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Moving toward markets? Labor allocation in rural China

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Abstract

China's economic reforms have brought rapid growth in rural off-farm employment, raising questions about the assumption that rural China is labor surplus and has poorly functioning factor markets. We investigate this by testing for separability between household labor demand and supply using panel data. We find that separability is rejected overall, indicating that factor markets remain underdeveloped. Nonseparability, however, is associated with labor surplus in some areas and labor shortage in others. Moreover, separability holds where substantial employment opportunities exist in the wider township, suggesting that such employment promotes competitive allocation within villages as well as the inter-village movement of resources.
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1. Introduction

In China farm production is carried out by households that both demand and supply labor. If these households are able to exchange land and labor freely through reasonably competitive factor markets, then the amount of labor used in production would in theory be independent of their consumption and labor supply considerations. This independence is referred to as "separability." Separability is made possible by the exchange of land and/or labor: if the desired supply of household labor exceeds the

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profit-maximizing level of labor input in production, then the household can hire labor out or rent more land; if household labor supply is less than this amount of labor input, then the household can hire labor in or rent out land. By allowing households to achieve their desired levels of work and leisure while employing the profit-maximizing amount of labor in production, exchange permits an efficient allocation of resources among farms.

Separability is a relevant issue for China because of questions regarding the structure of rural labor markets and employment. The conventional view is that, despite substantial economic reforms in rural China, the development of factor markets has lagged (Lin, 1988). Underdeveloped factor markets may constrain households' ability to exchange land and labor, and so generate nonseparability. Moreover, many observers inside and outside China believe that China is characterized by surplus, underemployed rural labor (Cook, 1996; Knight and Song, 1995, 1996; Taylor, 1988).[1] Surplus labor goes hand in hand with nonseparability, as in a typical surplus labor economy households with underemployed family members work their land more intensively and so interlink their labor supply and demand decisions.

Evidence of substantial shifts in China's rural employment, however, raises questions about the conventional characterization of employment and labor markets (Parish et al., 1995). The government has actively supported development of nonagricultural production, especially by township and village enterprises (TVEs), so as to provide employment for the perceived labor surplus (Du, 1988). Nonagricultural employment in rural China has indeed grown rapidly. Employment in TVEs has grown from 30 million in the early 1980s to about 130 million in the late 1990s (National Bureau of Statistics, 1997, p. 400, 2001, p. 40). Private and individual sideline businesses, which have also benefited from economic reform policies, now employ over 40 million workers in rural areas (National Bureau of Statistics, 2001, p. 40). Rural-to-urban migration has been a third, but not fully sanctioned, form of labor absorption. One source estimates the stock of rural migrants in cities in 1993 at about 39 million people (Knight and Song, 1995, p. 114, citing the Rural Development Institute). By the early 1990s, then, these three forms of off-farm employment provided over 200 million jobs, as compared to China's rural work force of about 500 million workers (National Bureau of Statistics, 2001, p. 40).[2]

Classical two-sector models of development predict that growth in nonagricultural employment can cause a transition from a low-income, labor-surplus economy to a high-income economy where labor use in both rural and urban sectors is allocated through markets and determined by market wages (Lewis, 1954; Fei and Ranis, 1964). Recent trends in China suggest that this process is taking place. Indeed, Rawski and Mead (1998), after calculating revised estimates of China's agricultural work force, conclude that "labor market behavior of farm households contributes to an emerging

[1] Estimates of surplus labor in rural China range from 120 to 150 million (Cook, 1996, p. 28; World Bank, 1997, p. 45), equivalent to 25–30% of the rural work force.

[2] Rawski and Mead (1998) point out that the official statistics probably understate the actual transfer of rural workers into nonagricultural employment.

national market that links supply and demand for urban as well as rural workers (p. 776).'' This alternative view maintains that rural household behavior is increasingly linked to markets, suggesting that labor supply and demand decisions may now be separable.[3]

In this paper we pursue these issues empirically by testing for the presence of separability using panel data from a survey of Chinese farm households. The data set covers the years 1990–1993, by which time progress in the reform of rural policies and growth in off-farm employment had been substantial both nationwide and in the survey locale. The survey locale is Zouping County, a rural county in Shandong Province with trends in overall growth, income and employment that are reasonably typical for North China. While care must be taken in generalizing from the experience of one county, analysis of these data provides useful evidence on whether and how the reforms have affected the allocation of labor in farming.

Our empirical approach builds on the work of Benjamin (1992), who tests for separability by examining whether labor demand in household farming is a function of household size and composition. Under separability, household labor demand should be independent of these consumption-side variables. Using relevant estimation techniques for panel data, we find that labor demand is a function of household size and composition and therefore reject the hypothesis that labor demand and supply are separable. The rejection of separability is robust to alternative specifications that address econometric issues of endogeneity, measurement error, omitted variables, and aggregation of different types of labor. These results suggest that, despite considerable progress in market reforms, in the early 1990s rural households in China apparently still faced difficulties transferring labor and land optimally in response to changes in household size and composition.

We go further, however, and use the separability test to explore the factors associated with nonseparability. Here we take advantage of the cross-village variation in our data set. Since nonseparability is thought to be related to surplus labor, we divide the sample into three groups based on land per capita in the villages. We find that separability is rejected not only for households in villages that are relatively land-scarce, but also in villages that have relatively abundant land. The only group for which we cannot reject separability is that within villages with medium amounts of land. These results are at odds with the conventional surplus labor story.

Since the development of off-farm employment is thought to create the conditions for separability, we also divide the sample based on the nature of off-farm employment in the villages. Here we find evidence of separability for households in areas with substantial township-wide nonagricultural employment, but not for households in villages with only within-village nonagricultural employment. As discussed below, these results raise some questions about China's rural employment policies.

[3] Note that nonseparability could persist even in economies without surplus labor and with relatively developed labor markets due to supervision costs, imperfect information, and other imperfections in the labor market (see, for example, Binswanger and Rosenzweig, 1984). Benjamin (1992), however, finds separability in rural Indonesia despite the possible presence of such imperfections.

2. Testing for separability and model specification

Separability of production and consumption greatly simplifies empirical analysis of farm production or consumption behavior, and so empirical studies usually assume that separability holds. Empirical studies that do not make this assumption and test for separability are relatively few.[4] One approach to testing for separability involves estimating a profit or labor demand function and including independent variables that should in theory influence consumption but not production. Tests of the significance of these variables reveals whether separability holds. Thus, Pitt and Rosenzweig (1986) estimate farm profits as a function of farmer health status, and Benjamin (1992) estimates the demand for labor in household farm production as a function of household demographic variables.

