Labor Market Participation of Chinese Agricultural Households

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Abstract

This work is devoted to the analysis of the different labor market participation regimes of Chinese farm households. Using household data over the period 1986-2000 from the province Zhejiang, we apply a multinomial logit model to empirically examine household, farm, and regional characteristics affecting the probability that farmers employ one of four alternative labor market regimes. Results suggest that labor market decisions are significantly related to several personal, farm, and village attitudes. In addition, we find the more market oriented policy reforms at the end of the 1980s stipulated that households participate in labor markets while the more anti-market reforms during the 1990s led to the opposite and encouraged autarky.

Key words: China, labor market, agricultural household, participation, multinomial logit

JEL classification: D13, J24, J43, Q12

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1. Introduction

Recently the Chinese government published a *White Paper* of the Ministry of Labor and Social Security on the employment situation in China. Comprising seven parts, the *White Paper* suggests that the Chinese government has paid great attention to the employment of the rural workforce. It is particularly pointed out that "…the government has […] expanded the rural employment capacity, adopted many measures to help the surplus rural workforce to transfer to the non-agricultural fields, and gradually removed the institutional obstacles to urbanization to guide the rational and orderly flow of the rural workforce." (China.org.cn, 2004; p. 12). Moreover, the improvement of labor market conditions and labor mobility seems to remain one of the major goals on the political agenda for the 21st Century in China (p. 17).

Undoubtedly, the adjustment of rural labor markets to economic reforms is an important indicator of the progress of transition. Without well-functioning labor markets, it will be difficult to achieve the primary mode of an efficient allocation of resources and thus to effectively enforce the economical transition (de Brauw et al., 2002). As in other transition economies, the institutional change of farm businesses in China at the end of the 1970s strongly increased rural underemployment. In particular, the participation of Chinese agricultural households in both the market for hired on-farm labor and the market for off-farm employment was rather limited, indicating purely developed labor markets. While the former was totally prohibited, the latter was effectively prevented by a package of policies, including the household registration system.[1] With the beginning of the second reform period in 1985, labor mobility was allowed for and hence an increasing integration of farm households into rural labor markets took place (Benjamin and Brandt, 1997; Rozelle et al., 1999; de Brauw et al., 2002). Following criticisms of the impact of the rural market program, the government introduced a set of adjustment policies starting in 1990 that aimed at further phasing out the old centrally planned system in agriculture in favor of more market oriented solutions. In addition, the government has actively supported development of non-agricultural production, in particular by township and village enterprises, to provide employment opportunities for the perceived rural labor surplus (Du, 1988; Bowlus and Sicular, 2003). Policy developments starting in 1994 are aimed at a rebirth of self-sufficiency policies, not only at the national level but also at the regional level. Despite the structural reform and a general slowing of economic growth in the late 1990s, off-farm employment has continuously grown. All in all, external conditions for labor mobility changed remarkably and frequently over the reform periods in the last two decades.

Although there is a bulk of literature contributing to the debate on labor market conditions in rural China, researchers do not agree regarding the level of progress in rural labor markets. While some studies have illustrated the emergence of functioning rural labor markets and the breakdown of institutional barriers, other works support the hypothesis that labor market imperfections still exist. For example, Benjamin and Brandt (1997) and Liu et al. (1998) identify an inverse relationship between farm size and labor use, indicating labor market constraints. Meng (2000) and Yang and Zhou (1996) suggest that institutional restrictions, such as land tenure arrangements and the mandatory quota system, decrease off-farm labor market participation. Bowlus and Sicular (2003) indicate the non-separability between labor supply and demand decisions of farm households and thus labor market imperfections. In contrast, Cook (1999) and Maurer-Fazio (1999) report that labor markets might be well-functioning because off-farm labor returns are equal over several alternative employment opportunities and education determines off-farm earnings. Lohmar (1999) finds only small effects of land tenure and quota policies on rural households' off-farm labor adjustments. In addition, Rozelle et al. (1999) report a strong increase of migration and off-farm participation, supporting the hypothesis that labor markets have improved over time.

However, it is well known that farm households are differentially integrated into the labor markets, with some selling labor services off-farm, others hiring on-farm labor, some simultaneously selling and hiring labor, and yet others opting for autarky. This might not only be the result of different external conditions, such as employment alternatives or political measures, but could also be related to household and farm characteristics, as well as the costs of accessing labor markets, such as information, transportation, and supervision costs.

There is a rich body of empirical studies examining factors affecting off-farm labor market participation decisions of agricultural households using data of several countries. For a survey of the related literature, see Hallberg, Findeis, and Lass (1991). Recent studies concentrating on China are published, for example, by Tuan, Somwaru, and Diao (2000); Zhao (2001); Zhang, Rozelle, and Huang (2001); Zhang, de Brauw, and Rozelle (2003); and Chen, Huffmann, and Rozelle (2004). Only a few empirical studies examine farm households' decisions of hiring on-farm labor or simultaneously hiring on-farm labor and selling family labor off-farm (see Findeis and Lass, 1994; Benjamin, Corsi and Guyomard, 1996; Sadoulet, de Janvry, and Benjamin, 1998; Glauben, Henning, and Henningsen, 2003). To our best knowledge, there is no work that explicitly analyzes the different labor market occupations of Chinese rural households yet.

