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Employment, emerging labor markets, and the role of education in rural China

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Abstract

The overall goal of this paper is to contribute to the ongoing assessment of China's rural labor markets. To meet this goal, we have three specific objectives. First, we provide an update of the trends in off-farm labor participation and wages of the sample households and examine how labor market outcomes have changed for those with different levels of education. Second, we examine whether education in different time periods—the late 1980s, the early 1990s, and the mid-1990s—can be associated with increasing access to off-farm jobs. Finally, we examine how returns to education have changed during the course of the reform era. Both the descriptive data and the multivariate analysis robustly support the findings that, between the late 1980s and the mid-1990s, labor markets have improved in the sense that rural workers have been increasingly rewarded for their education both in terms of off-farm job access and higher wages. © 2002 Published by Elsevier Science Inc.

1. Introduction

The massive flow of labor into the off-farm sector has brought new prosperity to millions of rural households during China's economic reform era. The proportion of the rural labor force that has entered the labor force rose from around 22% in 1988 to 34% in 1995 (Rozelle, Li, Shen, Hughart, & Giles, 1999). By 2000, nearly 200 million people (or about 40% of laborers) held off-farm jobs. The rise in wage earnings and income from self-employed activities has created most of the increase in rural incomes in the late 1980s and 1990s (Parrish, Zhe, & Li, 1995; Rozelle, 1996).

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Beyond being a source of income for rural migrants, labor markets play an even more important role in the development process (Stark, 1976; Todaro, 1976). For China to develop, labor markets must operate effectively in order to help shift a large part of China's population from rural to urban. Labor markets also facilitate the shift of the economy from agricultural to industrial. Hence, as China's leaders make economic development policies, they should be interested in knowing if labor markets have been emerging in a way that will facilitate China's modernization ambitions.

Although the focus of considerable research, scholars do not agree on the role that China's labor markets have played in the nation's growth during the past two decades (Cai, Wang, & Du, 2002; Zhu, 2002). Some researchers believe that significant barriers still exist in China's economy and that absence of well-functioning rural labor markets has hindered growth. For example, Benjamin and Brandt (1997) and Liu, Carter, and Yao (1998) both have evidence that on farm labor markets were not functioning well during the 1990s. Others have focused on institutional features in rural and urban areas that may constrain the movement of labor, despite high wage gaps and positive expected gains from migration. Mallee (2000) and Yang and Hao (1996) demonstrate that a number of barriers, such as land tenure arrangements and mandatory marketing delivery quotas, continue to increase the cost of out-migration and dampen off-farm labor market participation. Johnson (1995) worries that several prominent urban institutions, such as the household registration system and the absence of social and educational services for rural residents in cities, restrict entrance into urban labor markets. In particular, a number of writings have shown that labor markets do not reward human capital; instead nonmarket factors are used in assigning jobs and wages (e.g., Meng, 1990, 1995).

In contrast, others believe that rural labor markets have emerged in a healthy way and are still continuing to evolve positively. For example, Cook (1999) demonstrates the equalization of off-farm labor returns between wage earning and self-employed workers in her rural Shandong sample. Lohmar's (1999) analysis of the effect of land tenure and quota policies finds that, although more restrictive policies have some impact on household labor response to the off-farm sector, their magnitudes are small. Knight and Song (2001) use their finding that some urban firms have become less discriminatory in their hiring practices of those without an urban *hukou* to support the hypothesis that labor markets have improved over time. Rozelle, Li, Shen, Hughart & Giles (1999), State Statistical Bureau (1999–2000), Zhang, Zhao, and Chen (1995), and others have documented the explosion of migration and off-farm participation. Moreover, most relevant to this paper (although her work is on urban labor markets), Maurer-Fazio (1999) argues that labor markets are improving because education is becoming an increasingly important determinant of migrant earnings.

The overall goal of this paper is to contribute to the ongoing assessment of China's rural labor markets. We believe that, in part, previous disagreements in the literature exist because previous analyses have studied labor markets at different times and in different places and in that sense lack comparability. In contrast, although our sample is geographically narrow, we collected our own data on labor market activities and wages on the same subset of households over a 9-year period that spans the late 1980s and most of the 1990s. By following the working lives of the same individuals over time, we believe our observations help develop an understanding of the evolving nature of labor markets in

China, although our relatively localized data set limits the generalizations that can be drawn from the study.