Here we follow Benjamin (1992) and estimate the demand for labor in farm production as a function of household size and composition. Our empirical model is:

$$\ln L_{jt} = \alpha + \gamma \ln A_{jt} + \delta_0 \ln n_{jt} + \sum_{i=1}^{D} \delta_i \frac{n_{jt}^i}{n_{jt}} + \sum_{i=1}^{K} \theta_i D_{it} + \sum_{i=1}^{M} \zeta_i X_{it} + \mu_j + \varepsilon_{jt}$$
$$j = 1, \ldots, J;\ t = 1, \ldots, T \tag{1}$$

where L is labor demand defined as total person-days used on land cultivated by the household, A cultivated land area, n household size, n^i household structure variables (such as the number of adult females, elderly, and children in the household), D_{it} year, village, and year*village dummy variables, X_{it} additional variables included to control for land quality and human capital,[5] μ_j an unobserved household component that is fixed over time, and ε_{jt} an error term. J refers to the number of households and T to the number of time periods. The coefficient δ_0 gives the elasticity of labor demand with respect to household size, and the coefficients δ_i capture the response of labor demand to changes in household composition. The null hypothesis is that $\delta_0 = \delta_i = 0$ for all i. Rejection of the null hypothesis implies nonseparability.

Panel data allow us to augment the usual across-household information with variation within households. Below we argue for the use of fixed-effects methods to estimate this equation in order to eliminate any unobserved time-invariant household components, μ_j. The use of panel data in combination with fixed-effects restricts the identification of the household composition coefficients to within-household variation in composition and labor use, as opposed to the more commonly used across-household variation when only cross-section data are available. In this case, then, the test of separability asks whether changes in a household's composition over time influence its labor demand.

[4] Examples include Lopez (1984, 1986), Pitt and Rosenzweig (1986), Benjamin (1992), Jacoby (1993), and Skoufias (1994). Only a few studies examine issues related to separability in China (Benjamin and Brandt, 2002; Brandt and Benjamin, 1997; Cook, 1996; Sicular, 1986).

[5] Research by Sicular (1995) suggests that in China nonseparability may be related to procurement quotas and related market restrictions. Therefore, we estimated specifications that included independent variables measuring quota levels for grain and cotton. These variables were uniformly insignificant, so we do not report the results. Their insignificance could be explained by lack of variability over time and/or by correlation with the time and location dummy variables.

The validity of this test depends on the consistency of the estimates of the δ's. Potential problems that can occur in the above specification include endogenous explanatory variables, correlation between the unobserved components of labor demand and household size or structure, and bias due to aggregation of different types of labor. Endogeneity is a possible issue for the cultivated land area variable, because decisions regarding land and labor use may both be determined by other common factors not captured in the regression. In Section 5 we investigate this issue using an instrumental variable's approach.

Correlation between the error component of labor demand and household size or structure could occur due to measurement error or omitted variables. Measurement error might be due to the mis-measurement of labor use or household composition or, in the case of panel data, the mis-measurement of the timing of changes in household composition relative to labor use. Errors of this type bias the household composition coefficients toward zero, making the acceptance of separability more likely.

Omitted variables that are correlated with the household composition variables are more problematic because the direction of the bias is unknown.[6] Such unobservables are likely to affect estimation of labor demand in rural developing areas, where differences among households in human capital, land quality, and other relevant variables may be substantial and difficult to measure. Two approaches are available to address this problem. The first tries to minimize the problem by adding available controls related to land quality and household human capital, as well as for regional variation. The second uses instrumental variables.

In our analysis we mainly follow the first approach and include village and time effects as well as land quality, age and education variables as controls. In addition, because we have panel data, we can go further. If the omitted variables are time-invariant unobserved household characteristics—the μ_j in Eq. (1)—then the omitted variable bias can be removed by using fixed-effects estimation. One caveat is that if, in addition, there exist transitory unobserved factors affecting labor demand and household composition, then fixed-effects estimation does not eliminate omitted variable bias completely. We control for transitory effects at the village level using village∗year dummy variables in the fixed-effects estimation; however, within villages some transitory factors could remain at the household level. In Section 5 we approach this problem using instrumental variables.

The dependent variable in our empirical model is total person-days used by the household in cultivation. This variable is a simple aggregate of different types of labor—male adult, female adult, and non-adult. If different types of labor supply different levels of efficiency or are not perfect substitutes in production, then our results could be biased. We consider this possibility in Section 5.

Finally, the estimation of labor demand functions requires reasonably complete and accurate price and especially wage data. In the context of rural developing areas, however, such data are often problematic. In these areas the structure of prices and wages can be complex, varying across seasons and among types of workers (e.g., male and female, long-term versus short-term). Furthermore, rural labor markets are typically characterized by a variety of wage payment schemes (Binswanger and Rosenzweig, 1984). These features of

[6] Omitted variables cause a problem even if they are not correlated with any explanatory variables, because their omission biases the standard errors upward and so possibly leads to false acceptances of separability.

rural developing areas complicate the choice of appropriate wage and price variables for use in estimation. Our analysis is further complicated by the fact that the majority of our households have missing information on wages, as only 20% of the households hire in labor and only half hire labor out.

Since we do not have adequate wage or price data, we rely on the village, year, and village*year dummy variables mentioned above to mitigate difficulties arising from complex price and wage structures. Within a particular locale at a particular time, the prices for goods and wages for labor of identical quality should be uniform. Village and time dummy variables therefore capture some of the influence of prices and wages on labor demand. In addition, controlling for household level unobserved heterogeneity captures household-specific differences in labor quality and other variables that are constant over time. Under reasonable assumptions, then, the inclusion of location and time dummy variables in conjunction with fixed-effects estimation makes wage and price variables redundant.

3. The survey data and economic setting

The data used in this study are from a stratified random sample of 259 farm households in 16 villages in Zouping County, a county situated south of the Yellow River in central Shandong Province.[7] The survey followed the households over 4 years (1990–1993), providing 1036 observations. After eliminating observations for households that did not engage in cultivation or for which data are missing, the sample contains 258 households and 1015 observations.

While this data set is relatively small, it has desirable features. Zouping remains one of the few counties to which foreign researchers have been granted access to conduct an independent survey directly supervised by the researchers. The survey questionnaire was designed by the researchers and tailored to provide rich information on a wide array of economic, social, and political variables. Close supervision and careful consistency checks ensured data of relatively high quality. In addition, the panel nature of the data makes it unusual.

