a significant part of the rise in rural welfare (Parish, Zhe, and Li, 1995; Rozelle, 1996). The rise of rural labor markets, however, is more important than its role in providing rural residents with a means to raise their incomes (Todaro, 1976; Stark, 1976). For China to successfully modernize, the nation must rely on labor markets to facilitate the shift from a largely rural population to an urban one.

Despite these changes and the important contributions that labor market development has made to the economy as a whole, scholars do not agree on the role that labor markets have played so far in contributing to the welfare of women in the rural economy. Some researchers believe that significant barriers still exist for women in China's labor markets (Chan and Senser, 1997; Chan, 2001; and Solinger, 1999). In contrast, others believe that rural labor markets are spearheading China's drive towards modernization and that this has created many opportunities for women (Meng, 1993; Wan, 1993; Lohmar and Rozelle, 2000). Hence, although the role of women in the off farm sector and effect of the emergence of labor markets on their welfare are important, fundamental disagreements remain and may exist because most previous analyses typically consider only part of the labor market, focus on only part of the country, or are limited to a subset of questions about labor market performance.

The overall goal of this paper is to contribute to the ongoing assessment of China's rural labor markets paying special attention to whether these markets are developing in a way that is helping or hurting the cause of women. Specifically, we have three objectives. First, we will provide an update of the trends in off-farm labor participation, and will especially try to estimate the nation's aggregate off-farm participation rates. Second, by disaggregating our date, we identify the changes in the participation of rural women in labor markets over the reform era (between 1980 and 2000).

Finally, in a multivariate framework, we analyze the determinants of labor market participation and seek to see if, all other factors held constant, women are making gains.

DATA

The data for this study were collected in a randomly selected, nearly nationally representative sample of 60 villages in 6 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 to randomly choose twenty households, both those with their residency permits in the village and those without. We surveyed 1199 households.

The CNRS project team gathered detailed information on household demographic characteristics, wealth, agricultural production, non-farm activities, and investment. Several parts of the survey are designed to learn about the household's migration decisions as well as its participation in other labor market activities over time. For roughly half of the households surveyed (610 out of 1199), a twenty-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 tracks 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 identified as people who had off-farm employment, were not self-employed, and lived at home while they worked. All people who reported being self-employed off the farm were categorized as such. The definitions held for both members of the household and children of the household head. 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 agricultural and/or industry in each year. 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. Since the data were collected by gender, we also were able to generate an indicator variable that is one if the household head is female and a variable that measures the proportion of the household's annual agricultural labor that is female (which itself is an indicator variable that equals one if more than 75 percent of the household's agriculture labor inputs were performed by females). Descriptive statistics for selected variables are included in Appendix Table 1.

THE EVOLUTION OF CHINA'S RURAL LABOR MARKETS

Consistent with previous findings of other national studies of rural off-farm employment, data from the CNRS show the off-farm labor force expanded steadily between 1981 and 1995. From around 16 percent in 1981, our survey estimates that by 2000, 48 percent of the rural labor force found some employment off-farm (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 1995, a growth in off-farm employment of more than 150 million during the reform era. Although based on a relatively small sample, these numbers demonstrate the consistency of our data with much larger national studies by the State Statistical Bureau (SSB, 1996) and our own 1995 national village survey.

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[1] The provinces are Hebei, Liaoning, Shaanxi, Zhejiang, Hubei, and Sichuan.
[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 pre-testing found that the data are fairly accurate.

For example, the estimate from the CNRS data of 1995 employment rate is almost the same as both SSB's estimate of the non-farm labor force (31 percent) and our own 1995 community questionnaire-based estimates of rural off-farm employment (34 percent—Rozelle et al., 1999).[3] Although not conclusive evidence by itself, such a large increase in labor flow would be one indicator that China's labor market is functioning well.

Table 1. Labor participation rate by employment type, 1981-2000.

Employment type	1981	1985	1990	1995	2000
Off-farm employment [a]	16	19	24	34	48
Of which:					
Full time	6	7	8	14	22
Part time-1[b]	3	4	5	6	7
Part time-2[b]	8	9	11	14	18
Farm only	84	81	76	66	52
Total labor force percent [c]	100	100	100	100	100

Note:
[a] Sum of rows 2-4. The difference between row 1 and the sum of rows 2-4 are due to rounding.
[b] Part time-1 refers to those who works off-farm on a seasonal basis. Part time-2 refers those who work on farm and off farm at the same time.
[c] Sum of Rows 1 and 5.

