

# **Poverty Dynamics of Households in Rural China: Identifying Multiple Pathways for Poverty Transition**

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Poverty → Poverty

Poverty → Non-Poverty

Non-Poverty → Poverty

Non-Poverty → Non-Poverty

(Ravallion, et al., 1995, JPE)



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# 1. Introduction

## I. Objectives

- (1) Empirically identify **causes for poverty transition** using household panel data (8 rounds, CHNS (China Health and Nutrition Surveys), 1989-2009).
- (2) Investigate **the role of livelihood strategies** in enabling households to escaping from poverty
- (3) Provide new **methodological insights** into the study of poverty dynamics in LDCs.

# 1. Introduction

## II. Motivations

(1) Huge poverty reduction, but considerable mobility in and out of poverty in LDCs and in China.

(e.g. Jalan and Ravallion 1998, 2000; Gustafsson and Sai, 2009).

Households are vulnerable- those who have become non-poor are easy to slip back into poverty

(e.g. McCulloch and Calandrino, 2003, Imai et al., 2010).

.....Evidence is scarce

# 1. Introduction

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## II. Motivations

(2) Incorporate **“time”** into analysis

(Barret et al., 2010 “use time as an additional degree of freedom”)

(3) Incorporate **“household’s unique record of past life trajectories”** into analysis

# 1. Introduction

## II. Contributions

- (1) identify some **pathways** constituting a strategy
  
- (2) methodological:
  - a. **discrete-time duration analysis**
  - b. **correlated unobserved heterogeneity**
  - c. **flexible modelling**: non-parametric maximum likelihood (NPML) estimation



## 2. Methodology for 'Poverty Dynamics' studies

### I. What has been done in the past?

- (1) Construct poverty transition matrix (e.g. Ravallion et al. 1995, JPE).
- (2) Apply multinomial logit for transition status (e.g. Gustafsson and Sai, 2009)
- (3) Having a lagged poverty status :(Cappellari & Jenkins, 2002) a first-order Markov model for British Panel

## 2. Methodology for 'Poverty Dynamics' studies

### (4) Applying duration analysis

\*Developed countries: Canto(2002) for Spain, Devicienti (2002, 11) for Britain; Maes (2011) for Belgium.

\*LDCs: Baulch and McCulloch (2002): Assumed continuous data for discrete data (Pakistan).

Bigsten and Shimeles (2008) Discrete hazards (Ethiopia)

Glauben et al. (2006): continuous data assumed (only Zhejiang).

**Limitations: (1) Unobserved heterogeneity ignored. (2) Dynamic selection / past history ignored. (3) Initial endogeneity ignored.**

## 2. Methodology

- empirical specification (complementary log-log) (e.g. Devicienti, 2002).
  - hazard rate of exit (the probability that household  $i$  escapes from poverty at duration  $d$  at time  $t_j$ )
  - $$e_i(d, X_{ij} | \nu_i^P) = 1 - \exp\left[-\exp\left(f^P(d) + X'_{ij}\beta^P + u_i^P\right)\right]$$

$f^P(d)$ : the baseline hazard which is a function of duration that  $i$  has been stuck in poverty spells

$X_{ij}$ : household-specific characteristics and aggregate covariates;

$u_i^P \equiv \log(\nu_i^P)$ : the unobserved household-specific heterogeneity which is time-invariant.

## 2. Methodology

- hazard rate of re-entry:

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

- **baseline hazard: 3 different specifications;**

- (1) a parametric specification:  $f^P(d) = \ln(d)$  and  $f^N(d) = \ln(d)$ ;
- (2) 3 time-period dummies, each of which containing two durations;
- (3) a non-parametric form, that is, a set of ‘duration-interval’ specific dummies at which households are at risk of shifting out of (non-) poverty spells.

## 2. Methodology

- **unobservables: 2 different ways of modelling**
  - (1) Parametric: normal and gamma distributions are assumed for the unobserved heterogeneity in turn
  - (2) Non-parametric: Heckman and Singer's (1984) non-parametric maximum likelihood (NPML) estimation where the distribution of unobserved heterogeneity is approximated by a bivariate discrete distribution with a number of latent classes – also termed as mass points – which are left determined by the data.
- Here we only report the results of the most flexible one based on **Heckman & Singer (1984)** or **Karlson (2011)** using NPML.

## 2. Methodology

- Heckman & Singer's (1984) NPML for correlated unobservables
  - $w \in \{1, 2, \dots, W\}$  groups of households with different unobservables in exit
  - $w \in \{1, 2, \dots, W'\}$  groups of households with different unobservables in re-entry
  - hazard rate of exit:  $e_i(d, X_{ij} | v_i^P) = 1 - \exp\left[-\exp\left(f^P(d) + X'_{ij}\beta^P + \mu_w^P\right)\right]$
  - hazard rate of re-entry:  $r_i(d, X_{ij} | v_i^N) = 1 - \exp\left[-\exp\left(f^N(d) + X'_{ij}\beta^N + \mu_w^N\right)\right]$
  - the joint distribution of correlated unobservables:

