The dynamics of Chinese rural households' participation in labor markets

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Contributed paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006

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1. Introduction

Undoubtedly, the adjustment of rural labor markets to economic reforms is an important indicator of the progress of transition. As in other transition economies the institutional change (de-collectivization) of farm businesses in China at the end of the 1970s strongly increases rural underemployment. In particular, the participation of Chinese agricultural households on both the market for hired on-farm labor and the market for off-farm employment was rather limited indicating poorly developed labor markets. While the former was totally prohibited the latter was effectively prevented by a package of policies, including the household registration system.[a] With the beginning of market liberalization at the beginning of the 1980s labor mobility was partially 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). Because of the relative decline of agricultural sector's importance[b] income sources from off-farm employment complement or substitute income from agricultural production.

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

[b] The agricultural sectors' importance for rural employment in China declined from 93 percent in 1978 to 64 percent in 2003. In the case of the Zhejiang province, the survey region of this paper, its share on rural labor force declined even faster from 89 percent to 39 percent during the same period (IFPRI, 2004; SSB). Development of off-farm employment in China faces mainly two determinants: the development of rural non-agricultural employment opportunities, to a large part the Township and Village Enterprises (TVE) as well as private enterprises, and migration restrictions including non-functioning land markets (Knight and Song, 2003).

However, farm households are differentially integrated into the labor markets, with some selling labor services, others hiring labor, some simultaneously selling and hiring labor, and yet others opting for autarky. This might be the result of different endowments of labor skills, land, or fixed assets or different costs in accessing labor markets, or external conditions. Moreover, during the 1990s frequent changes of households' labor market participation regimes could be observed, indicating remarkable changes in (labor) market and/or farm household conditions. There is an extensive literature about labor market participation of agricultural households using data from several countries. For a survey of literature see Hallberg, Findeis and Lass (1991). The most commonly used methods in the literature involve the estimation of probit, logit or multinomial logit models to assess individual's or household's labor market participation.[c] This group of models assumes a kind of steady-state situation: Once households have chosen one participation regime they will remain in it.[d]

The present study is devoted to the analysis of the different labor market participation regimes of Chinese farm households. Using individual data over the period 1995-2000 from several regions in the province Zhejiang we investigate households' labor market histories. The focus will be on the frequency of each possible transition from one state to the other. To empirically evaluate factors, as household, farm, and regional characteristics, affecting the

[c] See for example Jarvis and Vera-Toscano (2004); Gould and Saupe (1989); Zhang, Rozelle and Huang (2001); Barkley (1990); Chen, Huffman and Rozelle (2004); Glauben et al. (2004); Buchenrieder, Knüpfer and Heidhues (2002) as well as Chaplin, Davidova and Gorton (2004)

[d] There are at least to exceptions which have to be mentioned: Corsi and Findeis (2000) as well as Weiss (1997) use different specifications of a probit model to explain the persistence of off-farm participation taking previously occupied labor market regimes into account. Most analyses of non-agricultural labor mobility use the more flexible technique of hazard models; see for example Orazem and Vodopivec (1997) as well as Sorm and Terrell (2000) which apply this methodology to non-agricultural labor markets of economies in transition.

frequency of transition between labor market states, we apply a continuous-time hazard model, allowing for unobserved heterogeneity.

The remainder of the paper is organized as follows: The methodological framework and the data are described in Section 2. This is followed in Section 3 by the presentation of the empirical results. Finally, Section 4 concludes.

2. Methodological framework and data

Methodological framework

As mentioned before, the households participating in the labor market could be classified in four independent and mutually exclusive states (Glauben et al., 2004): hire on-farm labor *(h)*, working off-farm *(s)*, hiring labor on farm and selling off-farm labor simultaneously *(sh)*, autarky *(a)*. The original status $j=(h,s,sh,a)$ of a household is not fixed over the observation period, given that the household may shift the status every time during the surveyed period. In fact, 12 possible transition events could occur. However, using a hazard approach, we only analyze eight transitions, that is the probability of slipping out of every actual state $j=(h,s,sh,a)$ in all states and the hazard of slipping into every potential state $i=(h,s,sh,a)$ from all preceding states.

