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The Elderly, Capital, and Late Transition Farming in China

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Introduction

Rural China has changed dramatically since the beginning of the 1990s. Whereas the primary sources of off-farm employment for rural households were traditionally local jobs and self-employment, internal labor migration grew quickly throughout the 1990s, becoming the largest off-farm sector in rural China by 2000 (de Brauw et al., 2002). In particular, younger workers have begun to leave in large numbers. Migration has a much larger effect than local off-farm work on the fabric of household production, because migrants can no longer physically participate in household farm production. Yet since rural households still have less than complete property rights over land, almost all households continue to farm.

Households could be responding to the decline in available laborers in one of several different ways. One might think that China's farmers have simply begun to decrease farm production. Yet according to China's National Statistics, total farm output and the value of farm production continued to grow throughout the 1990s (NBS, 2002). A significant productivity increase would explain these joint observations, but Jin et al. (2002) report modest agricultural productivity increases. Therefore, two explanations remain. Since migrants tend to be younger rural residents, it could be that other demographic groups have taken on a larger burden on the farm. If off-farm opportunities are more available for men than women, then it migt be likely that women are taking over the farming. Whereas press reports in China have proclaimed a "feminization of agriculture," de Brauw (2004) finds no trend of increasing farmwork among women. It could be that agriculture is being mechanized rapidly, and households use capital for tasks previously performed with labor. Alternatively, the agricultural labor force could be aging rapidly. If the latter were true, even in certain areas, it would have profound implications for the welfare of the elderly, particularly as their numbers increase.

The objective of this paper is explain changes in labor demand in China's agricultural sector, and to begin to explain how the value of China's agricultural output has not fallen despite changes in inputs. In meeting this objective, we will be able to understand whether or not women or the elderly are taking over a larger portion of the farmwork. To meet

this objective, I will use two microeconomic data sources. First, I will use a panel of 1840 households from the China Health and Nutrition Survey (CHNS), which were collected in seven different provinces in 1991, 1993, and 1997. These data contain limited farming information, but detailed labor allocation information. Second, I will use the China National Rural Survey (CNRS), collected in 1199 rural households, which include a great deal of information about farming and labor allocation in the cross-section.

The paper will meet these objectives as follows. First, I will describe the data sets and their limitations in more detail. Second, I will examine agricultural patterns in more detail, using national statistics as well as the two data sets introduced above. The following sections will present my econometric methods and results. The final section will conclude.

Data

The data for this study primarily come from two sources. The first data source that will be used in the paper are from the China Health and Nutrition Survey (CHNS), collected by researchers at the University of North Carolina at Chapel Hill in 1991, 1993, and 1997.[1] I will use data that were collected in the rural households in the sample in seven provinces: Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, and Shandong. Each cross-section includes roughly 2,000 households, and I construct a panel of 1840 households that were tracked in each of the three surveys. Because suburban villages and county towns are both included in the sample, the proportion of households that farm is lower than in the CNRS described below.

The CHNS asked a detailed set of questions about labor allocation by each household member. Regarding agriculture, the CHNS asked how many hours per day, days per week, and months per year each individual worked in the garden (vegetable plots near the house), on the farm, on livestock, and in fishing. However, the survey did not account for differences in time allocation across agricultural seasons. Further information about the household's farming activity was relatively incomplete. For example, questions about

[1] I omit the data collected in 1989, because the questions on time allocation are not comparable to the questions asked in the following three periods. Although the CHNS website says that the 1997 data should not be used as part of the panel, I matched them up by hand.

the household's landholdings were brief. In the 1991 survey, households were asked how much land they cultivated to the nearest tenth of a *mu*; in 1993 and 1997, they were asked to the nearest *mu*.[2] The survey only asked about an aggregate amount spent on inputs, and did not directly ask about crops grown by the household. It did ask abotu self-produced consumption, so I was able to obtain information about specific crops growth through the consumption data.

The second data set, the China National Rural Survey (CNRS), was collected in a randomly selected, nearly nationally representative sample of 60 villages in Hebei, Liaoning, Shaanxi, Zhejiang, Hubei, and Sichuan Provinces during November and December of 2000.[3] To ensure broad coverage within each province, one county was randomly selected from within each income quintile for the province, as measured by the gross value of industrial output. Two villages were randomly selected within each county. The survey teams used village rosters and a census of households not included in the village's list of households to randomly choose the twenty households; both households with and without residency permits (*hukou*) in the village were included. A total of 1199 households were surveyed.

