

This article was downloaded by: [Renmin University of China]

On: 31 May 2014, At: 18:53

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Journal of Economic Policy Reform

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/gpre20>

### Poverty dynamics in rural China revisited: do assets matter?

Jing You<sup>a</sup>

<sup>a</sup> School of Agricultural Economics and Rural Development, Renmin University of China, Beijing, China

Published online: 29 May 2014.

To cite this article: Jing You (2014): Poverty dynamics in rural China revisited: do assets matter?, Journal of Economic Policy Reform, DOI: [10.1080/17487870.2014.920705](https://doi.org/10.1080/17487870.2014.920705)

To link to this article: <http://dx.doi.org/10.1080/17487870.2014.920705>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

## Poverty dynamics in rural China revisited: do assets matter?

Jing You\*

*School of Agricultural Economics and Rural Development, Renmin University of China,  
Beijing, China*

This paper uses an asset-based approach to examine poverty dynamics in rural China over the period 1989–2006. The analysis documents a significant structural component in the poverty dynamics of households. The lack of profitable agricultural asset accumulation plays an unneglectable role in causing households to be trapped in persistent poverty. The escape from poverty is increasingly dominated by stochastic upward mobility rather than by structural movement in terms of asset accumulation. This could threaten the prospect of poverty reduction in rural China. It is argued that future reform and policy-making should pay more attention to building households' asset base.

**Keywords:** poverty dynamics; poverty transition; persistent poverty; agricultural assets; rural China

**JEL Classifications:** I32, O12

### 1. Introduction

China has achieved significant poverty reduction due to its consistent economic growth. The rate of absolute poverty dropped sharply from 30.7% in 1978 to 2.3% in 2006, and the absolute poverty population in rural areas decreased dramatically by 230 million.<sup>1</sup> Using a conventional growth-inequality decomposition framework, many studies have revealed that this remarkable success has largely been a result of the overall economic growth across the country since the 1978 reform (Ravallion and Chen 2007). Looking into sectoral contributions, it appears that agricultural growth serves as a driving force in poverty reduction (Huang, Zhang, and Rozelle 2008; Ravallion 2009; Montalvo and Ravallion 2010).

Despite significant achievements, it is also worth noting that nearly 80% of the reduced number of population in poverty noted between 1978 and 2006 had happened prior to 1996.<sup>2</sup> The speed of poverty reduction has been increasingly slowed by the declined growth rates in the agricultural sector since the mid 1990s (Ravallion 2011). If the share of agriculture in the growth rate of GDP in 1980 could have been held constant, the poverty rate would have been further reduced by 2.66% by 2005 (Huang, Zhang, and Rozelle 2008) and the mean annual reduction rate of poverty over 1981–2002 would have been 6.8% higher (Ravallion and Chen 2007), which means that the reduced proportion of the population in poverty in that period would have been achieved within the first decade. Overall, since the mid 1990s, poverty has become concentrated and persistent with stagnation of income for most of the poor (Chen and Ravallion 2010).

---

\*Email: [jing.you@ruc.edu.cn](mailto:jing.you@ruc.edu.cn)

Observing the remaining poor with low income and consumption, Jalan and Ravallion (2005), among other micro-empirical work, conjecture the existence of poverty traps, but their analysis does not find supporting evidence. Households in their sample appeared to be able to escape, given sufficient time. Other research suggests that households moved frequently into and out of poverty (McCulloch and Calandrino 2003). This results in a considerable transient component of poverty in rural China (Jalan and Ravallion 1998, 2000). Recent literature finds that despite frequent poverty transitions, the longer duration the household spends in poverty, the less likely it is to escape, while this negative duration dependence varies geographically across rural China (Glauben et al. 2012).

The aforementioned studies examine poverty by measuring income or consumption against a certain monetary poverty line. However, Carter and May (2001) and Carter and Barrett (2006) argue that flow-based poverty measures can hardly provide enough information on households' material situation, as such a measure only delineates a snapshot of household well-being. Having this shortcoming, past literature on poverty dynamics in rural China leaves the classic questions open: (1) why have some households in rural China remained in poverty and found them difficult to escape and (2) why others frequently move into and out of poverty and this appears to co-exist with persistent poverty? Aid does not appear to have lasting effects on the poor's income or consumption (Chen, Mu et al. 2009). It therefore calls for alternative measures to better investigate the nature of poverty dynamics, transitions and persistence of households in rural China. The stock-based indicators, such as the asset holdings, may offer a solution. As noted by Carter and Barrett (2006), it is the assets, rather than any flow indicators, that underlie rural households' livelihoods and are the means allowing them to sustain a growth path out of deprivation. Recent applications for developing countries can be found in South Africa (Adato et al. 2006), Kenya (Barrett et al. 2006), India (Naschold 2012) and literature reviews in Baulch (2011) and McKay and Perge (2013).

This paper provides the first examination of poverty dynamics in rural China from the perspective of households' agricultural asset holdings, in an effort to answer the above questions and to offer insights into the root causes of the dynamics and persistence of poverty in rural China. Agricultural assets are the most important productive capital for households in rural China.<sup>3</sup> Agricultural productivity growth is found to be the engine of poverty reduction not only for China (Ravallion and Chen 2007; Montalvo and Ravallion 2010) but also for many other developing countries (Christiaensen, Demery, and Kuhl 2011; Dethier and Effenberger 2012). Therefore, this paper uses rural households' agricultural asset holdings to indicate their asset position. In particular, Carter and May's (2001) asset-based approach is applied for the first time in rural China to breakdown poverty transition matrices into structural and stochastic components according to the underlying changes of households' agricultural asset holdings and the associated livelihood strategies. Overall, the analysis reveals that a great deal of poverty transition over the period 1989–2006 can be attributed to the structural component, that is, the failures in profitable agricultural asset accumulation. This calls for attention to the asset base of rural households for those who are concerned with poverty reduction and development in rural China.

This paper proceeds as follows. Section 2 introduces the data-set and construction of key variables of our interest. Based on the constructed household panel, Section 3 discusses various static and dynamic expenditure-based poverty statistics in rural China, in order to assure the credibility of the data-set and highlight the co-existence of persistent and transient poverty. Section 4 outlines the analytical framework of the

asset-based poverty measure and decomposition. We discuss estimation results on asset-based poverty in Section 5 and conclude with policy implications in Section 6.

## 2. Data

We extract a balanced panel containing 1446 rural households from China Health and Nutrition Surveys (CHNS) in 1989, 1991, 1993, 1997, 2000, 2004 and 2006.<sup>4</sup> The sample households in the constructed panel are basically equally distributed in seven provinces from coastal to inland China: Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi and Guizhou.

Household consumption is calculated as the sum of food consumption including self-production, expenditure on consumer durables, housing and the out-of-pocket cost of health and medical treatment, and insurance.<sup>5</sup> All monetary variables are translated into real terms by using the spatial rural CPI constructed by the CHNS team which is comparable simultaneously across provinces and over time. This could help to improve the accuracy of monetary variables in real terms (Brandt and Holz 2006).

We draw upon Kolenikov and Angeles's (2009) polychoric Principal Component Analysis to construct the household's agricultural asset index from various asset components such as fixed assets including the quantity of different types of farming machinery and irrigation,<sup>6</sup> and financial assets including money spent on seeds, fertilisers and labour. Table 1 lists descriptive statistics of all variables used in the estimation.

