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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 will 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 will then seek to examine if 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 will examine how returns to education have changed during the course of the reform era. In short, our hypotheses are that if labor markets are increasingly rewarding those with a.) better education job access; b.) easier entry; and c.) higher wages, such outcomes will count as evidence that labor markets are improving. 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.

Employment, Emerging Labor Markets, and the Role of Education in Rural China

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 percent in 1988 to 34 percent in 1995 (Rozelle et al., 1999). By 2000, nearly 200 million people (or about 40 percent 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, and Li, 1995; Rozelle, 1995).

Beyond being a source of income for rural migrants, labor markets play an even more important role in the development process (Todaro, 1976; Stark, 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. 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 non-market 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) demonstrate how some urban firms have become less discriminatory in their hiring practices of those without an urban *hukou* supports the hypothesis that labor markets have improved over time. Zhang, Zhao, and Chen (1995), Rozelle et al. (1999), and SSB (1990 to 2000) and others have documented the explosion of migration and off-farm participation. And, 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 off-farm 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 seek to examine the evolving nature of labor markets.

To meet this goal, we have three specific objectives. First, we will 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 will then seek to examine if 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 will examine how returns to education have changed during the course of the reform era. In short, our hypotheses are that if labor markets are increasingly rewarding those with a.) better education job access; b.) easier entry; and c.) higher wages, such outcomes will count as evidence that labor markets are improving.

Space constraints and data limitations have forced us to narrow the focus of our inquiry in several ways and our relatively localized data set limits the generalizations that can be drawn from the study. First, our study focuses on education and labor supply behavior of the individual and does not consider a number of other traits or institutions that might indicate that labor markets are improving or not. Second, while our data set facilitates an assessment of the evolution of labor markets over time by concentrating on the same set of households, the local nature of the sample limits casual attribution of the findings to all of China. 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. In short, our results should be considered as a careful case study that, while not being able to prove labor market improvements, can contribute to the debate on how China's labor markets have evolved during the reforms. Finally, 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 micro-level, must consider the context within which the household's labor allocations and firm employment decisions are being made.

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 non-farm employment from 67 million to 130 million between 1985 and 1996 (State Statistical Bureau, 1997).

China's Stop and Go Economy

China's economy, however, has not grown at a uniform pace over time, a fact that scholars agree on, but the causes of which 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 cause (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 most clearly manifests itself in employment. During these years, employment has risen and fallen with economic growth. After increasing in the 1980s by more than 8 percent, growth of employment in the manufacturing sector fell to nearly zero during the 1989-91 recession and then climbed again in the mid 1990s. Construction employment, one of the largest employers of rural labor, displayed a similar pattern of employment, rising in the 1980s, slowing as GDP growth declined in 1989 and 1990, and finally growing again once GDP growth rates recovered in the mid-1990s. The economic growth of Jiangsu Province has followed the same general trends found in China (Jiangsu Statistical Yearbook, 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 percent 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 percent between 1988 and 1992 and grew from 16 to 167 percent between 1992 and 1996. A large part of the fall in total income arose due to the fall in off-farm income; off-farm income 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 macro-economic pressures. As the economy sagged in the early 1990s, total off-farm labor employment of our respondents fell by about 20 percent, from 104 to 84 days per year. The opposite employment patterns occurred when the growth of the economy picked up again in the mid-1990s; off-farm labor rose although less than it had originally fallen (Table 1, row 2). In contrast, average agricultural labor use for the total sample jumped by 63 percent during the recession period, increasing from 51 to 83 days per person (row 3). Between 1992 and 1996, when the economy was booming, household labor input into agriculture fell by about 30 percent.

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. Between 1988 and 1992, the real wage rate fell by nearly 30 percent to 4.5 yuan per day. As the economy recovered during the four years after 1992, the average daily wage of our respondents nearly tripled.

Labor Markets, Education, and Work in Rural China

While the rising and falling of off-farm work and wages in our sample households show that the local labor market is clearly influenced by macroeconomic conditions, in the rest of this paper, we want to further extend our analysis of the operation of China's rural labor markets. One way to do so is to examine whether or not hiring, firing, or wage-setting decisions reflect the education differentials among workers. Our hypotheses are that if rural labor markets are improving, we should observe that access to off-farm work improves and wages rise with education and that the relationship should become stronger over time. In this section we first use our data to descriptively examine China's record in providing education to rural households and whether or not labor supply and wages are associated with educational attainment. In the next two sections we build an econometric framework and subject the hypotheses to statistical testing.

