



The Rise of Self-Employment in Rural China: Development or Distress?

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Summary. — This paper evaluates the role of self-employment in China's rural economy, while paying attention to whether the rise of self-employment promotes entrepreneurship and is a sign of development, or whether it is a stopover for disadvantaged workers and a sign of distress. Using data on 20-year labor market histories of a nationally representative sample of individuals, we provide descriptive evidence that self-employment in rural China, unlike in some other places, is a sign of development. Econometric evidence from a random-effects probit model and a continuous-time Markov model shows also that self-employment in rural China shares many features of a productive small-business sector.

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1. INTRODUCTION

One of the most significant employment trends in rural China is the rise of off-farm self-employment; in recent years, there has been a veritable explosion of traders, merchants, and small- and medium-scale, individual- and household-run businesses (Entwisle, Henderson, Short, Bouma, & Zhai, 1995). During 1988–95, up to 30 million self-employed workers emerged in rural China (Rozelle, Guo, & Minggao, 1999). According to the survey, during 1988–95 the self-employment sector was the fastest growing off-farm sector in rural China (Rozelle *et al.*, 1999). During this period, almost 40% of all new off-farm jobs belonged to the newly self-employed. Self-employment grew fastest in the rich coastal provinces but rural residents began working for themselves in other provinces as well. While either the reasons for or broader implications of the rise of self-employment are still not well understood, it is clear that the increase in earnings from self-employed work was a major contributor toward increasing China's rural incomes in the late 1980s and 1990s (Parish, Zhe, & Li, 1995).

Many development and transition economists believe that the emergence of a strong self-employment sector in an economy plays an important role in the overall development

process, apart from being a source of income and employment for rural residents (Blau, 1985; Yu, 1999).¹ Schumpeter described the sector as the “prime mover of economic growth” (Schumpeter, 1943, p. 132). de Soto (1989) described the emergence of self-employed workers as “the foundation of development” (p. 243). Transition economists believe the rise of self-employment to be a sign of the growing importance of markets relative to the state (Gerber, 2001). Essentially, self-employment opens up new opportunities for workers that can significantly improve incomes, increase capital assets and the overall standard of living in the rural community as new enterprises grow into medium and large size businesses (Henley, 2002).

However, not all scholars agree that the rise of self-employment is a sign of a healthy labor market and some downplay its importance in the process of economic development. At the heart of this alternate view of the sector is the observation that the emergence of self-employment often parallels the rise of informal forms of employment in developing economies (Mazumdar, 1983; Portes, Castells, & Benton,

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1989). Some scholars believe that self-employment may be part of a less productive informal sector that serves as a coping mechanism for disadvantaged workers who are less educated and unskilled, or those who are seeking employment and cannot obtain a formal job (e.g., Gong & Soest, 2002; Tokman, 1992). In short, it is a sign of distress, not development. In fact, some analyses of developing economies consider the rise of self-employment as an indicator of reform failure. In other words, in these cases self-employment is not viewed as a step-up on the development ladder, but instead as a last resort for laborers who cannot find a job in the formal sector.²

The overall goal of this paper is to understand the role that self-employment is playing in China, one of the fastest growing countries in the world. In light of differing opinions over the contribution of self-employment to the future development of an economy, it is important to consider whether or not the rise of a self-employed class in rural China truly signals the arrival of entrepreneurs, innovators and imitators in the rural economy who will help accelerate the process of economic development. In contrast, one may wonder if self-employment in rural China is merely a stopover for workers experiencing difficulties in the formal wage-employment sector. Is it possible that the self-employed are anxious, looking forward to exiting the sector as opportunities in other sectors open up? What are the factors that affect an individual's mobility in and out of self-employment? In China, policymakers need to understand the nature of the self-employment sector in order to devise measures to help foster it if it is contributing to development, or to look for reasons why labor markets are festering if it is an indicator of distress.

To meet our broad goal and answer some of these questions, we have three specific objectives. First, we examine the rise of the importance of self-employment in the off-farm sector during the first two decades of China's reform, 1981–2000. Our aim here is to show how off-farm employment opportunities have grown in rural China during the course of the country's transition toward a market economy, and how workers are increasingly turning to self-employment.

Our second objective is to examine the nature of the evolution, and the quality of self-employment activity in rural China. To do so, we decompose the self-employment sector into two sub-sectors on the basis of the nature of

self-employment activity and the level of capital invested in the self-employed business (Arum, 1997; McManus, 2000). In this sense we seek to divide a broad class of employment into those that appear to be more dynamic, capital forming and have a greater likelihood of leading to higher productivity (*high productivity self-employment*, henceforth) from those that involve more trivial, less capital-intensive pursuits and are less likely to lead to future productivity growth of China's economy (*low productivity self-employment*, henceforth). In this context, we evaluate also if self-employment activities are attracting young, dynamic and more educated people to participate in the sector. One interpretation of more educated workers participating in the sector, particularly in high productivity self-employment, is that the sector is becoming more sophisticated over time, and requiring entrepreneurs to be increasingly technically qualified. Alternatively, one could interpret this phenomenon as indicative of problems and imperfection in the labor market.

Our third objective is to examine the determinants of self-employment, identifying some of the factors that allow workers to participate in high productivity self-employment activities. To do so, we use a static framework and examine how individual characteristics (such as educational attainment, age, and skill training), household characteristics (such as the size of household labor force), and parental characteristics (such as father's primary occupation) affect participation. We supplement our analysis with a dynamic framework and analyze the nature of labor movement in and out of self-employment over time to evaluate whether self-employment in rural China seems to be a stopover for workers moving into more desirable sectors over time, or whether it represents upward mobility and is a resource that is capable of generating economic growth.

To meet these objectives, the rest of the paper is organized as follows. In Section 2, we introduce the data that are used for the analysis. We use a set of rural household data that were collected with information on labor market histories and other characteristics of more than 2000 individuals across China. In Section 3, we use descriptive analysis and non-parametric regressions to demonstrate the growth of off-farm labor markets in China's rural economy over the past two decades, the growth of self-employment in particular and its evolution over time. In Section 4, we examine the determinants

of participation in high productivity self-employment using a random-effects probit model. The panel structure of the dataset allows us to hold constant time and regional variation in demand conditions, and to control for the effects of unobserved ability and risk-preference differences among individuals in identifying the main determinants of self-employment participation. Next, we follow up the static analysis with a dynamic analysis of transitions among sectors of the labor market, the entry and exit decision into self-employment and its determinants using a continuous-time Markov model. The final section concludes.

2. DATA

The data for this study are drawn from a randomly selected, almost nationally representative sample of 60 villages in six provinces of rural China. The provinces are Hebei, Liaoning, Shaanxi, Zhejiang, Hubei, and Sichuan. To reflect accurately varying income distributions within each province, one county was selected randomly from within each income quintile for the province, as measured by the gross value of industrial output. Two villages were selected randomly within each county. The survey teams used village rosters and their own counts to choose randomly 20 households, both those with their residency permits (*hukou*) in the village and those without. A total of 1,199 households were surveyed.

The data collection effort involved students from the Center for Chinese Agricultural Policy, Renmin University, and China Agricultural University. Several scholars from China collaborated with one of the authors to design the sampling procedure and final survey instrument with the village as the unit of analysis, after more than three years of rigorous pre-testing. The field work was undertaken by more than 30 graduate students and research fellows all with PRC citizenship and an average education level higher than a masters degree.

During the survey, enumerators used a pre-coded form to collect a wide range of data. The data include detailed information on household demographic characteristics, wealth, agricultural production and non-farm activities, including self-employment, wage employment, and investment. Several parts of the survey are designed to learn about the household's labor market decisions, in general, and its self-employment participation, in particular.