The concept of the parametric estimation of the hazard model (Kalbfleisch and Prentice, 2002) can be illustrated in the following form, allowing for time-varying covariates.[e] The hazard function is represented by $\lambda_{ji}(t,z,\alpha,\beta,\theta)=\lambda_{0ji}(t,\alpha_{ji})\theta\exp\left[z(t),\beta_{ji}\right]$. Here $\lambda_{ji}(t,z,\alpha,\beta,\theta)$ denotes the hazard of the transmission form one state to another state j,i

[e] Reflecting the discussion about the treatment of time-varying covariates, only so-called external time-varying covariates are included in this analysis. These variables are observable independently of the participation status. Therefore, standard asymptotic estimation techniques provide viable means of estimates of the relative risk parameters β (Kalbfleisch and Prentice, 2002, p. 196).

$j \neq i$, where *j* represents the original status at time $t_1,...,t_{n-1}$ and *i* denotes the shifted state at time t_n. Further $\lambda_{0ji}\left(t,\alpha_{ji}\right)$ indicates the baseline hazard of an event *j, i*, say climbing out of off-farm employment (s) in all possible states $i=\left(h,s,sh,a\right)$, that can be chosen from a parametric family (here Weibull[f]), under the condition $\exp\left[z\left(t\right),\beta_{ji}\right]=0$, that is no heterogeneity among the individuals. Heterogeneity of individuals reflected by differences in the observed (*z*) and unobserved characteristics (θ) might change the individual hazard. The former explains the estimated distributions of household's time spent in or out a certain participation regime and the latter is proved to change the baseline hazard rate of transition as a latent multiplicative effect, called frailty parameter (Meitzen, 1986; Blau and Riphahn, 1999). Or in other words, if $\exp\left[z\left(t\right),\beta_{ji}\right]>1$, then the probability of the event *j, i* for this individual would increase, and if $\exp\left[z\left(t\right),\beta_{ji}\right]<1$ the opposite holds. Thus, the hazard model provides both insights in how the risk of slipping into and out of a state changes with an increasing time spent in this state and, in addition, with the covariates.

Data and descriptive analysis

The sample data used in the study is drawn from the fixed-point household and village survey data in Zhejiang province for the period of 1995-2000. The annual survey is directed by the Ministry of Agriculture and covers 500 households in 10 villages. Most of households remain in the survey for the whole period.[g] Thus, the data consists of an unbalanced time-series and cross-section sample with 2063 observations over 6 calendar years. 472 households are observed over the whole survey period.

[f] Frequently applied are Weibull, Log-logistic, Exponential, Gompertz, and Erlang-2 distributions. In this paper all models were estimated as a Cox proportional hazard model and with Weibull, Exponential and Gompertz distributions as baseline hazard. The Akaike Information Criterion is used to find the distribution which minimizes this information criterion, which is the Weibull distribution.

[g] A household could be dropped from the survey due to migration or death.

In addition to recording household's status in labor market from 1995 onwards, the survey also reports the labor participation behavior of the given household precisely before the survey. This allows us to track the households' mobility between different labor market regimes during the whole survey period. Table A1 in the Appendix summarizes households' participation in the four regimes in each year from a static perspective. It is obvious that significant numbers of households either work off-farm or do not participate in the labor market. The varying shares show that there is some mobility of households between these four regimes over time. To capture this mobility, Table A2 in the Appendix presents the absolute number of households shifting from one regime to another. Particularly, most households move into off-farm employment and into autarky, with a majority of shifts between these two regimes ($s \leftrightarrow a$). With around 413 identical households in the sample, the incidence of transition occurs 767 times over the six periods. This implies that some of the households have changed their status more than once.