Educational attainment in rural China, while high compared to many developing countries, is still relatively low, stagnant over time, and differs between men and women (Table 2). Almost the same as the national average (according a national representative survey that we ran in 2000), the typical sample rural resident between the ages of 16 and 60 attended school between 5 and 6 years. Reflecting past differences in educational investment as well as the ability and willingness of farmers to send their children to school, rural educational levels lag far behind those of urban China (China Statistical Yearbook, 2000). There also is no statistical difference in attainment rates in our rural sample across the years; the nominal differences that appear in the table mainly reflect differences in household composition between the years of the survey and reporting error.

Men (about 6.5 years of education), however, have attained significantly higher levels of education than women (around 4 years).

Our survey data clearly show that education affects the ability of the household to take advantage of off-farm employment opportunities in rural China and that this tendency is rising over time. In all three years of our survey—1988, 1992, and 1996—those individuals with a middle school education and above have 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 is expanding 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 percent. By 1996, however, the difference had risen to more than 100 percent. In contrast, those with less education worked more on the farm (rows 3 and 4) in every period. Interestingly, however, during the 1992 recession period, those with education did increase their annual working days by more than 60 percent.

The relationship between education and wages also has changed during the reform (Table 3, rows 5 to 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. For all age groups, those 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 percent faster annually between 1988 and 1996 for those with higher education levels when compared to those with only elementary schooling.

Our household data also show the effect of education on employment behavior as rural China moves into and out of recession, though the impact is more apparent in the later year of the sample (Table 4). From 1988 to 1992, 37 percent of the individuals exited the labor force, more than the 28 percent that entered. Of these, however, those with more education exited somewhat less (35 percent) than those with less education (39 percent). Such a finding would indicate a slight propensity (in our descriptive data) that those with higher education are better able to buffer themselves from the unemployment effects of a recession. 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 able to take advantage of the employment opportunities and keep themselves from being laid off.

Econometric Analysis

Our strategy for more rigorously testing the changes in the relationship between education and labor market outcomes is to estimate labor participation, entry into the labor market, and wage models for our sample's different years. Holding other factors constant, we first estimate how education has affected participation in and entry into the off-farm sector. 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.

Model Specifications

Off-farm work participation

In this study, a Probit model is used to estimate off-farm work status determinants. The basic form of the model is:

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

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-squared, education and education squared), 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 the differential impact of village characteristics might have on employment participation). We measure education by the number of years of schooling attained. The model will be run three separate times, once for each year of the sample.

Entry model

The second set of equations is used to identify the determinants of entry into the off-farm sector of the sample individuals:

(2) $E = aX_1' + bX_2 + cX_3' + dX_4 + eX_5 + \ldots + e$, for i = 1 and 2

where E is a dummy variable equal to 1 if the individual entered the off-farm sector during one time period (either 1992 or 1996) after being without an off-farm job in the previous period (either 1988 or 1992, respectively). The explanatory variables are similar to those included in the participation model. The sample for the entry analysis is limited to those in the labor force who do not work off-farm at the beginning of either of our two periods of study. We run the analysis separately for the 1988-1992 and the 1992-1996

periods to see if the effect of education on entry changes over time. The coefficients can be interpreted as the probability that entry is increased or decreased.

Wage equation

In order to analyze the determinants of off-farm wages, a Heckman two stage least square model is used.[1] The basic logic is that if we only estimate the wage equation in a single equation model, we might have biased results because the sample does not include those individuals that choose not to work since we do not have wage observations on those who do not work off the farm. But, the behavior of non-working individuals includes information that can help identify the determinants of wages. At the wage that they face in the labor market, such individuals do not choose to supply labor to the market (conditional on all non-wage factors that affect their labor allocation decisions). Our estimation allows us to include all individuals in the analysis.

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

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

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 equation 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).

Agricultural labor allocation equations

We also test whether or not education attainment affects the labor response in agriculture. An ordinary least square equation is used to estimate the determinants of individual agricultural labor allocation, measured in standard labor days (8 hours) per year. In the labor response equation, as in the other equations, measures of human capital, household traits, and gender effects are included. 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 their on-farm use of labor when their off-farm work (or the off-farm work of their families) decline. The model is run for three separate time periods, i.e.1988, 1992 and 1996.

General Performance of the Econometric Models

To implement our testing procedure for the impact of education on employment during times of boom and bust on off- and on-farm employment, we estimate sets of equations for determinants of off-farm work status (Table 5), entry (Table 6), the off-farm wage (Table 7), and the individual's on-farm employment (Table 8). Most of the models perform well in terms of their goodness of fit. The adjusted R-square statistics of agricultural labor supply equation and the wage equations that are estimated by OLS are both above 0.44. 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 also are as expected 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 are indicative of the unequal access of women to job off the farm, a result consistent with many other works (Meng, 1995; Rozelle et al., 1999; Rozelle, forthcoming). In the 1996, we also observed in the off- and on-farm labor participation and entry equations that the coefficient on the linear age variable is positive and that on the squared age variable is negative.