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 a way consistent with modernization trends (Chenery and Syrquin, 1976). Trends by employment type clearly show that the target destination of workers over the past 20 years has shifted from rural to urban (Figure 2). In 1981, most rural individuals (nearly 85 percent) spent their time in 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 percent were local self-employed; 4.2 percent were local wage earners) than to work outside of the village and live away from home (less than 1 percent were self employed migrants; less than 4 percent were migrants). By 2000, almost as many off farm workers were living away from home (more than 85 percent in cities or suburban villages of major metropolitan areas) as in the village. Migrants composed both the largest and fastest growing component of the rural labor force.

According to our data, our previous work (Rozelle et al., 1999), and the work of others (e.g., Solinger, 1999), migrants have also been venturing further from home over the past twenty years, a trend that has continued in recent years. In 1990, over 70 percent of migrants worked within their own province; just under 30 percent went out of the province in search of work. By 2000, almost 40 percent of migrants left the province for their job, a change that was especially striking among workers under 30 years old.

The labor movement contours created from the off-farm employment histories of different age cohorts amplify these trends and demonstrate one of most striking characteristics of China's changing employment patterns: the shift towards off farm employment being dominated by younger workers (Figure 1). Workers in all age cohort categories participated at similar rates in 1981 (ranging from 18 to 19 percent—not shown in figure). In 1990, participation rates of all age cohorts similarly fell into a narrow range (from 20.5 to 33.6 percent, column 1). 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 oldest to the youngest cohort (column 2).

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[3] Our data are also consistent with the estimates of SSB in the late 1980s and Parish's study (Parish, Zhe, and Li, 1995) in the early 1990s.

In 2000 young workers in the 16 to 20 year old cohort participated at rates more than three times (75.8 percent) those of 16 to 20 year olds in 1990s (23.7 percent). 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 (by 17 percentage points), worked off the farm at less than half the rate (only 37.6 percent) than those in the 16 to 20 year old cohort. The work behavior of younger workers also illustrates their increasing specialization in the off-farm sector. In 1990, for example, of those in the younger cohorts who had off farm jobs, more than half spent time working on the farm, while by 2000 less than one-third of the youngest cohort spent any time in agriculture
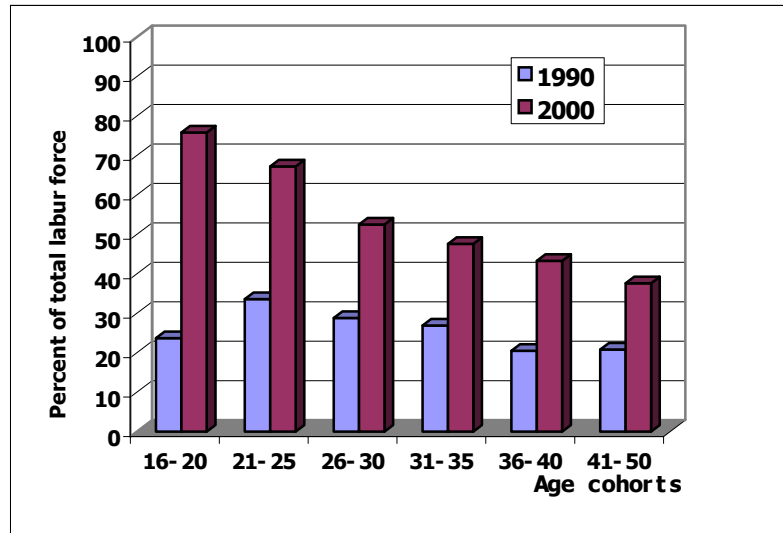
Figure 1. Comparison of labor participation rates (percent with any off-farm work)
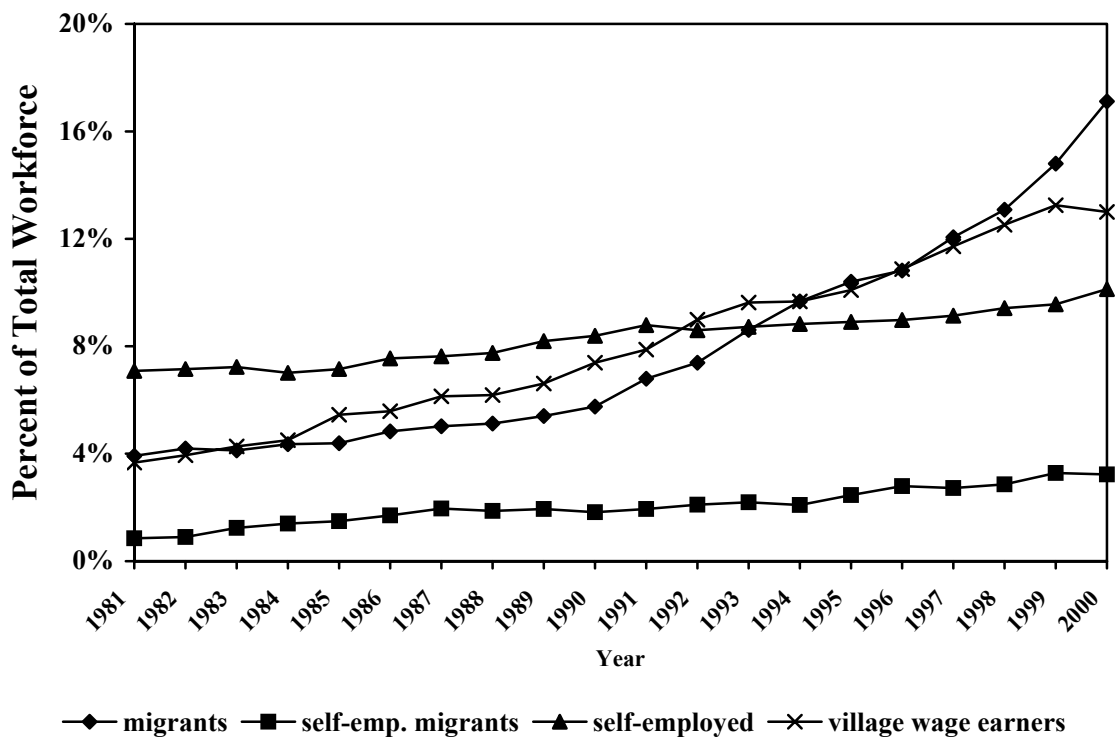by age cohorts, 1990 and 2000