For roughly half of the households surveyed (610 out of 1,199), a 20-year employment history form was completed for each household member and each child of the household head, even when they were no longer considered household members. For each year during 1981–2000, the questionnaire tracks each individual's participation in 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.³

Using the employment history data, we identify individuals as being self-employed, wage earners or subsistence farm workers. If an activity pursued by an individual is registered as a small business (with less than eight employees), then we categorize the individual as self-employed. This includes individuals whose main source of income is from operating his/her own individual or household business (including all businesses except small-scale livestock or aquaculture enterprises). Although technically, all people who farm also are self-employed, we do not include any household that is engaged in traditional farming practices as "self-employed" in our study. Hence, with the exception of those that are engaged in large-scale livestock or aquaculture operations, self-employed should be considered "non-agricultural self-employed." Local wage earners are identified as people who have off-farm employment, are not self-employed, and live at home while they worked. The definitions hold for both members of the household and children of the household head. A household labor force measure was created by aggregating all individuals in the households above age 16 who indicated that they were either working in or searching for employment in agricultural and/or industry in each year. If a person over 16 indicated he had retired, could not work for health-related reasons, or had full-time enrollment in school, he was not included in the labor force total. Subsistence farming refers to those individuals and households who produce a large share of their own consumption basket and engage in relatively few commercial transactions in output and factor markets.

One major block of the survey, consisting of three sub-sections, was designed to learn about self-employment in rural China. The first sub-section asks the household for detailed information on firm start-up. In particular, this sub-section gathers information on the type of

business the household was engaged in, the amount of the initial investment, the sources of the initial investment funds, the relationship with the village and its leaders and the formal ownership structure of the self-employed enterprises at the time of the firm starting up.

The second part asks firms about the way they organize their operations. Specifically, this part of the survey form solicits information on who within the family operates the firm and collects information that can be used to describe the firm's utilization of labor, especially its use of family and hired labor. Finally, the survey also provides information on the composition, level and growth rate of capital of each firm.

The final part of the self-employment block gathers information about the firm's financial performance. Enumerators recorded information on all of the firm's revenues and expenses. The survey form also records detailed information on all assets and liabilities, including capital equipment, investment in buildings and land, inventories, accounts receivable, accounts payable, and other debts owed by the firm to banks and private individuals. With the information provided in the survey on capital use and self-employment occupation type, we were able to group the self-employed into two sub-sectors: high productivity self-employment (self-employed activities of trade/transportation and private enterprises that required substantial capital investment), and low productivity self-employment (custom labor service providers and handicrafts that required relatively less capital investment). The capital intensities of these two categories of self-employment were calculated as the ratio of enterprise assets to number of laborers. The mean capital intensity in the high productivity sector was almost twice the magnitude of the mean capital intensity observed in the low productivity sector.⁴

3. OFF-FARM LABOR MARKETS AND SELF-EMPLOYMENT IN RURAL CHINA

Consistent with previous studies, our data show that off-farm participation rates have grown steadily during China's two decades of reform. Off-farm employment as a proportion of the total rural labor force grew from about 15% in 1981 to about 43% in 2000 (Figure 1, top). In fact, the trend of off-farm sector growth is almost linear if not accelerating.

The consistent rapid growth of off-farm labor markets is particularly surprising considering that China's overall economy, while growing from 896 billion yuan in 1986 to 6.9 trillion yuan in 1996 (in terms of national GDP, State Statistical Bureau, 1997), fluctuated significantly over this period.

Consistent with the growth of the off-farm sector, the data reveal the growing importance of the self-employment sub-component. Self-employment as a proportion of the rural labor force grew steadily from 4% in 1981 to about 16% in 1995 (Figure 1, bottom).⁵ Interestingly the figure shows the same trend as Rozelle *et al.* (1999); self-employment was the fastest growing segment of the labor force before 1995. In the late 1990s, the growth of self-employment has continued, and by 2000, 16% of the rural labor force was self-employed.

The above pattern of the growth of the entry of workers' into self-employment can be better understood by examining the changing economic and social climate of China's economy over the past two decades of reform. During the early 1980s, self-employment was restricted by impediments, such as state laws regarding the employment practices of entrepreneurs, which persisted from the pre-reform era and kept small businesses from proliferating. Funding for self-employment activities also was difficult to obtain because rural income and savings levels were low (Croll, 1988). In the late 1980s and early 1990s, however, changes in policies removed some of these constraints (Oi, 1999). As a result the number of self-employed businesses activities increased significantly relative to township and village run enterprises (State Statistical Bureau, 1989); most of the self-employed reaped large profits as reforms led to greater flexibility in prices, wages and production decisions, and they were able to exploit market gaps left behind from the planned economy (McMillan & Naughton, 1992).

Although the number of self-employed has risen steadily over time, pure counts of workers fail to capture the full dynamism of the sector. Evidence regarding the quality shifts of self-employment can be gathered by decomposing the growth in self-employment. Using the two categories of self-employment activity (high and low productivity), we examine the growth of self-employment over the 1981–2000 time period to determine the direction of evolution of the sector.

Given our definition, the data suggest that a striking pattern of self-employment growth is

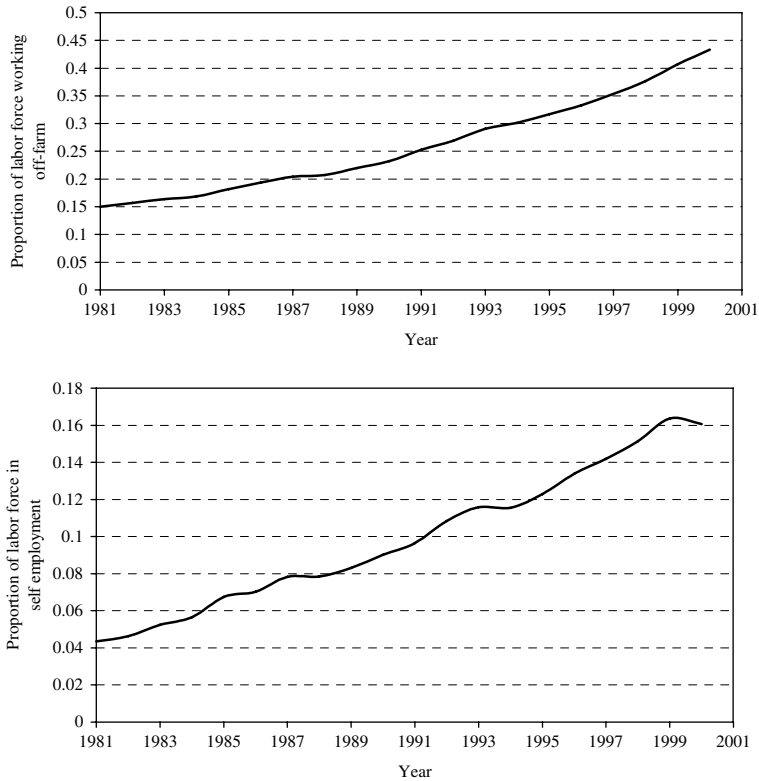


Figure 1. Trends in off-farm work (top) and self-employment (bottom) in rural China, 1981–2000 (source: author's survey).

emerging in China (Figure 2). High productivity self-employment is dominant, and growing over time. Low productivity self-employment, in contrast, is small, and shrinking over time. During 1981–2000, high productivity self-employment increased and in 2000, it accounted for over 75% of all self-employment in rural China. In contrast, over the same period low productivity enterprises declined and accounted for less than 25% of all self-employed workers in 2000.

To further examine the quality of self-employment using descriptive data, we examine the correlation between self-employment participation and wealth (measured as the value of durables of households). To do so, we group the households in the sample in order of increasing wealth and observe how occupations change across the groups in the 2000 time period (Figure 3). We find that self-employment participation increases almost monotonically with wealth. This finding suggests that self-employ-

ment activity in rural China requires capital and therefore richer households may have an advantage in participating in the sector.

Self-employment participation rates have also been increasing among more educated individuals. Using non-parametric regression analysis we show that educated workers are more likely to participate in self-employment, and this pattern has become accentuated over time.⁶ For example, in 1981, educational attainment was not correlated with self-employment participation rates (Figure 4, top). In contrast, by 2000, those with higher levels of education were much more likely to participate in self-employment (Figure 4, bottom).

Most strikingly, we find that the probability of participation increases with educational attainment for the high productivity self-employed firms, much more than the probability of participation for low productivity firms (Figure 5).⁷



Figure 2. *Self-employment quality, rural China, 1981–2000* (source: author's survey). Mean capital intensities of the high and low productivity self-employment sectors are 6956.48 and 3950.06, respectively.