We have three specific objectives. First, we describe the trends in off-farm labor participation and wages of the sample households and examine how labor market outcomes have changed for those with different levels of education. Second, we examine whether education obtained in different time periods—the late 1980s, the early 1990s, and the mid-1990s—can be associated with increasing access to off-farm jobs. Finally, we examine how returns to education have changed during the course of the reform era.

Space constraints and data limitations require that we narrow the focus of our inquiry in several ways. First, our study focuses on education and labor supply behavior of the individual and does not consider a number of other personal traits or institutions that might indicate whether labor markets are improving or not. Nevertheless, the data's relatively high quality and its unique feature of following the same households and individuals in the households over a 9-year period allow us to examine differences of labor supply during a time when the economy has been undergoing rapid change. Second, the fact that we look at only three snapshots of the household—1988, 1992, and 1996—means that the trends are also subject to the fluctuations of the rural economy. Hence, any discussion of the trends at the microlevel must consider the context within which the household's labor allocations and firm employment decisions are being made. We hope that this will be considered a careful case study that, while not being able to prove labor market improvements for all of China, can contribute to the debate on how China's labor markets have evolved during the reforms.

To meet our objectives, the rest of the paper is organized as follows. In Sections 2 and 3, we document the periods in our sample area that experienced periods of recession and periods of expansion and examine the pattern of household labor allocation during these periods. Section 4 builds the empirical model and tests econometrically the hypothesis that labor markets increasingly rewarding education with greater access to off-farm jobs and higher wages. Section 5 discusses the implications of the findings and concludes.

2. Recessions and expansion in reform China

China's reform period is characterized by remarkable economic growth in both agriculture and industry. National GDP rose from 896 billion yuan (1997 value) in 1986 to 6.9 trillion yuan in 1996 (State Statistical Bureau, 1997). Much of the credit for this growth goes to a series of agricultural and rural industrial reforms implemented beginning in 1978 (Naughton, 1995). The reforms provided new opportunities for farmers, allowing them to respond to market signals instead of central planning commands. Agricultural production shifted to the household responsibility system, and as farm families also took greater control of labor allocation decisions, production increased as farmers responded to the new incentives (Lin, 1992). Led by the rapid growth of township and village enterprises (TVEs) and expanding urban labor markets, many farmers and their family members began to supply their labor to off-farm activities, resulting in the rise of nonfarm employment from 67 million to 130 million between 1985 and 1996 (State Statistical Bureau, 1997).

Scholars agree that China's economy has not grown at a uniform pace over time, but the causes remain controversial. Naughton (1995) describes a complicated cycle of reform and retrenchment. Yusuf (1994) details a policy and inflation cycle. Zhu and Brandt (1995) blame financial and fiscal policy. Whatever the causes (the explanation is beyond the scope of this paper), the economy surged ahead in the mid- and late 1980s, slowed following the retrenchment of 1989, and after recovering slowly in the early 1990s boomed again in the mid-1990s.

This period of rapid development followed by recession followed by rapid development is reflected in employment, which has risen and fallen with economic growth. After increasing in the 1980s by more than 8%, manufacturing employment growth fell to nearly zero during the 1989–1991 recession and then climbed again in the mid-1990s. Construction employment, one of the largest employers of rural labor, displayed a similar pattern, rising in the 1980s, slowing as GDP growth declined in 1989 and 1990, and finally growing again once in the recovery of the mid-1990s. Economic growth of Jiangsu Province has followed the aggregate Chinese economy (State Statistical Bureau, 1997).

Incomes of our sample households followed the same up–down–up pattern that characterized those of China and Jiangsu Province from the late 1980s to the mid-1990s. Deflated per capita family income fell by nearly 30% between 1988 and 1992 and had recovered and exhibited healthy new growth by 1996 (Table 1, row 1). Mean per capita family income in each of the villages fell from 5% to 58% between 1988 and 1992 and grew from 16% to 167% between 1992 and 1996. A large part of the fall in total income was due to the fall in off-farm income, which fell sharply between 1988 and 1992 before recovering and expanding between 1992 and 1996.