Empirical Results

Taken as a group, the results of the off-farm participation, entry, wage, and on-farm employment equations tell a strong and consistent story with regards to the role of education in rural China. First, 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. As time passed since the onset of the reforms, however, education clearly is being rewarded increasingly.

The off-farm labor participation equations clearly illustrate the increasing importance that labor markets place on human capital in rural China (Table 5). In 1988, the signs on the education variables are insignificant, implying that jobs were given to people in our sample irrespective of their educational level. In contrast, the coefficient on the two village dummy variables demonstrates that in 1988 the community in which one lived was an important determinant of an individual's off-farm job status. By 1996, however, the situation had reversed. Those with high levels of schooling clearly had a greater probability of getting an off-farm job. In 1996 village characteristics, however, do not matter. By the mid-1990s, education is playing a positive role in allowing farmers to participate in China's rural off-farm labor market.

The entry analysis provides additional evidence of the rising importance of education in the ability of an unemployed (or never employed) individual to enter into the off-farm labor market (Table 6). Education did not help an individual who did not work in 1988 to find a job by 1992 (columns 1 and 2, rows 3 and 4). Between 1992 and 1996, however, education began to play a significant role in helping those who were unemployed (in 1992) to find a way to enter the off-farm labor force (by 1996). For every additional year of education, farmers had a 6 to 10 percent greater chance of finding an off-farm job.

The results embodied in the wage equations demonstrate that the role that education is playing in the determination of wages is also rising 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 and 4; 19 and 20). However, the coefficients on variable that interacts the 1996 year dummy and education shows that in 1996, the effect of education on wages has emerged (rows 21 and 22).

The coefficients on the wage variable imply that the rate of return to education to farmers in our northern Jiangsu Province sample is fairly high. The rate of return of increasing education from 6^{th} to 7^{th} grade, or from having a student continue onto junior high from elementary, is 9 percent, a rate that is high in comparison to other studies in rural China. The previous findings on rural China have consistently found rates of return between 0 and 6 percent. The rate of return does not fall below 5 percent in our sample until the student moves from 9^{th} to 10^{th} grade.

Our findings on the return to investment in schooling, while high, may not be so out of line with previous studies. Our estimates for 1996 are similar to those of developing countries, summarized in Psacharopoulos (1994). In that survey, he shows that the rate of return is 10.1 percent for the world on average and 9.6 percent for Asia. Moreover, for rural China, although some earlier studies (such as Parish, Zhe, and Li, 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 et al., 2001) find significant and rising returns. The higher rates found in our study also are consistent in level with those for urban China (e.g., Li, 2001), but differ in the fact that we find that returns fall as the level of education rises. In sum, however, our results may be reasonable when considering the fact that we are studying at a group of farmers who have a fairly low stock of education (and hence may have higher marginal returns) and who live on the edge of one of the China's most dynamic and rapidly growing areas.

Finally, the results of the agricultural labor response equation also show an alternative way that education increasing affects the number of days that farmers invest in work on the farm (Table 8, rows 3 and 4). 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 (Ye and Rozelle, 1994; Putterman and Ciacu, 1995), individuals with higher education, ceteris paribus, earn more in agriculture due to a higher input of labor.

Conclusions

In this paper, we have shown that the role of education is changing over time and that higher 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 and those with less education have been hurt more from rising opportunities off the farm. Most poignantly, education increases the propensity of individuals to participate in the off-farm labor force, find jobs when they are unemployed, and earn a higher wage. In addition, as long as 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 non-market factors were instrumental in off-farm employment participation and wage determination. In the 1990s, many of these non-market effects have disappeared and human capital is being rewarded.

As a result, our results are consistent with the policy suggestion that investment in rural education is desperately needed. In addition to the additional earnings and employment access that rural education contributes to household income, China's emerging labor markets may be contributing to a faster transformation of the economy. Better labor markets will be the engine of the demographic shift from rural to urban and from agriculture to industry.

On the macro-level, 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. In a more macro-sense, if inequality also leads to instability, investment in the education of those that have historically attained lower levels of education will help mitigate the trend towards greater inequality.

References

Benjamin, Dwayne, and Loren Brandt. 1997. "Land, Factor Markets, and Inequality in Rural China: Historical Evidence." *Explorations in Economic History*. 34:460-494.