Figure 2. Increase in migration, 1981-2000.

WOMEN, OFF-FARM EMPLOYMENT AND WAGES

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 the development of the country (which by implication means better labor markets). However, by other indicators (such as the relative number of hours of housework performed by women versus men) there is little improvement. In short, the effect of economic development on women's welfare is complicated and depends on many different factors. In the rest of this study, we assume, as do Thomas, Contreras, and Frankenberg (1997) and Quisumbing and Maluccio (1999), that increased participation in the off farm labor market and higher wages for those with off farm jobs is a metric that is positively correlated with the welfare of women. The logic of this is that when a woman earns a wage that increases their assets, the income that is generated is directly attributable to her labor and because of this she has more power to make her own decisions and this will contribute to her higher welfare.

Panel A. Male off-farm participation rate
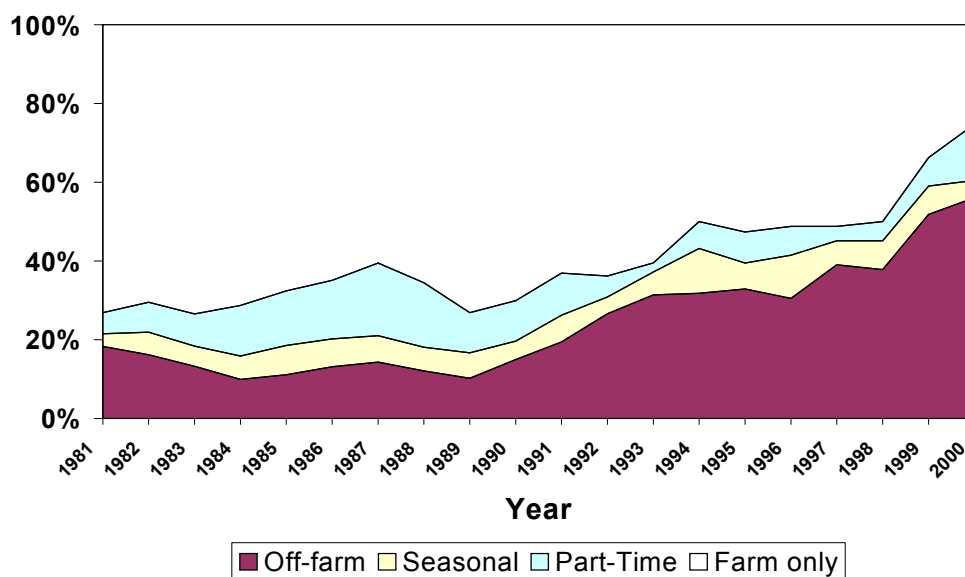
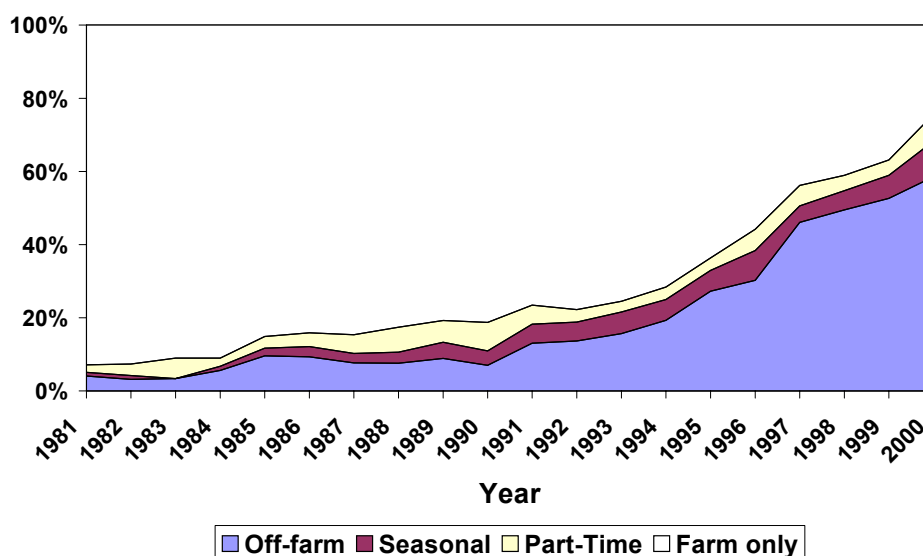Panel B. Female participation rate.

Figure 3. Comparison of off-farm participation by gender (aged 16-20)

In fact, according to our data, when examining the rate at which women have participated in the off farm labor markets, the newly emerging labor markets have already begun to positively affect women (Figure 3, Panels A and B). 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), the participation rates of men (more than 25 percent in 1981) far exceeded those of women (less than 5 percent). Moreover, despite low initial levels of involvement in the off-farm sector, participation rates for women grew more slowly than those of men during the 1980s.

In the 1990s, however, the participation rate of women in the off-farm sector has risen faster than that of men. The rising participation rates of women have been driven by the entry by women into all job categories, although the most striking absolute gains have come from migration (Figure 3, Panels A and B). Throughout