Off-farm employment opportunities for rural households followed similar patterns, displaying evidence that they were responding to macroeconomic pressures. As the economy sagged in the early 1990s, total off-farm labor employment of our respondents fell by about 20%, from 104 to 84 days/year. The opposite employment patterns occurred when growth resumed in the mid-1990s; off-farm labor rose although less than it had originally fallen

Table 1
Income, labor days, and wages in rural China, 1988–1996

Year	1988	1992	1996
Income trends (real 1988 yuan/family)			
Total income	4172	2663	5690
Labor supply trends			
Average total labor days (days/year)[a]			
Off-farm labor (days/year)	104	84	88
Agricultural labor (days/year)	51	83	58
Wage trends			
Average off-farm wages (in 1988 yuan/day)	6.5	4.5	13

Source: Authors' survey.

[a] Measured as standard days (8 h) per person.

(Table 1, row 2). In contrast, average agricultural labor use for the total sample jumped by 63% during the recession period, increasing from 51 to 83 days/person (row 3). During the 1992–1996 boom, household agricultural labor input fell by about 30%.

Wages of our sample workers, while growing in real terms over time, also reflect the rising and falling of the economy. Over the entire 9-year period, the real daily wage (deflated by the consumer price index) nearly doubled, from 6.5 yuan in 1988 to 13 yuan in 1996 (Table 1, row 4). However, the growth was not steady, falling by 30% to 4.5 yuan/day between 1988 and 1992, and nearly tripling as the economy recovered during the 4 years after 1992.

3. Labor markets, education, and work in rural China

The fluctuation of off-farm work and wages in our sample households clearly shows that local labor markets are influenced by macroeconomic conditions. In the rest of this paper, we extend our analysis to examine whether hiring, firing, or wage-setting decisions reflect worker education. We hypothesize that, if rural labor markets are improving, we should observe that the benefits in terms of access to off-farm work and wages accrue more to workers with higher levels of education. We first use our data to describe China's record in providing education to rural households and illustrate whether labor supply and wages are associated with educational attainment. In Sections 4 and 5, we subject our hypotheses to econometric testing.

Educational attainment in rural China, while higher than many developing countries, is still relatively low (when compared to other nations in East Asia that have developed rapidly during the past 50 years), stagnant over time, and differs between men and women (Table 2). The typical sample rural resident between the ages of 16 and 60 attended school between 5 and 6 years, almost the same as the national average for rural residents (according a national representative survey that we ran in 2000), but rural educational levels lag far behind those of urban China (State Statistical Bureau, 1997–2000). There is no within sample statistical difference in attainment rates over time, the negligible differences that appear in the table mainly reflect changes in household composition and reporting error. Men average about 6.5 years of education, considerably more than women, who average only approximately 4 years of schooling.

Our survey data clearly show a positive and increasing relationship between education and off-farm employment. In all 3 years of our survey—1988, 1992, and 1996—those individuals

Table 2
Level of education for rural population between 1988 and 1996

Education level	1988	1992	1996
Total	5.33 (3.78)	6.10 (3.61)	5.20 (3.69)
Male	6.51 (3.49)	7.30 (3.12)	6.64 (3.04)
Female	3.92 (3.63)	4.72 (3.64)	3.63 (3.72)

Figures in brackets are the standard deviations.
Source: Author's survey.

with a middle school education and above had higher off-farm participation rates (Table 3, rows 1 and 2). Perhaps more importantly, the difference between those with less and those with more education grew sharply over time. In 1988 and 1992, the off-farm participation rates of those with middle school or above exceeded that of those with less education by around 50% and this gap rose to more than 100% by 1996. In contrast, those with less education worked more on the farm (rows 3 and 4) in every period than those with less education. Despite their evident advantage in the off-farm labor market, workers with higher levels of education increased their annual farm working days by more than 60% during the 1992 recession. This illustrates the important role of the agriculture sector as a buffer to fluctuations in the industrial sector.