$$G\left(\mu_1^P, \dots, \mu_W^P, \mu_1^N, \dots, \mu_{W'}^N\right)$$

## 2. Methodology

### III. Modelling multi-path of multiple poverty transitions (panel data) ('dynamic selection' model)

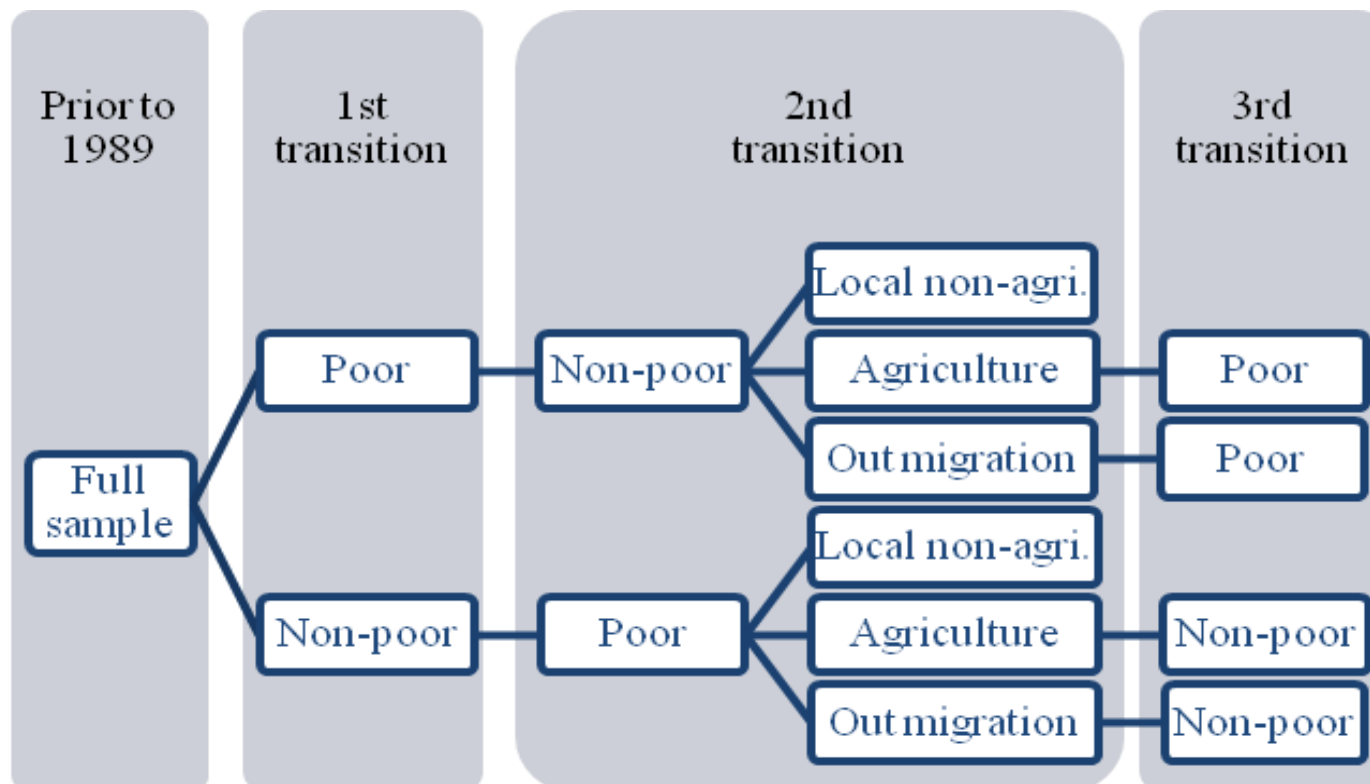
“putting time on the map” of poverty analysis (Clark and Hulme, 2010, p.352)

- We focus on: (i) multiple spells of poverty and non-poverty,
- (ii) **endogenous 'dynamic selection' (Cameron & Heckman, 1998).**
- (iii) unobserved heterogeneity correlated across spells as well as various destinations within the spell.
- “A choice of pathways” is guided by a simpler version of duration models.

## 2. Methodology

### III. Modelling multi-path of multiple poverty transitions (panel data) ('dynamic selection' model)

#### (1) By Livelihood Strategy





## 2. Methodology

### II. Modelling multi-path of multiple poverty transitions (panel data)

(2) Multinomial transition model with unobserved heterogeneity (MTMU, Karlson, 2011)

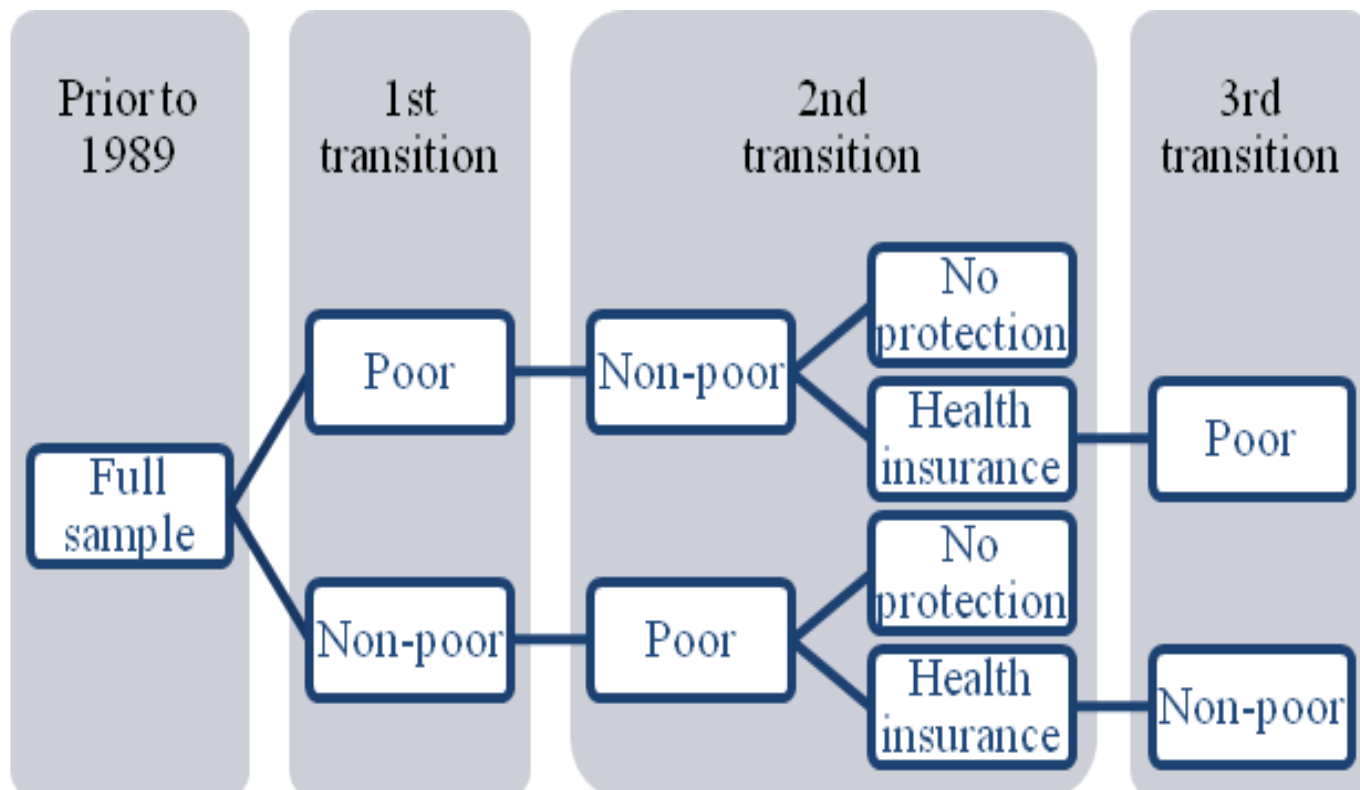
➤ Issues in modelling:

- at each transition, **correlated unobservables across destinations**: inter-dependent livelihood options
- over multiple transitions, **correlated unobservables across transitions: dynamic selection** (which also takes account of “endogenously initial status”).

## 2. Methodology

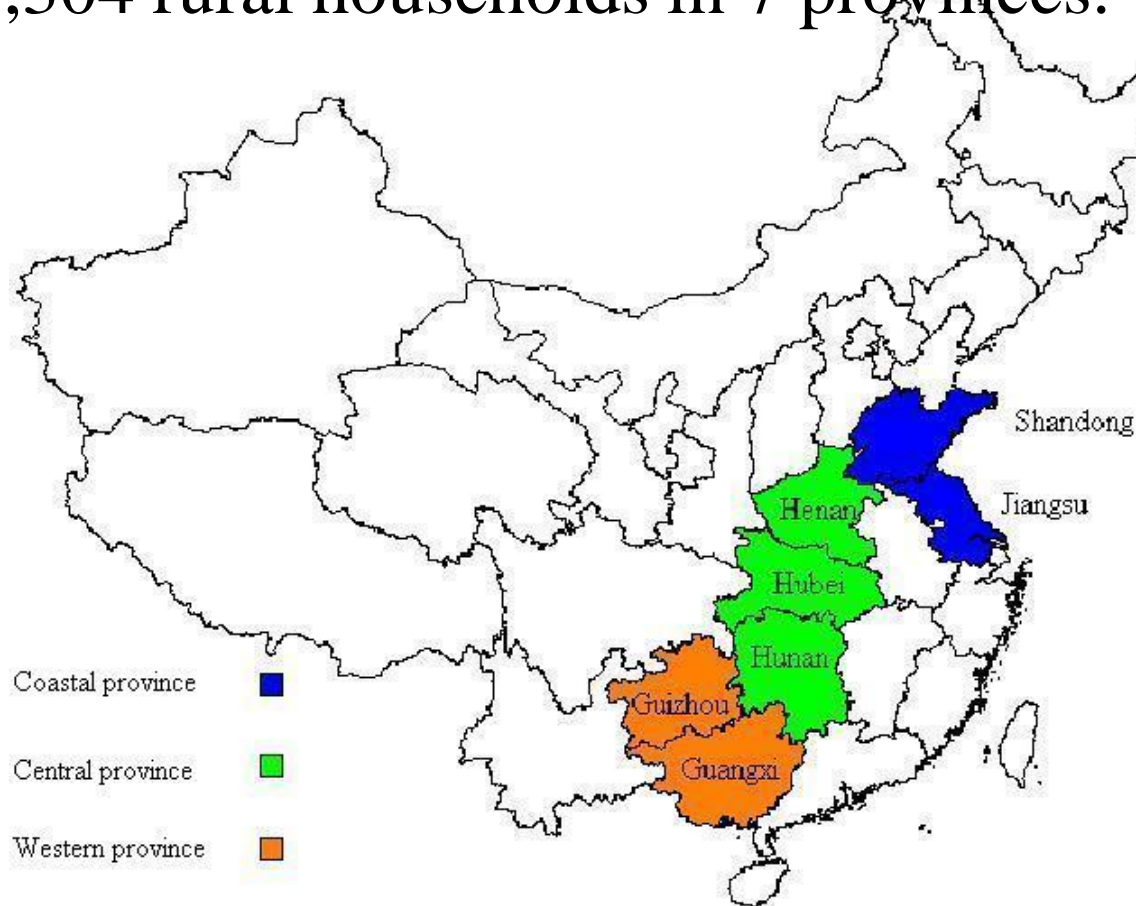
### II. Modelling multi-path of multiple poverty transitions (panel data)

(2) By Health Insurance (Gustafsson and Li, 2004, CER)



### 3. Data

China Health and Nutrition Surveys (CHNS), 1989-2009 (8 rounds) 1,304 rural households in 7 provinces.



### 3. Data

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(a) Advantage:

Long balanced panel data

Disadvantage: non-random attrition- but not so large.

[24.5% of households reported 'excluded' family members; in one of the eight survey years. For these households, the average number of 'excluded' family members was around only 1.5.]

New household members: very rare.

(b) 7 provinces; Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi and Guizhou (Liaoning and Heilongjiang, are excluded because of missing observations).

### 3. Data

(c) We use consumption to measure poverty.