Official statistics show that Zouping is an unexceptional rural county.[8] Zouping experienced rapid economic growth during the 1980s, but its per capita GDP in the early 1990s was still 18% below the national average. In 1990–1993, the time period of the survey, the income of rural households in the county averaged 701 yuan per capita (in constant 1990 prices), slightly below the national average of 717 yuan. Rapid development of nonagricultural activities in the county has caused agriculture to decline in importance

[7] The data were collected through an independent survey organized by Terry Sicular and Jonathan Morduch (New York University). See Cook (1996), chapter 3, and Sicular (1998) for a discussion of the survey and survey sample.

[8] National-level information in this paragraph is from National Bureau of Statistics (1994); county and township statistics here and elsewhere were provided by the Zouping County government. Zouping's GDP per capita in 1990 was 1280 yuan and in 1993 2303 yuan (current prices). For a more extensive description of the county, see Cook (1998b), Sicular (1998), and Walder (1998).

Table 1
Descriptive statistics from the Zouping survey

	Sample average, 1990–1993
Household income per capita	1165
Share of income from:	
agriculture	0.73
of which: crop cultivation	0.66
nonagriculture	0.26
Household size	3.97
Share of population that is working-age (18–65)	0.69
Share of working-age population that is male	0.51
Share of population that is below age 18	0.26
Share of population that is above age 65	0.04
Average years education of working-age adults	5.44
Average age of working-age adults	36.5

Notes:

1. This table gives averages for 258 households over 4 years, or over 1015 observations. A few households did not remain in the sample for the full 4 years of the survey. Observations are weighted by the ratio of the village sample size to the village population in order to correct for sampling bias among villages.
2. Income statistics are in constant 1990 yuan. Shares of income from different sources sum to one for individual households, but average shares over all households shown above need not sum to one.
3. The relatively low mean level of education reflects generational differences in schooling.

as a source of income and employment. In 1990 agriculture contributed 56% of county GDP, but by 1993 agriculture's share had fallen to 30%.

For Zouping's rural households, however, agriculture has remained the major source of income, contributing more than two-thirds of net income in the early 1990s. Cultivation of wheat, cotton and corn accounts for the majority of agricultural output value. Regarding employment, official statistics for the county show that the share of the rural labor force employed in agriculture declined from over 90% in 1980 to 76% in 1993. This shift in employment is close to that for rural areas nationwide, for which the agricultural share of the rural labor force declined from 94% in 1980 to 75% in 1993.

The survey sample captures key features of the county (Table 1). Between 1990 and 1993 net income (in constant prices) of households in the sample averaged 1165 yuan.[9] During these 4 years the share of household income from agriculture declined, but agriculture remained by far the dominant income source, on average contributing over 70% of household income. Cultivation of crops alone accounted for two-thirds of household income.[10] Among working-age individuals in the surveyed households, 97% undertook some agricultural work, 66% worked only in agriculture, and 34% engaged in

[9] This number is larger than that given by the official sources cited above, but the two numbers are calculated differently and so not directly comparable. For example, the official figures for net income of rural households value retained grain at below-market planned prices, while the survey figures value such output at market prices. The official figures also subtract depreciation and new purchases of productive assets, while the survey figures do not.

[10] Note that the sample does not include urban residents, so agriculture plays a larger role for the sample households than for the county as a whole.

nonagricultural work, either in wage jobs or household-run private businesses (Cook, 1998b).[11]

Since our empirical test relies on changes in household size and structure, some discussion of these variables is in order. In the survey a household is defined by place of residence: a household consists of a group of individuals who reside for 1 or more months of the year in the same house or residential compound. In theory households can contain individuals who are not relatives, but in practice this is rare. Most households in the sample consist of nuclear families—parents with children, and, less frequently, a married couple living alone. The sample also contains inter-generational households of older married couples that live with a son, daughter-in-law and grandchildren, or households composed of younger married couples living with their children and one or both parents.

Due to changing family planning policies and preferences, family size has declined over time. Young couples start a family immediately, with the first child usually born within 1 or 2 years of marriage. Current policies in Zouping permit a second child with spacing after the birth of the first. These practices are reflected in the average household size for the sample of 3.97, equal to the county average. The dependency ratio (ratio of nonworking-age household members to working-age household members) for the sample is about 0.3. Although government policies strongly discourage higher-order births, our sample contains a few couples who have had a third or even a fourth child since 1980, when the government adopted strict limits on family size.

Changes in household size and structure occur as the result of aging, birth, death, or marriage. Aging affects household structure and labor supply when children mature, finish school and become full-time working members of the household, and when older adults become less active economically.[12] Births increase and deaths reduce household size. Marriage of an adult child typically reduces the number of adult workers in a household, but in cases where newlyweds reside with their parents, marriage increases household size through the addition of a daughter-in-law to the household.[13]

Table 2 presents data from our sample on such changes in household composition. Change in household composition is measured by changes in the population of the household and by changes in the fractions of working-age men and women, elderly, and children. Of the 258 households in the sample, 132 (52%) report one or more such changes in household composition during the 4 years of the panel. Most common are changes in the fractions of children and adult men and women. More than three-quarters of the households that report changes in the fraction of children had a child enter working age

[11] These statistics are for 1990. As discussed in Cook (1998b), the survey data give higher nonagricultural employment levels than the official statistics because the survey identifies individuals who work in more than one activity.

[12] We treat household members below the age of 18 as children and above the age of 65 as elderly. Household members aged 18–65 are treated as working-age adults. Eighteen is used because it is the usual age of completion for senior middle school. By 18 most children in our sample have completed or left school. Males tend to leave school between the ages of 16 and 18, while females leave between 14 and 18. In the data we find very little labor is performed by non-adult members (children or elderly): less than 3% of all households employ non-adult labor.

[13] Marriage customs are patrilocal and consequently the addition of a son-in-law to the household of a bride's family is rare.

Table 2
Changes in household composition among sample households (258 households, 1015 observations)

Change in:	Number of households	Number of observations
Household size and/or composition	132 (52%)	180 (18%)
Household size	80 (31%)	96 (9%)
Fraction of adult males	102 (40%)	131 (13%)
Fraction of adult females	113 (44%)	143 (14%)
Fraction of children	116 (45%)	152 (15%)
Fraction of elderly	36 (14%)	45 (4%)

Notes:

1. If a household reports one or more changes in family size, or in the fraction of adult males or females, children, or elderly in the household, it is counted as having a change in household size and/or composition.
2. Household size is the number of people resident in the same house or residential compound for 1 or more months during the calendar year.
3. Adults include individuals of ages 18 to 65, inclusive. Individuals below age 18 are counted as children and above age 65 as elderly.