The relationship between education and wages also has changed during the reform (Table 3, rows 5–10). In the late 1980s, wages for middle school graduates and above were actually below those who had only graduated from elementary school education (in the middle aged and old aged categories). By the mid-1990s, however, a sharp reversal had occurred and, for all age groups, workers with a middle school education and above earned more on a per day basis than those with only an elementary education. Across all age categories, the real wage rose more than 10% faster annually between 1988 and 1996 for those with higher education levels compared to those with only elementary schooling.

In Table 4, we can see how education correlates with labor flows into and out of the nonagricultural labor force as rural China moves into and out of recession. The impact is more apparent in the later years of the sample. From 1988 to 1992, 37% of the individuals exited the labor force, exceeding the 28% that entered during this period. Those with more

Table 3
Education, labor market participation, and wages in rural China, 1988–1996

	1988	1992		1992
Labor market participation				
Off-farm work (percentage in workforce)				
Primary school	41	33		33
Middle school and above	62	49		69
On-farm work (days worked per year)				
Primary school	67	113		80
Middle school and above	28	45		29
Wages				
Age group[a]	Level of education			
Young	Primary school	3.4	3.2	7.8
	Middle school and above	4.3	4.3	11.7
Middle aged	Primary school	10.2	5.5	14.7
	Middle school and above	4.0	4.5	20.9
Old aged	Primary school	11.0	5.7	4.5
	Middle school and above	4.9	7.7	6.3

Source: Authors' survey.

[a] The young are those between 16 and 30; the middle aged are those between 31 and 50; the old aged are those between 51 and 65.

Table 4
Exit and entry behavior of sample households in rural China, 1988–1996

Year	1988–1992	1992–1996
Percentage of off-farm labor who exit[a]		
Total average	37	22
Elementary school	39	31
Middle school and above	35	16
Percentage of off-farm labor who enter[b]		
Total average	28	43
Elementary school	27	38
Middle school and above	28	46

Source: Author's survey.
[a] Using 1988 off-farm labor force as base.
[b] Using 1992 off-farm labor force as base.

education exited somewhat less (35%) than those with less education (39%). This difference may indicate a slight employment advantage for those with higher education in the presence of recession-related layoffs. During the period of recession, however, there was almost no difference in entry between those with different amounts of education. In contrast, between 1992 and 1996, as the economy was expanding, those with education were better able to take advantage of expanding employment opportunities and to avoid being laid off.

4. Econometric analysis

To rigorously test hypotheses regarding the effect of education on measures of labor-market outcomes, we construct and estimate models for labor participation, entry into the labor market, and wages models. We first estimate how education has affected participation in and entry into the off-farm sector, holding constant other relevant variables. Next, we attempt to isolate the effect of education on wages. The parameters from the wage equations are used to calculate returns to education during the sample years. Finally, we also explore how education affects *on-farm* employment.

4.1. Model specifications

4.1.1. Off-farm work participation

We use a probit relationship to model off-farm work status determinants. The basic form of the model is:

$$Y = aX_1 + bX_2 + cX_3 + dX_4 + \ldots + e \quad (1)$$

where Y is a dummy variable equal to 0 if the individual did not work off-farm and 1 otherwise. The sets of explanatory variables include human capital characteristics (X_1—age and age^2, education and education^2), family characteristics (X_2—both on the consumption

side, such as the number of children under age 6 at home, number of elderly at home, number of working age family members, and on the production side, such as land size), a gender variable (X_3—equal to 1 if the individual was female), and villages effects (X_4—to hold constant any impact of village characteristics on employment participation). We measure education by the number of years of schooling attained. The model is estimated separately for each year of the sample.

4.1.2. Entry model

Eq. (2) models the determinants of entry into off-farm employment:

$$E = aX_1' + bX_2 + cX_3' + dX_4 + eX_5 + \ldots + e, \qquad \text{for } i = 1 \text{ and } 2 \tag{2}$$

where E is a dummy variable equal to 1 if the individual entered the off-farm sector in either 1992 or 1996 from a status of no off-farm job in the preceding period, 1988 or 1992, respectively. The explanatory variables are similar to those included in the participation model. Individuals who had an off-farm job in both 1988 and 1992 are excluded.[1] The regression equation is estimated separately for the 1988–1992 and the 1992–1996 periods to see if the effect of education on entry changes over time. The coefficients (as we report them) can be interpreted as the probability that entry is increased or decreased.