Cook, Sarah. 1999. "Surplus Labor and Productivity in Chinese Agriculture: Evidence from Household Survey Data." *Journal of Development Studies*. 35 (3 Feb.):16-44.

Ho, Samuel, Dong, X-Y, Bowles, P. and F. MacPhail, 2001, "Privatization and Enterprise Wage Structures During Transition: Evidence from China's Rural Industries", forthcoming, in *Economics of Transition*.

Johnson, D. Gale, 1995. "Is Agriculture a Threat to China's Growth?" Working Paper No. 95:04, Office of Agricultural Economics Research, University of Chicago, April 1995.

Knight, John and L. Song, 2001. "Urban Hiring Practices and Rural Migrants in China," Paper Presented at the Hong Kong University Science and Technology, Division of Social Science workshop on the Evolution of China's Rural Economy in the 21st Century, Clear Water Bay, Hong Kong, June 2001.

Li, Haizheng, 2001, Economic Transition and Returns to Education in China, unpublished manuscript, School of Economics, Georgia Institute of Technology, Atlanta, GA.

Lin, Justin Yifu. 1992. "Rural Reforms and Agricultural Growth in China." *The American Economic Review*. 82(1 March):34-51.

Liu, Shouying, Michael Carter, and Yang Yao. 1998. "Dimensions and Diversity of Property Rights in Rural China: Dilemmas on the Road to Further Reform." *World Development.* 26**(**10 October):1789-1806.

Lohmar, Bryan, 1999. "The Role of Institutions in Rural Labor Flow in China." Unpublished Ph.D. Dissertation, Department of Agricultural and Resource Economics, University of California, Davis, CA, 1999.

Mallee, Hein. 2000. "Agricultural Labour and Rural Population Mobility: Some Observations." In Loraine A. West and Yaohui Zhao, Eds., Rural Labor Flows in China, Berkeley: University of California Press, 2000.

Maurer-Fazio, Margaret. 1999. "Earnings and Education in China's Transition to a Market Economy: Evidence from 1989 to 1992." *China Economic Review*. 10**(**1 Spring):17-40.

Meng, Xin. 1990. "The Rural Labor Market." Chapter in William A. Byrd and Lin Qingsong, eds., China's Rural Industry: Structure, Development, and Reform. World Bank: Washington DC.

_____. 1995. “The Role of Education in Wage Determination in China’s Rural Industrial Sector.” *Education Economics.* 3(3):235-247.

Naughton, Barry. 1995. “China’s Macroeconomy in Tranistion.” *The China Quarterly*. 144 (December): 1083-1104.

Parish, William L., Xiaoye Zhe, and Fang Li. 1995. “Nonfarm Work and Marketization of the Chinese Countryside.” *The China Quarterly*. 143 (September):697-730.

Psacharopoulos, G., 1994 Returns to Investment in Education: A Global Up-date, *World Development*, 22: 1325-1343.

Putterman, Louis and Anna Ciacu, 1995. “A Review of Production Function Estimations in China,” *China Economic Review* 1995

Rozelle, Scott, Amelia Hughart, and Linxiu Zhang. 1998. “Migration, Gender and Wage in Rural China.” Working paper, Department of Agricultural and Resource Economics, University of California at Davis.

Scott Rozelle, Xiao-yuan Dong, Linxiu Zhang, and Andrew Mason. Forthcoming. “Opportunities and Barriers in Rural China: Gender, Work, and Wages in Rural China.” *Pacific Economic Review*.

Rozelle, Scott, Guo Li, Minggao Shen, Amelia Hughart, and John Giles. 1999. “Leaving China’s Farms: Survey Results of New Paths and Remaining Hurdles to Rural Migration,” China Quarterly 158 (June 1999): 367-393.

Rozelle, Scott. 1995. "Stagnation Without Equity: Changing Patterns of Income and Inequality in China's Post-Reform Rural Economy," *The China Journal* 35(January):63-96.

Stark, Oded. 1976. “Rural to Urban Migration and Some Economic Issues: A Review Utilising Findings of Surveys and Empirical Studies Covering 1965-1975 Period.” Working Paper, World Employment Programme Research Series, International Labour Office, Geneva, Switzerland. 1976.

State Statistical Bureau. 1997-2000, various issues. *Zhongguo Tongji Nian Jian, 1997* [China Statistical Yearbook, 1997]. State Statistical Press: Beijing, China.

State Statistical Bureau. 1997. *Jiangsu Tongji Nian Jian, 1997.* [Jiangsu Statistical Yearbook, 1997]. State Statistical Press: Beijing, China.