Figure 1 shows the distribution of household agricultural assets.<sup>7</sup> There are multiple peaks and many of households appear to have gravitated at a lower asset level. Such distribution of households' agricultural asset holdings gives rise to the possibility of multiple equilibria in asset dynamics which underlie Carter and Barrett's (2006) asset-based poverty traps. By using the key variables of household consumption and agricultural asset holdings, Section 3 will provide in-depth discussion on poverty statistics and shows their consistency compared to those in the existing literature based on other data-sets.

Table 1. Descriptive statistics.

Variable	Definition	Mean	Std. dev.
ln(per capita consumption)	Logarithm of household per capita consumption in 2006 prices	7.188	0.539
Agricultural asset index	Household agricultural asset index	-0.001	0.674
hh size	The total household members registered and interviewed	4.235	1.517
ln(age of hh head)	Logarithm of the age of household head	3.863	0.263
ln(yrs. of edu of hh head)	Logarithm of the number of years of formal education completed by the household head	1.829	0.514
% male adults	Share of male adults in household size	0.711	0.347
Dependency ratio	Share of children ( $\leq 18$ yrs) and the elderly ( $\geq 60$ yrs) in household size	0.359	0.291
% having health insurance	Share of family members having health insurance in household size	0.182	0.350
% off-farm employment	Share of family members having local off-farm jobs in household size	0.492	0.341
% village out-migration	Share of village out-migrants in village population measured. Both of the numerator and denominator are obtained by aggregating the household-level data	0.015	0.035

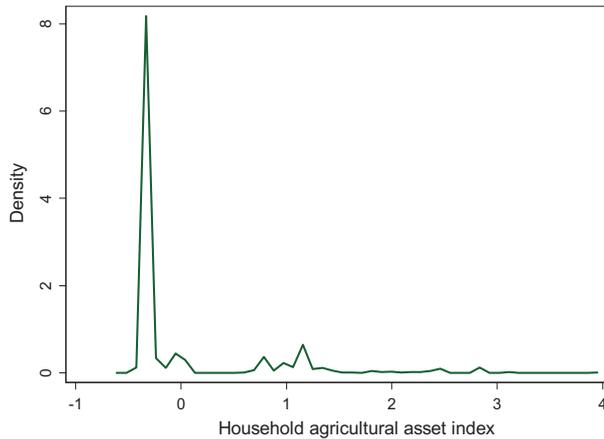


Figure 1. Distribution of household agricultural assets, 1989–2006.

### 3. Profile of poverty in rural China

Based on our constructed panel, this section investigates static and dynamic poverty measured against household consumption and compares results with the past literature. This is to assure the credibility of our data-set and to highlight severity of both transient and chronic poverty experienced by rural households. It is especially worth noting the concentration of poverty in some rural populations. This problem has been obscured by the veil of increased average household income and consumption, and so has been under-researched by previous poverty studies of rural China.

#### 3.1. *Static expenditure poverty*

Figure 2 depicts consumption poverty incidence, i.e. FGT (0) (Foster, Greer, and Thorbecke 1984). There is an overall downward trend in poverty incidence over the sample period 1989–2006. However, the incidence increased between 1997 and 2000 under all poverty lines except the highest two, which is consistent with Chen and Ravallion's (2010) finding. During 1991 and 1997, the population in poverty consistently declined in rural areas due to the positive effect of economic growth. Particularly during 1993 and 1997, there was a sharp decrease in consumption poverty incidence, from 16.3 to 25.8 percentage points at various poverty lines. This is mainly a result of the rising prices of agricultural goods and therefore dramatic increases in rural households' income. According to Chen and Wang (2001), the Chinese government raised the official purchasing prices of agricultural product by 75%, particularly for grain which was doubled. This benefited the poor and near poor (the adjusted US\$1.25 and US\$1.08 poverty lines) most, since the share of food expenditure declines as households get rich. However, in the late 1990s, soaring education and out-of-pocket medical costs as a result of decentralised budget reform and non-existence of health insurance schemes for the rural population placed hurdles in the way of escape from poverty (Gustafsson and Li 2004). Furthermore, the lower the poverty line, the greater the percentage decrease in the whole sample period: 82.7–47.6% for poverty lines from the lowest to the highest. This implies that per capita consumption concentrates at the lower end of the consumption spectrum.

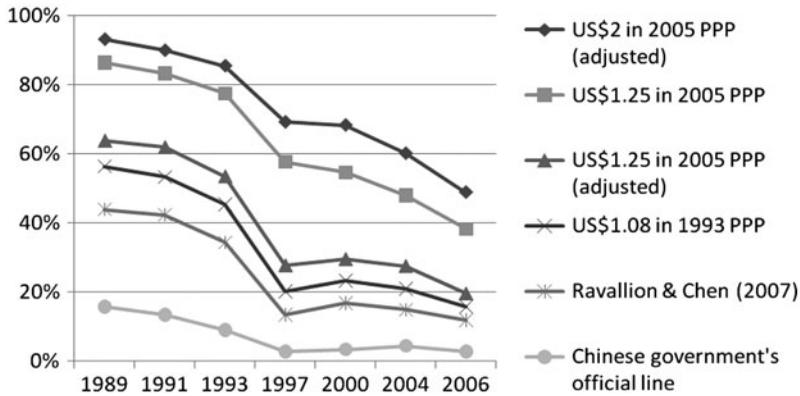


Figure 2. Consumption poverty incidence.

Notes: (a) The Chinese official poverty line is 530 *yuan* in 1995 prices.

(b) Ravallion and Chen (2007) set an adjusted poverty line for rural China at 850 *yuan* in 2002 prices.

(c) US\$1.08 in 1993 PPP is the old international poverty line used by the World Bank.

(d) The adjusted US\$1.25 in 2005 PPP allows for a 37% difference in cost-of-living between rural and urban areas in 2005 (Ravallion and Chen 2007).

(e) The US\$1.25 in 2005 PPP is the new international poverty line suggested by the World Bank (Ravallion, Chen, and Sangraula 2009), without adjustment to the urban–rural price gap in China.

(f) The US\$2/day is about the median of 75 countries' national poverty lines (Ravallion, Chen, and Sangraula 2009).

Besides the poverty incidence, we also check the severity and depth of poverty by the poverty gap (FGT (1)) and the squared poverty gap (FGT (2)). On the one hand, the higher order FGT-class measures for the study population declined during 1989–2006 under all five poverty lines. This is similar to the trend in poverty incidence (FGT (0)), but the percentage changes for higher order FGT indicators are greater than that of the FGT (0).<sup>8</sup> This reaffirms the finding drawn from the RHS, RCRE and CHNS data by Ravallion and Chen (2007) and Zhang and Wan (2008) and implies that per capita consumption for the least well-off and those around the poverty line are positively correlated. However, on the other hand, the increase in consumption for the least well-off is proportionately less than that of the relatively rich. As shown in Table 2, although the well-being, indicated by the ordinates of the generalised Lorenz curve  $GL(p)$ , rose in general, the consumption shares for poorer households dropped, for example, from 9.55% in 1989 to 7.36% in 2006 for the poorest 20%. The poorest 20% of the study population even experienced decreasing welfare between 1997 and 2004, reflected by decreasing  $GL(p)$ . Poverty appears to have been concentrated on the ultra-poor whose consumption is lower than the adjusted US\$1 or US\$0.5/day. As illustrated by Figure 3, persistence of poverty for those existing on less than adjusted US\$0.5/day seems to have been accentuated between 2000 and 2004. The reduction of poverty gap and squared poverty gap has also become stagnant since 1997 and even increased between 1997 and 2004, indicating the increasing difficulty in lifting these people out of poverty.