4.1.3. Wage equation

A Heckman two-stage least square model is used to analyze the determinants of off-farm wages.[2] This procedure avoids a possible bias that may result from not including in the sample those individuals who choose not to work and who do so because they face different labor-market alternatives than those who do work. The behavior of nonworking individuals includes information that can help identify the determinants of wages. At the wage that they face in the labor market, such individuals choose not to supply labor to the off-farm market (conditional on all nonwage factors that affect their labor allocation decisions). Our estimation allows us to include all individuals in the analysis.

[1] In this regression, we exclude those who worked in both periods because we are essentially interested in understanding the factors that helped those who did not have a job in 1988 get one in 1992 (as well as understand the factors that kept individuals from entering the off-farm labor market).

[2] The solution to this problem is to estimate the wage equation in two stages. The first stage is to estimate a probit equation of the choice whether or not the individual chooses to work (similar to Eq. (1)). From the first stage of the analysis, one can recover the Inverse Mills ratio (IMR), which measures the propensity for a person to participate in the labor market. Its inclusion in the second stage, the determinants of wage equation, corrects for the bias that would otherwise affect estimates of the wage equation with the censored sample.

To get better identification on the coefficients of the wage equation (better that is than just relying on the inclusion of the Mills ratio), one also wants to include variables in the estimation of the participation (probit) that are significant determinants of whether or not to work, but have no independent effect on the wage, the dependent variable in the second stage of the model. In our case, we assume that land size, family size, the number of children, and the number of elders at home affect labor participation but do not affect the wage rate which is determined by labor market traits and the individual's human capital.

Following Heckman, our specification of the model includes two equations. The first stage of the analysis is similar to Eq. (1). The second stage wage model is:

$$ln(\text{Wage}) = aX_1 + cX_3 + eX_5 + fX_6 + \ldots + e, \quad (3)$$

where the dependent variable is a measure of the daily wage net of mandatory, work-related expenses; X_1, X_3, and X_5 are matrices of human capital variables, gender, and year effects (nearly the same—except for the year effects—as in Eq. (1)). In order to examine the impact of education on wages during different periods, we include a set of interaction terms between education and year and age and year (X_6).

4.1.4. Agricultural labor allocation equations

We also test whether or not education attainment affects the labor response in agriculture. An ordinary least squares (OLS) regression is used to estimate the determinants of individual agricultural labor allocation measured in standard labor days (8 h) per year. As in the other equations, measures of human capital, household traits, and gender effects are included as regressors. In addition, a measure of the off-farm work status of the other members of the individual's family and a measure of the individual's off-farm work status are included to estimate the propensity of the individual to increase on-farm work when off-farm work (or the off-farm work of other family members) declines. The model is estimated for three separate time periods, 1988, 1992, and 1996.

4.2. General performance of the econometric models

Estimation results for determinants of off-farm work status, entry, the off-farm wage, and the individual's on-farm employment are presented in Tables 5–8, respectively. Most of the estimated equations perform well in terms of their goodness of fit. The adjusted R^2 statistics of the agricultural labor supply equation and the wage equations that are estimated by OLS are both above .44. The goodness-of-fit measures of the probit equations for off-farm labor participation and entry into the off-farm labor force show even better precision.

The signs of the coefficients of many of the explanatory variables are as hypothesized and significant. For example, in the equations explaining the determinants of off-farm employment status for the entire period (Table 5, columns 3 and 4), the negative and significant signs on the gender variables in almost all of the off-farm participation equations indicate the unequal access of women to jobs off the farm, a result reported by many other researchers (e.g., Meng, 1995; Rozelle, Dong, Zhang, & Mason, 2002; Rozelle, Li, Shen, Hughart, & Giles, 1999). In the 1996 regressions for off- and on-farm labor participation and entry, the estimated coefficient on the linear age variable is positive and that on the squared age variable is negative.