The CNRS gathered information on household demographics, labor allocation, agricultural production, and non-farm activities. Several parts of the survey were designed to learn about the household's participation in labor markets over time. For roughly half of the households surveyed (610 out of 1199), a twenty-year employment history form was completed for each household member and each child of the household head.[4] For each year between 1981 and 2000, the questionnaire tracked each individual's participation in farm and off-farm employment, the main type of off-farm work performed, the place of residence while working (within or outside the village), the location of off-farm employment, and whether or not each individual was self-employed or wage earning. All individuals who worked were coded as either working on the farm full time, part time, only during the

[2]Old footnote about conversion.

[3]The data collection effort involved students from the Center for Chinese Agricultural Policy, Renmin University, and China Agricultural University. It was led by Loren Brandt of the University of Toronto, Scott Rozelle of the University of California at Davis, and Linxiu Zhang of the Center for Chinese Agricultural Policy.

[4]The survey asked these questions about all children of the household head, even if they were no longer considered household members. The subsample asked about the employment history was randomly chosen.

busy season, or not working on the farm at all. Time rearing small amounts of livestock (e.g. one pig or a small flock of fowl) were counted as housework rather than as farming.[5]

The CNRS also collected detailed information about each household member's on-farm work in 2000. After asking whether or not they worked on farm, each household member was asked about the number of weeks they worked on the farm during the busy and slack seasons, the number of days they worked in each season, and the hours spent working on the farm on a typical day in each season. By adding up the number of hours they worked overall in the busy and slack seasons, the number of hours each individual in the household worked on the farm in 2000 can be calculated.

The CNRS included much more detailed farming information than the CHNS. It completely enumerated the five largest plots held by the household, including the area to the nearest tenth of a *mu*, yield, irrigation status, and quality. All smaller plots were aggregated by crop, and the same information was gathered. Finally, the survey enumerated inputs in detail, including any hired labor, fertilizers, and the rental of any services.

Farming Patterns in the 1990s

Nationally published statistics show that China's agricultural production increased over the 1990s (NBS, 2002; Figure 1). By 2001, the gross value of agricultural output (GVAO) in China had increased 50% over 1991 in real terms. Although grain production has roughly stagnated over the same period, the increasing value of farm product indictaes that farmers have continued to farm intensively over the 1990s.

Accompanying the increase in value of output has been a change in the input mix. The available measures of the primary two inputs, sown area and labor, have barely changed since 1991. Whereas sown area increased slightly between 1991 and 2001, the number of agricultual laborers in China has decreased slightly. Therefore, changes in sown area and labor cannot help explain the GVAO increase.

A casual look at trends in other inputs indicates that technical change does not ac-

[5]Since the CHNS asked a detailed set of questions about time allocated to livestock rearing, to minimize differences I only use the time spent farming as a measure of labor demand for the household, to ensure consistency between the two data sets.

count for the total increased value of output either. Specicially, fertilizer use and machinery inputs have increased dramatically as well. Fertilizer use increased by roughly 50%, mirroring the increase in output value. It seems likely that increased fertilizer intensity helps explain the GVAO increase. However, the most striking change is in the stock of agricultural machinery available in rural China. The aggregate power of agricultural machinery, measured in kilowatts, nearly doubled between 1991 and 2001. Therefore, it seems possible that China's farmers have begun to substitute capital for labor in their farming technology. One might be able to attribute some of the increase in output value to machinery as well.

This brief description of China's national statistics implies that it is unlikely that farm labor is increasing in the aggregate in China. In the remainder of the paper, I will argue that the labor allocated to farming has decreased even more than the aggregate statistics indicate, and that the burden of agricultural labor does not fall on any specific demographic group. Since labor demand is in general decreasing, technology is slowly improving (Jin et al., 2002), and we cannot attribute the entire increase in GVAO to fertilizer, I argue that capital must be more important to China's farming methodology than it was at the beginning of the 1990s. Little is known about the determinants of capital use by households, because it is difficult to define (Benjamin and Brandt, 2002). The CNRS is perhaps uniquely able to estimate demand for one type of capital among households, capital in the form of custom service rentals. Therefore I investigate the determinants of service rental in a later section.