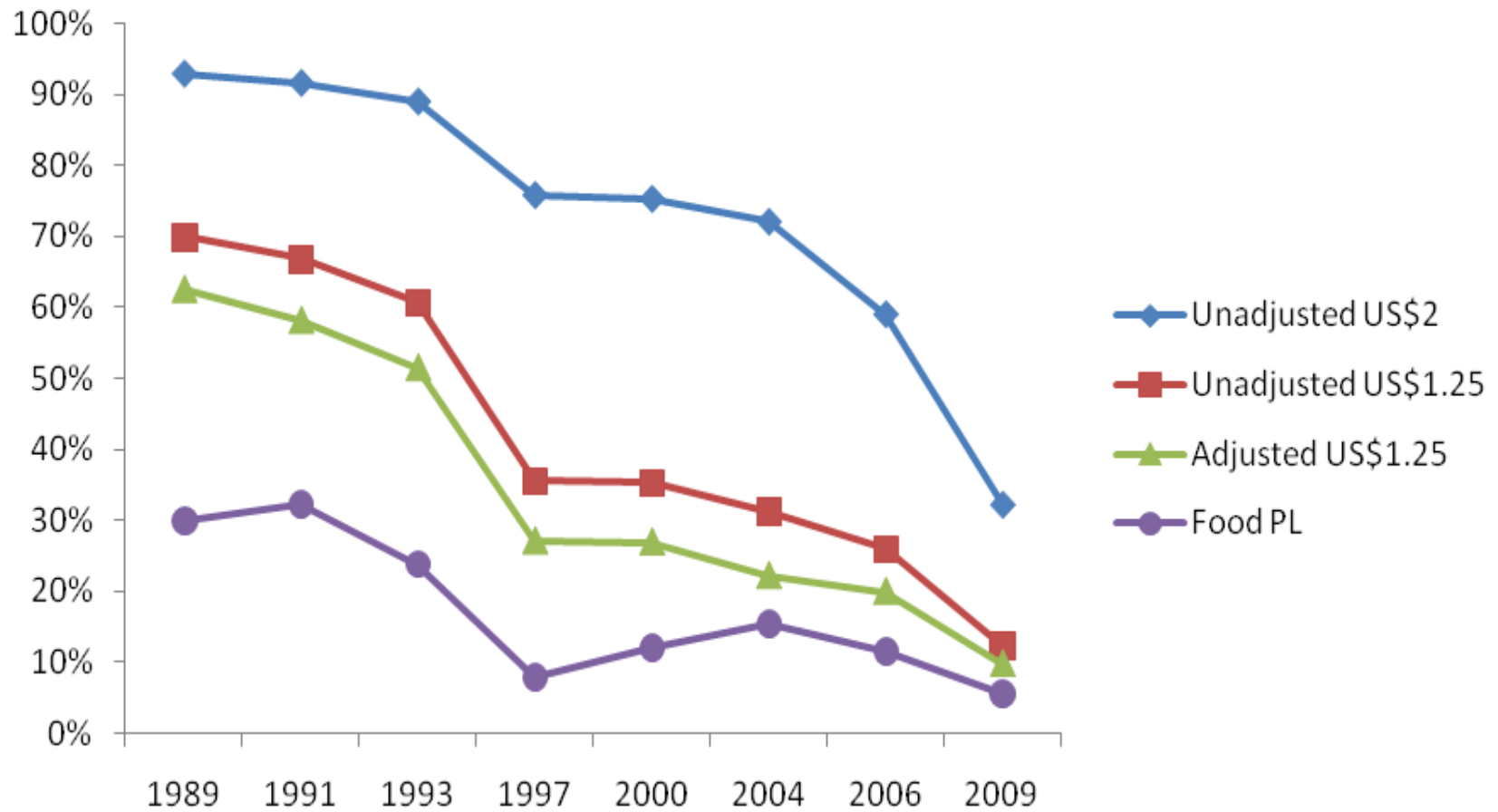
-Use the international poverty lines of US\$1.25/day and US\$2/day

-Follow Devicienti (2002) and define the poor as those whose per capita household consumption falls below 90% (or 110%) of the recalculated poverty lines of US\$1.25/day and US\$2/day ('adjusted' poverty lines).

-Also use a food poverty line of 620 *yuan* in 2002 prices based on 2,100 calories intake per person per day to check the robustness of poverty statistics.

