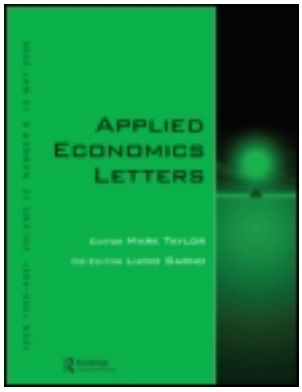

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Evaluating poverty duration and transition: a spell-approach to rural China

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Evaluating poverty duration and transition: a spell-approach to rural China

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This article uses a discrete-time multivariate duration model to study poverty transition in rural China between 1989 and 2006. The analysis identifies nonlinear negative duration-dependence for both exit and re-entry rates of poverty. There is significant difference in hazard rates of exit and re-entry associated with geographic location and educational level of households, but less related to gender, occupation or ethnic background of household head. The factors facilitating households' ending a poverty spell are found to be education, land ownership, asset accumulation, health insurance and outmigration, whereas larger family size and dependence ratio may reduce the chance of exit.

I. Introduction

Poverty dynamics in rural China have been well examined from the perspectives of its transient and chronic components (Jalan and Ravallion, 1998a, b, 2000) and the probability of becoming poor (McCulloch and Calandrino, 2003; Zhang and Wan, 2006). Although useful for understanding the changes of households' poverty status within a given period, they have weak explanatory power for the persistent poverty, which has been emerging since the late 1990s. Chen and Ravallion (2008) find that, although the incidence of poverty dropped sharply by 68% between 1981 and 2005, 47% of this reduction had happened before 1996. The missing explanatory factor may be 'time-varying and individual-specific determinants of households' poverty transitions' (Bigsten and Shimeles, 2008). If so, the spell-approach is more insightful as it reveals individual households' trajectories of sliding in and out of poverty spells and the determinants of these repeated shifts.

This approach has been widely applied to poverty transitions in developed countries (e.g. in United Kingdom by Devicienti, 2002, 2010; in Italy by Devicienti and Gualtieri, 2007) and a few developing economies (e.g. in Ethiopia by Bigsten and Shimeles, 2008). However, little has been known for rural China. As far as we are aware, only Glauben *et al*. (2006) use duration analysis to measure to what extent and how households' individual past (non)poverty experience affects their probabilities of suffering or escaping poverty in future. Their study shows that past exposure to poverty may be less decisive because both exit and re-entry rates of poverty tend to increase at longer duration. Nevertheless, this may lack representativeness for rural China, especially the poor areas, as their samples were selected from Zhejiang province only, which is coastal and one of the richest provinces. Moreover, their hazard model is based on the presumption of underlying continuous data without unobserved heterogeneity, which may be an oversimplification and overestimate (underestimate) negative (positive) duration-dependence and the proportionate response of the hazard to an estimated negative (positive) coefficient (Jenkins, 2005).

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This article offers new evidence on the shape and correlates of transition in and out of poverty for rural China, by using a highly representative panel and a discrete-time hazard model controlling for unobserved heterogeneity. The next section sets up the model. Section III describes the data and discusses the results. Section IV concludes.

II. Analytical Framework

Modelling poverty duration

There are two states, poverty and nonpoverty, between which households shift over time.[1] Following Bigsten and Shimeles (2008), the (discrete) survival time is indexed by $t_1, t_2, \ldots, t_j, \ldots, t_k$ with equal intervals for simplicity. The rates of exit pertain to households who 'just started a poverty spell'.[2] Among them, d_j households end their poverty spells at t_j. n_j households stay poor in at least j waves and are at 'risk' of moving out of poverty at t_{j+1}. The survival function is therefore defined by

$$\hat{S}(t_j) = \prod_{j|t_j \le t} \left(1 - \frac{d_j}{n_j}\right) \tag{1}$$

Correspondingly, the hazard rates for ending a poverty spell at t_j are calculated by

$$h(t_j) = \begin{cases} 1 - \hat{S}(t_j), & \text{if } j = 1 \\ \frac{\hat{S}(t_j) - \hat{S}(t_{j-1})}{\hat{S}(t_j)}, & \text{if } j > 1 \end{cases} \tag{2}$$

By the same token, the poverty re-entry rates refer to those who just started a nonpoverty spell. The hazard rates of ending nonpoverty spells are calculated analogously.