Farm Labor Allocation, 1990 to 2000

To investigate farm labor allocation over the 1990s, I use the panel constructed with the CHNS and augment it with the CNRS in 2000. The CHNS households show that the amount of time that the typical household allocates to farming decreased substantially between 1990 and 1996 (Table 1).[6] In 1990, the average household reporting any farming activity reported working 2568 hours on the farm, whereas the average dropped to 1468 hours by 1996, or by around 40%. Although these averages are a strong indication that farm labor inputs decreased over the 1990s, the decrease may not have been so large. Households may

[6]The CHNS asked questions about the previous year's farming and labor allocation, so the labor allocation in the 1991 survey corresponds to the actual allocation in 1990, and so forth.

have systematically overestimated the amount of farmwork they did in the early 1990s, simply because there were few other activities in which they could productively work. As off-farm participation had increased by 1996, people might more accurately account for their time. However, it is unlikely that they were overreporting by 1000 hours a year per household. Nor could household members have been responding to different questions, as the wording was the same in each of the three surveys.[7] A final explanation might be that there is a strong cohort effect in the data, and older cohorts tend to spend less time on the farm. However, if that were true one would observe a smaller decline in the repeated cross-section, which has less of a cohort bias. Exactly the same pattern is found in the repeated cross-section (not shown).

The burden of agricultural labor has not shifted to women, either (Table 1, rows 2 and 4). Whereas women did 1293 hours of farmwork in the average household in 1990, by 1996 they did only 700 hours. Between 1990 and 1996, the average proportion of farmwork done by women decreases from 51.9% to 49.6%. These findings would refute the increasing feminization of agriculture claimed by some (e.g. Song and Jiggins, 2000).

Though women are not taking on a larger share of farmwork, the elderly could be (Table 1, rows 3 and 6). Although the average hours spent by the elderly on the farm declines from 261 hours to 205 hours, the percent of total household hours spent by the elderly on the farm increases from 9.4% to 13.9%. In this case, the averages are somewhat deceiving. Only 222 households in 1991 have any elderly members farming, which increases to 267 households by 1996. The elderly only do 50% or more of the farmwork or more in half of those households in both years. Since the panel ages six years, at least part of this effect may be a cohort effect. The repeated cross-section though shows the same pattern, as with total farm hours. Given the small increase in the share of hours worked by the elderly, it could be that in a small proportion of households, the elderly are taking over more of the farm burden. As China's demographics continue to change, this finding may be quite important.

To further examine the labor allocation of the elderly to farming, I look at the retrospective labor histories in the CNRS. They have a different problem. Since they were

[7]The 1989 survey was dropped from this analysis because the wording and pattern of questions about labor allocation changed between the 1989 and 1991 surveys.

collected in 2000, they may form representative samples of their villages in 2000, but not in 1990, as some households would have dissolved or passed away. Furthermore, some members of existing households may have farmed in 1990 but had died by 2000. Finally, I can only tell how many laborers were working on the farm, not the intensity. The first is the most pressing problem, as the proportion of the sample that is over 55 in 1990 is only would be considered elderly is 5.9%, whereas the National Bureau of Statistics found 10.3% of China's population was elderly in 1990 (NBS, 1999). That figure includes urban areas, and so it should be taken as an upper bound as life expectancy is longer in China's urban areas. Therefore the difference between the two should be taken as an upper-bound.[8]

Despite these problems, the data show a similar pattern; the elderly seem to be doing a larger share of farmwork (Figure 2). I calculate the proportion of elderly amng workers who only work on the farm in each year between 1990 and 2000, and I adjust the figures two ways. First, I adjust for the missing elderly described above. Second, among the general population a large and increasing proportion of farmers described themselves as part-time farmers. I add them as two-thirds of a normal farmer in the second adjustment, as they seem to work about two-thirds as much as a full-time farmer in the 2000 cross-section.

The unadjusted figure shows a dramatic increase in the amount of farmwork done by the elderly between 1990 and 2000, which cannot fully be explained by the two adjustments. Unadjusted, the percentage of the farm labor force that was elderly increased from roughly 4% to 12% in 2000. In the first adjustment, I place more weight on elderly members of the farm labor force, which increases the figure in 1990 to just over 6.5%. Without the adjustment for part-time farmers, these data would imply that the share of the elderly in the farm labor force nearly doubled between 1990 and 2000. When I add part-time workers, continuing to adjust for the proportion of elderly actually in the population in each given year, I still find that the elderly are taking on a larger share of farmwork, albeit a smaller increase than the first two lines showed. If part-time workers are treated as two-thirds of a full-time worker, then the share of farmwork done by the elderly increases from around

[8]To actually adjust the population, I used the 10.3% figure for 1990 and the proportion of elderly in the 2000 census (12.2%), and did a linear extrapolation for years between. I then made an adjustment to the proportion of elderly to match the 2000 CNRS data, which only include rural areas, unlike the Census data. The adjustment is then a linearly declining proportion of the shares in 1990 and those in 2000.