the entire decade of the 1980s, less than 1 percent of women left worked for a wage. Since 1990, however, the rate of growth has been higher than any category of job types for either men or women. By 2000, nearly 6 percent of the female labor force was working as wage- earning migrants. One interpretation of this rise in the participation of women is that as labor markets have become more competitive, the scope for managers to exercise their discriminatory preferences has declined, therefore opening up new employment opportunities for those who had previously not been able to participate. Alternatively, the rise in women's work could have occurred as the types of industries that have a preference for the skills of women rose.

The nature of the work of women, like that of the entire labor force, is also changing fast (Table 2). In 1990, not only were fewer women working, most of them tended to work at jobs in local factories, close to home. For example, when dividing migrant workers into three groups – those the worked at jobs within their own county; those that worked at jobs outside their county but within their own province; and those that worked outside of their province (frequently thought to be the highest paid, most secure jobs by migrants), 47 percent of women migrants worked in their own county. Only 26 percent migrated out of the province (row 4). By 2000, however, the most likely destination of female migrants changed. In 2000 the percent of women migrants working in their own county fell to 35 percent, the percent that worked outside of the province rose to 33 percent (row 2). Although the rise the in the percent of migrants leaving their own province was relatively small (only 7 percentage points), the absolute number rose sharply by more than 10 times (from 5 to 54). For female migrants under 30, the shift in destination follows the same pattern (rows 6 and 8). If the better jobs are indeed in these labor markets that are far from home (typically in coastal area for the inland rural residents), this trend indeed shows that females, like their male counterparts are gaining access to these jobs.