To assess the extent of overall mobility between regimes, the transition probability, on average, is calculated by a commonly used Markov transition matrix and probabilities are presented in Table A3 in the Appendix. The probability of a household's transition into any of the other states is only conditional on the current state being occupied. Each cell shows the average probability to shift from one state to another state between spells. The highlighted figures in the leading diagonal show the probability of households to remain in the same state in the following year. Households with off-farm employment show the highest probability to stay in this regime in the subsequent period. Out of the households which originally worked off-farm, on average, 18 percent shifted to autarky. Contrary, with 58 percent the highest proportion of shift is reported for the transition from autarky to off-farm employment. Thus, the data for China reveal similar asymmetric behavior between entry and exit from off-farm work as observed in other countries (Gould and Saupe, 1989; Weiss, 1997).

3. Empirical results

As mentioned before, the study examines household, farm and regional characteristics affecting the hazard of slipping out and into the four labor market regimes. To explore their effects on households' aggregated and disaggregated transitions, several proportional hazard models were estimated. As presented in Table A2 most transitions are concentrated on the regimes off-farm employment and autarky. Therefore, we estimate the aggregated entry into and exit from the four regimes and present the estimated hazard ratios in Tables 1 (entry into regimes) and 2 (exit from regimes) and concentrate within the following discussion on the determinants of entry into and exit from autarky.[h]

Figure 1 illustrates some main results of the analysis that are the predicted hazard rates of the exits from and entries into the several labour market regimes over time. Obviously, the predicted hazard is highest for entering off-farm employment followed by leaving off-farm work. Entry and exit regarding autarky show the reversed relationship, the probability to leave autarky is higher than for entering it. Further, for almost all labor market regimes we find that with an increasing time households spend in the respective regime the hazard to escape this state increases but with decreasing rates. Or in other words, the parameter *p* (see tables 1 and 2) indicates that the conditional probability of transition increases with adherence to each of the labor market regimes in all eight specifications. This result highlights the importance of a dynamic view. Assuming a constant probability of entering for instance off-farm employment is not appropriate within this framework.

Include Figure 1 around here

[h] All models are estimated as Cox proportional hazard model and as parametric models with Weibull, Exponential and Gompertz distributions. On the basis of the Akaike information criterion (AIC), the Weibull version is preferred in all specifications. The results of the comparison as well as the results of the transitions between each regime could be obtained from the authors upon request.

Tables 1 and 2 document the relationship between the hazards of transition out of and into all labor market regimes as well as several household, firm, and regional characteristics. However, in the following discussion we will highlight the hazard of climbing out and falling into autarky. Note, that the parameters controlling for unobserved heterogeneity are statistically significant from zero in seven out of eight cases.[i]

Include Tables 1 and 2 around here

As expected, households with an older head *(AGEHEAD)* and a higher share of educated laborers *(ELEMENTS, SECONDS, HIGHS)* face a significantly lower probability to exit autarky. Surprisingly, education has a similar effect on entering autarky leading to the conclusion that higher educated households show a lower mobility to enter or to leave their current labor market regime. Increasing the share of family members with a high school degree (*HIGHS*) about one percentage point reduces the probability to enter or to exit autarky by 89 percent and 86 percent, respectively. Returns to education seem to drive specialization in off-farm employment or household production and increases persistence in these two regimes. This result is in contrast with the findings of the static analyses by Zhang, Huang and Rozelle (2002) and Glauben et al. (2004), where higher education increases the probability to work off-farm.

In view of the household's demographic structure, the magnitude and effect of the gender of labor force on the transition between the states differ apparently. Whereas every additional male laborer (*MLABOR*) reduces household's mobility, each additional female laborer (*FLABOR*) increases the likelihood to leave autarky, however, not statistically significant. The number of non-working family members (*DEPENDENT*) significantly decreases household's likelihood to enter autarky by 20 percent. It is very likely that also family member younger than 16 or older than 65 years work in the household business

[i] An asymptotic z-test is used to test whether unobserved heterogeneity influences the transition process and the results are reported as variable θ in Tables 2 and 3.

making other family member's off-farm occupation possible. Finally, households receiving higher transfers (*TRANSFER*) exhibit a lower mobility in respect to leaving autarky.