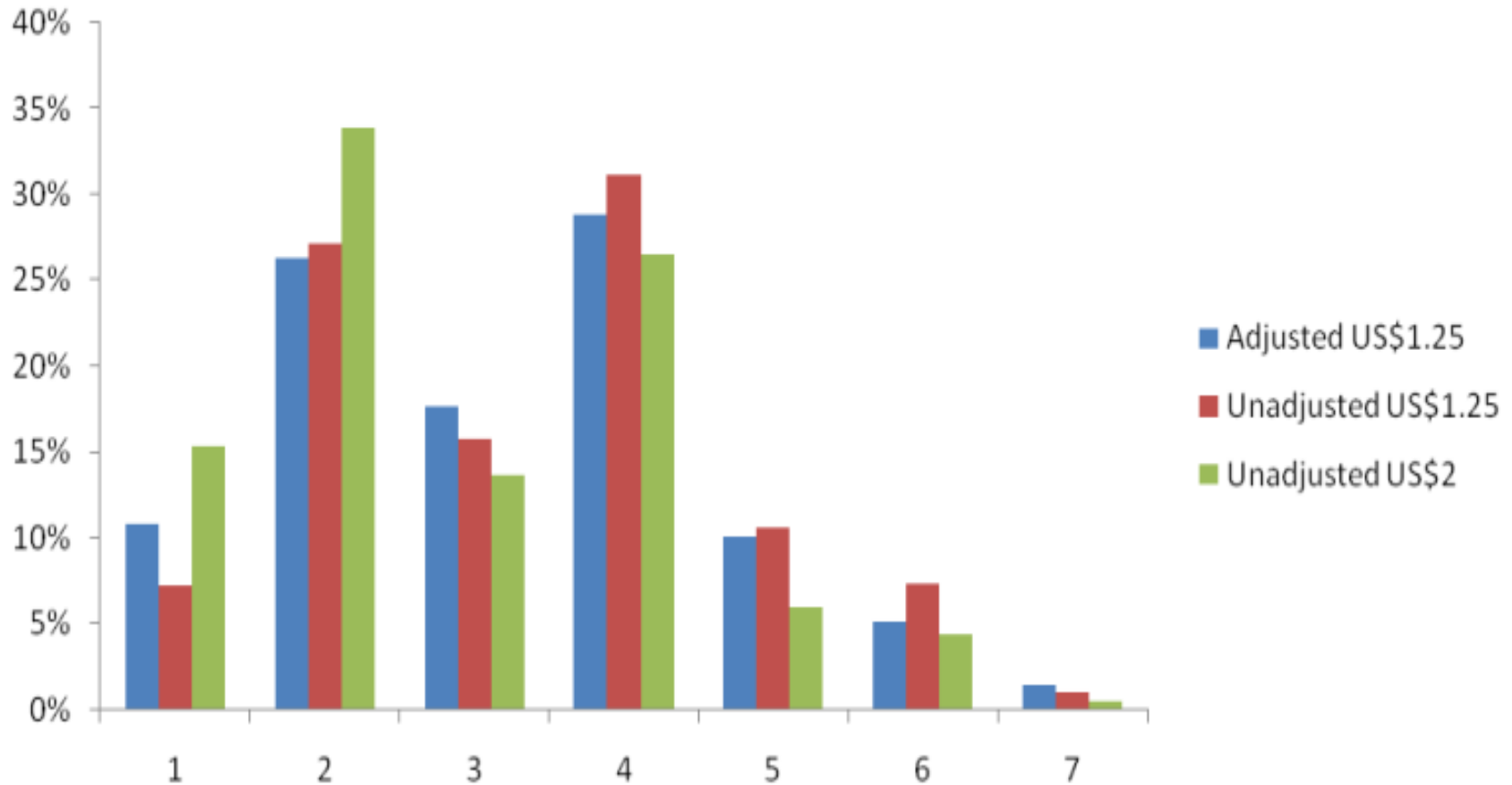
### 3. Data

**Fig. 2 Profile of poverty rates**



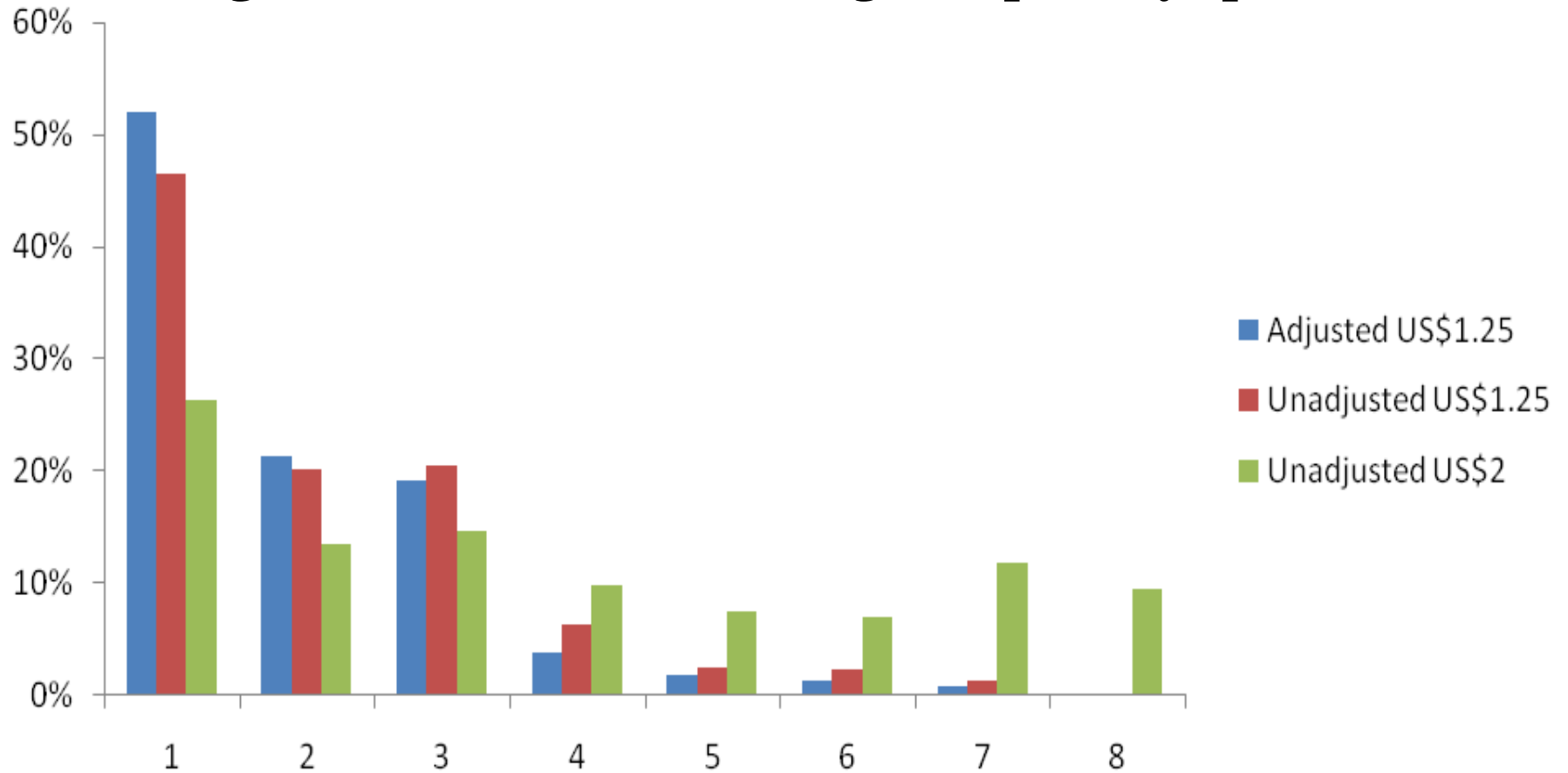
### 3. Data

**Fig. 3 Distribution of the number of transitions (spells)**



### 3. Data

**Fig. 4 Distribution of the length of poverty spells**





## 4. Results and Discussion

### I. Correlates of poverty exit and re-entry (results from pooled data)

Independent variable	Exit (1)	Re-entry (2)
<i>Duration dependence</i>		
D1	-0.154 (0.073)**	-0.391 (0.116)***
D2	-0.320 (0.090)***	-0.945 (0.171)***
D3	-0.367 (0.110)***	-2.831 (0.453)***
D4	-0.033 (0.115)	-3.568 (0.712)***
D5	-0.108 (0.160)	-2.581 (0.508)***
D6	0.839 (0.204)***	-3.418 (1.007)***
<i>Household characteristics</i>		
% primary edu.	0.442 (0.145)***	0.171 (0.261)
% secondary edu.	0.588 (0.146)***	0.256 (0.272)
% tertiary edu.	0.180 (0.183)	1.996 (0.311)***