Table 2. Comparison of location of migration employment (number of migrants working in specific locations) by age and gender in 2000 and 1990.

		Migrant job located within:			
		Own County	Province, other county	Another Province	Total Migrants
All Off-Farm Workers					
2000	Men	89 (29)	87(29)	128(42)	304
	Women	58 (35)	52(32)	54(33)	164
1990	Men	51 (46)	30(27)	30(27)	111
	Women	9 (47)	5(26)	5(26)	19
Workers under 30 years old					
2000	Men	45(25)	49(27)	89(49)	183
	Women	43(32)	41(30)	51(38)	135
1990	Men	29(39)	23(31)	23(31)	75
	Women	8(47)	5(29)	4(24)	17

Notes: Table compares workers who were, for example, 25 years old in 1990 with workers who were 25 years old in 2000.

Figures in brackets are the percentage numbers.

Perhaps most poignantly, specialization of another type is emerging and becoming common, especially for younger women. While participation rates for all women are still lower than that for men (by 41 percentage points—72 percent for men and 31 percent for women) in 2000, the gap narrows for the younger cohort groups and disappears for the youngest (Table 3). Both men and women in the 16 to 20 year old age groups have equal participation rates (74.7 percent for men; 75.6 percent for women—row 1). And, like men (and, in fact, even more so), women in this category are increasingly *specializing* in off farm labor. Specifically, in 2000 when young women work off the farm, they almost never work on the farm (that is, 59 percent of those that work off the farm, work *only* off the farm). The shift of young migrants that specialize in off farm work contrasts sharply with the situation in 1990 when most of those that worked off farm continued to work on the farm on either a part time or at least seasonal basis. The emergence of specialized modes of production in different villages across China's geographical landscape may very well have been facilitated by the emergence of labor markets (Mohapatra, 2001).

Table 3. Comparison of off-farm labor participation Rates by gender,
2000 and 1990.

| Age Range | Percentage (%) with off-farm work in: | | | |
| | 1990 | | 2000 | |
	Men	Women	Men	Women
16-20	21.4	13.1	74.7	75.6
21-25	47.3	13.1	78.8	53.5
26-30	47.9	8.8	72.8	33.7
31-35	44.4	6.8	70.5	22.5
36-40	37.3	3.6	70.0	20.3
41-50	33.3	5.2	61.2	18.7

With older women, however, the gender gap in off farm employment participation remains (Table 3). For example, the difference (in percentage points) between male and females widens to 25.3 percent for 21 to 25 year olds; 39.1 for 31 to 35 year olds; and 48 for 41 to 45 year olds (rows 2 to 6). Moreover, the participation rates in agriculture of older women (either full time, part time or seasonal) are almost as great as in the 1990s. And, with men both working more (columns 1 and 3) and specializing more (that is, not working in agriculture—not shown in table), this means that it is older women who are being asked to do the farming. While it is beyond the scope of this paper to say if this is a good or bad thing, in the next section of the paper, we will examine the effect on production of having women heavily involved in farming.

IMPACT OF LABOR MARKET EMERGENCE AND THE WAGES OF WOMEN

Although it is also beyond the scope of this paper to analyze the determinants of wages, in other work that we have done with a data set of 200 villages across China we find that the emergence of labor markets in China have not adversely affected labor markets (Rozelle et al., 2002). In that analysis, we decompose the change of the wage rate earned by women between 1988 and 1995, a time period of rapid labor market development. The decomposition exercise (using the methodologies of Neumark, 1988, and Oaxaca and Ransom, 1994) isolates the part of the change of the wage of women that is due to changes in their human capital characteristics (and other demographic factors) from the part of the change of wage that is due to labor markets. According to our analysis, although there was downward pressure on the wages of women between 1988 and 1995 (and a rising wage gap between males and females), this pressure is almost entirely accounted for by the lower human capital characteristics of the women that are entering the labor force (they are younger and less educated). In contrast, we find no significant adverse effect of labor market development on the male-female wage gap.