### 3.2. Dynamic expenditure poverty

Taking time into account, Table 3 shows that about 15% of sample households successfully managed to stay above the poverty line of adjusted US\$1.25/day in every

Table 2. Household per capita consumption shares, by quintile.

Year	Quintile	Quintile max	% of median	% of total	GL( $p$ )
1989	1	671.22	68.21	9.55	104.06
	2	885.69	90.00	14.34	260.28
1991	1	705.86	69.92	9.68	112.46
	2	902.54	89.40	13.82	272.99
1993	1	774.20	69.49	9.69	123.60
	2	986.68	88.57	13.75	299.11
1997	1	1048.64	71.94	9.48	165.24
	2	1324.54	90.86	13.66	403.16
2000	1	990.37	66.66	8.34	155.17
	2	1322.60	88.99	12.48	387.21
2004	1	1033.69	63.88	7.54	154.38
	2	1387.46	85.75	11.71	394.36
2006	1	1165.90	62.20	7.36	172.53
	2	1619.75	86.41	11.85	450.36

Note: The generalised Lorenz ordinates  $GL(p) = \text{mean}(\text{household per capita consumption}) \times L(p)$ , where  $p = F$  (quintile maximum) and  $L(p)$  is the cumulative group share of per capita consumption. Other wealthier quintiles are not reported, since their welfare, represented by  $GL(p)$ , consistently increased during 1989–2006.

wave.<sup>9</sup> Approximately 85% fell into poverty at least once and 40% experienced poverty at least twice. Three per cent were persistently poor throughout the sample period.<sup>10</sup> This is consistent with former studies identifying a significant transient component in poverty reduction in rural China (Jalan and Ravallion 1998, 2000; McCulloch and Calandrino 2003; World Bank 2009).

More specifically, Table 4 presents consumption poverty dynamics over time, using McCulloch and Calandrino's (2003) categorisation and referring to the poverty line of adjusted US\$1.25/day. On the one hand, 54.7% of non-chronically poor rural households, whose intertemporal mean per capita consumption is higher than the poverty line, experienced poverty in 1989. This proportion decreased to 8.4% in 2006. On the other hand, 11.3% of the chronically poor, whose intertemporal mean consumption is below the poverty line, were non-poor in 1989. This figure mounts up to 50.5% in 2006. These two phenomena are consistent with the reduction of static consumption poverty presented in Section 3.1 and suggest that whether they are chronically or non-chronically poor, rural households escape and suffer poverty from time to time.<sup>11</sup>

Table 3. Distribution of the number of waves in poverty.

No. of waves in poverty	Frequency	Share (%)	Cumulative share (%)
0	216	14.94	14.94
1	191	13.21	28.15
2	234	16.18	44.33
3	282	19.50	63.83
4	220	15.21	79.05
5	147	10.17	89.21
6	113	7.81	97.03
7	43	2.97	100
Total	1446	100	

Note: Households' poverty status is defined by measuring household per capita consumption against the US \$1.25/day adjusted to the rural–urban price gap in China.

Table 4. Household decomposition by intertemporal mean per capita consumption and poverty status.

	1989		2006	
	No. of households with intertemporal mean consumption ...		No. of households with intertemporal mean consumption ...	
	Below the poverty line	Above the poverty line	Below the poverty line	Above the poverty line
Poor	346	578	193	89
Row %	37.4	62.6	68.4	31.6
Column %	88.7	54.7	49.5	8.4
Non-poor	44	478	197	967
Row %	8.4	91.6	16.9	83.1
Column %	11.3	45.3	50.5	91.6
Total	390	1056	390	1056
Row %	27.0	73.0	27.0	73.0

Note: The poverty line is the adjusted US\$1.25/day.

In addition to frequent transitions across the poverty line, there is a sharp rise in the share of those being poor and having lower intertemporal mean consumption than the poverty line: from 37.4% in 1989 to 68.4% in 2006. This implies an accentuated persistence of poverty for the remaining poor and increasing difficulties in escape. As Gustafsson and Sai (2009), we find even higher degrees of poverty persistence in two western provinces where ethnic minorities dwell. Around 60.3% of the poor in two western provinces in 1989 had lower intertemporal consumption than the poverty line and this share increased to 94.5% in 2006.

Substantial transient poverty would, as argued by Jalan and Ravallion (1998) and McCulloch and Calandrino (2003), provide misleading signals to policy-makers. Specifically, if the government targets aid towards static poverty from one year, 62.6 and 31.6% of the poor in 1989 and 2006, respectively, might be inappropriately included, since their intertemporal mean consumption in the long run is higher than the poverty line and being in poverty is only an occasional situation for them. However, should the aid be allocated based on the intertemporal mean, 54.7 and 8.4% of the non-chronically poor in 1989 and 2006, respectively, would not be able to benefit from the plan, although they did suffer from some degree of poverty in that year.

The discussion in this section has been largely consistent with past literature on the stylised facts of poverty dynamics in rural China, that is, huge poverty reduction but at lower speed since the mid 1990s. More importantly, we highlight the co-existence of persistence and transitions of poverty, and the increasing difficulties of poverty reduction for the remaining poor. As argued in Section 1, the poverty measures using flow indicators are powerless to reveal the causes underlying these phenomena. The paper proceeds to investigate the third generation of poverty measures using household agricultural asset holdings, in order to shed some new light on poverty dynamics and transitions in rural China.

#### 4. Methodology

We employ Carter and May's (2001) (CM henceforce) asset-based poverty measures and their decomposition of poverty dynamics. As a starting point, assume that the rural household  $h$  at time  $t$  has per capita consumption  $c_{ht}$  and possesses agricultural assets

$A_{ht}$ . The conventional FGT-family indicators only measure household consumption against a certain poverty line. Nevertheless, CM are further concerned with households' underlying livelihood strategies. Specifically, they assume that the household  $h$  derives consumption based on its asset holdings. In the context of rural China and of the particular data-set used in this paper, we focus on the role of agricultural assets which have been the most vital productive assets for rural households. Thus, the household per capita consumption can be written as a function of agricultural assets:

$$c_{ht} = c(A_{ht}) \quad (1)$$

In order to estimate the Equation (1), we specify a consumption regression as follows:

$$\ln c_{ht} = \beta_1 A_{ht} + x'_{ht} \beta_2 + \alpha_h + \varepsilon_{ht} \quad (2)$$

where  $x'_{ht}$  includes households' observed characteristics;  $\alpha_h$  represents household-specific time-invariant unobserved characteristic; and  $\varepsilon_{ht}$  is an *i.i.d.* error with normal distribution. It is worth noting that family members' participation in health insurance and local off-farm employment, among various household characteristics, may introduce endogeneity problems (e.g. Huang, Wu, and Rozelle 2009; Lei and Lin 2009). We implemented the Durbin-Wu-Hausman test to detect this. Specifically, following Lei and Lin (2009), we selected whether the county implemented the NCMS as the excluded instrument for the individual's participation in health insurance and according to Huang, Wu, and Rozelle (2009), we used one-wave-lagged share of family members who had local off-farm employment as the excluded instrument for the current share of off-farm employment within the household. In the first step of Durbin-Wu-Hausman test, each suspiciously endogenous variable is estimated by standard fixed effects with included instruments and its excluded instrument, respectively. I calculated the residual after estimation. In the second step, the residual is inserted to Equation (2), which is then estimated under the standard fixed-effects model specification. The estimated coefficient of the residual is 0.170 at 1% significance level in the case of health insurance, but statistically insignificant (with the  $p$ -value of 0.181) in the case of off-farm employment. This indicates endogenous participation in health insurance but not in local off-farm employment. We therefore used the IV approach to estimate Equation (2) rather than the standard OLS. The health insurance variable is instrumented as above according to Lei and Lin (2009).