The present study is devoted to the analysis of the different labor market participation regimes of Chinese farm households. We first provide a theoretical framework that accounts for labor market constraints and can explain all labor markets under consideration, which are autarky, hiring on-farm labor, selling off-farm family labor, and particularly hiring and selling labor at the same time. Using individual household data over the period 1986-2000 from several regions of the province Zhejiang, we then apply a multinomial logit model to empirically examine household and farm characteristics as well as regional conditions affecting the probability that farmers occupy one of four alternative states. In addition, we implicitly consider the impact of changing external conditions by controlling for the different reform periods over the observation time.

The remainder of the work is organized as follows. The next section provides a theoretical background. The section after that gives an overview over the data. Section 4 presents the methodology and the empirical results, and section 5 concludes.

2. Theoretical framework

To concentrate on the role of labor market decisions, we construct a static model that ignores some aspects of farmers' decisions, for example, risk (Finkelshtain and Chalfant, 1991; Fafchamps, 1992), credit constraints (de Janvry et al., 1991), the role of costs associated with transactions on product markets (Key, Sadoulet, and de Janvry, 2000) and other input markets. To analyze labor market occupation, it is convenient to specify labor market participation as a choice variable (Key, Sadoulet, and de Janvry, 2000). That is, in addition to deciding how much of leisure to consume and labor to use as an input, the household also decides how much of labor to "market" (conditional on the chosen labor market regime). As mentioned above, four labor market participation regimes are possible. First and second, farmers either (only) sell family labor off-farm or (only) hire on-farm labor. Third, the households sell and hire labor at the same time. Fourth, they neither sell nor hire labor (autarky). The model can cover both the case of imperfect and, with few rearrangements, perfect labor markets. In particular, it is applicable for all labor market schemes mentioned above.

The farm household is assumed to maximize utility derived from consumption and leisure subject to a technology constraint (2), a time constraint (3), and a budget constraint (4). Therefore, farm households solve the following maximization problem(s):

$$\max_{c,x} U\left(c; z_U\right) \tag{1}$$

subject to

$$G(x, r; z_G) = 0 \tag{2}$$

$$T_l + X_l + D_l^h X_l^h - D_l^s X_l^s - C_l \geq 0 \tag{3}$$

$$P_m C_m \leq P_c X_c + P_v X_v - D_l^h g\left(X_l^h; z_g\right) + D_l^s f\left(X_l^s; z_f\right) + E \tag{4}$$

Here, $U(c)$ is farm household's utility function, which is assumed to be well-behaved. C is a vector of consumption goods consisting of market commodities (C_m) and leisure (C_l), and z_U are

exogenous utility shifters, e.g. household characteristics. *G* represents a well-behaved production technology (2) where x is a vector of production goods, *r* is a vector of quasi-fixed factors, and z_G are exogenous productions shifters (household and farm characteristics). The farm household is assumed to produce agricultural products ($X_c > 0$) using variable inputs ($X_v < 0$), labor ($X_l < 0$), and the quasi-fixed factors capital and land. The farm household faces a time constraint (3), where T_l is the total time available and $\left|X_l\right| = X_l^f + X_l^h$ is the total of on-farm labor time subdivided into family labor time (X_l^f) and hired labor (X_l^h). Furthermore, X_l^s indicates off-farm family labor. Farm household budget constraint (4) states that the household's expenditures (left-hand side) must not exceed its monetary income (right-hand side). Here, $P_i, i = m, a, c, v$ are the exogenous consumer and producer prices.

Conditional on the labor market participation regimes noted above, the farm households might generate revenue from farming $\sum_{i=c,v} P_i X_i - g\left(X_l^h, \boldsymbol{\kappa}^h; z_g\right)$, where $g\left(X_l^h; z_g\right)$ denote the costs of hired on-farm labor, and labor income from off-farm work $f\left(X_l^s; z_f\right)$, as well as exogenous transfers (E)[2]. The regime dummy variables in the budget (4) and the time constraint (3) indicate the four respective labor market participation regimes. If D_l^h and D_l^s are equal to one ($D_l^h = D_l^s = 1$), then the household participates on both the market for hired on-farm and the market for off-farm family labor. If $D_l^h = 1$ and $D_l^s = 0$, then the household hires labor, but does not sell family labor off-farm. Just the opposite holds, if $D_l^h = 0$ and $D_l^s = 1$. Finally, the case of autarky is indicated when both variables are equal to zero ($D_l^h = D_l^s = 0$).