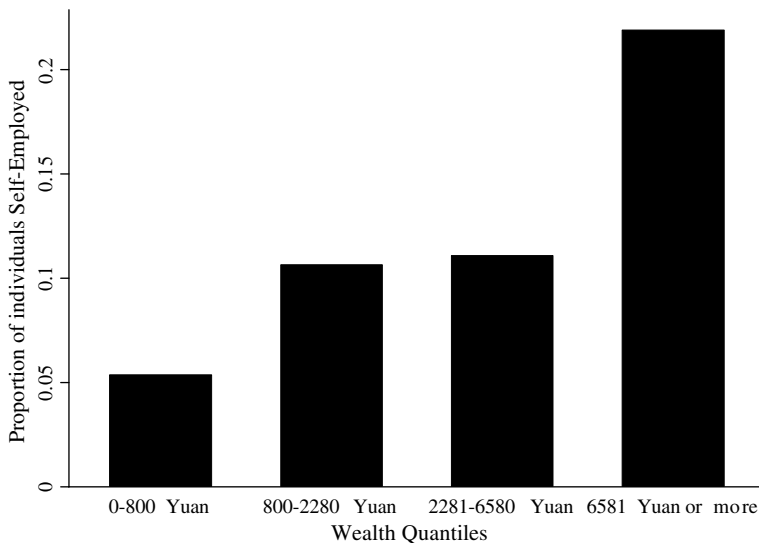


Figure 3. *Relationship between self-employment participation rates and household wealth* (source: author's survey).

Given that self-employment is becoming more capital-intensive over time, and given that the positive relationship between educational attainment and participation is more pronounced in high productivity self-employment, it is reasonable to expect that increasing participation of more educated individuals is a sign of the evolution in self-employment into a more formal sector.

4. DETERMINANTS OF SELF-EMPLOYMENT: MULTIVARIATE ANALYSIS

To examine the determinants of an individual's decision to enter into high productivity self-employment, we use a random-effects probit model similar to that developed by Butler and Moffitt (1982). In each year t , an individual

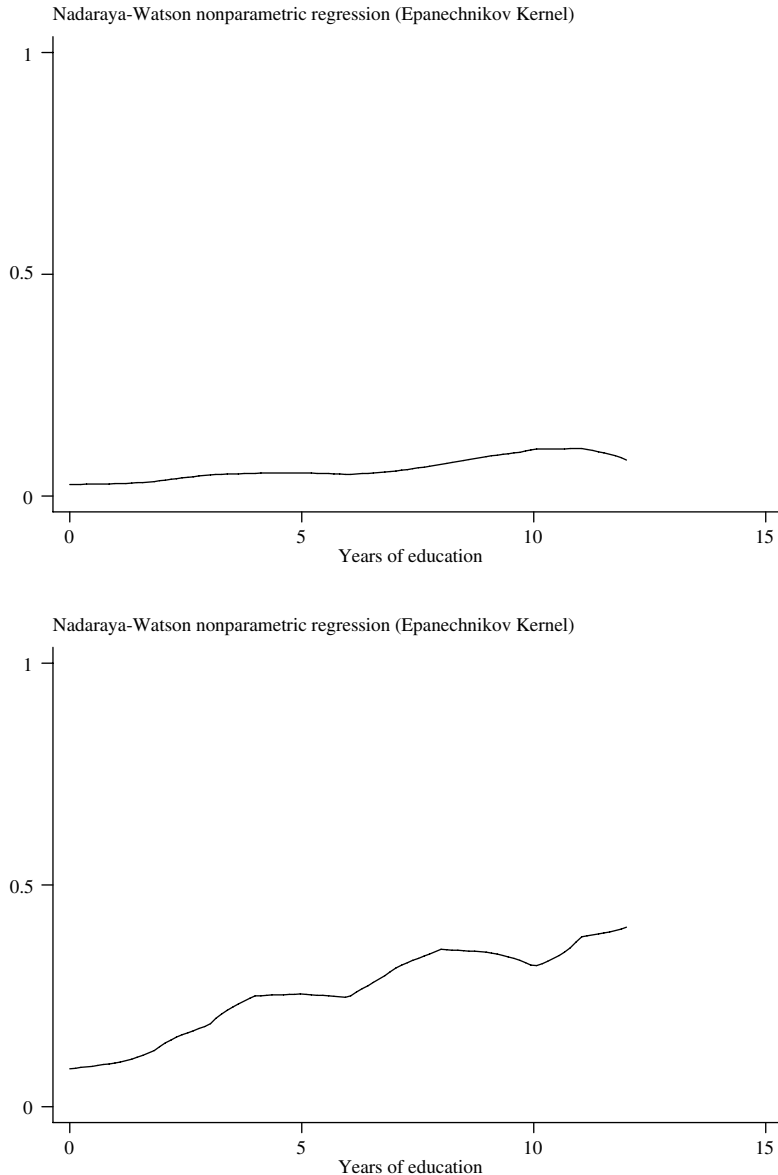


Figure 4. Probability of self-employment participation across individual education levels: 1981 (top) and 2000 (bottom) (source: author's survey).

i chooses to participate in a high productivity self-employment activity if it maximizes the expected utility from his/her labor allocation decision, given a vector of individual, household and regional characteristics, \mathbf{X}_{it} . If we define an indicator variable, y_i , that equals 1 when individual i participates in high productivity self-employment and is 0 otherwise, we can esti-

mate the effects of the variables contained in \mathbf{X} on the individual's participation decision by estimating the general model

$$y_{it} = \mathbf{B}\mathbf{X}_{it} + \mu_i + \zeta_{it}, \quad (1)$$

where \mathbf{B} represents the effect of individual or household characteristic on participation, and μ_i is a randomly distributed heterogeneity

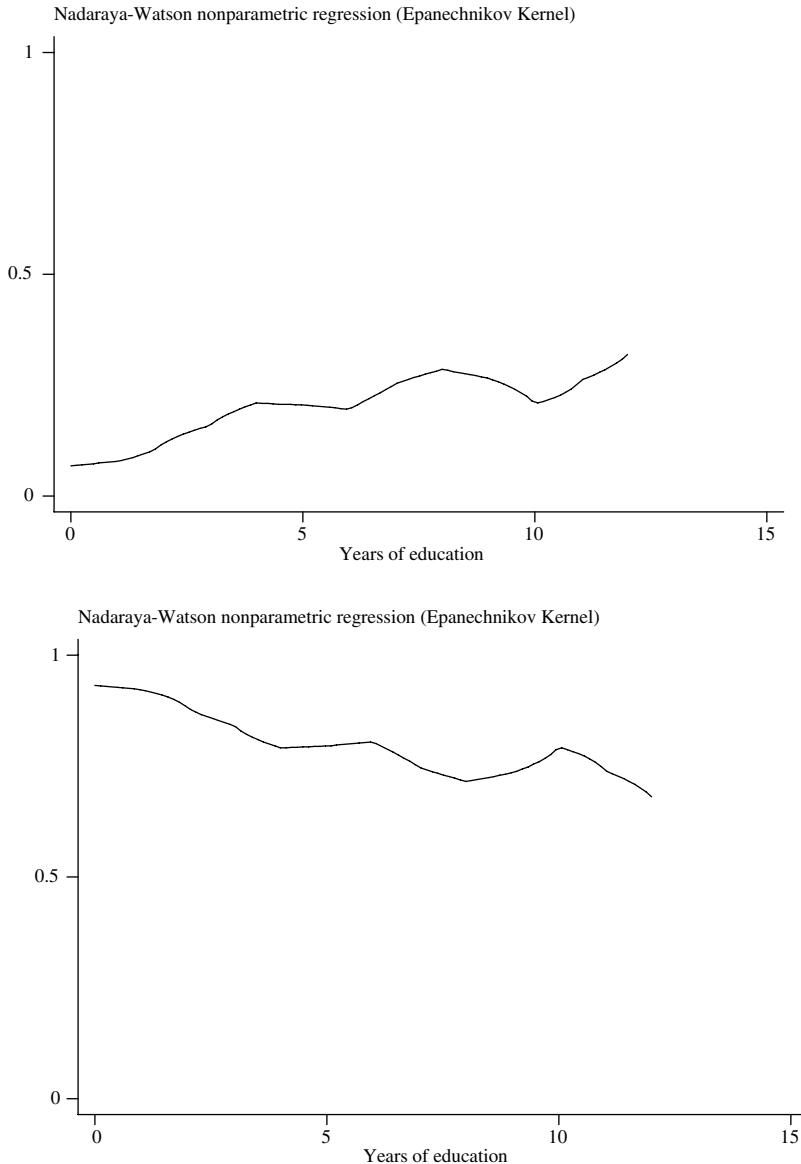


Figure 5. *Probability of self-employment participation across individual education levels, 2000: high productivity (top) and low productivity (bottom) (source: author's survey).*

parameter. We include variables in X_{it} that are measured at the individual and household level to explain participation.⁸