(18–65). Less than one-quarter of the households that report changes in the fraction of children experienced an increase due to the birth of a new child. Changes in the fraction of adult men and women are also largely due to older children entering working age. About one-third of the households report a change in household size during the 4 years of the survey. Changes in household size occur for a variety of reasons, including death of a parent, birth of a child, and marriage in or out. No single factor dominates, but death of a parent and departure of an adult child are more common than births and the addition of a daughter-in-law.

Since nonseparability is likely to be driven by incomplete factor markets, in Table 3 we present some indicative statistics on land and labor exchange and use in cultivation. Cultivated land area in the sample is 7.19 *mu* per household, close to the county average.[14] This land area consists largely of what we call the land ‘‘endowment,’’ that is, collectively owned land allocated to the household by the village through the household responsibility system. In some villages endowment land also includes some reclaimed land or former private plot area. National laws state that all rural households have rights to receive land from the village under the household responsibility system. This land was initially allocated by the village on a per capita basis, and cultivation rights usually are linked to a contract that requires the household to pay the agricultural tax and fulfill a grain quota. National laws mandate that households have the right to cultivate this land for 15–30 years, and cultivation rights can be transferred to other households or passed from parents to children.

Actual land area cultivated differs from the ‘‘endowed’’ area because households transfer land among themselves and with their villages. For example, households that do not want their full allocation of contract land from the village may transfer the land to another household or simply return the land to the village. Households that want additional land sometimes make arrangements to transfer in land from another household or rent

[14] 7.19 *mu* equals approximately 1.2 acres. The county average is 6.64 *mu* per household, but this is calculated over both rural and urban households.

Table 3
Land and labor used in cultivation by sample households

	Sample average, 1990–1993	Standard deviation		
		Overall	Between	Within
Total cultivated land area (*mu*)	7.19	3.36	3.13	1.22
Of which:				
land "endowment" (*mu*)	6.83	2.66	2.58	0.62
land transfers (*mu*)	0.44	1.95	1.63	1.06
Share of households transferring land in or out	0.11	–	–	–
Total labor use (days/year)	442	238	205	121
Of which:				
male	210	137	119	69
female	236	136	115	73
Of which:				
family	438	238	205	120
non-family	4	13	9	10
Share of households using non-family labor	0.19	–	–	–

Notes:

1. This table gives averages over 258 households over 4 years, or a total of 1015 observations. A few households did not remain in the sample for the full 4 years of the survey. Standard deviations give the variation between and within households.
2. Cultivated land includes land "endowments" (land allocated by the village under the responsibility system, private plots, reclaimed land) plus (or minus) additional land transfers between-households or between the households and villages (e.g., bid or *toubiao* land). Land "endowments" are so-called because households have the right to cultivate this land (see discussion in the text). A total of 15 *mu* equal 1 hectare; 6.07 *mu* equal 1 acre.
3. Labor use is measured in standardized 8 hour days.
4. Non-family labor includes both hired labor and labor exchanged between households without compensation.

additional land from the village. Some villages auction or lease to individual households collective land that has not been distributed to households under the responsibility system, for example, former collective orchards or vegetable plots.

Such transfers constitute the beginnings of a market for land, but at the time of the survey, the extent of land transfers in Zouping remained small. Only 11% of households in the survey sample engaged in such transfers, and the average transfer was less than 6.4% of the average land endowment. Furthermore, land transfers among households often did not involve any rental payment. The receiving household, however, was usually responsible for meeting any quotas and paying any taxes associated with the land. This lack of a land market appears to characterize much of rural China (Brandt et al., 2002).

The survey data also suggest that labor markets, like land markets, are as yet underdeveloped. A noticeable share—20%—of households use non-family labor in cultivation, but the amounts used are small. On average only 1% of labor used for cultivation is non-family labor. Moreover, two-thirds to three-quarters of this non-family labor is unpaid labor exchanged informally among households. Such exchange often occurs among relatives living in distinct households, say, between parents and their adult children, or between families of adult siblings. In these regards Zouping is similar to other rural areas in China.

While the descriptive statistics in Table 3 suggest that factor markets are underdeveloped, they do not tell us why. One explanation could simply be that, since the distribution of land in Chinese villages is fairly equal on a per capita basis, the need for exchange is minimal. Another explanation, however, could be that barriers such as policies inhibiting trade or the absence of legal mechanisms for enforcing land and labor contracts impede exchange. In this case the lack of exchange is likely associated with nonseparability.

4. Testing for separability

Regression results from three different specifications of Eq. (1) are shown in Table 4. Column 1 shows results from pooled cross-section regression. The second and third

Table 4
Demand for labor in cultivation: base regression results

	Pooled cross-section OLS		Random-effects		Fixed-effects	
Log household size	0.494***	(0.112)	0.588***	(0.074)	0.492***	(0.119)
Female adult fraction	0.173	(0.159)	−0.073	(0.131)	−0.563***	(0.189)
Elderly fraction	−0.824***	(0.226)	−0.942***	(0.158)	−1.140***	(0.244)
Children fraction	−0.645***	(0.104)	−0.680***	(0.099)	−0.679***	(0.180)
Log cultivated land area	0.439***	(0.110)	0.298***	(0.059)	0.100	(0.075)
Number of plots	−0.011	(0.016)	−0.017	(0.013)	−0.014	(0.015)
Fraction of land that is flat	−0.640	(0.477)	−0.389	(0.329)	−0.222	(0.350)
Fraction of poor land	−0.039	(0.133)	−0.007	(0.094)	0.002	(0.109)
Fraction of good land	0.103	(0.063)	0.032	(0.046)	−0.022	(0.053)
Fraction of land with poor irrigation	0.018	(0.111)	0.074	(0.140)	0.109	(0.151)
Fraction of land with good irrigation	−0.135	(0.103)	−0.068	(0.081)	−0.027	(0.093)
Average adult education	−0.019*	(0.010)	−0.022**	(0.009)	−0.037***	(0.014)
Average adult age	−0.001	(0.002)	−0.001	(0.002)	−0.005	(0.004)
R-squared	0.73		0.47		0.49	
Test of the null hypothesis of separability	$F(4,257)=28.48$		$\chi^2(4)=135.44$		$F(4,694)=8.24$	
Number of obs./households	1013/258		1013/258		1013/258	

Dependent variable: ln of person-days.
Notes:

1. All regressions include time, village, and time*village dummy variables.
2. Standard errors are in parentheses.
3. Standard errors for the pooled cross-section estimates are calculated using the Huber/White estimator of variance.
4. *R*-squared statistics for the random- and fixed-effects regressions are for within-household variation.