On estimating Equation (2), CM split the household  $h$ 's realised consumption as:

$$c_{ht} = \hat{c}(A_{ht}) + \hat{\varepsilon}_{ht} \quad (3)$$

where  $\hat{c}(A_{ht})$  denotes the consumption level that would be expected for  $h$  given its agricultural asset level  $A_{ht}$ , that is, the predicted consumption based on the estimates of Equation (2). Equation (3) underlines two sources of shocks facing households. A household can be consumption poor as a result of agricultural asset losses or entitlement failures indicated by a negative  $\hat{\varepsilon}_{ht}$ .<sup>12</sup> In the spirit of Sen (1981), entitlement failures refer to the households' incapability to smooth consumption as opposed to entitlement windfalls indicated by a positive  $\hat{\varepsilon}_{ht}$ . Asset losses are deemed as a structural phenomenon which could bring about long-term consequences of low consumption for households. By contrast, entitlement failures may cause short-term hardship, given that the household still possesses sufficient agricultural assets to recover in the future.

With a 90% confidence interval estimate of  $\hat{c}(A_{ht})$ , CM define the stochastically poor as a household who is observed to suffer from lower consumption than the poverty line, but is expected to have higher consumption (or predicted well-being) given its current agricultural asset holdings. That is,

$$C_{ht} < \underline{c} \text{ and reject } H_0 : \hat{c}(A_{ht}) < \underline{c}$$

By rejecting  $H_0$ , households are classified as stochastically poor only if its agricultural asset holdings are completely higher than the level that can support its consumption at the poverty line. Analogously, a household is stochastically non-poor if it is observed non-poor, but is expected to have lower consumption than the poverty line as its current agricultural asset possession would not be able to sustain such a high consumption level. That is,

$$C_{ht} \geq \underline{c} \text{ and reject } H_0 : \hat{c}(A_{ht}) \geq \underline{c}$$

Using these definitions, CM further break down households' dynamic expenditure poverty between  $t-1$  and  $t$ . The second generation of poverty measures can be decomposed into stochastic and structural movements according to households' agricultural asset holdings. In particular, the chronically poor encounter dual entitlement failures if they are also stochastically poor in both periods. Those falling behind at  $t$  are only stochastically downwardly mobile if they were observed as non-poor at  $t-1$  but stochastically poor at  $t$ . Those escaping from poverty get ahead stochastically if they were poor at  $t-1$  but only stochastically non-poor at  $t$ . The remaining transition that cannot be explained by the stochastic component is attributed to an upper bound of structural component.<sup>13</sup> Carter and Barrett (2006) term this the (static) asset poverty measure.

## 5. Results and discussion

By applying Carter and May's (2001) decomposition method to each sub-period containing two consecutive waves, we find substantial structural components underlying poverty persistence and transitions in rural China. Investment in agricultural asset accumulation plays an important role in determining household poverty dynamics. Table 5 summarises the estimation results.<sup>14</sup>

Specifically, of full sample households, 48.4% were observed to fall below the adjusted poverty line of US\$1.25/day in 1989 and 1991, of which 35.1% had entitlement failures (i.e. negative  $\hat{\epsilon}_{ht}$ ) in both years. This yields an upper bound of 64.9% for the structurally trapped. Carter and May (2001) note that this upper bound of estimate cannot be further reduced, as it might be the case that some households accumulate fewer assets because of their intrinsic incapacities and hence appear to have negative  $\hat{\epsilon}_{ht}$ . Prior to 1997, over 60% of the chronically poor (i.e. the "poor  $\rightarrow$  poor" cell in each sub-period) did not have enough assets to lift their consumption up to the adjusted US\$1.25-a-day poverty line. The proportion of those who were structurally trapped in the per-period chronically poor has declined since then, but remains more than a half.

In the first sub-period, 13.8% slide backward (i.e. the "non-poor  $\rightarrow$  poor" cell), of which 57.5% were stochastically poor in 1991. This defines an upper bound of 42.5% who were potentially structurally poor in 1991, as some of them might be beneficiaries of entitlement windfall in 1989 but simply regressed in 1991 to lower expected consumption than the poverty line (Carter and May 2001), rather than facing real

Table 5. Decomposition of poverty transition.

		1991		1993		1997	
		Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
1989	Poor	48.4% chronically poor, of which: – 35.2% dual entitlement failure – Structurally poor $\leq 64.8\%$ 13.8% fell into poverty, of which: – 57.5% stochastically mobile – Structurally poor $\leq 42.5\%$	15.8% escape, of which: – 53.1% stochastically mobile – Structurally mobile $\leq 46.9\%$	43.7% chronically poor, of which: – 38.3% dual entitlement failure – Structurally poor $\leq 61.7\%$ 9.8% fell into poverty, of which: – 54.6% stochastically mobile – Structurally poor $\leq 45.4\%$	18.3% escape, of which: – 50.4% stochastically mobile – Structurally mobile $\leq 49.6\%$	22.1% chronically poor, of which: – 37.8% dual entitlement failure – Structurally poor $\leq 62.2\%$ 5.6% fell into poverty, of which: – 85.2% stochastically mobile – Structurally poor $\leq 14.8\%$	31.3% escape, of which: – 51.7% stochastically mobile – Structurally mobile $\leq 48.3\%$
1997	Poor	2000 14.5% chronically poor, of which: – 47.4% dual entitlement failure – Structurally poor $\leq 52.6\%$ 15% fell into poverty, of which: – 76.5% stochastically mobile – Structurally poor $\leq 23.5\%$	2000 13.3% escape, of which: – 79.2% stochastically mobile – Structurally mobile $\leq 20.8\%$	2004 14.5% chronically poor, of which: – 46.4% dual entitlement failure – Structurally poor $\leq 53.6\%$ 13.1% fell into poverty, of which: – 75.3% stochastically mobile – Structurally poor $\leq 24.7\%$	2004 15.1% escape, of which: – 75.3% stochastically mobile – Structurally mobile $\leq 24.7\%$	2006 11.3% chronically poor, of which: – 47.9% dual entitlement failure – Structurally poor $\leq 52.1\%$ 8.2% fell into poverty, of which: – 88.2% stochastically mobile – Structurally poor $\leq 11.8\%$	16.2% escape, of which: – 70.5% stochastically mobile – Structurally mobile $\leq 29.5\%$
	Non-poor						

hurdles to asset accumulation. The proportion of the potentially structurally poor in downward mobility declined from over 40% in 1989 to 11.8% in 2006. In comparison, the stochastic movement rose from 57.5 to 88.2%, indicating that more and more of those falling behind failed to obtain expected returns to their agricultural assets or were simply knocked back by bad luck. These households would be able to regain well-being equivalent to or higher than the poverty line, given sufficient time.

The structural poverty in the “poor → poor” and “non-poor → poor” cells adds up to the total structural component. The proportion of the structurally poor among those who are observed as consumption poor, reflected by Figure 4, decreased from nearly 60% in 1991 to 37.8% at the end of 2000, but increased to 40% from 2000 to 2004. Though this proportion decreased again afterwards to 35%, the magnitude of this aggregate structural component in poverty is still significant. Through 1989–2006, on average, 47.3% of consumption poverty can be attributed to failures in agricultural asset accumulation in rural China. Insufficient asset accumulation which induced structural poverty offers an explanation for the severity and depth of consumption poverty that appears to be persistent in Figure 3.