## 4. Results and Discussion

### I. Correlates of poverty exit and re-entry (results from pooled data)

Independent variable	Exit (1)	Re-entry (2)
<i>Wealth</i>		
ln(cultivated land)	0.065 (0.026)**	-0.013 (0.042)
index of agricultural assets	0.087 (0.086)	-0.628 (0.187)***
<i>Access to off-farm labour market</i>		
% local non-agricultural employment within hh	-0.054 (0.129)	-0.285 (0.383)
% village out-migration	2.453 (0.305)***	-0.091 (0.566)
<i>Social protection</i>		
% hh members having health insurance	1.500 (0.075)***	-0.451 (0.168)***
<i>Local development</i>		
urbanisation	0.800 (0.210)***	0.009 (0.372)
Log-likelihood	-4413.743	-4413.743

## 4. Results and Discussion

### I. Correlates of poverty exit and re-entry (results from pooled data)

<i>Independent variable</i>	Poverty Exit (2)	Poverty Re-Entry (5)
<i>Social protection</i>		
% hh members having commercial insur.	-0.641 (0.241) <sup>***</sup>	-0.040 (0.798)
% hh members having government free insur.	-0.313 (0.302)	0.119 (0.639)
% hh members having cooperative insur.	1.515 (0.075) <sup>***</sup>	-0.542 (0.206) <sup>***</sup>
[NCMS (National Cooperative Medical Scheme)]		

## 4. Results and Discussion

*Other factors that promotes poverty exit:*

-smaller hh size; -older hh head;

**-larger cultivated land**

**-urbanisation index** (econ. activities, inc. marketisation; infrastructure, communication) Jones-Smith & Popkin

*Other factors that prevents poverty reentry:*

**-agricultural asset accumulation**

### **Role of agriculture in poverty reduction**

[Christiansen et al., 2011; de Janvry and Sadoulet 2010-  
agricultural productivity matters]

## 4. Results and Discussion

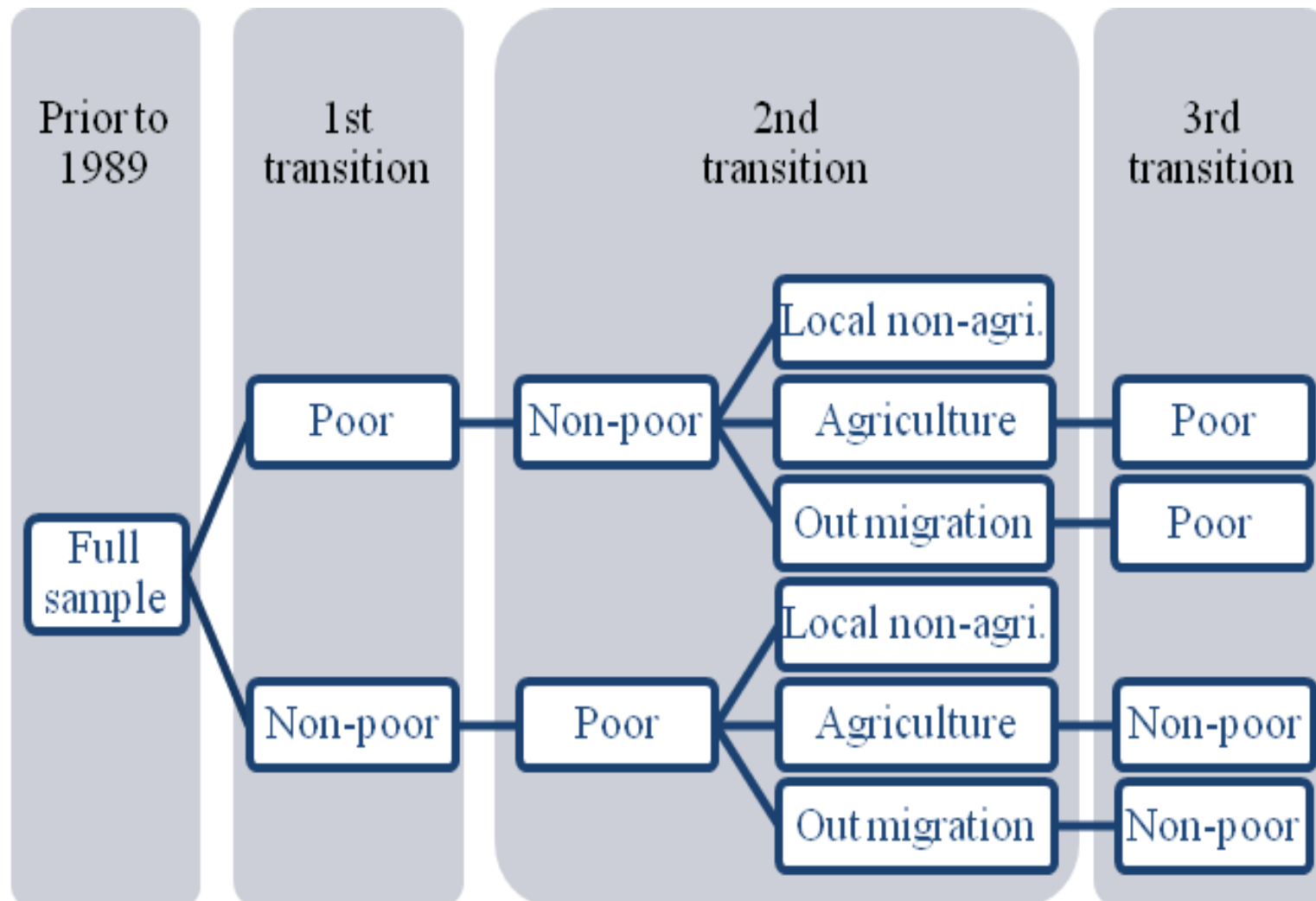
<i>Independent variable</i>	Poverty Exit (3)	Poverty Re-Entry (6)
economic activity	-0.011 (0.011)	-0.023 (0.023)
access to markets	0.026 (0.008) <sup>***</sup>	0.001 (0.014)
social service (provisions of preschool)	0.054 (0.013) <sup>***</sup>	0.019 (0.038)