* Indicates significance at the 10% level of confidence.
** Indicates significance at the 5% significance level.
*** Indicates significance at the 1% level of confidence.

columns present results from random-effects and fixed-effects estimation, respectively. Choice among these specifications depends on the nature of the unobserved household heterogeneity. Pooled cross-section yields unbiased results in the absence of household unobservables, random-effects if the household unobservables are uncorrelated with the regressors, and fixed-effects if the household unobservables are correlated with the regressors.[15]

As discussed earlier, unobservable household characteristics are likely to affect estimation of rural labor demand. For this reason random- or fixed-effects methods of estimation are most appropriate. Comparison of the results of the random- and fixed-effects specifications leads us to favor the fixed-effects specification. While these specifications tell the same basic story with respect to separability, they do not give identical results for the household composition variables. Most notably, the coefficient on the adult female variable is small and insignificant in the random-effects specification (as well as in the pooled cross-section specification). In the fixed-effects specification, however, the coefficient on adult females increases in magnitude and becomes significant. This pattern of results suggests that household composition is likely correlated with the unobserved household component.[16]

Regardless, all specifications in Table 4 give the same results regarding separability. The household size and composition variables are, for the most part, highly significant individually. Test statistics indicate that they are jointly significant at the 1% level of confidence in all the regressions (bottom panel of Table 4). These findings support rejection of the null hypothesis of separability.

For most other variables the results are also similar across the specifications. Significant coefficients occur for education. Its significance and magnitude in absolute value terms increase as one moves from pooled cross-section to random-effects to fixed-effects, perhaps reflecting some correlation with household unobservables. The negative effect of education may reflect that workers with more education work more efficiently. Alternatively, if educated workers have a greater chance of obtaining off-farm employment, then households with more educated workers would face a relative shortage of workers and so use less labor in cultivation. Also, as a group the location and time dummy variables are highly significant.[17] Their significance indicates the importance of village and time effects.

Land is significant in the pooled cross-section and random-effects estimations, but not in the fixed-effects estimation. This difference likely reflects the fact that the first two

[15] The pooled OLS, random-effects and fixed-effects specifications require time homogeneity in the parameters. In view of the substantial change occurring during China's reform, the parameters might change over time. We investigated time homogeneity for the household size and composition parameters using a first-differences approach and assuming a linear time trend in the δ's. Tests showed that the time trend components of the δ's were not significantly different from zero, implying that the δ's do not differ significantly across time periods. This may reflect the relatively short time span of the panel.

[16] Note that the Hausman test did not reject the random-effects specification. Yet, given the probable correlation between the unobserved components and the household composition variables—our main variables of interest—we prefer the fixed-effects estimates.

[17] Due to space limitations, the coefficients on the time, location, and time∗location dummy variables are not reported in the tables.

specifications make use of the between-household variation, and land shows nearly three times as much between- as within-household variation (Table 3).[18]

Focussing on the household composition variables, we note that the coefficient on household size is positive. This indicates that larger households employ more labor in cultivation, which is consistent with the theoretical prediction that under nonseparability adding a person to the household should increase the household supply of labor and so lower the shadow price of labor. While this elasticity is less than one, it is nevertheless fairly large—about 0.5—implying that a 10% increase in household size would increase labor use in cultivation by about 5%, or that increasing household size by one member increases labor use by 12% or 54 person-days at the mean.

The other household coefficients—the fractions of female adults, elderly and children—are also significant, indicating that household composition, not just size, influences labor use in production.[19] These coefficients are difficult to interpret directly, so in Table 5 we present the implied elasticities for these variables calculated using the fixed-effects results.[20] The elasticities for adult males and females are large and statistically significant. Adding an additional adult male to the household increases labor use by 24% or 106 person-days at the mean, and adding an additional adult female increases labor use by almost 10% or 38 person-days. This less than one-to-one increase in adult work time in cultivation when an adult is added to the household likely reflects reallocation of time between cultivation and other activities.

The smaller impact of adult females reflects the net result of the positive effect of increasing household size and negative effect of increasing the share of adult females. This smaller impact could be explained in several ways. First, the adult female coefficient reflects the response of labor use to variation in the fractions of adult males and females, and the main source of this variation is the maturation of sons and daughters into adulthood. Daughters leave school and begin to work in the fields at an earlier age than sons, so that reaching age 18, the age of completion for senior middle school, shows less of an effect.[21] Second, household time budget studies have

[18] Given the rules governing land allocation discussed earlier, it is likely that cultivated land and household demographic variables are multicollinear. To investigate this possibility, we ran the fixed-effects estimation excluding all household demographic variables and then excluding only household size. In both cases, land is significant with the coefficient increasing to 0.163 (0.068) in the first case and 0.220 (0.070) in the second. However, in the second regression the household composition variables remain significant ($F(3,695) = 5.20$), showing that nonseparability is robust to this specification change. Since changes in household size are only partially correlated with land changes and exhibit considerably more within-household variation than land, we maintain the specification that includes both household size and land.

[19] Note that in our specification, one category of household members must be omitted. Here we omit the share of adult males in the household.

[20] The formula for the elasticities is $\eta_{L,n^i} = n^i\left[\delta_0 + I^*\delta_i - \sum_{j=1}^{D}\delta_j n^j/n\right]\Big/ n$ where I is an indicator function equal to 0 if household category i is the omitted category of adult males and 1 otherwise (Benjamin, 1992, p. 304).

[21] As noted in an earlier footnote, we find evidence of females leaving school earlier than males in our data. This type of measurement error will bias the effect of changes in adult females toward zero. Thus, our results likely understate the effects of household composition, particularly the fraction of adult females, on labor demand. Despite this potential bias, the coefficient is still significant.

Table 5
Implied elasticities of labor demand with respect to household composition variables

(A) Elasticity of labor demand		
Male adult share	0.322***	(0.065)
Female adult share	0.118***	(0.050)
Elderly share	−0.010	(0.010)
Children share	0.062*	(0.036)
(B) Percentage change in labor demand (%)		
Male adult	24	
Female adult	9	
Elderly adult	−5	
Child	6	
(C) Level change in labor demand (person-days)		
Male adult	106	
Female adult	38	
Elderly adult	−22	
Child	25	

Notes:

1. Panel A presents elasticities of labor demand with respect to the household composition variables, which are shares of household size. Panel B gives the percentage change in labor demand in response to an increase of one additional household member in each category. Panel C gives the level change in labor demand (in person-days) in response to increasing each category by one person. The formula for the elasticities can be found in footnote 20. All figures are calculated with respect to mean values using results from fixed-effects specification in Table 4.
2. Standard errors are in parentheses.