Nevertheless, there has been growing concern over spurious transition between the two states. A cause may be the measurement errors in consumption data. A household might be misclassified as 'poor' simply because its consumption seems to fall below a certain poverty line but this may be a measurement error rather than evidence of adverse events. Following Devicienti (2002), this problem could be addressed by adjusting the poverty line so that households are deemed to be poor (nonpoor) only if their per capita consumption falls below (surpasses) 90% (110%) of the unadjusted poverty line at US$1.25/day.

Another cause is the construction of survival and hazard functions itself. Equations 1 and 2 are essentially aggregate measures of transition into and out of poverty for the full sample, whereas some households sharing certain characteristics might remain poor/nonpoor for a long time. These characteristics can be either observed or unobserved, such as the lack of endowments and intrinsic incapabilities. It is hence necessary to investigate whether the revealed shape of poverty transition is a common feature. In this article, this is done in two ways. Nonparametric estimates of survival and hazard function are replicated for various subgroups. We also implement a multivariate analysis to explore the correlates of exit from and re-entry into poverty.

Explaining the correlates of poverty transition

For the household i in the time interval j, a standard discrete-time hazard model takes the following specification

$$h_i(t_j) = \Pr(T_i = t_j | T_i \ge t_j) \tag{3}$$

where T_i is the time a (non)poverty spell ends. Empirically, a complementary log-log hazard function is used to model poverty exit and re-entry rates separately. Following Devicienti and Gualtieri (2007), the probability that household i escapes from poverty at duration d at time t_j, given it has stayed in poverty spells up to t_j, is expressed by

$$e_i\left(d, X_{ij} | \upsilon_i^P\right) = 1 - \exp\left[-\exp\left(f^P(d) + X'_{ij}\beta^P + u_i^P\right)\right] \tag{4}$$

where the vector X_{ij} contains household-specific time-varying characteristics; $f^P(d)$ is a function explicitly modelling how exit rates depend on the duration that households have spent in poverty spells; $u_i^P \equiv \log\left(\upsilon_i^P\right)$ denotes the unobserved heterogeneity, which is time-invariant and common across i's all poverty spells.[3]

[1] As Bigsten and Shimeles (2008), there is presumably no correlation between repeated spells for the same household over time, that is, independence between multiple spells. In fact, we split households into subjects with single-spells and then pooled them for estimation.

[2] The concept employed here is in line with Devicienti (2002, 2010) and Bigsten and Shimeles (2008). A household just starting a (non)poverty spell at t means it was in (non)poverty at $t-1$ and shifts out of this state at t. Our sample contains seven waves of the surveys. Therefore, the first (non)poverty spell starts at the second wave and the maximum duration is 5.

[3] Households' initial (non)poverty status is assumed to be exogenous to their characteristics. Devicienti's (2010) model controls for endogeneity of initial conditions, which may lead to our future research.

Similarly, the probability that the household i re-enters poverty at duration d at time t_j, given it has been nonpoor up to t_j, is written by

$$r_i\left(d, X_{ij}|v_i^N\right) = 1 - \exp\left[-\exp\left(f^N(d) + X'_{ij}\beta^N + u_i^N\right)\right] \quad (5)$$

To integrate out the unobservables in estimating the hazard models, normal distributions are assumed for u_i^P and u_i^N.[4] To make models more flexible, the baseline hazards $f^P(d)$ and $f^N(d)$ take a fully nonparametric form motivated by Devicienti (2002, 2010): a set of duration-interval-specific dummies at which households are at risk of shifting out of (non)poverty spells.

III. Empirical Results

Data

A balanced panel containing 1429 rural households are extracted from seven rounds of China Health and Nutrition Surveys (CHNS) in 1989, 1991, 1993, 1997, 2000, 2004 and 2006. The samples are basically equally distributed in seven provinces from coastal to inland China.[5] Table 1 summarizes the variables used in estimation.