To consider labor market imperfections, revenues form off-farm employment $f\left(X_l^s; z_f\right)$ and hired labor costs $g\left(X_l^h; z_g\right)$ are conceptualized as functions of supplied $\left(X_l^s\right)$ and hired labor $\left(X_l^h\right)$ time (Glauben, Henning, and Henningsen, 2003). Here, z_f and z_g, respectively, denote exogenous shifters, that may include differences in external wage levels, skills, or (fixed and variable) transaction costs. When labor markets are assumed to be imperfect, both functions become nonlinear with the following properties: $\partial f(.)/\partial X_l^s > 0$; $\partial^2 f(.)/\partial X_l^{s2} < 0$ and $\partial g(.)/\partial X_l^h > 0$; $\partial^2 g(.)/\partial X_l^{h2} > 0$. That is, off-farm income is an increasing and strictly concave function of supplied labor time, and the costs of hired labor are an increasing and strictly convex function of hired labor time.[3] Therefore the price of labor and leisure *(P_l)* is endogenously determined and the model is non-separable. Note, this framework is applicable for several kinds of labor market constraints. In particular, it accounts for labor market imperfections which lead to a decreasing price effectively received for each further unit of off-farm employment and to an increasing price effectively paid for each further unit of hired labor time. Hence, such conditions can be interpreted as increasing per-unit costs of accessing labor markets (increasing transaction costs).

Increasing costs associated with working off the farm might be caused by an increasing heterogeneity between on-farm and off-farm family labor. With a growing migration, household members are first transferring to the "best jobs" followed by the "next best jobs" and so on (Kahn and Low, 1982; Low, 1986). Similarly, increasing search and transportation costs may lead to a decreasing net wage rate. Increasing per-unit costs of hired labor may result from increasing search, supervision, and monitoring activities. It seems to become more and more difficult to find the "right" staff for the different and often farm-specific areas of production. Moreover, with increasing staff and hired labor time, respectively, the supervision and monitoring per-unit of hired labor may become more costly. Similarly, the existence of land-specific experience may lead to a decreasing substitutionality between family and hired labor. Hired labor becomes less productive and the costs for a standardized hired labor unit increase.

The agricultural household selects among the four mutually exclusive labor market regimes mentioned above. Because of the labor market imperfections the optimal solution cannot be found by simply solving the first order conditions; the solution is thus decomposed in two steps, first for the optimal solution conditional on the market participation regime, and then choosing the market participation regime that leads to the highest level of utility.

Optimal solution conditional on labor market participation

The stationary solutions of the maximization problem (1)-(4) determine the optimal quantities of consumption and production goods, and the allocation of time conditional on the labor market regime,[4] assuming there exists interior solutions ($\lambda, \phi, \mu > 0$ and $c, x > 0$).

$$U_i(.) - \lambda P_i = 0 \qquad i \in CG = \{m, l\} \tag{5}$$

$$\phi G_i(.) + \lambda P_i = 0 \qquad i \in PG = \{c, v, l\} \tag{6}$$

$$D_l^s f_l(.) - P_l = 0 \tag{7}$$

$$-D_l^h g_l(.) + P_l = 0 \tag{8}$$

$$\sum_{i=c,v} P_i X_i - D_l^h g\left(X_l^h; z_g\right) + D_l^s f\left(X_l^s; z_f\right) + E - P_m C_m = 0 \tag{9}$$

$$G(x, r; z_G) = 0 \tag{10}$$

$$T_l + X_l + D_l^h X_l^h - D_l^s X_l^s - C_l = 0 \tag{11}$$

Here, $\lambda, \phi, \mu > 0$ are Lagrangian multipliers associated with the budget, the technology, and the respective time constraints, and U_i, G_i, f_l and g_l represent the first derivatives of the corresponding utility, production, and labor market functions. Further, $P_l = \mu / \lambda$ denotes endogenous price for labor and leisure, which probably differs among the four participation regimes. Let $\Pi(p, r; z_G)$ be the maximal profit as a function the production prices (*p*) and the quasi-fixed factors (*r*), the optimal quantities of production goods are defined by $\partial \Pi(.) / \partial P_i = X_i(p, r; z_G); \forall i \in \{c, v, l\}$. Further, let $V(p, Y; z_u)$ be the indirect utility function where *p* is the vector of consumption prices, and *Y* indicates the income. Using Roy's identity, we can define the optimal quantities of consumption goods with $-\frac{\partial V(.)}{\partial P_i} \Big/ \frac{\partial V(.)}{\partial Y} = C_i(p, Y; z_u)$. Finally, conditional on the labor market regime, condition (7) and/or (8) define the off-farm labor supply $X_l^s = X_l^s(P_l; z_f)$ and the demand for hired labor $X_l^h = X_l^h(P_l; z_g)$ as implicit functions of the endogenous labor price (P_l) and exogenous shifters (z_f, z_g) that directly affect the position of the labor market functions. Substituting the dual and implicit functions into equation (11), the time constraint defines the regime specific shadow prices as an implicit function of all exogenous variables $P_l = \chi(p, r, T_l, E, z)$ including the exogenous consumption and production prices (*p*), fixed resources (*r*), total time available (T_l), and the household, farm, and labor market characteristics (*z*). It has been noted that the labor function shifter only affects the internal price if farmers sell (z_f), hire (z_g), or simultaneously sell and hire (z_f, z_g) labor.