Taken as a group, the results of the off-farm participation, entry, wage, and on-farm employment equations tell a strong and consistent story about the role of education in rural China. They suggest that in the early years of the reforms, job access, entry, and wages were unaffected by one's level of education. Employers were apparently using other criteria to make their hiring and wage setting decisions. Over time, it appears that employers have increasingly recognized the value of an educated workforce. In Table 5, we see that, in 1988,

Table 5
Determinants of off-farm labor participation in rural China, 1988–1996

	Dependent variable: off-farm labor participation					
	1988		1992		1996	
	dF/dx[a]	z	dF/dx	z	dF/dx	z
No. of observations	295		332		305	
Human capital						
Age	2.1	(1.31)	4.8**	(3.03)	6.4**	(3.61)
Age^2	0.0*	(1.80)	−0.1**	(3.18)	−0.1**	(3.92)
Education	−1.0	(0.36)	6.0**	(2.24)	14.3**	(4.09)
Education^2	0.1	(0.51)	−0.3*	(1.89)	−0.9**	(3.02)
Household traits						
Number of kids at home	−0.4	(0.04)	19.2**	(3.34)	−12.2	(1.08)
Number of elders at home	−0.1	(0.01)	1.9	(0.36)	5.2	(0.80)
Family labor	3.0	(0.93)	0.9	(0.30)	6.6*	(1.63)
Land size	−6.8**	(3.91)	−0.3	(0.17)	−2.3	(1.51)
Gender						
Female	−40.1**	(5.62)	−15.3**	(2.36)	−32.8**	(4.46)
Village effects						
Village 3	6.3	(0.82)	−14.3**	(2.04)	−9.1	(1.13)
Village 4	−17.6*	(1.69)	−28.8**	(3.36)	3.5	(0.34)
Village 5	−20.1*	(1.88)	−19.2**	(2.24)	−3.3	(0.31)
Obs. P	.49831		.39759		.47213	
Pred. P	.49798		.37989		.42847	

(1) Dummy variable results represent the effect of a discrete change from 0 to 1. (2) Probit model included a constant, but coefficient not reported.

[a] dF/dx may be interpreted as the change in likelihood of exiting or entering the off-farm labor force with a 1-unit change of independent variable.

* Denotes statistically significant at 10%.

** Denotes statistically significant at 5%.

the signs on the education variables are insignificant, implying that jobs were given to people without regard to of their educational level; rather, as indicated by the two village dummy variables the community in which one lived in 1988 was an important determinant of an individual's off-farm job status. By 1996, the situation had reversed. Those with high levels of schooling clearly had a greater probability of getting an off-farm job and village characteristics did not matter.

Table 6 provides additional evidence on the rising importance of education for the ability of an unemployed (or never employed) individual to obtain off-farm employment. Even though education did not help an individual who did not work in 1988 to find a job by the recession year of 1992 (columns 1 and 2, rows 3 and 4), education played a significant role in helping those who had no off-farm work in 1992 to obtain off-farm work by 1996. For every

Table 6
Impact of economic recession on entry into the off-farm employment in rural China, 1992–1996[a]

	Dependent variable			
	Entry into off-farm sector			
	1988–1992		1992–1996	
	dF/dx[b]	z	dF/dx	z
Human capital				
Age	0.0	(−0.01)	3.4**	(2.36)
Age^2	0.0	(0.02)	−0.1**	(−2.65)
Education	3.2	(1.26)	15.1**	(3.82)
Education^2	−0.1	(−0.87)	−1.0**	(−3.28)
Household traits				
Number of kids at home	5.7	(0.90)	−12.2	(−1.00)
Number of elders at home	3.0	(0.59)	6.0	(1.01)
Family labor	4.2	(1.30)	8.0*	(1.80)
Land size	0.0	(0.00)	−0.9	(−0.74)
Gender				
Female	1.3	(0.20)	−21.5**	(−2.61)
Village effects				
Village 3	−0.9	(−1.39)	14.4	(1.43)
Village 4	−14.6*	(−1.78)	23.9*	(1.91)
Village 5	−6.4	(−0.81)	13.6	(1.15)
Number of observations	184		177	
Obs. P	.19022		.32203	
Pred. P	.16450		.18732	

(1) Dummy variable results represent the effect of a discrete change from 0 to 1. (2) Probit model included a constant, but coefficient not reported.