Farm characteristics, especially the sown area, the agricultural income and the number of livestock, have a significant impact on household's mobility. An increase of sown area per capita (*FSIZE*) by one mu[j], increases the probability to leave autarky by 5.8 percent. The covariate of agricultural income (*AGR-INC*) indicates a very strong incentive to enter autarky and reduces the probability to engage in any employment outside the household. Increasing agricultural income by one unit (thousand Yuan per capita) raises the probability to enter autarky by 12 percent and lowers at the same time the propensity to leave autarky by 11 percent.

As expected, households located in villages with a higher unemployment rate (*UNEMP*) face a higher probability of entering autarky. Increasing search costs in non-agricultural labor markets drive households to withdraw their labor force. Therefore, the autarky regime overlaps with hidden unemployment. Surprisingly, the local unemployment rate has also a mobility enhancing effect as it increases the likelihood to leave autarky. This unexpected result could point to a positive correlation between general activities on the labor market and unemployment. Comparing the net effect, a one percentage point rise of the unemployment rate increases the probability to enter autarky by 0.6 percent. Considering village income per capita *(ANIPP)*, we find that households located in the wealthier villages tend to move less into and out of autarky. One explanation could be a higher supply of non-farm employment opportunities in more prosperous villages or an increasing specialization of households in agricultural production as well as off-farm employment. In densely populated villages (*POPDENS)* a higher probability to enter and to leave autarky is observed. Unexpectedly, increasing agricultural Terms of Trade (*TRADE*) raise the probability to leave autarky.

[j] 1mu = 0.067 hectare

4. Summary

The study contributes to the on-going debate over Chinese agricultural households' participation on rural labor markets during the last twenty years. In particular, it focuses on the mobility of rural households' participation in labor markets. Farm households are differentially integrated into the labor markets, with some selling labor services, others hiring labor, some simultaneously selling and hiring labor, and yet others opting for autarky. This might be the result of different endowments of labor skills, land, or fixed assets or different costs in accessing labor markets, or external conditions. During the 1990s frequent changes of households' labor market participation could be observed.

Using individual data over the period 1995-2000 from several regions in the province Zhejiang we investigate households' labor market histories during this time, focusing on the frequency of each possible transition from one state to the other. A hazard approach is applied to empirically evaluate factors, as household, farm, and regional characteristics, affecting the frequency of transition between labor market states. Results suggest that there are frequent changes of labor market participations regimes among the households. Given the change in external conditions and other factor endowments this might indicate that households quickly response in allocating labor in order to equilibrate the resources. Further, we find that there are good chances climbing out of autarky; however the probability to fall in autarky was also remarkable over time.

In addition, we find several household, farm and regional characteristics affecting the transition between the labor market regimes over time. For example, higher agricultural incomes advance household's transition into autarky and delay entry into off-farm occupation. Furthermore, households in richer villages enter and leave autarky later.

Acknowledgements

The authors acknowledge financial support of the Deutsche Forschungsgemeinschaft (DFG).