# 4. Results and Discussion

## II. Multiple pathways underlying poverty transition (by livelihood strategy)

Independent variables	1 <sup>st</sup> transition	2 <sup>nd</sup> transition	3 <sup>rd</sup> transition		
	<i>Initial State:</i>	<i>Non-poverty</i>	<i>Poverty</i>		
	<i>Poverty</i>				
Strategy	Livelihood	Agriculture	Out-migration	Agriculture	Out-migration
<b>Panel A: baseline alternative at the 1<sup>st</sup> transition is 'non-poor'</b>					
ln( <i>d</i> )	0.399 (0.141)***	-0.107 (0.259)	0.047 (0.283)	-1.349 (0.325)***	-2.378 (0.432)***
hh size	-0.065 (0.030)**	-0.133 (0.107)	-0.152 (0.118)	-0.189 (0.100)*	-0.243 (0.128)*
age of hh head	-0.022 (0.003)***	0.026 (0.014)*	0.019 (0.015)	-0.006 (0.009)	-0.025 (0.012)**
% primary edu.	-0.570 (0.184)***	1.333 (1.292)	1.613 (1.331)	-0.166 (0.618)	-1.121 (0.838)
% secondary edu.	-0.494 (0.199)**	0.711 (1.186)	1.033 (1.227)	0.052 (0.575)	-0.883 (0.782)
% tertiary edu.	0.481 (0.268)*	3.804 (1.532)**	3.935 (1.596)**	6.216 (1.536)***	6.227 (1.582)***
ln(cultivated land)	0.179 (0.042)***	-0.414 (0.188)**	-0.438 (0.200)**	-0.026 (0.140)	-0.764 (0.186)***
index of agricultural assets	-0.397 (0.136)***	0.648 (0.447)	0.547 (0.487)	0.114 (0.467)	-0.738 (0.696)
% local non-agr. employment in hh	1.063 (0.334)***	-0.234 (0.688)	1.011 (0.774)	-1.721 (0.714)**	-0.616 (0.827)
% village out-migration	-2.157 (0.770)***	2.562 (1.913)	0.042 (2.079)	-2.931 (2.052)	-0.521 (2.273)
% hh members having health insurance	-0.122 (0.145)	-0.279 (0.442)	-0.377 (0.482)	-0.249 (0.359)	0.008 (0.479)
urbanisation	0.724 (0.354)**	4.022 (1.255)***	3.102 (1.331)**	-2.506 (1.329)*	-2.171 (1.405)
Log-likelihood	-5285.704				