Labor market participation decision

We can now establish the conditions determining the labor market participation of a farm household. It has been noted that the assumed labor market conditions can create non convexities of

the budget set. Thus, the simple story of reservation wage in the neighborhood of zero "marketed" labor hours and autarky, respectively with labor selling by a household if the autarky wage rate $\left(p_l^a\right)$ is lower then the wage for off-farm employment $\left(p_l^s\right)$ and higher then the price for hired labor $\left(p_l^h\right)$, does not hold. Both the net wages and the time intervals over which it, the story of reservation wage, holds, and thus the complete budget set, must be considered in assessing labor market participation. Or in other words, the purely local considerations of reservation wage models are no longer sufficient to determine whether a household chooses to participate in labor markets when non-convexities are present (Hausman, 1980).

Therefore, labor market participation is determined by comparing the utilities obtained for the four participation regimes (Key, Sadoulet, de Janvry, 2000; Hill, 1989). Because all four regimes can be formally written as a similar optimization problem, the maximum utility that can be attained in each regime *j* can also be formally written with the same indirect utility function V^j. In more detail, the following utility levels have to be compared:

$$\begin{aligned}
V^h &= V\left(P_i, Y; z\right), \quad where \;\; Y = \Pi - g + P_l^h\left(T_l^h + X_l^h\right) + E \\
V^s &= V\left(P_i, Y; z\right), \quad where \;\; Y = \Pi + f + P_l^s\left(T_l^s - X_l^s\right) + E \\
V^{sh} &= V\left(P_i, Y; z\right), \quad where \; Y = \Pi - g + f^* + P_l^{sh}\left(T_l^{sh} + X_l^h - X_l^s\right) + E \\
V^a &= V\left(P_i, Y; z\right), \quad where \; Y = \Pi + P_l^a T_l^a + E
\end{aligned} \tag{12}$$

The superscripts *s*, *h*, *sh,* and *a* indicate those households that only sell off-farm labor (*s*), only hire on-farm labor (*h*), simultaneously sell and hire labor (*sh*), or opt for autarky (*a*).

3. Data

The database is drawn from survey data conducted by rural survey teams across ten regions in the Zhejiang province. We use individual household data which are linked to village data over the period 1986-2000; however, the years 1992 and 1994 are missing. The sample covers around 1,000 households per annum from 1986-1991 and 500 households per annum from 1993 onwards. The sample collection proceeds in a stratified way for the village data. After that, the household data of the respective villages are randomly selected. First, every county is ramified by annual net income per capita into upper, middle, and lower levels (Benjamin, Brandt, and Giles, 2001). Second, the respective village is chosen from the three county groups according to geographic factors (plain, hilly, or mountainous area), location (city, suburb, or rural), and economic features such as mainly agriculture, forestry or fishery. The village survey provides information on resource endowment, employment, and production activities, as well as welfare and socio-economic indicators. The individual household data contain detailed information on personal, household, and farm characteristics. For each year, the questionnaire records the labor time allocation of every family member in various employment activities, as well as hired labor.

In order to explain farm households' labor market participation decisions, we classify the households according their market occupation states during the observation period. Thus, the four labor market regimes are taken as the endogenous variables in the following empirical analysis. It has been noted that we consider 8,199 observations because some households occupy different labor regimes over the observation period. As reported in **Table 1,** (only) hiring on-farm labor (*hire*) is chosen in just around 2 percent of all cases (138 observations), while in almost 76 percent of all cases (6,177 observations), households (only) supply family labor off-farm (*sell*). Around 13 percent of the cases (1,120 observations) reflect farm households that simultaneously hire on-farm labor and supply off-farm labor (*sell and hire*) and in 9 percent of the observations *autarky* is the selected labor market status.

The explanatory variables used for the analysis and their descriptive statistics are also reported in **Table 1.** We use several household attitudes, for example education, and transfers, as well as farm characteristics such as agricultural income, size, and the production structure that might be related to the household's labor market decision. Further, we consider some regional characteristics to control for external labor market conditions.

Table 1. Definition and description of variables by labor market participation regime.

	Regime	*Hire (h)*	*Sell (s)*	*Sell and Hire (sh)*	*Autarky (a)*
		(n=138)	(n=6177)	(n=1120)	(n=764)
Variable	*SYMBOL*	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)
Household characteristics					
Education attainment of the household's head (1= illiteracy, 2= elementary school, 3= secondary school, 4= high school or above)	*EDUHEAD*	2.07 (0.93)	2.16 (0.77)	2.36 (0.80)	2.04 (0.85)
Number of male labor force (persons)	*M-LABOR*	0.98 (0.71)	1.45 (0.77)	1.39 (0.79)	1.15 (0.70)
Number of female labor force (persons)	*F-LABOR*	0.81 (0.66)	1.26 (0.72)	1.23 (0.66)	1.01 (0.68)
Number of children and elder (persons)	*CHILD-ELD*	1.38 (1.17)	1.24 (0.99)	1.45 (0.99)	1.18 (0.94)
Communist party membership	*CPMEMBER*	0.18 (0.39)	0.11 (0.31)	0.17 (0.38)	0.14 (0.35)
Net transfer (yuan)	*TRANSFER*	-120.12 (985.65)	-184.29 (1370.87)	-215.17 (1361.58)	-39.31 (1502.74)

Table 1. continued.