6.0% in 1990 to 10.8% in 2000. It should be noted that the findings are consistent with those from the CHNS, as in 1996 the share of the elderly in the farm labor force had increased to 8.2% after adjustments. The elderly indeed do seem to be increasing as a share of the farm workforce, and to be doing an increasing share of the farm labor, albeit a small increasing share.

Hypotheses

The preceding discussion of changes in farming patterns across China leads to hypotheses that can be tested with more rigorous analysis. First, I want to test whether household composition has an effect on labor demand on the farm in the household. Since on-farm wage rates are non-existent in China, due to the lack of a farm labor market (Benjamin and Brandt, 2002), I cannot directly estimate an elasticity of labor demand to wages. Therefore labor demand depends upon shadow wages rather than observable wages. It is further reasonable to assume that the shadow wage differs across demographic groups, since younger workers are much more likely to find off-farm work or migrate (de Brauw et al., 2002). If I find that labor demand is affected by the household demographic composition, it implies that the shadow wage is different for different groups. Specifically, the descriptive statistics above suggest that the shadow wage should be increasing for the elderly on the farm as opportunities arise for other groups. Therefore the elasticity of demand for elderly labor may be increasing. Since we see no feminization of agriculture occurring, we should further see no difference between the elasticity of male and female labor on the farm.

Second, the national statistics indicate that households are using a great deal more machinery in agriculture. The CNRS data are particularly suited to understand the demand for rental capital, because they include so much detail about inputs. Over half of the households in the sample that farm rent a service from others (Table 2). Households that rent services use less labor inputs (rows 1 and 2), although it seems they use less labor inputs primarily in the off-peak season. This would seem to indicate that households are using services such as plowing services to save labor in lieu of harvesting services. Households that have more educated workers also seem to use more service rental (rows 4 and 5). Finally, it seems clear that there is a great deal of dispersion in the use of service rental. Wheeras

households in Hebei, Liaoning, and Zhejiang quite frequently rent servces, it is much rarer in Sichuan and Hubei.

Clearly, there is a great deal of variation in the use of these services that can be explained, which lead to several interesting questions that can be asked about demand for these services, like the questions we ask about the labor demand. First, does demographic composition of a household affect rental demand? It could be that in some households, the elderly are intensifying their participation in agriculture, which would preclude the use of services, whereas younger households without elderly members are using more service rental. If so, we would expect to see the proportion of elderly in a household affect service rental demand. Second, do human capital endowments affect service rental? There are several mechanisms by which one could tie human capital to rental. For example, if educated members of households are more likely to find off-farm jobs, then one would expect to see a positive effect of education on service rental demand.

There are several other hypotheses generated by the above figures that I will not attempt to test. For example, I will not attempt to understand what household endowments affect household farm income or revenue, because I do not have an appropriate data source with which to do so. The questions in the CHNS lead to a great deal of measurement error in the value of farm output, and the CNRS is unfortunately a cross-section, so although it includes a great deal of information about farm revenue it is far more difficult to control for unobserved heterogeneity in the CNRS.

Econometric Methods

Estimating Labor Demand

To estimate labor demand for farm households in China, I follow Benjamin (1992) and Bowlus and Sicular (2003) and specify the following model for household h in year t:

$$\ln\ L_{ht} = \alpha + \gamma \ln\ A_{ht} + \delta_0 \ln n_{ht} + \sum_i^D \delta_i \frac{n_{ht}^i}{n_{ht}} + \sum_i^N \beta_i X_{ht}^i + \sum_i^M \eta_i D_t^i + \mu_h + \varepsilon_{ht} \quad (1)$$

where L is labor demand, defined as person-hours spent farming by people in the household, A is the household land endowment, n is the household size, n^i the number of household members in each demographic category i, X^i other control variables, and D^i are a

set of dummy variables. Finally, μ_h is an unobserved household specific variable, and ε_{ht} the error term. Because this equation can essentially be derived from a Cobb-Douglas production function, the elasticity of labor demand is δ_0, and the δ_i coefficients measure the response of household labor demand to household demographic composition. The null hypothesis associated with separability of the household model is $\delta_0 = \delta_i = 0 \forall\ i$. To understand whether household labor demand might be affected by the gender composition of the household, we are particularly interested in the coefficients δ_m and δ_f, where m and f represent males and females of working age, respectively.