# (1) By Livelihood Strategy



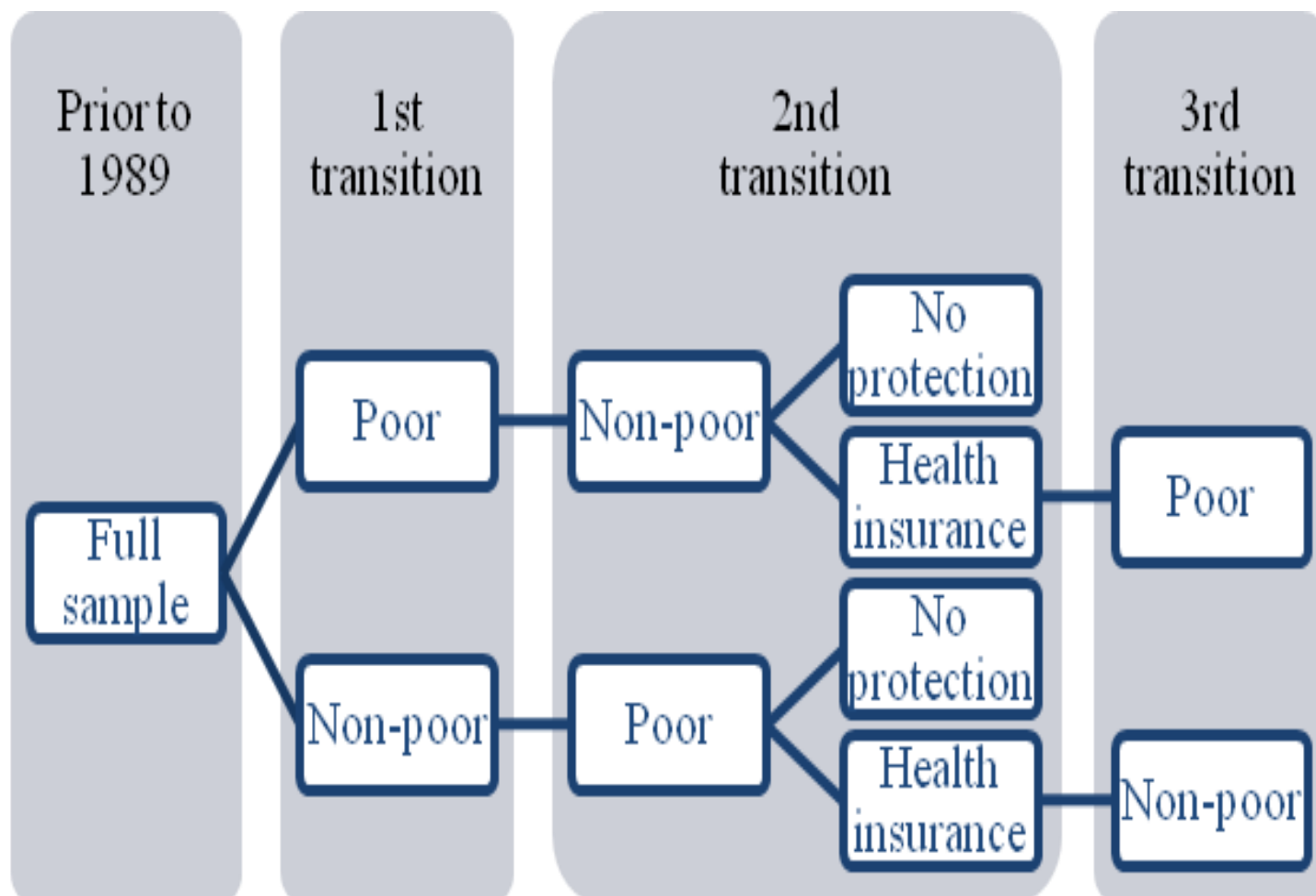
## 4. Results and Discussion

### II. Multiple pathways underlying poverty transition

Independent variables	1 <sup>st</sup> transition	2 <sup>nd</sup> transition	3 <sup>rd</sup> transition
	<i>Initial State:</i> <i>Poverty</i>	<i>Non-Poverty</i>	<i>Poverty</i>
	<b>Social Protection</b>	<b>Health insurance</b>	<b>Health insurance</b>
<b>Panel A: baseline alternative at the 1<sup>st</sup> transition is 'non-poor'</b>			
ln( <i>d</i> )	0.399 (0.141) <sup>***</sup>	-1.163 (0.372) <sup>***</sup>	-0.930 (0.188) <sup>***</sup>
hh size	-0.065 (0.030) <sup>**</sup>	-0.026 (0.125)	-0.099 (0.066)
age of hh head	-0.022 (0.003) <sup>***</sup>	-0.142 (0.020) <sup>***</sup>	-0.036 (0.006) <sup>***</sup>
% primary edu.	-0.570 (0.184) <sup>**</sup>	-6.895 (1.119) <sup>***</sup>	-1.141 (0.454) <sup>**</sup>
% secondary edu.	-0.494 (0.199) <sup>**</sup>	-5.608 (1.059) <sup>***</sup>	-0.525 (0.396)
% tertiary edu.	0.481 (0.268) <sup>*</sup>	-2.606 (1.106) <sup>**</sup>	1.901 (0.503) <sup>***</sup>
ln(cultivated land)	0.179 (0.042) <sup>***</sup>	-0.219 (0.156)	-0.175 (0.085) <sup>**</sup>
index of agricultural assets	-0.397 (0.136) <sup>***</sup>	-1.715 (0.714) <sup>**</sup>	-0.020 (0.290)
% local non-ag. emp. in hh	1.063 (0.334) <sup>***</sup>	2.194 (1.114) <sup>**</sup>	1.145 (0.429) <sup>***</sup>
% village out-migration	-2.157 (0.770) <sup>***</sup>	7.354 (2.218) <sup>***</sup>	-2.777 (1.017) <sup>***</sup>
% hh members having health insurance	-0.122 (0.145)	18.688 (2.338) <sup>***</sup>	1.215 (0.244) <sup>***</sup>
urbanisation	0.724 (0.354) <sup>**</sup>	2.944 (1.399) <sup>**</sup>	0.998 (0.623)



## (2) By Health Insurance (Gustafsson and Li, 2004, CER)



## 5. Conclusions

- (1) The likelihood of exiting poverty first decreases and then increases as households have spent more time in poverty. The longer the households have stayed above the poverty line, the lower chance of re-entry into poverty.
- (2) However, agriculture or out-migration helped poverty exit (but outmigration mainly for the initially non-poor).
- (3) Primary and secondary education helped poverty exit.

## 5. Conclusions

- (4) **Cultivated land** matters for reducing initial poverty and prevents poverty re-entry (for those out-migrated).  
**Agricultural assets** served as reducing initial poverty.
- (5) **Health insurance matters, but is not universally good** (its effect depends on the path of livelihood strategies). –

## 5. Conclusions

(7) Policy should;

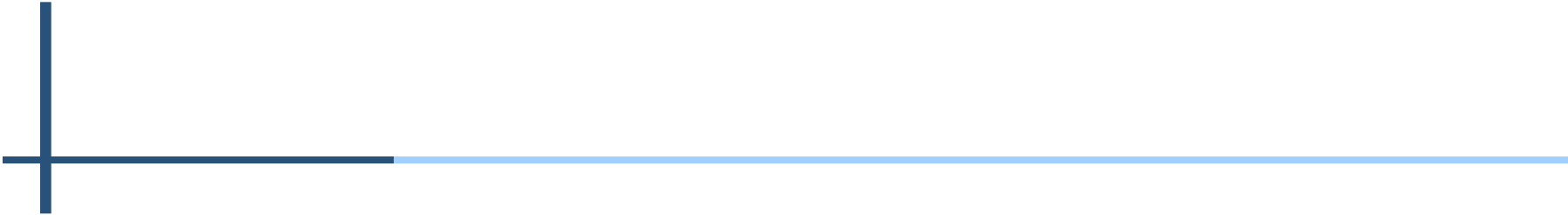
(a) pay attention to **dynamic aspects of poverty**.

take different stages of transitions into account (e.g., education, urbanisation);

(b) needs to support **the chronically poor**;

(c) **agriculture matters** (cultivated land; agricultural land to help the poor escape from poverty; safety-nets).

(d) **Cooperative insurance (NCMS) was effective** in helping the poor escape from poverty and prevent the poor from backsliding.



Thank You!  
Q&A