Farm characteristics					
Household's production durable assets at 1985 constant price (1000 yuan)	*ASSETS*	8.62 (11.75)	9.71 (14.00)	14.88 (17.98)	7.70 (10.32)
Total sown area (mu)	*SOWN*	6.61 (17.39)	6.39 (5.43)	5.50 (6.82)	5.55 (4.57)
Income from agricultural production at 1985 constant price (1000 yuan)	*AGR-INC*	2.79 (4.05)	2.25 (3.35)	2.41 (3.11)	3.91 (7.62)
Share of area sown with vegetables from total sown area (0-1)	*VEGET*	0.22 (0.20)	0.20 (0.34)	0.26 (0.40)	0.23 (0.36)
Animal husbandry (Dummy variable, 1= yes, 0= no)	*ANIMAL*	0.58 (0.50)	0.50 (0.50)	0.61 (0.49)	0.44 (0.50)
Village characteristics					
Unemployment rate (percent)	*UNEMP*	19.24 (12.33)	11.04 (12.56)	16.53 (12.71)	14.11 (11.66)
Annul net income per capita in the village at 1985 constant price (yuan/person)	*ANIPP*	1356.24 (542.24)	1432.93 (593.17)	1730.14 (649.09)	1280.20 (501.62)
Population density (inhabitants/mu)	*POPDENS*	0.53 (0.72)	0.79 (0.76)	0.68 (0.82)	0.74 (0.70)
Policy Regimes					
Period 1986-1989 (Dummy variable, 1= yes, 0= no)	*PERIOD1*	0.54 (0.50)	0.51 (0.50)	0.52 (0.50)	0.28 (0.45)
Period 1990-1994 (Dummy variable, 1= yes, 0= no)	*PERIOD2*	0.21 (0.41)	0.27 (0.44)	0.25 (0.43)	0.16 (0.36)
Period 1995-1998 (Dummy variable, 1= yes, 0= no)	*PERIOD3*	0.19 (0.39)	0.15 (0.36)	0.14 (0.35)	0.42 (0.49)

Finally, to capture the different policy measures during the observation span that can be divided into four regime periods (1986-1989, 1990-1993, 1995-1998 and 1999-2000), we include three dummy variables covering the first three periods. The last period is included as a reference case. As mentioned in the introduction, frequent adjustments of agricultural policies occurred – sometimes in favor of market liberalization, but often the direction was less clear. On several occasions, policy changes aimed at putting the old central planning back in force. One can roughly summarize that reforms between the mid-1980s until the beginning of the 1990s are more market-oriented, whereas more anti-market reforms took place during the mid-1990s (for example, see OECD, 1995; Brümmer, Glauben, and Lu, 2003)[5].

4. Method and empirical results

As mentioned above, we apply a multinomial logit analysis to study labor market participation choices. Let V_k^j be, the level of indirect utility for a household *k* if it chooses regime $j = (h, s, sh, a)$, a function of explanatory variables Z_k (i.e. household and individual characteristics z_{ku}, farm characteristics z_{kG}, regional and local characteristics z_{kf}, z_{kg} that might cover differences in labor market conditions). V_k^j is not directly observable, but it is possible to define an observable dichotomous variable W_k^j equal to 1 if $V_k^j = \max\left(V_k^h, V_k^s, V_k^{sh}, V_k^a\right)$, 0 otherwise. The probability p_{jk} that the *k*th household selects the *j*th alternative may then be written as:
$p_k^j = prob\left(W_k^j = 1\right) = prob\left[\left(\beta_j^{'} - \beta_i^{'}\right) z_k > e_k^i - e_k^j\right]; \forall i \neq j$. If we assume that the perturbations have identical and independent Weibull distributions, the difference $e_k^i - e_k^j$ has a logistic distribution and the choice model is multinomial logit (Madalla, 1983). The multinomial logit approach does not allow analyzing the probability of being allocated to a specific labor market regime. Because of identification restrictions, only the relative probabilities can be discerned. We assume the reference regime is the solution where the household neither sells nor hires labor (autarky). This normalization implies that the estimated model reduces to three log-odds ratios of the form: $\ln\left(p_k^j / p_k^a\right) = \beta_j^{'} z_k$;
$j = h, s, sh$. Thus, the estimated coefficient $\left(\beta_j^{'}\right)$ could be interpreted as the marginal change in the logarithm of the odds of each possible alternative over the reference regime caused by a marginal change in the relevant explanatory variables.