Todaro, Michael, 1976. Internal Migration in Developing Countries: A Review of Theory, Evidence, Methodology and Research Priorities. Geneva, Switzerland: International Labor Office, 1976.

Yang, Dennis and Hao, Zhou, 1996. “Rural-Urban Disparity and Sectoral Labor Allocation in China.” Research Papers in Asian Pacific Studies, Duke University, Durham, North Carolina, 1996.

Ye, Qiaolun and Scott Rozelle. 1994. "Fertilizer Demand in China's Reforming Economy," *Canadian Journal of Agricultural Economics*. 42(May 2):191-208.

Yusuf, Shahid. 1994. “China’s Macroeconomic Performance and Management During Transition.” *Journal of Economic Perspectives*. 8(2 Spring):71-92.

Zhang, Xiaohui, Zhao, Changbao, and Chen, Liangbiao. 1995. “1994: Nongcun Laodongli Kua Qutu Liedong di Shezheng Miaoshu.” [1994: A Real Description of Rural Labor’s Cross-regional Flow]. *Zhanlue Yu Guanli* [Strategy and Management]. 6:30-35.

Zhu, Xiaodong, and Loren Brandt. 1995. “Soft Budget Constraints and Inflation Cycles: A Positive Model of the Post Reform Chinese Economy.” Working Paper, Department of Economics, University of Toronto (October).

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 hours) per person.

Table 2. Level of education for rural population between 1988-1996

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)

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

Table 3. Education, labor market participation, and wages in rural China, 1988 to 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 & above	4.3	4.3	11.7
Middle aged	Primary school	10.2	5.5	14.7
	Middle school & above	4.0	4.5	20.9
Old aged	Primary school	11.0	5.7	4.5
	Middle school & above	4.9	7.7	6.3

[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.

Source: Authors' survey.

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

Year	1988-92	1992-96
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.

Table 5. Determinants of off-farm labor participation in rural China, 1988-96

	Dependent variable: Off-farm labor participation					
	1988		1992		1996	
	dF/dx[a]	z	dF/dx	z	dF/dx	z
Number of observations	295		332		305	
Human capital						
Age	2.1	(1.31)	4.8**	(3.03)	6.4**	(3.61)
Age squared	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 squared	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	0.49831		0.39759		0.47213	
Pred. P	0.49798		0.37989		0.42847	

[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.

Notes: 1) ** denote statistically significant at 5%, * denote statistically significant at 10%.

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

3) Probit model included a constant, but coefficient not reported.

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 squared	0.0	(0.02)	-0.1**	(-2.65)
Education	3.2	(1.26)	15.1**	(3.82)
Education squared	-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	0.19022		0.32203	
Pred. P	0.16450		0.18732	

[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.

Notes: 1. ** denote statistically significant at 5%, * denote statistically significant at 10%.
2. Dummy variable results represent the effect of a discrete change from 0 to 1.
3. Probit model included a constant, but coefficient not reported.

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

	Wage equation[b]		Participation equation (Probit)	
	n= 928[c]			
Human capital				
Age	0.11**	(3.82)[d]	0.04	(1.22)
Age squared	-0.00**	(3.33)	-0.00	(1.58)
Education	-0.02	(0.40)	0.01	(0.16)
Edu squared	-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*year92	-0.06	(1.16)	0.09*	(1.78)
Age^2*year92	0.00	(1.16)	-0.00*	(1.67)
Age*year96	0.02	(0.38)	0.09*	(1.76)
Age^2*year96	-0.00	(0.70)	-0.00	(1.82)
Education*year92	0.02	(0.22)	0.10	(1.12)
$Education^2$*year92	-0.00	(0.08)	-0.01	(1.19)
Education*year96	0.22**	(1.94)	0.32**	(3.02)
$Education^2$*year96	-0.01*	(1.78)	-0.02**	(2.59)
Constant	-0.23	(0.38)	-0.03	(0.04)

[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-square of the OLS version of the wage equation was 0.49.

[c]Number of observations.

[d]z- statistics given in parenthesis

Notes:

1. ** denotes statistically significant at 5%, and * denotes 10% level of significance.
2. Dummy variable results represent the effect of a discrete change from 0 to 1.

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

	Dependent variable: Labor days per year					
	1988		**1992**		**1996**	
No. of observations	293		330		304	
Human capital						
Age	8.90**	(10.4)	16.74**	(10.5)	11.82**	(9.8)
Age squared	-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 squared	-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 squared	0.54		0.44		0.42	

Notes: ** and *denote statistically significant at 5% and 10%, respectively.

Endnotes

[1] 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 equation 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.