MULTIVARIATE ANALYSIS: DETERMINANTS OF OFF-FARM PARTICIPATION

To explain the determinants of different types of off-farm employment 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 $\mathbf{X_{ivt}}$. If we define an indicator variable, y_i, 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 $\mathbf{X}$ on the individual's labor market participation decision by estimating:

$$y_{ivt} = f(\mathbf{X_{ivt}} \ulcorner + \ulcorner_v) + \ulcorner_{ivt,} \tag{1}$$

where $\ulcorner$ represents a vector of parameters that corresponds to the effects of the individual and household characteristics on participating in each economic activity, and $\ulcorner_v$ is a village level intercept.[4]

In order to test the effect of labor market development on the participation of women, we specify a dummy variable that is one if the individual is male and zero if female. In a regression in which we include all observations from the 1980s and 1990s (regression 1), the gender indicator variable is interacted with a period dummy variable that is one if the year of observation is in the 1990s and zero if it is the 1980s. In two other regressions, we include only a gender dummy. In one (regression 2), we only use the data for the 1980s; in the other we only use data for the 1990s (regression 3). The increased participation of women in the labor force is measured two ways--by the coefficient on the interaction term in regression 1; and by comparing the magnitudes of the coefficients of the gender variable in regressions 2 and 3.

We also include the rest of the variables in $\mathbf{X_{ivt}}$ measured at the individual and household level to 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 age in year t affects their participation rates. We further hypothesize that human capital measures, including years of education and whether or not they received any training in a trade (either in a formal apprenticeship program or in a formal training program), will positively affect participation rates if labor markets are working relatively efficiently. At the household level, we include two variables that control for wealth (the value of durable goods owned and the amount of land held), the size of the household labor force in year t, and the average amount of off-farm experience that an individual's household members have in year t.[5] Finally, we include a time trend. All variables in all equations are time varying by year except for the measures of wealth, land size, and the value of the household's durable goods. In the first set of regressions that include observations for all of our sample years these variables are set at their 2000 level and act as shifters.

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 during the period 1981-2000. Because some individuals enter the labor force during this period and others stop working, we do not have a full panel of 45,940 observations; rather, we have 34,257 observations in total. We dropped villages in the rare case in which there was zero participation in a particular type of employment. For example, in the case of one village, none of the individuals in the sample household migrated during the sample period. These households could not be included in the migration equation as there was no variation within the village for the left-hand side of equation (1), making the village fixed effect perfectly correlated with the dependent variable for that village. As a result, 33,214 observations from 59 villages were used to explain migration participation, and 33,198 observations from 59 villages were used to explain participation in self-employment.

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[4] In using the logit estimator, we assume that the error term ε_{ivt} is independent and identically distributed across observations according to the Weibull distribution.

[5] To create the "household labor participation experience" variable, we sum, back to 1981, the total number of years in which each member of a person's household worked in the off-farm sector. We then sum all of the years that the other individuals in the household worked during this period. In order to avoid endogeneity concerns, we lag the variable in our regression analysis. Although not shown, in order to address concerns that the endogeneity of such a variable could affect our results, we dropped the variable and found that the other parameter estimates did not change.

In almost all respects, the multivariate regression analyses perform well (Table 4). The R-square measures of goodness of fit of OLS versions of the equations all exceed 0.90. Most of the coefficients of the basic variables in the models have the expected signs and are highly significant. For example, we find that the size of the household's labor force increases participation in the wage earning sectors (row 6). Moreover, education is shown to increase the individuals participation in off-farm labor markets and increasingly so over time (row 3).

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		
	(Regression 1) Migration	(Regression 2) Migration: Between 1980-1990	(Regression 3) Migration: Between 1990-2000
Age	0.94	0.94	0.92
	(14.53)**	(13.43)**	(30.26)**
Gender (1=male)	6.10	12.87	3.23
	(16.55)**	(20.58)**	(21.76)**
Years of Education	1.10	1.06	1.17
	(7.07)**	(5.55)**	(17.35)**
Skill Training (1=yes)	2.37	1.87	1.58
	(9.43)**	(21.85)**	(8.13)**
Average Household Experience	1.55	1.64	1.16
	(17.51)**	(27.84)**	(15.77)**
Size of Household Labor Force	1.16	1.17	1.28
	(6.83)**	(7.93)**	(18.07)**
Total Land Area, 2000	0.98	0.99	0.99
	(3.58)**	(1.33)	(3.82)**
Value of durables, 2000	1.00	1.00	1.00
	(1.44)	(0.95)	(3.16)**
Age* 90s dummy	0.99		
	(3.20)**		
Gender* 90s dummy	0.57		
	(4.74)**		
Education* 90s dummy	1.08		
	(4.96)**		
Training* 90s dummy	0.64		
	(4.22)**		
Experience* 90s dummy	0.74		
	(11.66)**		
Labor Force* 90s dummy	1.13		
	(5.21)**		
Land Area* 90s dummy	1.01		
	(1.83)		
Durables* 90s dummy	1.00		
	(1.85)		
Time Trend	1.09		
	(11.80)**		
Year Dummies:		Included	Included