Preliminary exploration of transition probabilities suggests coexistence of persistence and transition of poverty in rural China. The upper panel of Table 2 shows that 36.52% of households had experienced at least one period of poverty within the sample time span. Among those who were poor at the beginning of the surveys, 58.23% ended up in poverty again. The degree of this persistent hardship is even greater (64.09%) if measured against the adjusted poverty line. In comparison, however, 80.49% of the initially nonpoor were likely to retain their livelihood position at the end of the surveys. As one might predict, using the adjusted poverty line makes it harder to remain nonpoor (78.04%). Meanwhile, there is also evident poverty transition. A total of 41.77% of initially poor households successfully moved out of deprivation, whereas only 19.51% of those who were nonpoor slipped back into poverty.

Estimated survival and hazard functions

The estimated survival and hazard functions in Table 3 indicate strong negative duration-dependence associated with the rates of poverty re-entry. This implies a good chance for households to escape from poverty in the long term. For those who just started a nonpoverty spell, 65.7% successfully remained above the unadjusted poverty line, after spending five periods in nonpoverty. Their re-entry rates quickly approach to zero. In the case of unadjusted poverty line, if a household has survived for five periods, it has only a 1.6% likelihood of sliding into poverty in the next period.

The exit rates are also negatively associated with duration in the first three periods in poverty for

Table 1. Descriptive statistics

	1989		2006	
Variables	Mean	SD	Mean	SD
hh per capita consumption	1091.130	619.025	2350.194	1969.907
hh size	4.603	1.445	3.928	1.724
Age of hh head	41.713	11.506	57.532	11.091
Dependance ratio	0.350	0.236	0.369	0.373
% male adults	0.778	0.354	0.564	0.306
% complete primary education within the hh	0.389	0.253	0.340	0.283
% complete at least secondary education within the hh	0.054	0.126	0.085	0.170
ln (farm land)	0.480	1.804	–0.210	2.091
ln (value of agricultural assets)	2.241	3.541	2.806	4.135
% local off-farm employment within the hh	0.712	0.290	0.141	0.231
% village outmigration (outmigration networks)	0.007	0.012	0.036	0.062
% having health insurance within the hh	0.117	0.269	0.324	0.386
% sown land affected by natural disasters within the province	0.217	0.053	0.113	0.045

Note: All monetary variables are in 2006 prices.

[4] We also experimented with Gamma and Heckman and Singer's (1984) mixed mass-point distributions but maximization procedures failed to converge to a solution.

[5] Coastal provinces are Jiangsu and Shandong. Central provinces are Henan, Hubei and Hunan. Western provinces are Guangxi and Guizhou.

Table 2. Poverty transition matrix (%), 1989–2006

	Poverty	Nonpoverty	Total
Unadjusted poverty line			
Poverty	58.23	41.77	100
Nonpoverty	19.51	80.49	100
Total	36.52	63.48	100
Adjusted poverty line			
Poverty	64.09	35.91	100
Nonpoverty	21.96	78.04	100
Total	43.70	56.30	100

those who just started a poverty spell. In other words, the longer the time spent in poverty, the lower the probability of escape for these households is becoming. The average length of a poverty spell is 2.55 periods, which is equivalent to 5.1 years if counting the real gap of years between surveys. Meanwhile, it is also worth noting that after four periods in poverty, exit rates tend to increase, signalling an opportunity for the poor to escape at longer duration. This seemingly mixed duration-dependence for exit will be examined more carefully by the multivariate analysis in the next subsection.

As aforementioned, adjusted poverty lines tend to bring about more difficulties for households sliding into and out of poverty. This is demonstrated by estimates in Table 3. The hazard rates of poverty exit (re-entry) are higher (lower) in the case of adjusted poverty lines relative to the unadjusted one. To best accommodate measurement errors in consumption data, from here, this article keeps using the adjusted poverty lines to split households' poverty/nonpoverty episodes in the analysis.