Our specification of the determinants of self-employment participation draws on the theoretical literature on self-employment as an occupational choice. In general, theoretical (and empirical) models of self-employment

point to four broad categories of factors that influence the decision of an individual to participate in self-employment: (a) education and other human capital characteristics which increase the chances of success in self-employment (Kangasharju & Pekkala, 2000); (b) start-up capital or wealth including access to credit and equity assets (Evans & Leighton,

1989); (c) influence of parental characteristics through the transmission of human capital and experience of running a business (Dunn & Holtz-Eakin, 2000; Lentz & Laband, 1990); and (d) risk-aversion and innate entrepreneurial abilities of an individual (Evans & Jovanovic, 1989).

Based on the observations in the previous section and the theory of self-employment participation, we first include a set of human capital characteristics such as an individual's age, years of education and skill training in a trade (either in a formal apprenticeship program or in a formal training program) as determinants of self-employment participation. With the exception of the age variable, we expect the human capital characteristics to positively affect participation rates. We also include a variable denoting the gender of an individual as a determinant of self-employment participation. Next, we account for the effects of initial wealth and access to capital and other resources by including the size of the household labor force in year t , initial wealth (the value of the household's durable goods), an indicator variable regarding the marital status of the individual and an indicator variable of household status of the individual. Household status refers to whether or not the individual is a household head or other member. If an individual is a head then he or she has more control over household resources which indirectly affect the ability of the individual to participate in self-employment. We account for the influence of parental characteristics by including a variable which denotes whether or not the occupation of the individual's father was self-employment. Given our theoretical discussion above, we expect this variable to have a positive effect on participation. Finally, in our specification we control for the effects of unobserved ability and risk-preference differences among individuals through the inclusion of the individual-specific random-effects parameter, μ_i .

In most of the regression exercises, we use data on 1,600 individuals from 600 different households that were employed in either the on-farm or off-farm sector or both at some time during the period 1981–2000.

To identify factors affecting high productivity self-employment participation, we estimate three versions of Eqn. (1): the first with random effects using the 20-year panel; the second without random effects as a pooled regression model; and the third using only the 2000 data. Data on some of the variables, such as household

status and marital status, are available for the year 2000 only and hence are included in the 2000 model alone. In addition to the explanatory variables included in X , we include provincial dummy variables in the models to isolate the effect of differences in levels of development across regions which could create heterogeneity in start-ups across the six provinces. A time trend captures changes over time in demand and other conditions that may change systematically over time.

(a) *Results of multivariate analysis*

In almost all respects, the multivariate regression analyses perform well. Most of the coefficients of the basic variables in the models have the expected signs and are highly significant. The random-effects model demonstrates that the findings in the descriptive results hold up to multivariate analysis, even after controlling for the effects of other influences on participation and holding constant unobserved heterogeneity among individuals (Table 1). Consistent with our expectations, we find that the probability of women participating in high productivity self-employment is significantly lower than the probability of men's during the sample period (row 1). Moreover, the results are robust across variations in specification, and after controlling for unobserved latent entrepreneurial ability. The R^2 measures of goodness of fit range from 0.17 to 0.33.

The multivariate analyses also demonstrate the importance of education in determining an individual's participation. For each additional year of education, the probability of becoming self-employed in a high productivity activity rises by up to 7.0%. This finding suggests that well-functioning markets give more employment opportunities to those with higher levels of human capital, and reaffirms the non-parametric analyses finding that self-employment in rural China is growing in a manner that requires education and promotes economic development. Formal training and apprenticeship program participation also have a large and significant effect in increasing participation. These findings are consistent across all three specifications.

Consistent with the findings on self-employment participation in other transition economies, we find that age has a positive effect on participation in high productivity self-employment and age squared has a negative effect on

Table 1. *The determinants of self-employment, rural China*

Explanatory variables	Dependent variable: self-employment participation		
	Random-effects model (1)	Pooled model (2)	2000 Model (3)
Gender (1 = female)	-0.545 (5.270)***	-0.172 (5.790)***	-0.403 (4.730)***
Years of education	0.069 (4.410)***	0.019 (4.230)***	0.034 (2.500)***
Training for skill	0.948 (9.070)***	0.508 (16.970)***	0.343 (3.610)***
Age	0.180 (9.370)***	0.140 (19.110)***	0.052 (1.870)***
Age squared	-0.002 (7.280)***	-0.002 (17.510)***	-0.001 (2.350)***
Household labor force size	1.102 (36.820)***	0.371 (49.260)***	0.026 (0.820)
Father's occupation (1 = self-employment)	2.171 (16.910)***	0.462 (13.310)***	0.780 (7.200)***
Household status (1 = household head)			0.207 (1.210)
Marital status (1 = married)			0.663 (4.050)***
Durables value, 2000	3.32e-06 (3.630)***	8.66e-05 (2.420)***	2.54e-06 (2.440)***
Time trend	0.001 (0.210)	0.000 (0.050)	
Provincial dummies	Included	Included	Included

* Z statistics in parentheses; *** denotes significance at the 1% level and ** denotes significance at the 5% level of confidence.

Source: Author's survey.

participation (Rona-Tas, 1994). The finding suggests that the self-employed are the relatively younger workers in the labor force. Individuals also benefit from the experience of other household members. Parental characteristics also have a strong significant effect on participation. The coefficient on the indicator variable for father's occupation is statistically significant, large and positive in all of the estimated models. This finding is consistent with the large body of literature that maintains that offsprings of the self-employed are more likely to be self-employed because they have the advantage of learning how to run their businesses from their parents.

Based on the 2000 data alone, we find that while household status is not a significant determinant of participation, marital status has a strong significant positive effect on participation. When we include a measure of each household's wealth (the value of durable assets), we find the effect of wealth to be positive

and statistically significant but the numerical value of the wealth coefficient is small. To facilitate interpretation, we report the wealth elasticity of the probability of self-employment. The elasticities in our three models range from 0.01 to 0.04. A statistically significant elasticity of 0.04 implies that a 1% increase in wealth triggers a 0.04% increase in the probability of self-employment. With poorly functioning markets, access to capital and wealth could be important determinants of an individual's decision to start a self-employed firm.

5. TRANSITION ANALYSIS

The objective of this section is to characterize the mobility of an individual into and out of the self-employment sector and identify how factors such as an individual's age and educational attainment or a region's level of development affect the mobility path. Specifi-

cally, we seek to demonstrate that self-employment is largely a strategy for upward mobility rather than a refuge for victims of market processes. If self-employment is a high-status outcome which attracts young and ambitious people to join the sector as entrepreneurs, then we may expect workers in other sectors (farming or wage employment) to switch to self-employment at every opportunity.⁹ Once an individual enters self-employment, we would expect that he/she will remain in the sector rather than exit rapidly into another sector. If instead, self-employment is a refuge for people who fall on hard times and try to make ends meet through activities such as polishing shoes and performing other relatively menial tasks that require no special resources, skills or talents, then we would expect to see the self-employed jump back into wage employment at every opportunity. "Success" means that if an individual is bumped into self-employment, he rushes out of it to other sectors whenever he can.