I estimate equation (1) using both the CHNS data and the CNRS data. Both of the data sets have advantages and disadvantages for learning about the effect of household composition of household labor demand. The CHNS is a panel, so I can include year and village or village-year interactions in the set of instruments to control for differences over time and unobservables at the village level. In some specifications, I also include household level variables. Although the CHNS asked quite detailed questions about labor allocation, it did not specify crops grown, or ask detailed questions about farm conditions. Therefore I cannot discern any measures of land quality, nor information about irrigation, which Rozelle et al. show is quite important to farm production in China. I can, however, learn about the household crop mix from consumption data, so I include in all regressions a variable indicating households that grew rice.[9]

Although it is not a panel, the CNRS includes much more detailed information about farming, so although I cannot I can control for more variable farm conditions. In regressions using the CNRS, I include village fixed effects, a variable measuring the percent of land irrigated by the household, and a variable that measures the percent of land that was reported high quality by the household. In explaining labor demand in the CNRS regression, I also use a more arguably exogenous measure of land, which is the land endowed to the household by the village.

[9]One could argue that when also including household fixed effects, much of this information would not vary over time, so it is included.

Estimating Service Rental Demand

The CHNS data show descriptively that labor input into agriculture is emphatically declining over time. Unless technology is improving rapidly, it would seem that households must be substituting capital for labor. Unfortunately, measuring capital inputs into Chinese agricultural systems is difficult, because some villages simply have larger agricultural capital endowments than others (Benjamin and Brandt, 2002). These inputs have a complex interaction with other household farming inputs. However, by 2000 customized services, such as harvesting rice by machine, were available. Service rental may depend upon these village factors, but I can control for some of them using village characteristics. Since the services that are rented typically substitute directly for labor inputs, so they can be estimated using an equation similar to equation (1):

$$Y_h^* = \alpha + \gamma \ln\ A_h + \delta_0 \ln n_h + \sum_i^D \delta_i \frac{n_h^i}{n_{ht}} + \sum_i^N \beta_i X_h^i + \sum_i^M \eta_i D_t^i + \varepsilon_h \tag{2}$$

I assume that the production function depends upon the same endowments in equation (2) as in equation (1).[10] Here, I am interested in whether or not the demographic composition of a household or the endowments of the household affect the service rental demand, Y_h^*. Unfortunately, there is a further econometric difficulty, as not every household rents custom services, so we observe Y_h, where $Y_h = 0$ if $Y_h^* \leq 0$ and $Y_h = Y_h^*$ otherwise. When censoring is present, the typical estimation strategy is to use a tobit, but the coefficients resulting from a tobit are inconsistent when heteroscedasticity is present, which is common in household level data (Deaton, 1997). Therefore, I compare a tobit with two alternative estimation strategies, a censored least absolute deviation regression and a Powell trimming estimator (Powell, 1985). Both are consistent even in the presence of heteroscedastic error terms. They cannot be estimated, however, using fixed effects, which limits the controls for unobserved heterogeneity in these equations. To control for more unobservables, I also do the regression with a least squares estimator including village dummies, to observe whether or not absorbing village level heterogeneity affects the signs of coefficients.

[10] I relax the assumption of a Cobb-Douglas production function because of the censoring problem described below.

Results

Labor Demand

I first estimate equation (1) using the CHNS panel data (Table 3). The results are consistent with other findings from China regarding agricultural labor demand in the 1990s (Benjamin and Brandt, 2002; Bowlus and Sicular, 2003). The coefficient on land is significantly below 1 and strongly significant across specifications. It implies that agricultural labor demand is relatively inelastic with respect to the amount of land a household holds; given increasing off-farm opportunities and the small amount of land held by households, this result is not surprising. The log of household size and the demographic composition variables can be used to test the hypothesis of the separability of the household farm model; the null hypothesis associated with seperability is that $\delta_0 = \delta_1 = \ldots = \delta_D = 0$. In all of the specifications, we can easily reject the seperability null. Since Bowlus and Sicular do not find the household farm model to be seperable in Zouping County, it is not surprising here that we can reject seperability. However,my finding shows that their results extend to more parts of China.