* Indicates significance at the 10% level of confidence.
** Indicates significance at the 5% level of confidence.
*** Indicates significance at the 1% significance level.

shown that wives/mothers take on the burden of substantial child-rearing and domestic work in addition to their usual work in the field, especially when children are young. When a daughter matures, then, she may take on some of the mother's workload. The daughter's increased work time may be offset in part or in whole by the mother's reduced work time, thus yielding little net change in total labor use in the field.

Children and elderly household members have smaller effects on labor use. The addition of a child increases labor use by 6% while the addition of an elderly person decreases labor use by 5%. While an extra child requires care and so may divert time from other uses, it also increases the number of mouths to feed and so may induce the parents to work more hours in the field. The desire to increase income and consumption by working more hours apparently dominates. The small, and insignificant, change for elderly members could reflect the fact that our analysis does not distinguish between two types of elderly people, those who are healthy and contribute labor to the household, and those who are not healthy, require care, and divert time from farm production.

5. Robustness

As discussed earlier, the current specification could suffer from endogeneity or omitted variable problems. The key variables of concern in this regard are cultivated land area and the household variables. One way to correct such bias is to use instrumental variables with the fixed-effects specification. This approach requires the presence of good contemporaneous instruments. A second approach is to use a first-differences specification, which allows lagged values of the regressors as instruments. Lagged values are predetermined and so are unaffected by current, demand-related shocks.[22]

For land we tried both approaches. First, we estimated a fixed-effects model with contemporaneous instruments (land endowment, cotton and grain quotas), and then we used a first-differences model with lagged levels of land, the grain quota, and the cotton quota for instruments. The finding of nonseparability was robust to both approaches and Hausman test results indicated land could be treated as exogenous.

For the household variables, the only available instruments were lagged values, so we used only the first-differences approach. When instrumenting household size and composition, we found that lagged differences performed better as instruments than lagged levels. Here our results again showed evidence of nonseparability–household size and the fraction of children remained significant, albeit only at the 10% level, and the Hausman test did not reject the null hypothesis that the household variables are uncorrelated with the error term.[23] In view of these findings, we conclude that in our sample the evidence for endogeneity and omitted variable bias associated with transitory shocks is weak. For these reasons, and because with fixed-effects we can control for potentially important transitory effects at the village level using village∗year dummy variables, in the remainder of the paper we use the fixed-effects specification.

In the above specifications total labor demand L is the sum of all person-days used in cultivation in a year regardless of the type of labor—male, female, adult or non-adult. This aggregation is only appropriate if these different types of workers supply the same efficiency units of labor and are perfect substitutes in production.[24] We first consider differences in efficiency, in which case labor demand should be specified as

$$L^* = L_M + \alpha_F L_F + \alpha_N L_N \tag{2}$$

where L^* is the total efficiency units of labor demanded; L_M, L_F, L_N are the labor units (person-days) of adult males, adult females and non-adults, respectively; and α_F (α_N) are the efficiency conversion factors for converting adult female (non-adult) labor into efficiency units. The efficiency factor of male labor has been normalized to 1. Under the null hypothesis of separability, L^* is not a function of household composition variables, but L may be. Thus, rejection of separability can stem from an inappropriate aggregation of labor units.

[22] We thank an anonymous referee for suggesting this approach.

[23] The instrumental variable results are available upon request from the authors. It should be noted that the household composition specifications suffer somewhat from low power. The use of lagged differences as instruments eliminates 2 years of the 4-year panel, which reduces the already small number of changes in the household variables (the changes needed for identification) by approximately half.

[24] We also disaggregated labor use between peak and slack seasons and found nonseparability holds in both seasons. All aggregation results are available upon request from the authors.

Estimates of labor demand using efficiency units of labor with α_F equal to 0.79 and α_N equal to 0.5 yielded the following conclusions.[25] First, the rejection of separability was robust to the efficiency units specification. Second, the coefficients on the household structure variables did not significantly differ, individually or jointly, from those in our base specification.[26] Thus, while the efficiency factors appear to be different from 1, aggregation on a one-to-one basis does not appear to significantly bias our coefficients or lead to a false rejection of separability.

A second possible cause of aggregation bias in the labor demand estimates is if male and female labor are not perfect substitutes. In this case, the production function should be specified as having three inputs: land A, male labor L_M, and female labor L_F.[27] In this case the demands for male and female labor should be estimated separately, and under separability neither should be influenced by household demographic variables. Note that unless the markets for both male and female labor are separable, one should expect to find that household composition variables affect both types of labor, and, therefore, the tests for male and female labor only provide information about the workings of the entire labor market.

The following conclusions emerged from estimating separate male and female labor demand functions. First, tests of the equality of the coefficients in the male and female specifications rejected the hypothesis that the male and female labor demand coefficients are equal, indicating that male and female labor are not perfect substitutes in production. With regard to separability, tests of the hypothesis that the coefficients on all household structure variables equal zero rejected the null hypothesis at the 1% level of confidence for both male and female labor. Thus, nonseparability is robust to disaggregation by gender. Since the results using efficiency factors for gender and age were not significantly different from the base specification and nonseparability holds for both male and female labor, in the remainder of the paper we simply use total person-days as our measure of labor demand.

6. Understanding the causes of nonseparability

The results discussed above provide robust support for nonseparability of household labor supply and demand decisions. They do not, however, provide information about the

[25] Estimates for the adult efficiency factors can come from wage data, as under separability market wages reflect productivity differentials, or by direct estimation (Benjamin, 1992, p. 317). Our choice of α_F equal to 0.79 for the male–female wage differential came from Zouping County data on the average village wages of unskilled males and females. For α_N, we followed the common practice of treating the elderly and children as half as efficient as adult workers. As a check on these choices, we also estimated the factors directly. The estimates implied factor levels of $\alpha_F = 0.81$ and $\alpha_N = 0.40$, levels very close to our chosen factors. To determine the sensitivity of the results to the choice of these factors, we also conducted the analysis for a range of efficiency factors. We allowed α_F to vary between 0.7 and 0.8 and α_N to vary between 0 and 0.5. In all cases, separability was rejected. Note that estimates of the female–male wage differential in rural China usually fall in the range of 0.6–0.9 (Hare, 1999; Parish et al., 1995; Meng, 1998).