Based on the above discussion, we draw two hypotheses regarding the quality of the self-employment sector in rural China. If we call the view that self-employment represents upward mobility as *H* and the alternative view that self-employment is a sign of distress, *h*, then:

Hypothesis 1. Conditional on being in self-employment in an initial state the probability of quick exit from self-employment and switch to wage employment is

H: low;
h: high.

Hypothesis 2. Conditional on being in the wage sector in an initial state, the probability of quick exit from wage employment and switch to self-employment is

H: high;
h: low.

We evaluate the above hypotheses using two approaches. The first approach is to track the flows of labor into and out of the aggregate self-employment sector. However, it is possible that there are reverse flows into low productivity self-employment. Therefore, the second approach is to disaggregate the self-employment sector into its high productivity and low productivity sub-sectors and estimate the disaggregated flows into and out of each separately. Finally, to get a stronger sense of the nature

of self-employment we also analyze how transitions between different occupational sectors, specifically into self-employment, are correlated with characteristics such as an individual's age and education.

(a) *Markov chain model of occupations*

To characterize the mobility of an individual into and out of the self-employment sector and to evaluate our two hypotheses, we use a Markov Chain model. Markov models are a convenient tool for analyzing the evolution of systems over time. At the crux of the Markov model is a transition probability matrix which gives the conditional probabilities of a system's future state given its current state. When the state of a system in any particular time period is not known with certainty, transition probability matrices are used to describe the movement of the system across time. In other words, a Markov model can help us explain how employment (which is an uncertain event) unfolds over time with respect to the sector employment of China's farm households.

To more fully understand Markov analysis, consider an individual worker in the labor market who can belong to one of the three occupational categories: farming (*F*), wage employment (*W*) and self-employment (*S*).¹⁰ Over time the worker may chose to remain in the initial occupation or switch to other sectors. Our goal is to track the individual's occupational choices over time, given our data, and to identify the probabilities with which the individual remains in the initial occupational state, or transitions to other states.

To do so we characterize the individual's movements in the labor market as a stochastic (or uncertain) process, $M_t \in \{F, W, S\}$, that represents the trajectory of the worker's occupational choices over time. We assume that the process, M_t , is Markov, that is, the conditional probability distribution of a future state of the process depends only on the present state and is independent of the past. In other words, we assume that what a household does today is in some sense a function of what it did in the recent past. Given this assumption, the movement of the worker between two states *i* and *j* is defined by the transition probability,

$$\pi_{ij} = \text{Probability}(M_{t+1} = j | M_t = i). \quad (2)$$

The complete set of the conditional probabilities that govern an individual's movement among the three sectors is given by a transition probability matrix

$$\mathbf{\Pi} = \begin{matrix} & \begin{matrix} F & W & S \end{matrix} \\ \begin{matrix} F \\ W \\ S \end{matrix} & \begin{bmatrix} \pi_f & \pi_{fw} & \pi_{fs} \\ \pi_{wf} & \pi_w & \pi_{ws} \\ \pi_{sf} & \pi_{sw} & \pi_s \end{bmatrix} \end{matrix}. \quad (3)$$

The diagonal elements π_i of the matrix denote the probability of an individual being in state i in the next period conditional on the fact that the individual is in state i in the current period. The off diagonal elements π_{ij} denote the probability that an individual will be in state j in the next period conditional on the fact that the individual is in state i in the current period. Using these denominations, the probability of a worker remaining self-employed during a time interval is π_s , while π_{sf} and π_{sw} capture the complementary probabilities of the worker migrating into the farming and wage-employment sectors, respectively. The rows of the transition matrix, thus, add up to one.

Using the transition probabilities, the trajectory of a worker's occupational choices over time can be determined as

$$\theta_{t+1} = \theta_t \mathbf{\Pi}, \quad \theta_t = [\theta_{Ft} \quad \theta_{Wt} \quad \theta_{St}], \quad (4)$$

where $\mathbf{\Pi}$ is the matrix of transition probabilities defined in Eqn. (3) and θ_t is the vector of state probabilities whose elements (θ_{Ft} , θ_{Wt} , and θ_{St}) denote the probability of a worker being in each of the three states at time t . Using this notation, we can characterize the time path of occupational choices for each type of worker. Consider for example a self-employed individual characterized by an initial state vector

$$\theta_0 = [0 \quad 0 \quad 1]. \quad (5)$$

The state probabilities for the next period can be calculated using (4) as follows:

$$\theta_1 = \theta_0 \mathbf{\Pi} \quad (6)$$

or

$$\begin{aligned} & [\theta_{F1} \quad \theta_{W1} \quad \theta_{S1}] \\ & = [\theta_{F1} \quad \theta_{W1} \quad \theta_{S1}] \begin{bmatrix} \pi_f & \pi_{fw} & \pi_{fs} \\ \pi_{wf} & \pi_w & \pi_{ws} \\ \pi_{sf} & \pi_{sw} & \pi_s \end{bmatrix}. \end{aligned}$$

By repeatedly applying Eqn. (4), we can calculate the state probabilities for any future period,

and obtain a trajectory of the self-employed individual's occupational choices,

$$\begin{aligned} \theta_2 &= \theta_1 \mathbf{\Pi}, \\ \theta_3 &= \theta_2 \mathbf{\Pi}, \\ \theta_T &= \theta_{T-1} \mathbf{\Pi}. \end{aligned} \quad (7)$$

To evaluate our two hypotheses, we first calculate the trajectory for self-employment as described above. We then perform the same set of calculations for a wage earner and compare the trajectories to our hypotheses.

(b) *Methods for estimating transition probabilities*

Most studies of labor market transitions focus on estimating transition probabilities using discrete Markov processes, usually based on two years of data (e.g., [Poterba & Summers, 1986](#)). Recent advances in Markov transition models emphasize the use of continuous processes as a more appropriate approach ([Jackson, Sharples, Thompson, Duffy, & Couto, 2003](#); [Kay, 1986](#)). In this paper, we specify a continuous-time Markov model and estimate the transition parameters using maximum likelihood methods (see [Jackson et al., 2003](#); [Kay, 1986](#)). The effects of individual specific and time varying effects on the transition rates are incorporated into the likelihood function using a proportional hazards model that specifies the transition parameters as a function of the individual specific and time variant characteristics ([Jackson et al., 2003](#); [Marshall & Jones, 1995](#)). The details of our econometric methodology are explained in [Appendix A](#).

(c) *Results of transition analysis*

The transition results using the three-states model show clearly that labor markets are active and transition rapidly in rural China. The statistically significant coefficient estimates for each transition between sectors of the labor market demonstrate that labor markets have been changing over the past 20 years, facilitating shifts between different employment sectors ([Table 2](#)). Whether these shifts facilitate modernization and development of the rural economy depends upon the magnitude and direction of the transitions.

A close examination of the nature of transition coefficients shows that a significant number of workers are moving out of farming and wage employment and entering the self-

Table 2. *Markov transition matrix: three-states model*

	Farming	Wage emp.	Self-emp.
<i>1-Year transition rates (maximum likelihood estimates)</i>			
Farming	0.859 (6.592)**	0.081 (4.669)**	0.060 (4.612)**
Wage emp.	0.030 (3.323)**	0.938 (4.108)**	0.032 (2.591)**
Self-emp.	0.017 (2.471)**	0.013 (2.310)**	0.97 (3.457)**
<i>20-Year transition rates (calculated)</i>			
Farming	0.172	0.355	0.473
Wage emp.	0.145	0.445	0.410
Self-emp.	0.115	0.197	0.688

*Z statistics in parentheses; *** denotes significance at the 1% and ** denotes significance at the 5% level of confidence.

Source: Author's survey.

employment sector. Based on the annual transition probabilities (Table 2), we estimate that about 14% of farmers leave the farming sector, or, the per year probability of a farmer exiting the sector is 0.14. Of these workers, about 42% (6/14, column 3, row 1) enter self-employment and about 57% (8/14, column 2, row 1) enter wage employment. A significant number of workers are also transitioning out of the wage sector into the self-employment sector. About 52% of workers who leave the wage sector enter into self-employment, and the rest enter the farming sector (row 3). Only about 3% of the self-employed quit the sector and these workers are equally likely to enter either farming or wage employment (row 3).