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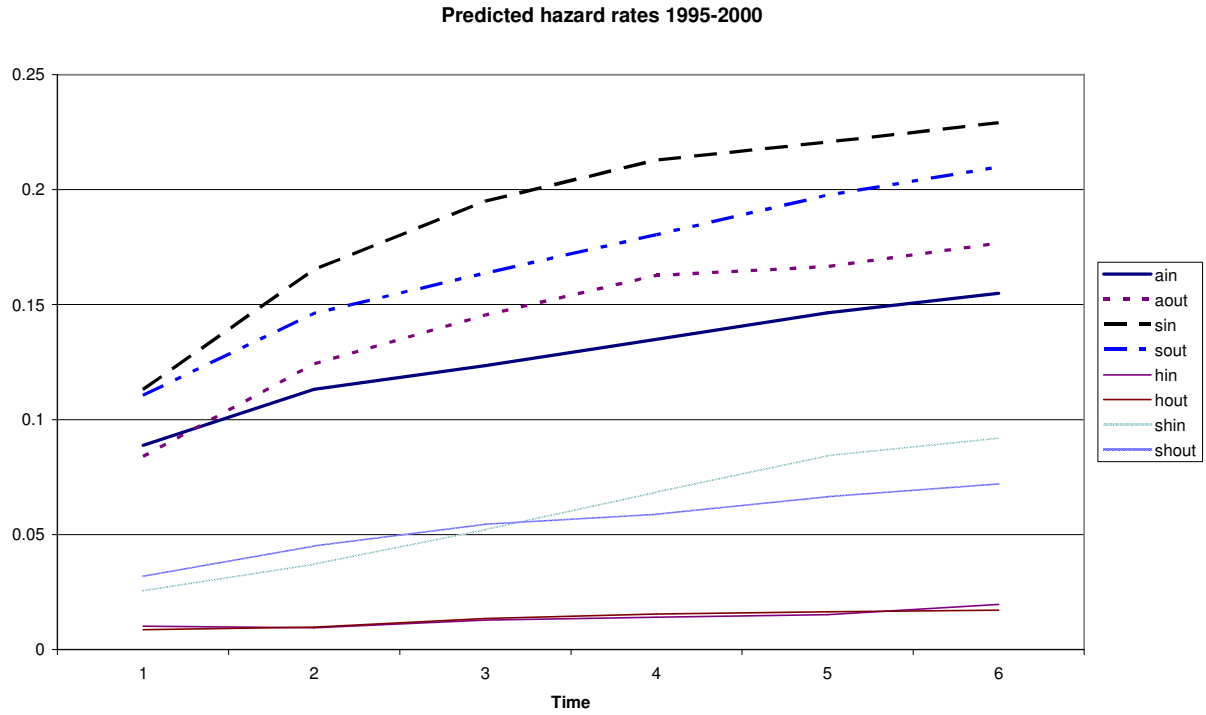