We find exactly what we expect for the effect of working age men and women on labor demand in the household. No matter whether I use community-year interactions, household and year, or household and community-year dummy variables in the regression, the raw coefficients on the male household proportion is statistically significant, and the female proportion is in the first and third cases.Somewhat surprisingly, the raw coefficients on both the share of men and women of working age in the household were positive and relatively similar.[11] This finding seems to show that labor is in surplus within the household. The positive coefficients imply that if an adult male or female joins a household, the household will do more farmwork. The same holds true for women. If wages or expected wages were higher outside the household, one would not necessarily expect the household to do more farmwork as a whole, because there would also be more labor available to move off-farm. However, it could also be that the work inside the home is taking on increasing value, because of increasing opportunity costs.

[11] An F-test cannot reject the hypothesis that they are the same across specifications.

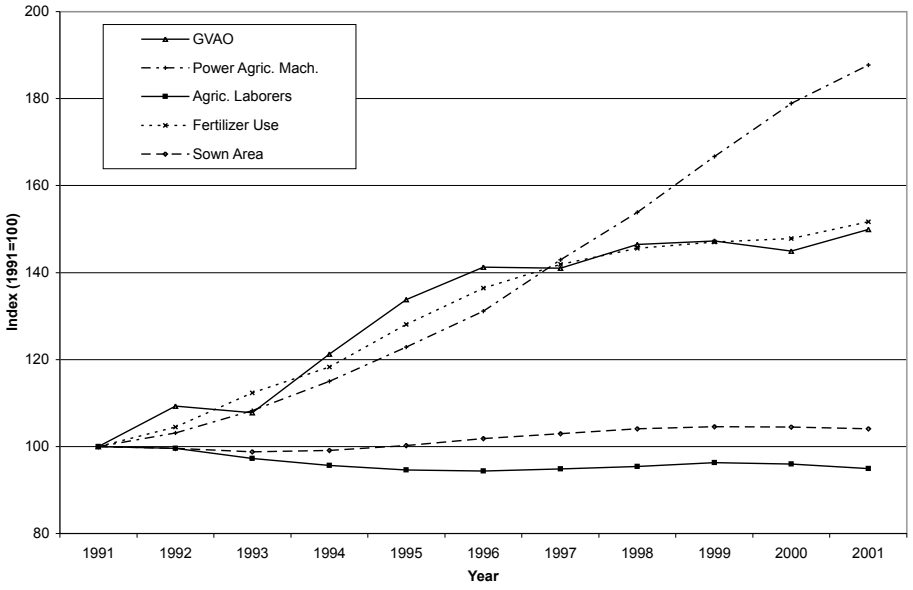
Although the coefficient on the proportion of the household that is elderly is difficult to interpret directly, in most specifications it is not statistically different than zero. The only time that it is not is when I do not control for household effects, which means the coefficient may be affected by unobservables. Since the coefficients on the male and female proportions of the adult labor force are positive and significant, the elasticity of labor demand with respect to the elderly is necessarily lower than for male and female labor. There are several possible explanations for a lower elasticity. One explanation is that I have not differentiated between the male and female elderly. Elderly women are unlikely to do farmwork, according to descriptive statistics (de Brauw, 2004), so the coefficient may reflect some of that uncertainty. It could also be that elderly households are more likely to subsitute capital for labor, or alternatively, that they are willing to apply labor less intensively and therefore make lower returns on the land. Finally, it could simply be a reporting issue. If the elderly are more aware of the time they actually spend on the farm than others, they may systematically report lower hours on the farm, which might show up in the coefficient estimate as a downward bias.

When I compute separate coefficients for the elderly, I find only mild evidence that the coefficient has changed over time (row 4). This is different when I run each equation as a cross-sectional regression (Table 4). In those regressions, the coefficients on the elderly are statistically insignificant and of varying sign. Again, they imply lower elasticities of farm labor demand with respect to the proportion of the elderly in the household.