The results of the econometric analysis are documented in **Table 2.** The estimated model is statistically significant at the 1% level or better as measured by the likelihood ratio test. The model correctly classifies 77.5% of all observations. Overall, the results in **Table 2** suggest that labor market participation is significantly related to a number of household, farm, and regional characteristics. In addition, significant time dummies that cover four different policy regimes during the 15 years could be observed. As mentioned above, while the time dummies *PERIOD1* and *PERIOD2* cover the more market-oriented reforms of the periods 1986-1989 and 1990-1993, the time dummy *PERIOD3* reflects period 1995-1998 when market orientation of the reforms was reduced and self-sufficiency as a major goal reappeared on the political agenda.

Table 2. Estimates of the multinomial logit model on labor market participation.

	Hire (h)		Sell (s)		Sell and Hire (sh)	
SYMBOL	Param.	Z-value	Param.	Z-value	Param.	Z-value
Household characteristics						
EDUHEAD	0.1954	(1.60)	0.3476***	(6.29)	0.4945***	(7.15)
M-LABOR	-0.3710**	(2.05)	0.6407***	(8.84)	0.6699***	(7.70)
F-LABOR	-0.6316***	(3.48)	0.5155***	(7.32)	0.4177***	(4.82)
CHILD- ELD	0.1183	(1.13)	0.1722***	(3.71)	0.3518***	(6.17)
PMEMBER	0.4284*	(1.69)	-0.2741**	(2.25)	0.2308	(1.54)
TRANSFER	-0.0001	(1.34)	-0.0001***	(2.86)	-0.0001***	(2.88)
Farm characteristics						
ASSETS	0.0617**	(2.52)	0.0013	(0.09)	0.0866***	(5.50)
SOWN	0.0241**	(2.46)	-0.0085	(1.11)	-0.0312***	(2.85)
ASSETS	0.0617**	(2.52)	0.0013	(0.09)	0.0866***	(5.50)
AGR-INC	0.0060	(0.36)	-0.0505***	(6.44)	-0.0399***	(3.12)
VEGET	-0.7229*	(1.92)	-0.0737	(0.87)	-0.1574	(1.10)

Table 2. continued.

LIVESTOCK	0.2109	(0.96)	0.0244	(0.27)	0.1098	(0.91)
Village characteristics						
UNEMP	0.0398***	(4.74)	-0.0156***	(4.44)	0.0311***	(7.05)
ANIPP	0.0019***	(7.32)	0.0008***	(5.75)	0.0029***	(19.32)
POPDENS	-1.3917***	(5.65)	-0.3662***	(4.07)	-1.9739***	(16.32)
Policy Regimes						
PERIOD1	1.3592***	(3.24)	1.1835***	(8.21)	1.3345***	(6.93)
PERIOD2	1.0196**	(2.29)	1.1803***	(7.52)	1.1898***	(5.78)
PERIOD3	-0.0742	(0.17)	-0.4894***	(3.62)	-0.7967***	(4.05)
CONSTANT	-4.6739***	(7.60)	-1.1850***	(4.82)	-6.4439***	(19.59)

LogL:	-5229.481	RLogL:	-6355.553
LR(DF):	2220.976(48)	N:	8199
R^2_{MF}:	0.177	Adj. R^2_{MF}:	0.169
R^2_{ML}:	0.240	R^2_{CU}:	0.305
AIC:	1.289	BIC:	-62941.884

Note: Z-statistics are presented in parentheses; ***, ** and * statistically different from zero at 1%, 5% and 10% significance level, respectively. Autarky regime is taken as base category.

With regard to the household characteristics, the education of the farm operator (*EDUHEAD*) turns out to be of particular importance. As shown in other studies (for example, Huffman, 1991; Kimhi, 1994; Zhang, de Brauw, and Rozelle, 2003), households with more educated operators show a significantly higher inclination to participate on labor markets when compared with autarky. The results of **Table 2** significantly indicate that they particularly choose working outside the farm (*regime s*) or selling off-farm labor and hiring on-farm labor at the same time (*regime sh*). Though education may increase the productivity both on and off the farm, Lass, Findeis, and Hallberg (1991) point out that it has a stronger effect on off-farm productivity than on on-farm productivity. Thus, education may positively affect off-farm employment. At the same time, a high on-farm productivity and therefore profitability may encourage the household to hire on-farm workers. This is particularly true for households that are off-farm employed and substituting hired labor for on-farm family labor (*regime sh*). Alternatively, since more educated farmers are more efficient, they can afford to hire workers while devoting a part of their own labor to managerial tasks or even increasing their leisure (*regime h*). Although not explicitly considered in the empirical analysis, one might further hypothesize that fixed and variable costs of accessing labor markets (i.e., search, transportation, or monitoring costs) for higher-educated farmers are lower than for less-educated farmers such that *ceteris paribus* the effective wage (net of transaction costs) received for off-farm employment is relatively high and the effective price paid for hired labor is relatively low, increasing the relative profitability of labor market participation.