The mobility toward self-employment from farming and wage sectors is more apparent if we observe how the above transition rates unfold over a longer time horizon. Based on the estimated transition rates, we calculate the 20-

year transition probabilities among different labor market states to evaluate the net flows into self-employment (Table 2).¹¹ We find that about 80% of farmers leave the sector during the period, and almost 60% of them (47/82, row 1, bottom panel) enter the self-employment sector. Over 50% of wage earners leave the wage sector and over 70% of these workers enter self-employment (41/55, row 2, bottom panel).

The results of the four-state model, which disaggregates self-employment into its high and low productivity and sub-sectors, suggest that the inflow of workers into self-employment is indeed into the high productivity sub-sector. For example, almost 70% of farmers who enter into self-employment enter into the high productivity sub-sector (Table 3, 0.106/0.152, row 1). Only 2% enter the low productivity sub-sector (0.004/0.152) and the rest enter the farming sector. Similarly, most of those who leave the

Table 3. *Markov transition matrix: four-states model*

	Farming	Wage emp.	Self-emp. (low)	Self-emp. (high)
<i>1-Year transition rates (maximum likelihood estimates)</i>				
Farming	0.848	0.042	0.004	0.106
Wage emp.	0.018	0.95	0.006	0.026
Self-emp. (low)	0.021	0.022	0.937	0.020
Self-emp. (high)	0.020	0.026	0.005	0.95
<i>20-Year transition rates (calculated)</i>				
Farming	0.132	0.316	0.053	0.498
Wage emp.	0.106	0.49	0.062	0.342
Self-emp. (low)	0.112	0.266	0.302	0.320
Self-emp. (high)	0.110	0.286	0.054	0.55

Source: Author's survey.

wage sector to enter self-employment do so to start a high productivity business and only few enter into the low productivity sector (row 2).¹² Evidence that rural workers are transitioning into high productivity self-employment is also clearly apparent in the 20-year transition probability matrix.

To formally evaluate our two hypotheses on whether self-employment is a sign of upward mobility or a sign of distress, we analyze the occupational trajectories of self-employed and wage earning individuals using the Markov model (Figure 6).

There appear to be striking differences between the occupational trajectories of self-employed and wage earners. The differences support the view *H* (self-employment is upward mobility) and refute the alternative *h* (self-employment is largely a sign of distress). Specifically, in the case of Hypothesis 1 we find that a self-employed individual is much more likely to remain in the sector than to switch to a different sector throughout the time period of analysis (Figure 6, Panel 1, top left). There appears to be no sign of a rapid exit out of self-employment into wage employment; the probability

of switching for the self-employed remains low, below 0.3. Thus, Panel 1 reveals that conditional on being in self-employment in an initial period, the probability of quick exit from self-employment and switch to wage employment is *low*.

Support for the *H* view is more apparent when we consider Hypothesis 2. A wage earner's probability of continuing in the sector declines much more rapidly than the corresponding probability for the self-employed (Panel 2, top right). Moreover, as the wage earner's probability of continuing to work in the wage sector falls, his/her probability of switching to self-employment increases steadily. These observations strongly support the *H* view in the case of hypotheses 2: conditional on being in wage employment in an initial period, the probability of quick exit from wage employment and switch to self-employment is *high*. Thus, based on this evidence we conclude that that self-employment represents upward mobility and not distress.

Disaggregating the self-employment sector into high and low productivity sub-sectors produces further support for the view that self-

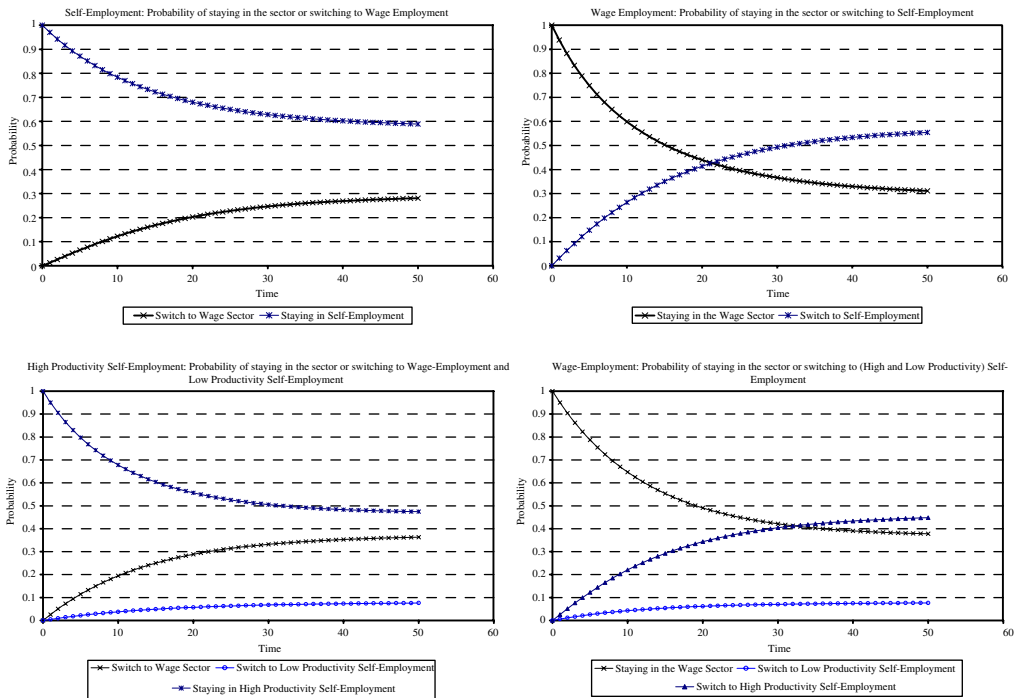


Figure 6. Survival trajectories of occupation choice, Markov analysis (source: author's survey).

employment in rural China is pre-dominantly a way to step-up the employment ladder (Panel 3, bottom left and Panel 4, bottom right). The probability of switching into the low productivity sector is low; in contrast, the probability of switching into the high productivity sector is much higher. By far the largest share of those that switch out of wage employment is moving toward the high productivity sector. While there are still some households that do move into the low productivity sector, our analysis shows how self-employment can indeed be a refuge even in a country that is developing as rapidly as China; in a country that is developing less rapidly, it is easy to imagine that a larger fraction of the labor force might be shifting to the lower productive sector especially during periods of economic stress. Our main point is that although China is no exception—there are some individuals who move from wage employment to the low productivity sector—by far the dominant direction of transition is moving from wage employment into the high productive, self-employment sector.

(d) *Marginal effects of individual and regional characteristics on transition*

We examine heterogeneity in labor market transitions across four characteristics—an individual's gender, age, education, and location. The results show that women are less likely than men to transition from farming into either self-employment or wage employment (Table 4, row 1). Women who have managed to break into the wage sector are also more likely than men to transition back into farming (column 1, row 2). These results are similar to the findings of other studies of rural China, which reveal an increasing concentration of women in farm work (e.g., Entwisle *et al.*, 1995; Jacka, 1997; Judd, 1990; Rawski & Mead, 1998; Song & Jiggins, 2000). The limited number of women in self-employment in rural China contrasts with findings in developed regions of the world. Recent studies show that women have been the fastest growing segment (in relation to men and all minority groups) among the self-employed in developed countries. For instance, in the United States self-employment rate among women increased from 4.1% in 1975 to 6.7% in 1990 (Devine, 1994).