Cross-country comparison suggests that the aggregate structural proportion in poverty in rural China is lower than in rural Vietnam (56.6% in 2010 in Cuong 2012) and African countries such as South Africa (over 50% between 1993 and 1998 in Adato, Carter, and May 2006), Kenya (85% from 2000 to 2009 in Radeny, van den Berg, and Schipper 2012), but higher than in rural Ethiopia (45% between 1994 and 2004 in Liverpool-Tasie and Winter-Nelson 2011), India (35% from 1992 to 2005 in Dutta and Kumar 2013) and Mexico (7% between 2004 and 2007 in López-Feldman and Parada 2011). There is no suggestive evidence of asset poverty traps in Bangladesh (Quisumbing and Baulch 2013) and Pakistan (Naschold 2013). Generally less structurally persistent poverty in South Asian countries benefits from their well-functioning factor markets compared to thin or even non-existent markets in Africa (Quisumbing and Baulch 2013), and segmented labour market (Fleisher and Yang 2008) and fragmented land (Wan and Cheng 2001; Chen, Huffman et al. 2009) in rural China.

For those who escaped in the second wave until 1997, about a half can be attributed to structural mobility as their predicted consumption, given their asset holdings, was higher than the adjusted US\$1.25-a-day poverty line. This is consistent with fast poverty reduction in this time period, as shown in Figure 2. Nevertheless, the proportion of structural upward mobility dropped to less than 30% after 1997, indicating a weakened asset base for households to successfully maintain better well-being in the longer term. This proportion is less than 58.6% in rural Mexico in the same period (López-Feldman and Parada 2011) and Vietnam in 2010 (68% in Cuong 2012), and cannot measure up to South Africa in the mid 1990s (42% in Adato, Carter, and May 2006) or Kenya from 2004 to 2009 (30–35% in Radeny, van den Berg, and Schipper 2012) where structural poverty prevails. Actually, Chinese rural households have more often returned to poverty since the late 1990s. The population experiencing poverty even increased in some years as illustrated by Figures 2 and 3. As another example, according to the Chinese government poverty line, the size of poor population in rural China rebounded by 0.8 million for the first time in 2003.<sup>15</sup> Lower agricultural asset accumulation may hamper sustainable poverty reduction and incur recurrent poverty, or even poverty traps due to backsliding toward some low asset equilibrium (as Carter and Barrett 2006 warned) for those who have recently escaped.<sup>16</sup>

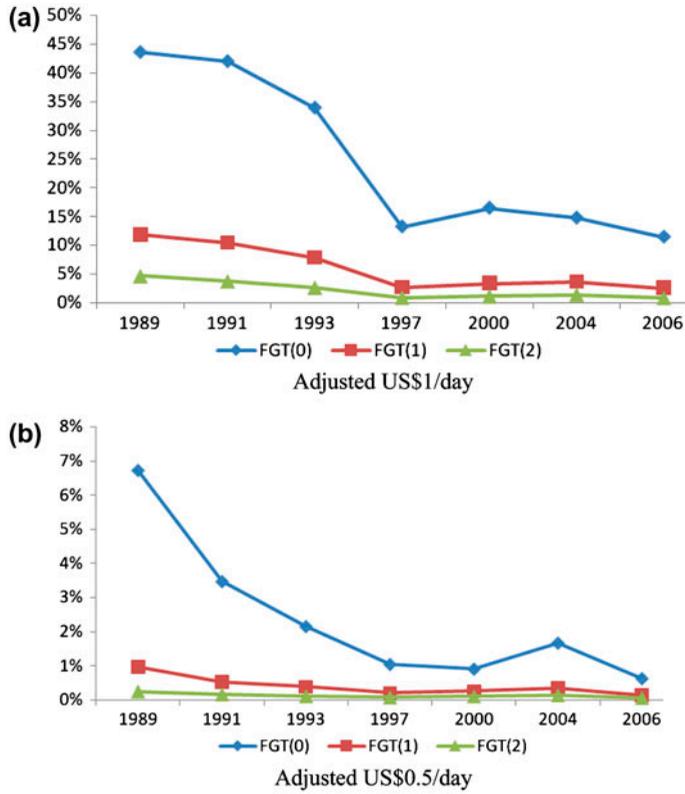


Figure 3. Poverty incidence and intensity for the ultra-poor. (a) Adjusted US\$1/day. (b) Adjusted US\$0.5/day.

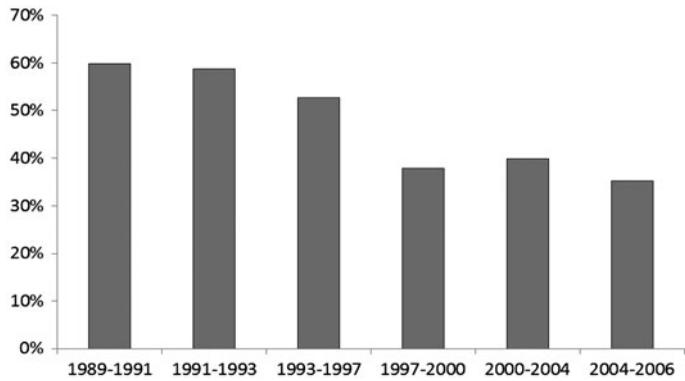


Figure 4. The aggregate structural component in poverty dynamics.

## 6. Conclusion

Despite remarkable success in reducing the proportion of the population in poverty, there are increasing difficulties in further poverty reduction in rural China. As poverty

incidence declines, poverty becomes more dispersed and the poor are more difficult to reach. The responsiveness of poverty to economic growth is also attenuated. These results challenge the effectiveness of the area-based and development-oriented anti-poverty policy that has been exercised in rural China for decades and has been criticised to have targeted the poor only weakly (Park and Wang 2002). How to retain poverty reduction and better help the remaining poor become the top priorities for policy-makers (World Bank 2009). A more viable policy design appears to be household-based, as recommended by the World Bank (2009). In this respect, neither static nor dynamic poverty measured by consumption can reflect the underlying causes of poverty or successfully tailor the policy and the aid to the needy. As a complement to the studies using the flow indicators, the asset-based examination of poverty dynamics in this paper provides some useful indications.

Carter and May's (2001) decomposition of poverty dynamics underscores the importance of agricultural assets in the changes of household poverty status. More than half of chronic poverty appears to be a structural component. The chronically poor lack sufficient agricultural assets to sustain their well-being at a level that is at least equivalent to the poverty line. Alarming, the structural movement accounts for part of downward mobility. This means that those who have recently escaped also need to accumulate sufficient agricultural assets to maintain their position and prevent possible re-entry. In sum, the asset-based investigation provides some clues for answering the questions raised in Section 1. Without a firm asset base, poverty is likely to propagate itself in the long run; upward mobility would be undermined; and thus households show apparent transitions into and out poverty.

Future agricultural policy reforms in China should encourage and facilitate rural households' accumulation of profitable agricultural assets and therefore help them earn more income and build productive safety nets to cushion risk and shocks. This latter has recently been shown as an effective instrument to help the ultra-poor in rural Bangladesh (Krishna, Poghosyan, and Das 2012) and may be more important for Chinese farmers. Having achieved strengthened access to markets during the economic reforms brings about not only more market opportunities to farmers, but also intensified risk and shocks against which limited formal insurance arrangements can protect them (Jalan and Ravallion 1999; Liu et al. 2012). For example, the transmission elasticity of prices (from retail prices to farmgate ones) is nearly 1 for grain and wheat and higher than 1 for vegetables, fruit and pork (Liu et al. 2012). When faced with risk, farmers tend to hold substantial precautionary savings in unproductive ways like cash (Giles and Yoo 2007) and grain stock (Park 2006), which will in turn deter their income growth in the next production period. An enhanced agricultural asset base for rural households, however, can serve as a safety net and protect them from being knocked below certain income or expenditure poverty lines by downside risk and shocks.