The fact that households with higher-educated farm operators more likely enter both the market for hired on-farm labor and for off-farm employment may be supported by the labor market conditions described in the theoretical framework; that is, a decreasing wage effectively received for off-farm labor and an increasing price effectively paid for hired labor. As mentioned above, an increased education leads to an increased heterogeneity between on-farm and off-farm labor, such that farmers tend to substitute hired on-farm labor for family labor on the farm and sell family labor off-farm as long as the marginal cost of hired on-farm labor is equal to marginal off-farm income.

Household characteristics also include the number of male (*M-LABOR*) and female (*F-LABOR*) laborers as well as the number of non-working household members (*CHILD-ELD*) such as children or the elderly. As expected, both the number of males and females significantly affect farm household's participation in labor markets. That is, households with more males and females show a significantly higher tendency toward working off-farm (*regime s)* as well as working off-farm and hiring labor simultaneously (*regime sh*). Furthermore, a high number of males and females negatively contribute to the decision of hiring on-farm labor, if the household is not off-farm employed (*regime h*). Clearly, a high number of both males and females in a household may *ceteris paribus* indicate a labor surplus

and relatively high time endowment, respectively, which encourages family members working off-farm or household substitute family labor for hired labor on the farm.

However, the positive relationship between the number of adults and the simultaneous participation on both markets (*regime sh*) needs to be further explored. Similarly, as discussed above, one might argue that a growing number of adults lead to an increasing heterogeneity between on-farm and off-farm family labor. Assuming the labor market conditions of the theoretical framework, household members tend to substitute hired on-farm labor for family labor on the farm and sell family labor off-farm as long as the marginal cost of hired on-farm labor is equal to marginal off-farm income. Also, some household members may prefer working off the farm (Lopez, 1994), which might be particularly true for females and younger adults (sons and daughters). Thus, large families tend to participate at both labor markets, substituting hired labor for on-farm family labor. The significantly positive relationship between the number of children and elderly family members (*CHILD-ELD*) and labor market participation (*regimes s and sh*) might reflect the fact, that elder children or elder people usually take over some farm tasks so that the adults can more easily work off the farm. These results confirm the findings of similar studies such as Lass, Findeis, and Hallberg (1991); Kimhi (1994); and Zhang, Rozelle, and Huang (2001).

As mentioned in Knight and Yueh (2002); Appleton, Knight, Song, and Xia (2002); and Chen, Huffmann, and Rozelle (2004), social capital, such as the size of social network or the membership of the Communist Party, may influence people's employment decisions. Knight and Yueh (2002), for example, find that the Communist Party membership significantly raises the income of employees in China. Further, Chen, Huffmann, and Rozelle (2004) show that that the availability of social networks increases the likelihood of rural households taking non-farm jobs. Our results suggest that membership in the Communist Party (*CPMEMBER*) increases the likelihood of hiring on-farm labor (*regime h*) and significantly reduces the probability of selling labor off-farm (*regime s*) when compared to autarky. Membership in the Communist Party might provide farm household more favorable conditions in farm business, such as better access to restricted input and factor markets or preferential treatment in marketing farm products. Such conditions undoubtedly lead to a higher profitability of farming and farm labor, respectively, and in turn reduce the likelihood of selling family labor off-farm.

A household's inclination to work off-farm (*regime s*) and to simultaneously hire and sell labor (*regime sh*) significantly decreases with the amount of unearned income (*TRANSFER*). An increasing amount of unearned income leads directly to an increasing demand of leisure and this in turn to a lower supply of family labor. Thus, a high amount of unearned income might lower the probability to supply labor off-farm.[6]

Farm attributes include total sown area (*SOWN*), real durable assets (*ASSETS)*, income from farming (*AGR-INC*), the share of vegetables on the total sown area (*VEGET*), and a dummy variable for households with animal husbandry like pigs and sheep (*ANIMAL*). All variables are considered as exogenous to work participation decisions. The capital stock as represented by the real durable assets is positively related to all three labor market participation regimes, but only for purely off-farm employment (*regime s*) and simultaneously hiring and selling labor (*regime sh*) of statistical significance. A relatively high capital stock (*ASSETS*) indicates high labor productivity (low labor intensity) such that hiring on-farm labor might become relatively profitable. On the other hand, high capital intensity may indicate that farmers substitute capital for family labor such that the household could provide labor forces outside the farm. As expected, larger farms (*SOWN*) tend to hire additional labor (*regime h*) and participate less on off-farm activities (*regime s*) or on both labor markets simultaneously (*regime sh*). Similarly, as expected, high agricultural income (*AGR-INC*) significantly reduces households' inclination toward working outside the farm (*regime s*) or simultaneously selling off-farm labor and hiring on-farm labor (*regime sh*) when compared with autarky. The production structure (*VEGET* and *LIVESTOCK*) does not significantly contribute to the explanation of households' labor market participation decisions.