[a] Entry is defined as a person who did not have a job in one period (e.g., 1992) who was able to get a job in the subsequent one (e.g., 1996).

[b] dF/dx may be interpreted as the change in likelihood of exiting or entering the off-farm labor force with a 1-unit change of independent variable.

* Denotes statistically significant at 10%.

** Denotes statistically significant at 5%.

additional year of education, farmers had a 6–10% greater chance of finding an off-farm job between 1992 and 1996. Appleton, Knight, Song and Xia (forthcoming, this issue) find that education has been instrumental in keeping workers from becoming unemployed.

The estimated wage equation provides evidence that the effect of education on wages is also increasing over time (Table 7). The signs of the base education variables (that enter in linear and quadratic form) are insignificant, suggesting no general effect of education on wages in 1988 and 1992 (rows 3, 4, 19, and 20). However, the coefficients on product of the 1996 year dummy and education shows that, in 1996, the effect of education on wages is

Table 7
Determinants of wages and recession in rural China (no sector effects), 1988–1996[a]

	Wage equation[b]			
	n=928[c]		Participation equation (Probit)	
Human capital				
Age	0.11**	(3.82)[d]	0.04	(1.22)
Age^2	−0.00**	(3.33)	−0.00	(1.58)
Education	−0.02	(0.40)	0.01	(0.16)
Education^2	−0.00	(0.35)	0.00	(0.61)
Household traits				
Number of kids at home			0.23*	(1.72)
Number of elders at home			0.12	(0.90)
Family labor			0.05	(0.96)
Land size			−0.05**	(2.32)
Gender				
Female	−0.13	(0.81)	−0.73**	(7.08)
Village effects				
Village 3			−0.16	(1.50)
Village 4			−0.41**	(2.69)
Village 5			−0.41**	(2.79)
Year effects				
1992	0.77	(0.75)	−2.17**	(2.20)
1996	−0.14	(0.14)	2.28**	(2.23)
Year and human interaction				
Age*year 1992	−0.06	(1.16)	0.09*	(1.78)
Age^2*year 1992	0.00	(1.16)	−0.00*	(1.67)
Age*year 1996	0.02	(0.38)	0.09*	(1.76)
Age^2*year 1996	−0.00	(0.70)	−0.00	(1.82)
Education*year 1992	0.02	(0.22)	0.10	(1.12)
Education^2*year 1992	−0.00	(0.08)	−0.01	(1.19)
Education*year 1996	0.22**	(1.94)	0.32**	(3.02)
Education^2*year 1996	−0.01*	(1.78)	−0.02**	(2.59)
Constant	−0.23	(0.38)	−0.03	(0.04)

(1) Dummy variable results represent the effect of a discrete change from 0 to 1.

[a] Estimated using Heckman two-stage least squared method.

[b] Wage in log form, t-value of coefficient of inverse mills ratio (−0.42) was −1.28, implying minimal selection bias. The R^2 of the OLS version of the wage equation was .49.

[c] Number of observations.

[d] z-statistics given in parenthesis.

* Denotes 10% level of significance.

** Denotes statistically significant at 5%.

Table 8
Agricultural labor supply response of individuals to recession in rural China, 1988–1996

	Dependent variable: labor days per year		
	1988	1992	1996
No. of observations	293	330	304
Human capital			
Age	8.90**	16.74** (10.5)	11.82** (9.8)
Age^2	−0.10** (9.0)	−0.19** (9.2)	−0.14** (8.9)
Education	3.28** (2.4)	1.68 (0.59)	6.83** (2.7)
Education^2	−0.21** (2.0)	−0.21 (1.1)	−0.76** (3.5)
Household traits			
Number of kids at home	−0.70 (0.2)	−20.83** (2.0)	2.48 (0.3)
Number of elders at home	−6.46 (1.1)	16.51* (1.9)	−9.14 (1.5)
No. of working age family members	−9.27** (4.1)	−2.43 (0.64)	−8.87** (2.4)
Land size	6.01** (5.9)	6.63** (3.5)	1.38 (1.4)
No. of family members working off-farm	2.49 (1.1)	3.46 (0.82)	4.86 (1.2)
Status of individual's off-farm work	−21.22** (4.5)	−29.24** (3.6)	−34.78** (4.9)
Gender			
Female	5.06 (1.18)	−3.73 (0.5)	−3.76 (0.6)
Village effects			
Village 3	−0.66 (0.2)	−7.29 (0.9)	4.44 (0.7)
Village 4	−7.76 (1.3)	13.52 (1.2)	4.02 (0.5)
Village 5	11.18 (1.8)*	19.16* (1.8)	21.85** (2.8)
Constant	−131.0** (6.8)	−268.9** (7.3)	−146.6** (5.2)
Adjusted R^2	.54	.44	.42