Figure 1: Predicted hazard rates of entry and exit

Table 1. Estimated results of Weibull hazard model, 1995-2000

SYMBOL	Entry into h	Entry into s	Entry into sh	Entry into a
AGEHEAD	1.3611	0.8613*	0.8608	0.8889
	(1.16)	(1.80)	(1.52)	(1.08)
ELEMENTS	0.4283	0.9490	1.3282	0.6286
	(0.82)	(0.21)	(0.66)	(1.42)
SECONDS	0.5241	0.5916*	1.4434	0.3086***
	(0.51)	(1.72)	(0.81)	(3.07)
HIGHS	0.4979	0.6182	2.8690*	0.1137***
	(0.29)	(0.99)	(1.79)	(2.98)
SKILLS	0.5648	0.6104*	0.8567	0.6813
	(0.46)	(1.65)	(0.46)	(0.84)
M-LABOR	1.0259	0.8555	1.4224**	0.7759
	(0.06)	(1.21)	(2.22)	(1.53)
F-LABOR	0.6926	0.9393	0.9875	0.9110
	(0.95)	(0.57)	(0.09)	(0.59)
DEPENDENT	1.4814	0.9239	1.0947	0.8039**
	(1.14)	(0.94)	(0.83)	(2.01)
PMEMBER	1.6850	1.2038	1.6037**	1.4514
	(0.63)	(0.95)	(1.99)	(1.52)
TRANSFER	0.9997	0.9997***	1.0001	1.0002
	(0.66)	(3.14)	(0.36)	(1.38)
ASSET	1.0306	0.9865	1.0204	0.8436
	(0.83)	(0.56)	(1.27)	(1.01)
FSIZE	1.1004***	1.0108	1.0524**	1.0256
	(5.14)	(0.40)	(2.41)	(0.80)
AGR-INC	0.9909	0.8936**	0.8437*	1.1245***
	(0.07)	(2.24)	(1.70)	(4.52)
LIVESTOCK	0.9991	1.0185*	1.0075	1.0277*
	(0.02)	(1.72)	(0.52)	(1.88)
UNEMP	0.9266**	1.0163**	0.9894	1.0216**
	(2.54)	(2.12)	(0.97)	(2.11)
ANIPP	1.0005	0.9999	1.0011***	0.9987***
	(0.85)	(0.41)	(4.34)	(4.86)
POPDENS	0.7905	1.1708	0.4591***	1.6654***
	(0.54)	(1.46)	(3.62)	(3.00)
TRADE	1.0014***	1.0004**	0.9995	1.0000
	(6.19)	(2.14)	(0.69)	(0.03)
ln (P)	0.8219***	1.0207***	0.7582***	0.9906***
	(6.62)	(32.29)	(9.65)	(22.29)
P	2.2748	2.7750	2.1344	2.6928
θ	35.0987**	5.2720***	3.08*E-6	7.9386***
χ^2	260.75	35.21	74.62	105.02
Log likelihood	-107.4338	-541.8357	-256.7861	-453.7098
AIC	256.8676	1125.6713	555.5723	949.4195
No. of transition	29	383	114	259

Note: Z-statistics are presented in parentheses and base on robust standard errors; ***, ** and * statistically different from zero at 1%, 5% and 10% significant level, respectively.

Table 2. Estimated results of Weibull hazard model, 1995-2000

SYMBOL	Exit from h	Exit from s	Exit from sh	Exit from a
AGEHEAD	1.3243	0.8973	1.0638	0.8401*
	(1.12)	(1.26)	(0.37)	(1.67)
ELEMENTS	0.1352	0.9093	3.7855*	0.5599*
	(1.61)	(0.31)	(1.94)	(1.89)
SECONDS	0.4237	0.4825**	3.5973*	0.2948***
	(0.69)	(2.12)	(1.70)	(3.20)
HIGHS	1.4054	0.5406	11.9667**	0.1384***
	(0.21)	(1.21)	(2.46)	(3.00)
SKILLS	0.1042	0.9685	0.3657*	0.6828
	(1.31)	(0.09)	(1.72)	(0.95)
M-LABOR	1.1006	1.0087	1.1951	0.8361
	(0.20)	(0.07)	(0.64)	(1.04)
F-LABOR	0.9459	0.9550	0.6320**	1.0279
	(0.11)	(0.36)	(1.98)	(0.21)
DEPENDENT	0.9109	0.9589	1.0684	0.9245
	(0.27)	(0.47)	(0.33)	(0.78)
PMEMBER	6.4838**	1.2833	1.3132	1.3620
	(2.49)	(1.20)	(0.62)	(1.29)
TRANSFER	0.9993*	1.0001	0.9999	0.9998**
	(1.78)	(0.98)	(0.44)	(2.02)
ASSET	0.9744	0.9662	0.9930	1.0113
	(0.46)	(0.98)	(0.23)	(0.65)
FSIZE	1.1298***	0.9857	0.7223*	1.0575***
	(4.57)	(0.41)	(1.70)	(4.36)
AGR-INC	0.3634	1.0928***	0.9226	0.8904**
	(1.44)	(3.07)	(0.70)	(1.98)
LIVESTOCK	1.0196	1.0335***	1.0017	1.0113
	(0.40)	(2.69)	(0.07)	(0.84)
UNEMP	0.9345*	1.0184**	1.0133	1.0159*
	(1.76)	(2.08)	(0.74)	(1.70)
ANIPP	1.0015*	0.9994***	1.0021***	0.9992***
	(1.88)	(2.89)	(5.87)	(3.68)
POPDENS	0.5169	1.1727	0.3154***	1.7777***
	(1.15)	(1.10)	(3.75)	(3.87)
TRADE	0.9936	0.9999	1.0005	1.0009***
	(0.57)	(0.34)	(0.84)	(7.06)
ln (P)	1.0053***	1.0391***	1.0376***	1.0376***
	(6.02)	(25.81)	(12.12)	(26.50)
P	2.7327	2.8266	2.8223	2.8223
θ	83.6285*	7.4886***	19.7069	6.7286***
χ^2	193.27	47.67	72.10	157.17
Log likelihood	-99.9327	-519.2501	-272.0010	-472.1104
AIC	241.8654	1080.5002	586.0021	986.2209
No. of transition	28	339	113	287