Pro-accumulation agricultural policies could also be a cost-effective intervention for fighting persistent and recurrent poverty and provide better targeting of poor households. Lawson, McKay, and Okidi (2006) have proved that in Uganda, using assets that are crucial to household livelihood in addition to expenditure poverty can rectify up to 60% of mismatches between quantitatively targeted and qualitatively observed poor populations.<sup>17</sup> With regard to the present study, the real needy who are more likely to be structurally trapped and to backslide in to poverty again in the long run would be targeted and could benefit, by focusing on the household asset base instead of directly transferring income or consumption reliefs to the poor defined by their residence (e.g. the national designated poor counties and villages) and/or by their temporarily low income or

consumption levels. At the same time, those for whom poverty is only a stochastic phenomenon in the short run would not attract so much poverty alleviation fund in the hard times as limited budget for poverty alleviation is a common challenge facing many Chinese local governments as well as other developing countries. More importantly, households being well endowed with agricultural assets are likely to not only mitigate adverse shocks, but also step into self-reinforced growth in the longer term.

### Acknowledgements

The author is grateful to the insightful comments on an earlier draft from two anonymous referees, Albert Park, Katsushi Imai, Adam Ozanne, Bernard Walters, Xiaobing Wang, Nick Weaver and the seminar participants at the University of Manchester. This work was supported by the Ministry of Education of China (MOE) Project of Humanities and Social Sciences [Grant No. 13YJCZH231] and the Scientific Research Foundation for the Returned Overseas Chinese Scholars, State Education Ministry. The financial support from Brooks World Poverty Institute and the North American Foundation for the University of Manchester at the early stage of this research is also gratefully acknowledged.

### Notes

1. Data come from Poverty Monitoring Report of Rural China 2008 published by the National Bureau of Statistics (NBS).
2. Author's calculation based on data from Poverty Monitoring Report of Rural China 2008 published by the NBS.
3. The share of agricultural income was 70% among sample household in 1989. This proportion declined over time along with income diversification and more off-farm opportunities (typically rising migration from rural to urban areas), but still accounted for more than 50% of household income. Agricultural income is particularly important for the poor as many of them are unable to engage in out-migration (Du, Park, and Wang 2005). The share of agricultural income in our sample is on average 7 percentage points higher for the poor than for the non-poor.
4. The CHNS used a multi-multistage, random cluster process to draw 3795 sample households covering 15,917 individuals in both rural and urban China from nine provinces in 1989. Rural households were defined as those who reported they permanently lived in home villages at the time of interview and were tracked by the "dwelling" rule in subsequent waves. Consistent questionnaires were used throughout different waves. Specific sampling methods and survey conduction can be found at <http://www.cpc.unc.edu/projects/china> [accessed July 28, 2013]. The discussion on the representativeness and appropriateness of using the constructed panel at the household level based on the CHNS can be found in Imai and You (2013).
5. This definition follows Benjamin, Brandt and Giles (2005) and is recently applied by Imai and You (forthcoming) to the CHNS in studying dynamics of household poverty. Due to data limitations, we cannot include more reliable sources of consumption expenditure. To verify our consumption data, we compared them with the Rural Household Surveys (RHS) collected by the NBS and find similar mean consumption for each sample province and trends of consumption changes over time. Our constructed household consumption has similar mean and time trend over the sample period of that of the RHS. Furthermore, as we will show in Figure 1, our constructed consumption also generates consistent poverty measures with past literature. Therefore, the validity of our consumption data could be reasonably believed.
6. Farm machines include large or medium-sized tractors, walking tractors, animal carts, irrigation equipment, power threshers and household water pumps. Land owned by households is not included, since in rural China land is allocated equally by local/village officials according to the number of household members. In our sample, the average household per capita farmland is very stable and lies between 0.79 and 0.96 in different waves. Land is not a tangible asset that households can accumulate or divest easily. That said, we do experiment with land when constructing the asset index. The shape of agricultural asset dynamics holds broadly same as before.

7. The constructed asset index is essentially an ordinal concept and thus can be either positive, negative or zero.
8. The only exception is the consumption poverty measured against the Chinese government's official poverty line.
9. This estimate does not mean that 15% of the sample households were always rich over the period 1989–2006 as there were 2–3 years gap between two consecutive waves. It should better be understood as an upper estimation of the size of the always non-poor population. Similar interpretation also applies to the 3% persistently poor in the next sentence.
10. If using the Chinese official poverty line which is approximately 80% of the adjusted US \$1.25/day, more people (32%) did not experience poverty in any wave and less people (1%) were always poor in every wave. Sixty-eight per cent fell in poverty at least once and 49% at least twice. Persistence of poverty becomes less severe as a result of low poverty line, while frequent transitions are still salient.
11. It should be noted that McCulloch and Calandrino's (2003) framework is open to weakness. We may have overstated the transitory poverty by using their methodology. The limitation of their method is that their transitory poverty calculations do not reflect the case that many households may escape as a result of increasing mean consumption. Even if these increases were perfectly linear and steady, they would show up as transitory poverty.
12. Carter and May (2001) caution that  $\hat{\varepsilon}_{ht}$  cannot be used directly to classify whether the household is stochastically poor, because it contains genuine entitlement failures as well as other unobserved disturbances, such as measurement errors. A less precise  $\hat{c}(A_{ht})$  from estimating Equation (2) would exaggerate  $\hat{\varepsilon}_{ht}$  and in turn overstate the stochastically poor. To improve the accuracy of the estimate of the stochastically/structurally poor and make the estimates less sensitive to the performance of Equation (2), they suggest an alternative test of one-side hypothesis presented in the following paragraph.
13. Carter and May (2001) note that it is impossible to further reduce this bound for the structurally poor. We will return to this point in Section 5.
14. Refer to Appendix 2 for the IV estimation results of the household livelihood regression (Equation 2).
15. Data come from Poverty Monitoring Report of Rural China 2008 published by the NBS.
16. One may concern that a household is likely to be classified as "structural poor" not because its failure in asset accumulation but simply divesting its wealth to smooth consumption. This is not a serious problem in our case. Following Barrett et al. (2006), we plot the volatilities (measured by coefficients of variation) of household per capita income and consumption over household intertemporal agricultural asset deciles. We actually find asset smoothing rather than consumption smoothing behaviour for the poorest 12.5% of households in the asset distribution as they have larger consumption variability compared with that of income. Extremely poor households have to defend their limited productive assets to survive rather than conducting consumption smoothing, e.g. rural Zimbabwe (Hoddinott 2006) and Kenya (Barrett et al. 2006). They would be classified as "structurally poor" if they encounter accumulation failures as well. By contrast, those lying above 40% in the asset distribution in general suggest consumption smoothing behaviour as their consumption variability is smaller than that of income. However, these households are less likely to be misjudged as "structurally poor" as they are relatively wealthy in the asset distribution even after using their wealth as a buffer and therefore can afford consumption smoothing.
17. At the regional level, Lang, Barrett, and Naschold (2013) combine estimated returns to various assets for geographically defined sub-groups and traditional poverty maps to better target candidates for policy intervention in terms of asset transfer schemes.