[26] Only when α_N is set equal to zero do we find a significant deviation between the results with and without efficiency factors, and in this case only the coefficient on the share of children changes significantly.

[27] Because the fraction of non-adult labor is small, we do not treat it as a separate input, but rather separate it by gender and combine it with the measures of female and male labor.

factors underlying nonseparability. As discussed in the introduction, surplus labor is often closely associated with nonseparability. Since the extent of surplus labor in rural China depends on the amount of arable land per capita, we explore the relationship between surplus labor and separability by grouping households according to land availability in their villages. If land quality and other variables are held constant, surplus labor should be more severe in villages with less land per capita than in villages with more land per capita. The labor-surplus view would suggest that even though nonseparability characterizes the county, separability could occur in villages that have more land per capita.

Nonseparability can also be affected by the development of off-farm labor markets. The Chinese government has adopted reforms to promote the development of nonagricultural activities in rural areas. The resulting substantial growth in nonagricultural employment has the potential to create the conditions for separability of household production and consumption decisions. Uneven development of off-farm employment among villages in our sample permits us to investigate this proposition.[28] Our hypothesis is that separability could exist in those villages where households have significant access to off-farm employment.

Ideally, we would like to investigate the issues of land/labor ratios and off-farm employment simultaneously, but unfortunately, the number of villages in our sample is insufficient. Still, below, we gain some insights into the relationship between land availability and off-farm employment by examining which villages fall into the different groups.[29]

6.1. Labor surplus and separability

To analyze the impact of surplus labor on separability, we divide the sample into three groups based on land availability. Land availability is determined using village-level statistics obtained from interviews with village leaders on average amounts of cultivated land per capita. The division of households into groups is therefore not based on data from the household survey.[30] Group I consists of households in villages with, on average, less than 1.5 *mu* per capita; group II of households in villages with between 1.5 and 2 *mu* per capita; and group III of households in villages with more than 2 *mu* per capita. These cut-offs were chosen in line with the observed clustering of land amounts among the villages, and they divide the sample into three groups of roughly equal size (groups I and II each contain 320 observations, and group III contains 390 observations).[31]

[28] See Cook (1998b) for a discussion of differing employment patterns among villages in the survey.

[29] Note that Benjamin and Brandt (2002) similarly identify land availability and off-farm employment as variables that have a significant effect on the labor use of Chinese farm households.

[30] In addition, place of residence is largely determined by family history and exogenous. When grown children form new households, they locate in the groom's village, and collective ownership of land prevents the movement of established households between villages. Therefore, selection into these groups is not an issue.

[31] In rank order from small to big, the average amount of land per capita for each village was: 0.94, 1.05, 1.12, 1.36, 1.41; 1.57, 1.63, 1.647, 1.652, 1.72; 2.10, 2.11, 2.14, 2.23, 2.29, and 2.35 *mu*. Note that land area per capita varies geographically within the county, with villages in northern townships having more land than villages in southern townships.

Table 6
Fixed-effects estimates of labor demand: by groups

	(A) Grouped by cultivated land per capita	(B) Grouped by development of off-farm employment
Log household size I	0.488** (0.204)	0.418*** (0.145)
Log household size II	0.187 (0.213)	1.028*** (0.252)
Log household size III	0.505*** (0.171)	0.153 (0.253)
Female adult fraction I	− 1.531*** (0.359)	− 0.144 (0.247)
Female adult fraction II	0.136 (0.419)	− 1.351*** (0.390)
Female adult fraction III	− 0.239 (0.282)	− 1.021** (0.473)
Elderly fraction I	− 0.764 (0.487)	− 0.922*** (0.295)
Elderly fraction II	− 0.427 (0.497)	− 2.126*** (0.528)
Elderly fraction III	− 1.282*** (0.399)	− 1.061 (0.837)
Children fraction I	− 0.981*** (0.277)	− 0.454** (0.216)
Children fraction II	0.115 (0.379)	− 1.712*** (0.424)
Children fraction III	− 0.721*** (0.259)	− 0.317 (0.384)
R-squared (within)	0.5	0.5
Test of null hypothesis I	$F(4,686) = 6.54$	$F(4,686) = 4.41$
Test of null hypothesis II	$F(4,686) = 0.95$	$F(4,686) = 6.86$
Test of null hypothesis III	$F(4,686) = 5.02$	$F(4,686) = 1.32$
Number of obs./households	1013/258	1013/258

Dependent variable: ln of person-days.
Notes:

1. To conserve space, only the family structure variables are reported here. All specifications also include the land, land quality, age and education variables, as well as the time and location dummy variables.
2. Standard errors are in parentheses.
3. Definitions of the groups I, II and III can be found in the text.

* Indicates significance at the 10% level of confidence.
** Indicates significance at the 5% significance level.
*** Indicates significance at the 1% significance level.

Regressions were estimated over the whole sample, but the household size and composition variables are now group-specific. This permits comparison of their estimated coefficients among the groups.[32] The regression results appear in Table 6, column A. Equality of the household coefficients across the groups is rejected at the 5% level of significance ($F(8,686) = 2.08$), suggesting that the three groups are different. As expected, the household composition variables are significant for households in villages that are land-scarce (group I) and thus prone to surplus labor. They are also significant, however, for households in villages that are land-abundant (group III). The only group for which separability cannot be rejected is that containing villages with medium-sized land endowments (group II).

These findings are not those implied by the simple labor-surplus story. One interpretation is that they reflect an environment where labor surplus in some localities coexists

[32] Note that variation in household size and composition variables is spread fairly evenly among the three groups, so that within-household variation in the household structure variables is sufficient for identification.

with labor shortage in other localities. While households in land-scarce villages face surplus labor, households in land-abundant villages face labor shortages. This situation would arise if inter-village labor and land markets are underdeveloped, preventing substantial exchange of labor and land among households in the different locales. Separability for households in the middle group could reflect that these households operate near the corner solution, so that separability can be achieved by exchanging small amounts of labor or land. Such exchanges can be carried out through informal arrangements within villages or between neighbours even where factor markets are not well-developed. Indeed, studies have found that in most regions households rarely use labor from outside the village (except for the occasional exchange of labor with families of daughters-in-law or wives from other villages), and that village land is rarely rented to or cultivated by people from outside the village. Even nonagricultural employment within villages is usually limited to village residents.[33]

6.2. Off-farm employment and separability

We capture differences in the development of off-farm labor markets by dividing the sample into three groups based on the extent of nonagricultural employment in the village or township.[34] The first group contains those households in villages with little or no off-farm employment, private or collective, either within the village or in the township (I). The second contains those households in villages with significant collective and/or private nonagricultural employment within the village (II). The third contains those households in villages located in townships that provide substantial nonagricultural employment beyond the boundaries of the village (III).[35] We differentiate between these last two groups so as to capture the potential differences between villages with only local, within-village employment opportunities and villages where households also have access to a wider off-farm labor market. Our hypothesis is that households in group I would be characterized by nonseparability, and households in groups II and III by separability.