Machine Rental Demand

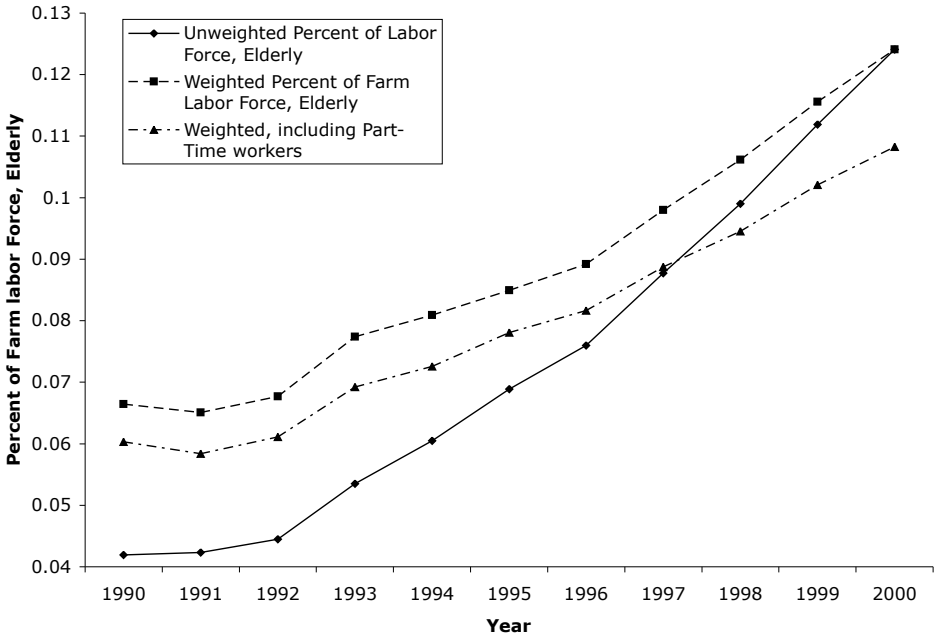
Since capital is becoming more important to China's agriculture (Figure 1), it is worthwhile to understand the determinants of machine rental demand (Table 5).

Conclusion



Notes: "GVAO" stands for gross value of agricultural output. All original figures are indexed to 1991. GVAO was originally expressed as value of output in 1991 yuan; fertilizer was originally expressed in tons; agricultural machinery in kilowatts; laborers in people; and sown area in *mu*.
Source: NBS, 2002.

Figure 1: Farm Output and Input Indices



Source: CNRS.

Figure 2: Proportion of Farmwork Done by the Elderly, 1990 to 2000

Table 1: Participation in Farmwork by Men and Women, 1990-2000

	1990	1992	1996
Total Household	2568	1814	1468
Farm Hours	(2607)	(1932)	(1763)
Female Farm	1293	889	700
Hours	(1440)	(1020)	(906)
Elderly Farm	261	194	205
Hours	(840)	(642)	(629)
Percent Farm	51.9%	51.7%	49.6%
Hours, Women			
Percent Farm	9.4%	9.6%	13.9%
Hours, Elderly			
N	1604	1604	1604

Notes: Standard deviations in parentheses. Averages are conditional on doing farmwork. Measures only include time spent on the farm, not including time spent fishing, gardening, or tending livestock. The elderly are defined as men over 60 and women over 55.
Source: China Health and Nutrition Survey (1991, 1993, and 1997).

Table 2: Descriptive Statistics by Machine Rental Status, CNRS, 2000

	Non-user	User, less than 250 yuan	User, more than 250 yuan
Avg. Hours worked, Peak season	769	756	721
Avg. Hours worked, Off-peak season	1161	932	861
Avg. Age, household head	45.4	45.0	45.5
Average male education	6.70	7.00	6.95
Average female education	5.07	5.25	5.85
Share in:			
Hebei	0.22	0.45	0.33
Shaanxi	0.37	0.37	0.26
Liaoning	0.38	0.39	0.23
Zhejiang	0.25	0.54	0.21
Sichuan	0.78	0.21	0.01
Hubei	0.60	0.38	0.02
N	505	482	212

Source: CNRS.