The marginal effect estimates of age on transition (Table 4) suggest that younger workers are more likely to transition out of farming into self-employment and wage employment. The

Table 4. *Marginal effects of individual and regional characteristics on transition*

	Farming	Wage emp.	Self-emp.
<i>Gender (1 = female)</i>			
Farming		-1.429 (-13.403)**	-0.409 (3.406)**
Wage emp.	0.350 (2.039)**		0.051 (0.206)
Self-emp.	0.230 (0.781)	-0.041 (-0.136)	
<i>Age (years)</i>			
Farming		-0.053 (-12.402)**	-0.019 (-3.821)**
Wage emp.	-0.011 (-1.396)		-0.009 (-0.826)
Self-emp.	-0.015 (-1.031)	-0.024 (-1.703)*	
<i>Education (years)</i>			
Farming		0.038 (3.032)**	0.087 (8.844)**
Wage emp.	0.045 (2.782)**		-0.005 (-0.240)
Self-emp.	0.009 (0.303)	0.024 (0.816)	
<i>Region (Zhejiang Province = 1)</i>			
Farming		0.070 (0.500)	0.789 (5.860)**
Wage emp.	-0.002 (-0.013)		0.362 (1.69)*
Self-emp.	0.058 (0.214)	-0.383 (-1.339)	

* Z statistics in parentheses; *** denotes significance at the 1% level and ** denotes significance at the 5% level of confidence.

Source: Author's survey.

negative effect of age on transition into self-employment is consistent with similar findings in other transitioning economies (Rona-Tas, 1994). Scholars of transitioning economies argue that the negative effect of age on transition into self-employment is due to the fact that that older people in post-reform economies are less mobile due to the accumulation of sector-specific capital.

We find a significant positive effect of education on the transitions out of farming into both self-employment and wage employment. Moreover, comparing the coefficient estimates we find that the effect of education is greater in the transition from farming to self-employment than in the transition from farming to wage employment.¹³ It is possible that supe-

rior education is more valuable in starting and running self-employed businesses relative to wage work in state and non-state enterprises. The positive marginal effect of education on transitions into self-employment is consistent with theoretical predictions regarding a formal business sector where, *ceteris paribus*, the likelihood of business failure decreases with education levels (Evans & Leighton, 1989). This finding provides further support for the hypothesis regarding the quality of self-employment and its implications for the development of China's rural economy.

To capture the effect of regional characteristics (level of development and wealth), we use a dummy variable representing the province of Zhejiang, one of China's richest coastal provinces (Table 4, bottom panel). Since labor markets in Zhejiang are among the most active in all of China, according to de Brauw, Huang, Rozelle, Linxiu, and Yigang (2002) in 2000 more than 43% of able-bodied rural individuals had employment off the farm and there were more migrants going to Zhejiang than almost any other province in China.

We find that region characteristics matter in facilitating two types of transitions. First, in Zhejiang the transition from farming into self-employment is significantly more likely (0.789). Second, in Zhejiang the transition from wage employment into self-employment is significantly more likely (0.362). To the extent that the rest of China is going to follow these patterns of labor movement in the coming years, this finding provides support for the hypothesis regarding the positive role of the self-employment in China's rural development. These findings support the hypothesis that workers are moving into high productivity self-employment over time.

6. CONCLUSIONS

In this paper, we assess the role that self-employment has played in rural China during the first two decades of reform, 1981–2000. This paper provides evidence that there has

been a rapid increase in the importance of self-employment activity during this period. Self-employment accelerated throughout the 1980s and the 1990s, a period characterized by dramatic changes in China's macroeconomy.

The findings suggest that self-employment in rural China is a sign of development, not distress. By decomposing the growth in self-employment by occupational differences, we show that rural China's self-employment sector is growing in a manner that is consistent with the promotion of development and modernization of the rural economy. We find clear evidence that high productivity self-employment (trade and transportation and enterprises) forms the bulk of total self-employment activity, and is growing over time. Self-employment activities that are less capital intensive (handicraft and custom labor provider/services) are a small fraction of the total self-employed and are disappearing over time.

The econometric results demonstrate that self-employment in rural China is productive and shares many features of a formal small-business sector found in developed countries. For instance, as in developed countries we find that (high productivity) self-employment participation rates in China are higher among younger, more educated workers who are trained in specific skills. As in developed country studies, we find also that parental characteristics have a strong significant effect on participation in high productivity self-employment.

The transition analysis results reinforce these findings. We estimate that a significant number of workers are exiting farming and wage-employment sectors to enter into high productivity self-employment. This pattern of transition into self-employment is found to be higher in the richer, more advanced region of Zhejiang. To the extent that Zhejiang represents the future of China's rural economy, as other less developed rural regions advance we may expect to see even more transitions into self-employment.

NOTES

1. The economies of Japan and Taiwan are excellent examples. Self-employment is regarded as one of the

major forces of Taiwan's post-war economic development. Despite the surge of wage sector jobs that came

about at the height of Taiwan's industrialization, more than 20% of Taiwan's labor force was self-employed (Yu, 1999).

2. The negative view of the self-employment sector is supported by empirical evidence. In some countries growth in inefficient forms of self-employment has caused conflict with poverty alleviation programs (World Bank, 2000). Informal sector self-employment in some parts of South Africa is commonly portrayed as being dominated by survivalist activities that are often unproductive and even criminal in some cases (McIntosh, 1991). Similarly, in Brazil informal sector wages have been found to be much lower than comparable jobs in the formal sector (Telles, 1993). In both of these cases, the informal self-employment sector contained less educated workers, and there was little sense that there was any future in the sector. Therefore, some scholars argue that self-employment may play a negative role in the economy by distorting labor market incentives, decreasing official output, reducing government tax revenues and constraining the growth of the private sector (Johnson, Kaufmann, & Shleifer, 1997; Lacko, 2000; Rosser, Rosser, & Ahmed, 2000).

3. Enumerators attempted to ask the employment histories from each individual themselves. If a household member or one of the children of the household head was not present, the respondent (which was almost always the household head or spouse of the household head) answered. Extensive pre-testing found that the data are fairly accurate.

4. Self-employed entrepreneurs in our sample typically run their own businesses without hiring labor.

5. In Figure 1 we include both self-employment initiated by individuals in their local area of residence and self-employment activities in destination regions of individuals who migrate away from their original place of residence. The latter category accounts for only a small fraction of the self-employed, ranging from 0.8% in 1981 to 3.0% in 2000.

6. Non-parametric regressions are a flexible method for exploring the relationship between two variables that

does not impose any functional form on the relationship and allows the data to choose not only the parameter estimates but also the shape of the curve itself (Deaton, 1997).

7. We also estimated a positive relationship between the overall off-farm participation and educational attainment. The results are available from the authors upon request.

8. It would be useful to incorporate demand side determinants as well, but we do not have data on the demand side of the market. Rather we settle for reduced form estimation and control demand side effects in the panel specification.

9. It is clear that that farming is not a candidate for top rank. Therefore, we do not report the comparisons to the farming sector. The results are available from the authors upon request.

10. The self-employment sector may further be disaggregated into high and low productivity categories, *SH* and *SL*.

11. We calculate the 20-year transition probabilities as follows: Denoting the 1-year transition probability matrix as \mathbf{P} , the 20-year transition rate is given as \mathbf{P}^{20} (see Bhat, 1985).

12. The disaggregation of self-employment into its sub-sectors creates additional Markov states that make calculation of standard errors computationally difficult. Even though we are unable to produce standard errors for the four-state model, the magnitude of the coefficient transition estimates shows whether or not labor flows from other sectors into aggregate self-employment is into the capital intensive sub-sector.

13. Compared to workers with wage earning jobs, those that are self-employed in rural China earn more on an hourly basis but also assume higher risks (Zhang, Zhang, Rozelle, & Boucher, 2005).

REFERENCES

- Arum, R. (1997). Trends in male and female self-employment: growth in a new middle class or increasing marginalization of the labor force? *Research in Social Stratification and Mobility*, 15, 209–238.
- Bhat, N. (1985). *Elements of applied stochastic processes*. New York: Wiley.
- Blau, D. (1985). Self-employment and self-selection in developing country labor markets. *Southern Economic Journal*, 52(2), 351–363.
- Butler, J., & Moffitt, R. (1982). A computationally efficient quadrature procedure for the one factor multinomial probit model. *Econometrica*, 50, 761–764.