Notes: Coefficients reported are odds ratios; asymptotic z statistics in parentheses. ** indicates significance at the 5% level. Odds ratios can be interpreted as the additional probability of an event if there is an additional unit of the explanatory variable, *ceteris paribus*. 34,257 observations were used in column (1); 12,623 observations were used in column (2); and 21,631 were used in column (3). 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 1981-1990 and column (3) only includes data from 1990-2000 (1990 was included in both regressions as the base year).

Most importantly, the results clearly demonstrate that the findings in the descriptive results hold up to multivariate analysis of migration (Table 4). For example, although according to the coefficient on the base gender indicator variable (regression 1, row 2), male participation in migration (holding all else constant) was 610 percent (or 6.1 times) higher than female participation, by the 1990s, the relative difference was only 57 percent as much (see coefficient on the interaction term—regression 1, row 10). A similar story is told by comparing the coefficients on the gender indicator variables in regressions 2 and 3. In the 1980s, males were more than 12 times likely to participate than females (row 2). By the 1990s, males were only 3.2 times as likely (row 2). Hence, in the same way as shown in the descriptive statistics, although men still participate in migrant labor markets at rates far higher than women, the employment access gap has narrowed considerably over time.

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. We 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.

Moreover, assuming that participation in off-farm labor markets, higher wages and increased income raises the welfare of women, we also produce evidence that women have become better off during the reforms. Although women still lag behind men in off farm participation, in general, access to off farm jobs have risen faster for women than men. By 2000, over 30 percent of women had jobs off the farm, up from only 10 percent in 1990. The brightest outlook, however, is shown to exist for the youngest cohort. In fact, in the case of 16-20 year old women, their level of participation is very high (more than 75 percent) 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. Hence, while 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 or the gaps do not widen in the future.

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Appendix A

Estimating the Effect of Women-headed on Cropping Income

Estimating equation (1) has both strengths and weaknesses. It enables us to use our village-level data on employment, infrastructure and topography, thereby increasing the degrees of freedom and allowing us to estimate the importance of these specific village characteristics. However, it is possible that we are missing the effect of variables that, although unobservable, may be correlated with irrigation. In such a case, we would have a case of omitted variables and our OLS estimates of γ would be inconsistent. If this were the case, it is possible, given our data, to include in place of the variables in Z_v, a set of 60 village indicator variables that capture all of the observed and unobservable village effects. Casting the problems in this way (henceforth, the fixed effects model), however, means that we cannot identify the effect of specific village effects and that there will be less variability available with which the relationship between irrigation and income can be estimated.

The tradeoffs of using OLS versus the fixed effects model are seen most clearly by rewriting equation (1) as a fixed effects model to capture the unobserved heterogeneity that cause inconsistency in the OLS cross-sectional regression (Deaton, 1998),

$$y_{hv} - \overline{y}_v = \alpha + \gamma\left(D_{hv} - \overline{D_v}\right) + \beta\left(X_{hv} - \overline{X}_v\right) + \delta\left(Z_v - \overline{Z_v}\right) + \left(\mu_v - \overline{\mu_v}\right) + \left(\varepsilon_{hv} - \overline{\varepsilon_v}\right) \qquad (2)$$

where $\overline{y}_v, \overline{X}_v, \overline{\mu}_v$ and $\overline{\varepsilon}_v$ denote the average village level. Since $Z_v - \overline{Z}_v = 0$ and $\mu_v - \overline{\mu}_v = 0$, equation (2) can be simplified to

$$y_{hv} - \overline{y}_v = \alpha v + \gamma\left(D_{hv} - \overline{D_v}\right) + \beta\left(X_{hv} - \overline{X}_v\right) + \left(\varepsilon_{hv} - \overline{\varepsilon_v}\right) \qquad (3)$$

and all village and other regional factors are held constant by the inclusion of a set of village-specific dummy variables (or fixed effects). In equation (3), one can see that all community level effects are accounted for (but they are all combined together in α_v) and the only variability that is available for the estimation is the within community differences among households.

Appendix Table 1. 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 hhds	6.00	--
% of hhds 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.