* Denotes statistically significant at 10%.
** Denotes statistically significant at 5%.

positive, significant, and quantitatively important (rows 21 and 22). The estimated rate of return to education to farmers in our northern Jiangsu Province sample is fairly high. For example, the marginal rate of return to entering the seventh grade, which is equivalent to entering junior high school from elementary school, is 9%, higher than obtained in other studies of rural China. Previous findings on rural China have consistently found rates of return between 0% and 6% (deBrauw, Huang, Rozelle, Zhang, & Zhang, 2002). The rate of return does not fall below 5% in our sample until the student moves from 9th to 10th grade. Our estimated rates of return for 1996 are comparable to those reported for developing countries by Psacharopoulos (1994). In that survey, he shows that the rate of return is 10.1% for the world on average and 9.6% for Asia. Although some earlier studies of China (such as Parish et al., 1995—which focused on all parts of rural China, inland and coastal) found no significant return to education, those done in later periods and those done in the coastal area (e.g., Ho, Dong, Bowles, & Macphail, 2001) find significant and rising returns over time. The

higher rates found in our study also are consistent in level with those reported by Li (2001) for urban China but differ from Li's in that we find that returns fall as the level of education rises. We conclude that our results are reasonable considering that the farmers in our sample have a fairly low stock of education, and hence may have higher marginal returns, and that they live on the edge of one of the China's most prosperous and rapidly growing areas.

The estimation results of the agricultural labor response equation illustrate further effects of education in terms of payoff to farm work. The results reported in Table 8 (rows 3 and 4 show that, although the coefficients on the education variables in the 1992 equation (columns 3 and 4) are insignificant and smaller than those in 1998 (a result that may be driven by the recession that China experienced in 1992), the coefficients on the education variables in 1996 imply that the impact of education is the highest in 1996. Assuming that the marginal product of labor is positive in agriculture (Putterman & Ciacu, 1995; Ye & Rozelle, 1994), individuals with higher education, ceteris paribus, earn more in agriculture due to a higher input of labor.

5. Conclusions

In this paper, we have shown that the role of education is changing over time and that the amount of education is increasingly associated with more favorable labor market outcomes. Our descriptive and multivariate results have shown in a number of ways that those individuals with more education have benefited more from rising opportunities off the farm and those with less education have been hurt more by recession. Education increases the likelihood that individuals participate in the off-farm labor force, find jobs when they are unemployed, and earn a higher wage. In addition, assuming that labor has a positive marginal product in agriculture, education also aids the farmer in his/her on-farm activities. In short, education's reward is increasing. And, the results show that the effect of education is increasingly important as the reforms have proceeded.

The rising returns to education also suggest that labor markets are maturing. In the 1980s, a number of nonmarket factors were instrumental in off-farm employment participation and wage determination. In the 1990s, many of these nonmarket effects have disappeared and human capital is being rewarded.

Our results suggest that investment in rural education is desperately needed. In addition to the additional earnings that rural education contributes to household income, China's emerging labor markets are critical to economic transformation. Labor market also aid in facilitating the demographic and economic shifts from rural to urban and from agriculture to industry.

On the macrolevel, investing in rural education—especially in those areas that currently have poor schools—may also help reduce the inequality that has risen rapidly in recent years. Benjamin and Brandt (1997) have found that education is one of the most inequality increasing factors in rural China in the last decade. Those with human capital have experienced income increases; those without have not. Hence, providing education to those without will also serve to reduce inequality.

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