## References

- Adato, M., M. R. Carter, and J. May. 2006. "Exploring Poverty Traps and Social Exclusion in South Africa Using Qualitative and Quantitative Data." *Journal of Development Studies* 42: 226–247.
- Barrett, C. B., P. P. Marennya, J. Mcpeak, B. Minten, F. Murithi, W. Oluoch-Kosura, F. Place, J. C. Randrianarisoa, J. Rasambainarivo, and J. Wangila. 2006. "Welfare Dynamics in Rural Kenya and Madagascar." *Journal of Development Studies* 42: 248–277.

- Barrientos, A., and J. Mase. 2012. "Poverty Transitions among Older Households in Brazil and South Africa." *European Journal of Development Research* 24: 570–588.
- Baulch, B. 2011. *Why Poverty Persists: Poverty Dynamics in Asia and Africa*. Cheltenham: Edward Elgar.
- Benjamin, D., L. Brandt, and J. Giles. 2005. "The Evolution of Income Inequality in Rural China." *Economic Development and Cultural Change* 53: 769–824.
- Brandt, L., and C. A. Holz. 2006. "Spatial Price Differences in China: Estimates and Implications." *Economic Development and Cultural Change* 55: 43–86.
- Carter, M. R., and C. B. Barrett. 2006. "The Economics of Poverty Traps and Persistent Poverty: An Asset-based Approach." *Journal of Development Studies* 42: 178–199.
- Carter, M. R., and J. May. 2001. "One Kind of Freedom: Poverty Dynamics in Post-apartheid South Africa." *World Development* 29: 1987–2006.
- Chen, Z., W. E. Huffman, and S. Rozelle. 2009. "Farm Technology and Technical Efficiency: Evidence from Four Regions in China." *China Economic Review* 20: 153–161.
- Chen, S., R. Mu, and M. Ravallion. 2009. "Are There Lasting Impacts of Aid to Poor Areas?" *Journal of Public Economics* 93: 512–528.
- Chen, S., and M. Ravallion. 2010. "China is Poorer than We Thought, but No Less Successful in the Fight against Poverty." In *Debates on the Measurement of Global Poverty*, edited by S. Anand, P. Segal and J. E. Stiglitz, 327–340. Oxford: Oxford University Press.
- Chen, S., and Y. Wang. 2001. *China's Growth and Poverty Reduction: Trends between 1990 and 1999*. World Bank Policy Research Working Paper, No. 2651.
- Christiaensen, L., L. Demery, and J. Kuhl. 2011. "The (Evolving) Role of Agriculture in Poverty Reduction – An Empirical Perspective." *Journal of Development Economics* 96: 239–254.
- Cuong, N. V. 2012. *Poverty Dynamics: The Structurally and Stochastically Poor in Vietnam*. MPRA Paper No. 45738.
- Dercon, S., and J. S Shapiro. 2007. *Moving on, Staying behind, Getting Lost: Lessons on Poverty Mobility from Longitudinal Data*. Global Poverty Research Group Working Paper Series, No. 075.
- Dethier, J., and A. Effenberger. 2012. "Agriculture and Development: A Brief Review of the Literature." *Economic Systems* 36: 175–205.
- Du, Y., A. Park, and S. Wang. 2005. "Migration and Rural Poverty in China." *Journal of Comparative Economics* 33: 688–709.
- Dutta, S., and L. Kumar. 2013. "Poverty Dynamics in Rural India: An Asset-based Approach." *Journal of Applied Economic Research* 7: 475–506.
- Fleisher, B., and D. T. Yang. 2008. "China's Evolving Labor Market." In *Policy Reform and Chinese Markets: Progress and Challenges*, edited by B. Fleisher, N. Hope, A. Pena and D. Yang, 125–158. Cheltenham: Edward Elgar.
- Foster, J., J. Greer, and E. Thorbecke. 1984. "A Class of Decomposable Poverty Measures." *Econometrica* 52: 761–766.
- Giesbert, L., and K. Schindler. 2012. "Assets, Shocks, and Poverty Traps in Rural Mozambique." *World Development* 40: 1594–1609.
- Giles, J., and K. Yoo. 2007. "Precautionary Behavior, Migrant Networks, and Household Consumption Decisions: An Empirical Analysis Using Household Panel Data from Rural China." *Review of Economics and Statistics* 89: 534–551.
- Glauben, T., T. Herzfeld, S. Rozelle, and X. Wang. 2012. "Persistent Poverty in Rural China: Where, Why, and How to Escape?" *World Development* 40: 784–795.
- Gustafsson, B., and S. Li. 2004. "Expenditures on Education and Health Care and Poverty in Rural China." *China Economic Review* 15: 292–301.
- Gustafsson, B., and Ding Sai. 2009. "Temporary and Persistent Poverty among Ethnic Minorities and the Majority in Rural China." *Review of Income and Wealth* 55: 588–606.
- Hoddinott, J. 2006. "Shocks and Their Consequences across and within Households in Rural Zimbabwe." *Journal of Development Studies* 42: 301–321.
- Huang, J., Y. Wu, and S. Rozelle. 2009. "Moving off the Farm and Intensifying Agricultural Production in Shandong: A Case Study of Rural Labor Market Linkages in China." *Agricultural Economics* 40: 203–218.
- Huang, J., Qi Zhang, and S. Rozelle. 2008. "Economic Growth, the Nature of Growth and Poverty Reduction in Rural China." *China Economic Journal* 1: 107–122.