Note: Z-statistics are presented in parentheses and base on robust standard errors; ***, ** and * statistically different from zero at 1%, 5% and 10% significant level, respectively.

Appendix

Table A 1: Static distribution of households' labor participation

Year	h		s		sh		a		Total
	No.	%[1]	No.	%	No.	%	No.	%	
Before 1995	7	1.70	252	61.17	55	13.35	98	23.79	412
1995	10	2.71	198	53.66	50	13.55	111	30.08	369
1996	7	1.94	252	69.81	34	9.42	68	18.84	361
1997	5	1.43	246	70.49	31	8.88	67	19.20	349
1998	4	1.18	233	68.73	35	10.32	67	19.76	339
1999	4	1.19	229	68.36	46	13.73	56	16.72	335
2000	4	1.29	210	67.74	47	15.16	49	15.81	310
1995-2000	34	1.65	1368	66.31	243	11.78	418	20.26	2063

Note: *h, s, sh* and *a* represent hiring labor force, working off-farm, hiring in and out labor simultaneously and autarky, respectively. 1. Percentage share on total sample in respective period.
Source: Survey done by Agricultural Fixed Point Survey Team in Zhejiang Province for the period of 1995-2000.

Table A 2: Yearly observation of households' labor participation transition, 1995-2000

	1995	1996	1997	1998	1999	2000	Total
$h \rightarrow s$	4	8	3	0	0	0	15
$h \rightarrow sh$	0	2	1	2	2	0	7
$h \rightarrow a$	1	0	0	2	1	2	6
$s \rightarrow h$	4	1	2	1	3	0	11
$s \rightarrow sh$	23	9	11	14	16	21	94
$s \rightarrow a$	68	38	45	36	32	15	234
$sh \rightarrow h$	0	3	1	2	0	1	7
$sh \rightarrow s$	18	22	17	13	5	15	90
$sh \rightarrow a$	6	2	0	5	2	1	16
$a \rightarrow h$	4	1	1	0	0	2	8
$a \rightarrow s$	45	77	45	43	44	13	267
$a \rightarrow sh$	1	1	4	3	2	1	12
Total	174	164	130	121	107	71	767

Note: *h, s, sh* and *a* represent hiring labor force, working off-farm, hiring in and out labor simultaneously and autarky, respectively.
Source: Survey done by Agricultural Fixed Point Survey Team in Zhejiang Province for the period of 1995-2000.

Table A 3: Transition probability matrix of households' participation in different labor market regimes, 1995-2000

Origin \ Destination	*h*	*s*	*sh*	*a*
h	**0.1463**	0.4634	0.1707	0.2195
s	0.0117	**0.7264**	0.0791	0.1828
sh	0.0235	0.4161	**0.4832**	0.0772
a	0.0174	0.5833	0.0349	**0.3643**

Note: *h, s, sh* and *a* represent hiring labor force, working off-farm, hiring in and out labor simultaneously and autarky, respectively.
Source: Survey done by Agricultural Fixed Point Survey Team in Zhejiang Province for the period of 1995-2000.