Table 3: Determinants of Farm Labor Demand, CHNS, 1990-1996

	(1)	(2)	(3)	(4)
Logarithm,	0.244	0.256	0.168	0.255
Land Size	(0.026)**	(0.038)**	(0.036)**	(0.038)**
Logarithm,	0.473	0.628	0.623	0.629
HH Size	(0.052)**	(0.111)**	(0.099)**	(0.111)**
Percent HH,	0.545	0.535	0.697	0.524
male adults	(0.094)**	(0.184)**	(0.163)**	(0.184)**
Percent HH,	0.590	0.249	0.411	0.249
female adults	(0.11)**	(0.207)	(0.186)**	(0.207)
Percent HH,	0.217	0.016	0.163	0.195
elderly	(0.108)**	(0.247)	(0.219)	(0.294)
Percent HH,				-0.488
elderly*92				(0.159)**
Percent HH,				-0.154
elderly*96				(0.210)
Average education,	-0.017	-0.001	-0.002	-0.001
male adults	(0.005)**	(0.010)	(0.009)	(0.010)
Average education,	-0.021	-0.019	-0.014	-0.019
female adults	(0.005)**	(0.010)*	(0.009)	(0.010)
Female head	-0.156	0.279	0.158	0.289
(1=yes)	(0.049)**	(0.126)**	(0.112)	(0.126)**
Age of Household	0.007	0.008	0.006	0.008
Head	(0.002)**	(0.003)**	(0.003)**	(0.003)**
Fixed Effects	Year*Community	ID, Year	ID, Year*Community	ID, Year
N	3714	3714	3714	3714

Notes: Standard errors in parentheses. All regressions include 3714 observations. *- indicates significance at the 10 percent level; **-indicates significance at the 5 percent level.
Source: CHNS (1991, 1993, and 1997).

Table 4: Cross-Sectional Determinants of Farm Labor Demand, 1990-2000

	CHNS			CNRS
Variable	1990	1992	1996	2000
Logarithm,	0.190	0.243	0.300	0.399
Land Size	(0.042)**	(0.045)**	(0.047)**	(0.049)**
Logarithm,	0.546	0.496	0.321	0.489
HH Size	(0.087)**	(0.090)**	(0.096)**	(0.108)**
Percent HH,	0.645	0.375	0.558	0.442
male adults	(0.158)**	(0.166)**	(0.164)**	(0.206)**
Percent HH,	0.734	0.635	0.324	0.343
female adults	(0.192)**	(0.196)**	(0.189)	(0.245)
Percent HH,	0.29	-0.055	0.272	-0.624
elderly	(0.186)	(0.203)	(0.184)	(0.280)**
Average education,	-0.019	-0.012	-0.020	0.000
male adults	(0.008)**	(0.008)	(0.009)**	(0.011)
Average education,	-0.027	-0.015	-0.018	-0.024
female adults	(0.008)**	(0.008)*	(0.009)**	(0.010)**
Female head	-0.147	-0.172	-0.126	-0.037
(1=yes)	(0.085)	(0.084)**	(0.087)	(0.165)
Age of Household	0.009	0.009	0.003	0.004
Head	(0.003)**	(0.003)**	(0.002)	(0.003)
Fixed Effects	Community	Community	Community	Village
N	1329	1329	1329	1003

Notes: Standard errors in parentheses. *- indicates significance at the 10 percent level; **-indicates significance at the 5 percent level.
Source: CHNS (1991, 1993, and 1997) and CNRS.

Table 5: Cross-Sectional Determinants of Machine Rental Demand, 2000

Specification	OLS	Tobit	Trimming	CLAD
Logarithm, land	48.3	101.845	67.102	74.118
endowment	(8.52)**	(11.511)**	(15.829)**	(25.347)**
Logarithm, household	34.3	-13.767	-3.709	-11.373
size	(18.9)*	(31.893)	(34.592)	(34.423)
Logarithm, average	5.18	36.345	26.884	62.687
age	(31.50)	(56.609)	(49.473)	(65.203)
Percent of household,	-60.9	169.703	90.544	72.056
adult females	(47.70)	(86.141)	(59.951)	(115.529)
Percent of household,	-31.4	75.444	10.056	-26.381
elderly	(57.60)	(96.151)	(64.762)	(117.886)
Percent of household,	25.2	111.465	79.347	57.92
children	(50.1)	(80.409)	(78.611)	(111.899)
Average female	1	7.246	5.47	10.982
education	(1.93)	(3.087)**	(2.463)**	(5.203)**
Average male	1.59	4.693	0.011	2.097
education	(1.87)	(3.419)	(2.687)	(3.677)
Percent of land,	28.80	209.754	136.586	179.279
irrigated	(17.00)*	(22.429)**	(33.408)**	(51.934)**
Fixed Effects	village	none	none	none
N	1022	1012	971	746

Notes: Standard errors in parentheses. Standard errors are clustered in the trimming regression. *- indicates significance at the 10 percent level, and **- indicates significance at the 5 percent level.
Source: CNRS.