- Imai, K., and J. You. (2013). "Poverty Dynamics of Households in Rural China." *Oxford Bulletin of Economics and Statistics*.doi: [10.1111/obes.12044](https://doi.org/10.1111/obes.12044).
- Jalan, J., and M. Ravallion. 1998. "Transient Poverty in Postreform Rural China." *Journal of Comparative Economics* 26: 338–357.
- Jalan, J., and M. Ravallion. 1999. "Are the Poor Less Well Insured? Evidence on Vulnerability to Income Risk in Rural China." *Journal of Development Economics* 58: 61–81.
- Jalan, J., and M. Ravallion. 2000. "Is Transient Poverty Different? Evidence for Rural China." *Journal of Development Studies* 36: 82–99.
- Jalan, J., and M. Ravallion. 2005. "Household Income Dynamics in Rural China." In *Insurance against Poverty*, edited by S. Dercon, 106–123. Oxford: Oxford University Press.
- Kolenikov, S., and G. Angeles. 2009. "Socioeconomic Status Measurement with Discrete Proxy Variables: Is Principal Component Analysis a Reliable Answer?" *Review of Income and Wealth* 55: 128–165.
- Krishna, A., M. Poghosyan, and N. Das. 2012. "How Much Can Asset Transfers Help the Poorest? Evaluating the Results of BRAC's Ultra-poor Programme (2002–2008)." *Journal of Development Studies* 48: 254–267.
- Lang, C., C. B. Barrett, and F. Naschold. 2013. "Targeting Maps: An Asset-based Approach to Geographic Targeting." *World Development* 41: 232–244.
- Lawson, D., A. McKay, and J. Okidi. 2006. "Poverty Persistence and Transitions in Uganda: A Combined Qualitative and Quantitative Analysis." *Journal of Development Studies* 42: 1225–1251.
- Lei, X., and W. Lin. 2009. "The New Cooperative Medical Scheme in Rural China: Does More Coverage Mean More Service and Better Health?" *Health Economics* 18: S25–S46.
- Liu, B., M. Keyzer, B. Van den Boom, and P. Zikhali. 2012. "How Connected Are Chinese Farmers to Retail Markets? New Evidence of Price Transmission." *China Economic Review* 23: 34–46.
- Liverpool-Tasie, L. S. O., and A. Winter-Nelson. 2011. "Asset versus Consumption Poverty and Poverty Dynamics in Rural Ethiopia." *Agricultural Economics* 42: 221–233.
- López-Feldman, A., and J. Parada. 2011. *Poverty Dynamics in Rural Mexico: An Analysis Using Four Generations of Poverty Measurement*. Mexico: Documentos de Trabajo DTE 505, CIDE, Division de Economía.
- McCulloch, N., and M. Calandrino. 2003. "Vulnerability and Chronic Poverty in Rural Sichuan." *World Development* 31: 611–628.
- McKay, A., and E. Perge. 2013. "How Strong is the Evidence for the Existence of Poverty Traps? A Multicountry Assessment." *Journal of Development Studies* 49: 877–897.
- Montalvo, J. G., and M. Ravallion. 2010. "The Pattern of Growth and Poverty Reduction in China." *Journal of Comparative Economics* 38: 2–16.
- Mundlak, Y. 1978. "On the Pooling of Time Series and Cross Section Data." *Econometrica* 46: 69–85.
- Naschold, F. 2012. "'The Poor Stay Poor': Household Asset Poverty Traps in Rural Semi-arid India." *World Development* 40: 2033–2043.
- Naschold, F. 2013. "Welfare Dynamics in Pakistan and Ethiopia – Does the Estimation Method Matter?" *Journal of Development Studies* 49: 936–954.
- Park, A. 2006. "Risk and Household Grain Management in Developing Countries." *The Economic Journal* 116: 1088–1115.
- Park, A., and S. Wang. 2002. "Regional Poverty Targeting in China." *Journal of Public Economics* 86: 123–153.
- Quisumbing, A. R., and B. Baulch. 2013. "Assets and Poverty Traps in Rural Bangladesh." *Journal of Development Studies* 49: 898–916.
- Radeny, M., M. van den Berg, and R. Schipper. 2012. "Rural Poverty Dynamics in Kenya: Structural Declines and Stochastic Escapes." *World Development* 40: 1577–1593.
- Ravallion, M. 2009. "Are There Lessons for Africa from China's Success against Poverty?" *World Development* 37: 303–313.
- Ravallion, M. 2011. "A Comparative Perspective on Poverty Reduction in Brazil, China, and India." *The World Bank Research Observer* 26: 71–104.
- Ravallion, M., and S. Chen. 2007. "China's (Uneven) Progress against Poverty." *Journal of Development Economics* 82: 1–42.

- Ravallion, M., S. Chen, and P. Sangraula. 2009. "Dollar a Day Revisited." *The World Bank Economic Review* 23: 163–184.
- Sen, A. 1981. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Clarendon Press.
- Wan, G., and E. Cheng. 2001. "Effects of Land Fragmentation and Returns to Scale in the Chinese Farming Sector." *Applied Economics* 33: 183–194.
- Wooldridge, J. M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
- World Bank. 2009. *From Poor Areas to Poor People: China's Evolving Poverty Reduction Agenda*. Beijing: Poverty Reduction and Economic Management Department, East Asia and Pacific Region, the World Bank.
- Zhang, Y., and G. Wan. 2008. "Poverty Reduction in China: Trends and Causes." In *Inequality and Growth in Modern China*, edited by G. Wan and A. Shorrocks, 33–55. Oxford: Oxford University Press.

### Appendix 1. Attrition of the household panel

In the constructed household panel, an important issue for such a long time period covering nearly two decades is the attrition population ageing. At the household level, the annual equivalent attrition rate is about 3% which is less than many other longitudinal surveys in developing countries (e.g. 7% in Brazil, 6% in South Africa and an average of 10% in developing countries according to Barrientos and Mase 2012 and Dercon and Shapiro 2007). At the individual level, 16–29.5% of households in various years after 1989 reported missing members compared to the previous survey, while the magnitude of this individual-level attrition is trivial. Among those households, the average number of reported missing members ranges from 1.42 to 1.55 in different years after 1989. Of an average 1.5 reported missing members throughout the entire sample period, 16 and 27% were attributed to death and out-migration, respectively. Moreover, among the excluded family members, some might live in the same sample village (for example, by marriage) or out-migrate to the areas still covered by the CHNS. In these cases, they would still be interviewed by the CHNS team, but appear as other new households in the survey. We find that this is not a serious problem in our panel. Among households reporting missing family members, on average merely 0.22 people were re-interviewed and included as other CHNS sample households. Meanwhile, some households also reported new family members. Bias would arise again if these new members were interviewed by the CHNS team as members in other sample households. Only 5–17 households out of the full sample of 1446 have reported new family members since 1993. Among those households reporting new members, the average number of new members is 1.32. We thus believe that repeated interview for new family members is less likely to cause substantial bias in our estimation.

Moreover, we also conduct diagnostic tests, considering that attrition may be particularly problematic if the households that drop out of the panel follow systematically different paths of asset accumulation over time compared with those remaining in the panel (Giesbert and Schindler 2012). Here, attrition can be based on both the observed and unobserved characteristics. We use Giesbert and Schindler's (2012) added regressor test to investigate the former case. Specifically, we first construct a binary selection indicator taking unity if the household was excluded from the original surveys. This indicator is multiplied with households' various observed characteristics and agricultural asset holdings. In each survey year, the household welfare indicator, per capita logarithmic consumption, is regressed on these interaction terms, the selection indicator and provincial dummies. The estimated coefficients of both the selection indicator and its interaction with agricultural assets are insignificant, indicating attrition might not cause systematic differences in marginal returns to agricultural assets between the dropped and remaining households. As households get older, they might become poor simply due to age. However, this might not have caused serious bias in our analysis, as the estimate of the interaction between the selection indicator and the age of household head (or the number of retired members) is insignificant. Then, a probit model for whether households appear in the second survey and thereafter is estimated, with households' observed characteristics and provincial dummies as explanatory variables. The estimated coefficients of agricultural assets are statistically insignificant, indicating that agricultural asset holdings might not determine whether a household was interviewed. To investigate the non-random attrition based on households' unobserved characteristics, we use Heckman-type selection

methods proposed by Wooldridge (2002). We estimate a pooled sample selection probit model (to save degrees of freedom) with a Mundlak (1978) specification and calculate the inverse Mills ratio. This ratio is inserted into the household livelihood regression as described in the added regressor test. We estimate the livelihood regression by household-specific fixed effects. The estimated inverse Mills ratio is insignificant at all three conventional significance levels, indicating that attrition is irrelevant to households' unobservables. Overall, the constructed panel proves to be acceptable for the particular type of empirical analyses in this paper.

## Appendix 2. Estimation results of the consumption regression

Table 2.1. Estimation results of the household livelihood regression.

Independent variable	Estimated coefficient	Standard errors
Agricultural asset index	0.019*	0.011
hh size	-0.073***	0.005
ln(age of hh head)	0.126	0.086
ln(yrs. of edu of hh head)	-0.008	0.029
% male adults	0.222***	0.024
Dependency ratio	0.021	0.027
% having health insurance	0.043*	0.026
% off-farm employment	0.145***	0.026
% village out-migration	0.040	0.195
No. of obs.	6688	
$R^2$	0.190	

\*\*\*, \*\* and \* denote 1, 5 and 10% significance levels. Year dummies and the constant are not reported.