As noted in Section II, the hazard rates in Table 3 are estimated based on the assumption of homogenous population. We further consider whether poverty exit and re-entry diverge for categories defined by households' geographic location, nationality, household heads' educational level, gender and occupation. For each of the subgroups, the differences of hazard rates between subcategories are examined by log-rank and Wilcoxon tests. With respect to the likelihood of exiting poverty, distinction exists across different education levels and regions at 1% significance level, whereas for the risk of re-entering poverty, variation is only found across regions at 10% significance level. As Glauben *et al.* (2006), we also observe first a decreasing and then an increasing relationship between exit rates and the duration of poverty spells in coastal provinces, but consistently decreasing exit rates in western provinces. Households residing in less-developed regions are more likely to be trapped in persistent poverty. This supports our argument that Glauben *et al.*'s (2006) conclusion does not represent the general situation in rural China.

The correlates of poverty transition

The LR test Table 4 shows that unobserved heterogeneity matters in poverty exit, but seems to be less of a problem in re-entry regressions. Negative duration-dependence can be confirmed in the cases of both poverty re-entry and exit. However, it would

Table 3. Survival and hazard functions of ins and outs of poverty

	Unadjusted		Adjusted	
	Sur. (SE)	Exit (SE)	Sur. (SE)	Exit (SE)
Poverty exit				
Time since the start of spell				
1	1 (.)	. (.)	1 (.)	. (.)
2	0.779 (0.009)	0.249 (0.011)	0.762 (0.009)	0.270 (0.011)
3	0.626 (0.012)	0.217 (0.014)	0.626 (0.011)	0.197 (0.013)
4	0.517 (0.013)	0.191 (0.017)	0.514 (0.012)	0.197 (0.016)
5	0.314 (0.014)	0.490 (0.034)	0.339 (0.013)	0.409 (0.030)
6	0.207 (0.013)	0.408 (0.044)	0.235 (0.013)	0.363 (0.039)
Poverty re-entry				
Time since the start of spell				
1	1 (.)	. (.)	1 (.)	. (.)
2	0.787 (0.013)	0.239 (0.017)	0.787 (0.012)	0.238 (0.015)
3	0.709 (0.015)	0.104 (0.014)	0.730 (0.014)	0.076 (0.010)
4	0.680 (0.016)	0.041 (0.010)	0.712 (0.014)	0.024 (0.006)
5	0.667 (0.016)	0.019 (0.007)	0.702 (0.014)	0.014 (0.005)
6	0.657 (0.017)	0.016 (0.007)	0.694 (0.015)	0.012 (0.005)

Note: Kaplan–Meier estimates.