With regard to the regional characteristics that should cover external labor market conditions, we find that a relatively high unemployment rate (*UNEMP*) significantly reduces the household willingness to work off-farm (*regime s*), but significantly increases the likelihood of hiring on-farm

labor (*regime h*) and of simultaneously hiring and selling labor (*regime sh*). A high unemployment rate might indicate relatively high transaction costs and in particular search costs of selling family labor off-farm, but low transaction costs of hiring on-farm labor. Thus, relatively high unemployment rates lead to relatively low general wage levels such that working off-farm becomes less attractive and hiring on-farm labor less costly. In addition, we try to more directly control for differences in external wage levels by using the annual net income per head of the respective villages (*ANIPP*).[7] We find that the average per head income of the villages is positively related to all three labor market states. Furthermore, a greater population density (*POPDENS*) significantly reduces the likelihood that households participate in labor markets. For a given unemployment rate and average per-head income, it might be more difficult for family members to find a job off the farm in regions with a high population density because there are a greater number of competitors looking for work.

It may be of particular interest, we find, that the first two time dummies (*PERIOD1* and *PERIOD2*) are significantly positively related to all three labor market participation options. Thus, one can carefully conclude that the more market oriented policy reforms stimulate households to participate in labor markets and thus lead to an increasing integration of labor markets. However, the third time dummy (*PERIOD3*) that cover the period 1994-1998, when more anti-market reforms took place, indicates a significant negative impact on market participation. That is, the estimated coefficients of this variable show significant negative signs in explaining all labor market regimes.

5. Summary

The study contributes to the ongoing debate over the participation of agricultural households in rural labor markets during the last twenty years. In particular, it accounts for the impact of China's several rural policy reforms on farmers' labor market decisions. During this period frequent adjustments of agricultural policies occurred – sometimes in favor of market liberalization but often the direction was less clear. On several occasions, policy changes aimed to put the old central planning back in force. Using individual data over the period 1986-2000 from several villages in the province Zhejiang, we apply a multinomial logit model to empirically examine household, farm, and regional characteristics affecting the probability that farmers employ one of four alternative options; that is, hiring on-farm labor, selling off-farm labor, hiring and selling labor at the same time, or autarky.

The result of the empirical analysis show significant relationships between households, farms, and regional attitudes. Households with higher educated farm operators and a higher number of household members show a significantly higher inclination to participate in labor markets. In contrast, the likelihood of autarky increases with the amount of unearned income. Further, membership in the Communist Party significantly reduces the probability of working off-farm but increases a household's inclination to hire on-farm labor. These results suggest that the membership in the party may lead to favorable conditions in farming. Regarding the farm attributes, we find capital endowments are positively related to the participation of all three labor market states when compared to autarky, whereas high land endowments encourage households to hire on-farm workers and participate less in off-farm activities. As expected, a relatively high unemployment rate significantly reduces the household's willingness to work off-farm but increases the likelihood of hiring on-farm labor.

From a policy perspective, we particularly find that the more market oriented policy reforms at the end of the 1980s stimulated households to participate in labor markets, while the more anti-market reforms during the mid-1990s led to the opposite and promoted autarky. If rural labor mobility is a key to economic development, the aim of public policy should be to remove institutional impediments and promote market orientation. Furthermore, policy measures should encourage the education of the rural population and efforts should be made to improve particularly large households' access to information about labor market conditions. Finally, improvements in regional job opportunities undoubtedly would encourage farm households' members to work off-farm.

Notes

[1] The household registration or residency permit system registers rural and urban households separately and firmly determines the access to public services, e.g. education, housing, or public welfare. According to the grain procurement quota system, the households are committed to fulfill the quota in kind or in cash to the state in order to maintain the use right on their contracted land.

[2] If E>0, then the household received transfers (or unearned income) and if E<0, it provided them.

[3] Note, if perfectly competitive labor markets would be assumed, then the functions are linear, with $\partial f(.)/\partial X_l^s = P_l$ or $\partial g(.)/\partial X_l^h = P_l$. Thus, marginal off-farm income or marginal costs for hired labor are equal to the exogenous labor price (P_l). In this case, the farm household model is separable and recursively solvable, first for the production decisions and then for the household decisions.

[4] Again, with few rearrangements the stationary solutions can cover all labor market regimes. That is, if D_l^h and D_l^s are equal to one, the household participates in both the market for hired on-farm and the market for off-farm family labor. If $D_l^h = 1$ and $D_l^s = 0$, then the household hires labor, but does not sell family labor off-farm. Just the opposite holds, if $D_l^h = 0$ and $D_l^s = 1$. Finally, the case of autarky is indicated when both variables are equal to zero.

[5] The most popular example is the introduction of the governor's grain bag responsibility policy in 1995.

[6] Moreover, comparative static results (not reported) suggest that, assuming labor markets are constrained the internal wage rate will increase with the amount of unearned income and farmers tend to provide less family labor off-farm.

[7] Regional wage levels are unfortunately not reported in the data set.

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