- Cox, D. R., & Miller, H. D. (1965). *The theory of stochastic processes*. London: Chapman and Hall.
- Croll, E. (1988). The new peasant economy in China. In S. Feuch-Rand (Ed.), *Transforming China's economy in the eighties*. Boulder, CO: Westview Press.
- Deaton, A. (1997). *The analysis of household surveys*. Baltimore: Johns Hopkins University Press.
- de Brauw, A., Huang, J., Rozelle, S., Linxiu, Z., & Yigang, Z. (2002). The evolution of China's rural labor markets during the reforms. *Journal of Comparative Economics*, 30, 329–353.
- de Soto, H. (1989). *The other path: The invisible revolution in the third world*. London: I.B. Tauris & Co.
- Devine, T. J. (1994). Changes in wage-and-salary returns to skill and the recent rise in female self-employment. *American Economic Review, American Economic Association*, 84(2), 108–113.
- Dunn, T., & Holtz-Eakin, D. (2000). Financial capital, human capital, and the transition to self-employment: evidence from intergenerational links. *Journal of Labor Economics*, 18(2), 282–305.
- Entwisle, B., Henderson, G. E., Short, S., Bouma, J., & Zhai, F. (1995). Gender and family businesses in rural China. *American Sociological Review*, 60(1), 36–57.
- Evans, D. S., & Jovanovic, B. (1989). An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy*, 97, 808–827.
- Evans, D. S., & Leighton, S. L. (1989). Some empirical aspects of entrepreneurship. *American Economic Review*, 79, 519–535.
- Gerber, T. (2001). Paths to success: individual and regional determinants of self-employment in post-communist Russia. *International Journal of Sociology*, 31(2), 3–37.
- Gong, X., & Soest, A. (2002). Wage differentials and mobility in the urban labor market: a panel data analysis for Mexico. *Labour Economics*, 9(4), 513–529.
- Henley, A. (2002). Job creation by the self-employed: the roles of entrepreneurial and financial capital. *Small Business Economics*, 25(2), 175–196.
- Jacka, T. (1997). *Women's work in rural China: Change and continuity in an era of reform*. Cambridge: Cambridge University Press.
- Jackson, C. H., Sharples, L. D., Thompson, S. G., Duffy, S. W., & Couto, E. (2003). Multi-state Markov models for disease progression with classification error. *The Statistician*, 52(2), 193–209.
- Johnson, S., Kaufmann, D., & Shleifer, A. (1997). The unofficial economy in transition. *Brookings Paper on Economic Activity*, (2), 159–221.
- Judd, E. (1990). Alternative development strategies for women in rural China. *Development and Change*, 21(1), 23–42.
- Kangasharju, A., & Pekkala, S. (2000). Self-selected self-employed: the role of education in success. <<http://www.ptt.fi/tyopaperit/20.pdf>>.
- Kay, R. (1986). A Markov model for analysing cancer markers and disease states in survival studies. *Biometrics*, 42(4), 855–865.
- Lacko, M. (2000). Hidden economy—an unknown quantity? *Economics of Transition*, 8(1), 117–149.
- Lentz, B., & Laband, D. (1990). Entrepreneurial success and occupational inheritance among proprietors. *Canadian Journal of Economics*, 23(3), 563–579.
- Marshall, G., & Jones, R. H. (1995). Multi-state Markov models and diabetic retinopathy. *Statistics in Medicine*, 14(18), 1975–1983.
- Mazumdar, D. (1983). Segmented labor markets in Ldcs. *American Economic Review. Papers and Proceedings*, 73(2), 254–259.
- McIntosh, A. (1991). Making the informal sector pay: rural entrepreneurs in KwaZulu. In E. Preston-Whyte, & C. Rogerson (Eds.), *South Africa's informal economy* (pp. 243–253). Oxford University Press.
- McManus, P. (2000). Market, state, and the quality of new self-employment jobs among men in the U.S. and Western Germany. *Social Forces*, 78(3), 865–905.
- McMillan, J., & Naughton, B. (1992). How to reform a planned economy: lessons from China. *Oxford Review of Economic Policy*, 8(1), 130–143.
- Oi, J. (1999). *Rural China takes off: Institutional foundations of economic reform*. Berkeley: University of California Press.
- Parish, W. L., Zhe, X., & Li, F. (1995). Nonfarm work and marketization of the Chinese countryside. *The China Quarterly*, 143, 697–730.
- Portes, A., Castells, M., & Benton, L. A. (1989). Conclusion: the policy implications of informality. In A. Portes, M. Castells, & L. A. Benton (Eds.), *The informal economy: Studies in advanced and less developed countries* (pp. 298–312). Baltimore: Johns Hopkins University Press.
- Poterba, J., & Summers, L. (1986). Reporting errors and labor market dynamics. *Econometrics*, 54(6), 1319–1338.
- Rawski, T., & Mead, R. W. (1998). On the trail of China's phantom farmers. *World Development*, 26(5), 767–781.
- Rona-Tas, A. (1994). The first shall be last? Entrepreneurship and communist cadre in the transition from socialism. *American Journal of Sociology*, 100, 40–69.
- Rosser, B., Rosser, M., & Ahmed, E. (2000). Income inequality and the informal economy in transition economies. *Journal of Comparative Economics*, 28, 156–171.
- Rozelle, S., Guo, L., & Minggao, S. (1999). Leaving China's farms: survey results of new paths and remaining hurdles to rural migration. *The China Quarterly*, 158, 367–393.
- Schumpeter, J. A. (1943). *Capitalism, socialism, and democracy*. London: Allan & Unwin.
- Song, Y., & Jiggins, J. (2000). *Feminization of agriculture and related issues: two case studies in marginal rural areas in China*. Working Paper presented at the European Conference on Agricultural and Rural Development in China. ECARDC VI, Leiden, Holland.
- State Statistical Bureau. (1989/1997). *Zhongguo Tongji Nianjian*. China Statistical Yearbook. Beijing, China.

- Telles, E. (1993). Urban labor market segmentation and income in Brazil. *Economic Development and Cultural Change*, 41(2), 405–425.
- Tokman, V. E. (1992). *Beyond regulation: The informal economy in Latin America*. Boulder, CO: Lynne Rienner publishers.
- World Bank. (2000). *Making transition work for everyone: poverty and inequality in Europe and Central Asia*. World Bank, Washington, DC.
- Yu, W. (1999). *Unequal employment, diverse career paths: gender stratification in Japan and Taiwan*. Doctoral Dissertation, University of Chicago, Department of Sociology.
- Zhang, J., Zhang, L., Rozelle, S., & Boucher, S. (2005). *Self employment with Chinese characteristics: the forgotten engine of rural China's growth*. Working Paper, University of California, Davis.

APPENDIX A. METHODS FOR ESTIMATING TRANSITION PROBABILITIES

To calculate the probabilities of transition between different labor market sectors, we use a continuous-time Markov model. Consider a worker in the labor market who moves independently among K labor market sectors (states). Let $L(t)$ denote the labor market state the worker is in at time period t . The subsequent state that the worker moves into is determined by a matrix of transition rates, \mathbf{Q} , with elements,

$$q_{ij}(x, z_t) \quad (8)$$

for each state pair i and j , where x and z represent individual specific influences (such sex) and time variant influences (such as age) on the transition rates. The transition rates q_{ij} represent the individual's instantaneous rate of transition from state i to state j :

$$q_{ij}(x, z_t) = \lim_{\Delta t \rightarrow 0} p(S(t + \Delta t) = j | S(t) = i) / \Delta t. \quad (9)$$

Given this rate of transition, the $K \times K$ matrix of transition probabilities can be calculated using the results of Cox and Miller (1965)

$$\mathbf{P}(t) = e^{\mathbf{Q}t}, \quad (10)$$

where the p_{ij} element of the transition probability matrix is the probability of a worker being in state j at time $t + n$, given that the state at time t is i . The transition rates are calculated using maximum likelihood methods, where the likelihood function is defined over all individuals and all transitions (see Kay, 1986). Individual specific effects and time varying effects are incorporated into the likelihood function using a proportional hazards model that specifies the transition rates as a function of the individual specific and time variant characteristics (Jackson *et al.*, 2003; Marshall & Jones, 1995)

$$q_{ij}(x, z_t) = q_{ij}^0 \exp \beta_{ij}(x, z_t). \quad (11)$$

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