Table 4. Covariates of hazard rates of poverty exit and re-entry

	Poverty exit regression		Poverty re-entry regression	
Indep. variable	Without heterogeneity	With normal heterogeneity	Without heterogeneity	With normal heterogeneity
Duration dependence				
D1	–0.335	–0.329	–1.101	–1.098
	(0.080)***	(0.081)***	(0.156)***	(0.156)***
D2	–0.432	–0.424	–2.280	–2.276
	(0.098)***	(0.099)***	(0.287)***	(0.287)***
D3	0.133	0.150	–2.724	–2.722
	(0.094)	(0.095)	(0.387)***	(0.387)***
D4	–0.207	–0.181	–3.340	–3.338
	(0.132)	(0.133)	(0.460)***	(0.460)***
D5	–0.080	–0.044	–17.009	–20.807
	(0.141)	(0.143)	(437.001)	(3080.321)
Household characteristics				
hh size	–0.142	–0.143	0.174	0.175
	(0.021)***	(0.021)***	(0.036)***	(0.036)***
hh head's age	0.021	0.022	0.017	0.017
	(0.003)***	(0.003)***	(0.005)***	(0.005)***
% completing primary edu.	0.173	0.173	–0.388	–0.390
	(0.111)	(0.113)	(0.230)*	(0.231)*
% completing at least sec. edu.	0.481	0.486	–0.089	–0.086
	(0.178)***	(0.182)***	(0.451)	(0.454)
% male adults within hh	0.044	0.049	–0.160	–0.160
	(0.100)	(0.102)	(0.192)	(0.193)
Gender of hh head (male 1)	–0.061	–0.062	0.234	0.239
	(0.110)	(0.112)	(0.235)	(0.237)
Dependency ratio	–0.423	–0.422	–0.349	–0.353
	(0.107)***	(0.108)***	(0.225)	(0.226)
Ethnic minorities of hh head (1)	0.035	0.039	0.097	0.098
	(0.121)	(0.123)	(0.268)	(0.270)
hh head's occup.: farmer	–0.044	–0.047	0.185	0.185
	(0.093)	(0.095)	(0.196)	(0.197)
hh head's occup.: unskilled labour	0.249	0.249	–0.104	–0.099
	(0.119)**	(0.120)**	(0.279)	(0.281)
Wealth				
ln (farm land)	0.042	0.043	–0.037	–0.038
	(0.019)**	(0.019)**	(0.036)	(0.036)
ln (value of agricultural assets)	0.024	0.024	–0.038	–0.037
	(0.008)***	(0.008)***	(0.017)**	(0.017)**
Raising livestock (yes = 1)	–0.134	–0.137	–0.120	–0.121
	(0.069)*	(0.070)*	(0.136)	(0.137)
Access to labour market				
% local off-farm empl. within hh	–1.151	–1.156	–1.144	–1.152
	(0.100)***	(0.100)***	(0.196)***	(0.198)***
Village outmig. networks	3.090	3.184	0.205	0.187
	(0.661)***	(0.678)***	(1.631)	(1.649)
Social protection				
% having health insur. within hh	0.407	0.415	–0.661	–0.663
	(0.076)***	(0.077)***	(0.230)***	(0.231)***
Aggregate shocks				
Prov. % land in natural disasters	–9.917	–10.018	1.348	1.320
	(0.662)***	(0.667)***	(1.062)	(1.068)
Geographic locations				
Living in central provinces (yes = 1)	0.738	0.752	–0.135	–0.135
	(0.082)***	(0.084)***	(0.163)	(0.164)
Living in western provinces (yes = 1)	0.279	0.285	–0.130	–0.128
	(0.087)***	(0.089)***	(0.201)	(0.203)
Log-likelihood	–2527.854	–2529.573	–839.578	–839.829
LR test of $\rho = \sigma_u^2/(1+\sigma_u^2) = 0$ (p-value)		0.032		0.239

Note: *, ** and *** Denote significance at 10%, 5% and 1% levels, respectively. SEs are in parentheses.

disappear after four periods in nonpoverty for the former and after two periods in poverty for the latter. The multivariate analysis seems not to support the increasing hazard rates of exit at longer duration revealed by the nonparametric examination. Moreover, the magnitude of estimates suggests that the negative relationship between spell duration and hazard rates is nonlinear.

Among various demographic characteristics, larger family size and higher dependence rate are major impediments to poverty exit and drivers of poverty re-entry. Primary education can reduce the risk of re-entry, whereas secondary and tertiary education are more helpful to chances of escape. Gender and ethnic background of a household head appear not to exert much influence on poverty transitions, whereas occupation may play a role. Households led by nonfarmer heads are more likely to move out of poverty. As expected, more asset accumulation, land ownership, outmigration and health insurance are conducive to shifting out of entrenched deprivation. When researching the impact of aggregate shocks on poverty exit, weather risk features. Compared with coastal provinces, living in less-developed western and central regions may also hamper prosperity.

IV. Conclusions

The analysis identifies negative duration-dependence for poverty exit and re-entry in rural China in the period of 1989 to 2006. This indicates that poverty tends to become a persistent state for those who started out with a poverty spell. Policies aiming to end current poverty may also facilitate households moving out of poverty in the future. The catalyst for poverty exit and impediments to poverty re-entry include education, asset accumulation, health insurance and outmigration. Living in less-developed regions, larger family size and dependence rate reduce the possibility of escape from poverty.

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