[33] Cook (1998a,b) and author interviews, Zouping County. In Zouping village collectives make an exception to the rule of employing only people from within the village if no villagers want additional jobs or if they need technical expertise that is not available within the village. Technical experts, however, usually come from urban areas rather than from other villages in the county. In this regard Zouping resembles other parts of China (Parish et al., 1995).

[34] These groupings are not based on data from the household survey but on information from interviews at the village and county levels. Note that Zouping County contains 18 townships, about 860 villages, and a rural population of 620,000. Townships typically encompass between 35 and 80 villages, and villages usually contain 200 to 300 households.

[35] Four villages are located in townships that report nonagricultural employment near or exceeding 50% of total employment (47%, 47%, 50% and 73%). Households in these villages belong to category III. Three villages report the presence within the village of collective or private enterprises that jointly employ 100 or more people in one or more years. Households in these villages belong to category II. Nine villages report zero or near-zero employment in collective and private enterprises within the village, and also are located in townships where nonagricultural employment is well below 50% of total employment (12% to 42%). Households in these villages belong to category I. Note that one village in group III also has a relatively high level of village employment (II). Testing revealed that category III was the appropriate classification for this village.

As above, regressions are estimated over the whole sample, but the household variables are allowed to vary among the three groups.[36] The regression results appear in Table 6, column B. Equality of the coefficients across the groups is rejected at the 5% level of significance ($F(8,686) = 2.22$). Household composition variables are significant for categories I and II, but not III. That is, nonseparability prevails in villages with little or no off-farm activity, and also in villages with off-farm activities within the village. Separability is not rejected for households in villages located in townships with substantial off-farm employment.

These results suggest that separability depends on the development of employment opportunities outside the village. Why would this be so? One explanation is that employment within villages is not allocated through competitive market mechanisms. Collective enterprises within villages are often managed by village-level officials who reportedly allocate jobs on the basis of political and social criteria. When hiring employees, village leaders may give preference to their relatives, or if concerned about equity within the village they may give preference to poor households or distribute jobs equally among households. Similarly, village leaders have the power to promote or hinder private enterprises within the village, and so within-village employment opportunities in the private sector may also be driven by nonmarket criteria (Cook, 1998a,b; Ho, 1994; Yao, 1999).

Village leaders' control over job allocation within the village, however, can be eroded by competition from outside the village. If nonagricultural job opportunities are available in the wider township, and if village residents have relatively competitive access to those jobs, then labor allocation within the village will be influenced by market forces from the outside. Such opportunities could take the form of employment in township collective enterprises or of casual wage labor in the wider area. By the early 1990s, farmers in some parts of the county reported that casual or temporary work was available in sectors such as construction and transportation for whomever wanted such jobs, without the need for personal or political connections (Cook, 1998b).

A second factor that could underlie our empirical results is that, as mentioned above, the main barriers to the exchange of labor (or land) are those between villages. In the absence of well-developed factor markets, within-village reallocation of labor can still be carried out by village leaders who can make adjustments in land allocations and hire employees for village enterprises, or by informal exchange among neighbor households. These sorts of informal intra-village reallocation mechanisms, however, do not function well between villages. If nonseparability is largely caused by barriers to factor movement among villages, then the development of nonagricultural employment within a village would not necessarily eliminate nonseparability. The development of factor markets that transcend the villages is needed to promote separability and the efficient allocation of labor.

How do these results relate to our earlier finding that separability is related to land availability? Comparison of the village groupings reveals that most of the villages with small amounts of land per capita have off-farm employment opportunities either within the village or in the wider township. Villages with medium amounts of land display the full

[36] Within-household variation in household size and composition variables is again spread fairly evenly among the three groups and so is sufficient for identification.

range of off-farm employment characteristics, that is, some have none, some have such employment within the village, and some have off-farm employment opportunities in the wider township. Land-abundant villages largely fall into a single employment grouping: all but one have no off-farm employment.[37]

This pattern of groupings suggests that off-farm employment tends to develop in areas where land is in short supply and labor is under-employed on the farm. That is, the presence of surplus labor provides an environment conducive to nonagricultural development. If this interpretation is correct, then generalizations about surplus labor in rural China and the single-minded emphasis on off-farm employment to absorb the surplus are overly simplistic. Such generalizations overlook areas where land is relatively abundant. In land-abundant areas, off-farm employment is unlikely to develop, and, in any case, in such areas off-farm employment is not the solution. Once again, these findings indicate that the underlying problem is not surplus labor per se, but the lack of mechanisms for the exchange of factors across village borders.

7. Conclusions

In this paper we test for separability between labor supply and demand decisions in rural China and investigate the factors underlying separability. Our overall results reject separability. These results are robust to estimation of alternative specifications that address possible econometric problems. The fact that we have panel data allows us to control for unobserved heterogeneity using fixed-effects estimation. Controlling for unobserved heterogeneity does not change the basic finding of nonseparability for our sample, but it does affect the size and significance of individual coefficients for certain household composition variables and so indicates the need for panel data when estimating household labor demand and supply in rural developing areas.

Our finding of nonseparability implies that in the early 1990s factor markets in a typical rural county in northern China remained underdeveloped despite more than a decade of economic reform and market liberalization. The conventional view that rural areas are characterized by surplus labor, however, appears to oversimplify the situation. Our results suggest that while some localities have a labor surplus, others may face labor shortages. Labor-surplus localities appear to have benefited from the development of off-farm employment opportunities, but it is not enough for a single village to develop off-farm employment internally. Separability is only found in areas where off-farm employment opportunities transcend village boundaries. Labor-scarce localities are less likely to develop off-farm labor markets, and in these areas, such employment opportunities would not necessarily eliminate nonseparability.

These complexities raise questions about the simple labor-surplus story, and they indicate that the more fundamental problem is the absence of mechanisms that facilitate labor and land transfers among villages and localities. What is needed, then, is not just the development of off-farm employment, but policies promoting the exchange of factors across-village borders.

[37] The exception has off-farm employment within the village but not in the wider township.

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