Mobility in China

by

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April 2013

Abstract

We examine the evidence on rank and income mobility in China during the decades immediately preceding and immediately following the millennium using panel data from the China Health and Nutrition Survey. We show that rank mobility changed markedly over the period: in this respect China is becoming markedly more rigid. By contrast income mobility has carried on increasing; so has income inequality.

Keywords: Mobility Measurement, Income Distribution

JEL codes: D63

Acknowledgments:

The research reported here uses data from the China Health and Nutrition Survey (CHNS):We thank the National Institute of Nutrition and Food Safety, China Center for Disease Control and Prevention, Carolina Population Center, the University of North Carolina at Chapel Hill, the NIH (R01-HD30880, DK056350, and R01-HD38700) and the Fogarty International Center, NIH for financial support for the CHNS data collection and analysis files from 1989 to 2006 and both parties plus the China-Japan Friendship Hospital, Ministry of Health for support for CHNS 2009 and future surveys. We thank Dirk Van de gaer and Philippe Van Kerm for helpful comments and Bobbie Macdonald for research assistance.

1 Introduction

This paper focuses on aspects of income dynamics in China over two recent decades. The extent and nature of income mobility in China has been of considerable interest to economists. It is seen as an integral part of the remarkable period of transformation and growth experienced by China from the late 20th century onwards; it is seen by some as a possible opposing force to the rapid increase in inequality that has accompanied the rapid growth in incomes. Here we look again at the evidence on short-run mobility and present the results from a particularly valuable data source that allows us to contrast developments in the dynamics of income immediately before and after the millennium. The results – focusing on both rank mobility and income mobility – contain some surprises.

The paper is organised as follows. Section 2 sets the scene and provides a short literature review. Section 3 introduces the data and considers briefly the issues of data quality. Section 4 describes the analytical tools that we will use and Sections 5 and 6 present our mobility estimates using the tools from section 4. Section 7 concludes.

2 Background

2.1 Income and its distribution: recent developments in China

It is well known that income distribution in China has changed dramatically in recent times. As Figure 1 illustrates, by 2009 real per-capita rural income grew to $3\frac{1}{2}$ times its 1989 value; urban incomes grew fivefold.[1] Apart from a couple of years, inequality increased relentlessly over the two decades (Chen et al. 2010, Ravallion and Chen 2007, Wu and Perloff 2005).

There is little dissent about the overall story illustrated by these simple snapshots; a similar picture would have emerged if we had charted other

[1]The two income series are per capita annual net income of rural residents and per capita annual disposable income of urban residents. The base-year (1989) income values are 1484 Yuan (rural) and 3500 Yuan (urban), both measured in 2009 prices.

measures of income and other inequality indices. But what has been going on in the dynamics of distribution?

2.2 Mobility in China

Analysing mobility presents a challenge because there is no nationally representative long-run annual panel dataset for incomes in China,[2] but nonetheless detailed work has been done on short-run (*intra*generational) mobility using data for specific subsets of the population.[3] Mobility is higher in rural areas of China, where income inequality is also higher (Sun et al. 2007), and general mobility appears high relative to other countries: for example Khor and Pencavel (2006) finds greater income mobility in urban China than in the US – see also Nichols (2010).

Does this apparently high income mobility in some sense "counteract" rising income inequality? It has been argued that, because of the pattern of income mobility, inequality of current income overstates long-run inequality (Wang 2005). However the rise in inequality appears to have been accompanied by a rise in inequality of opportunity (Zhang and Eriksson 2010). Furthermore although some claim that short-run income mobility appears to have been increasing in both China (Nichols 2010), others claim after a sustained increase in the 1990s and mobility may have stabilised towards the end of the millennium (Ding and Wang 2008, Sun et al. 2007, Yin et al. 2006). The beneficial effects of mobility on inequality may have been eroding.

3 The Data

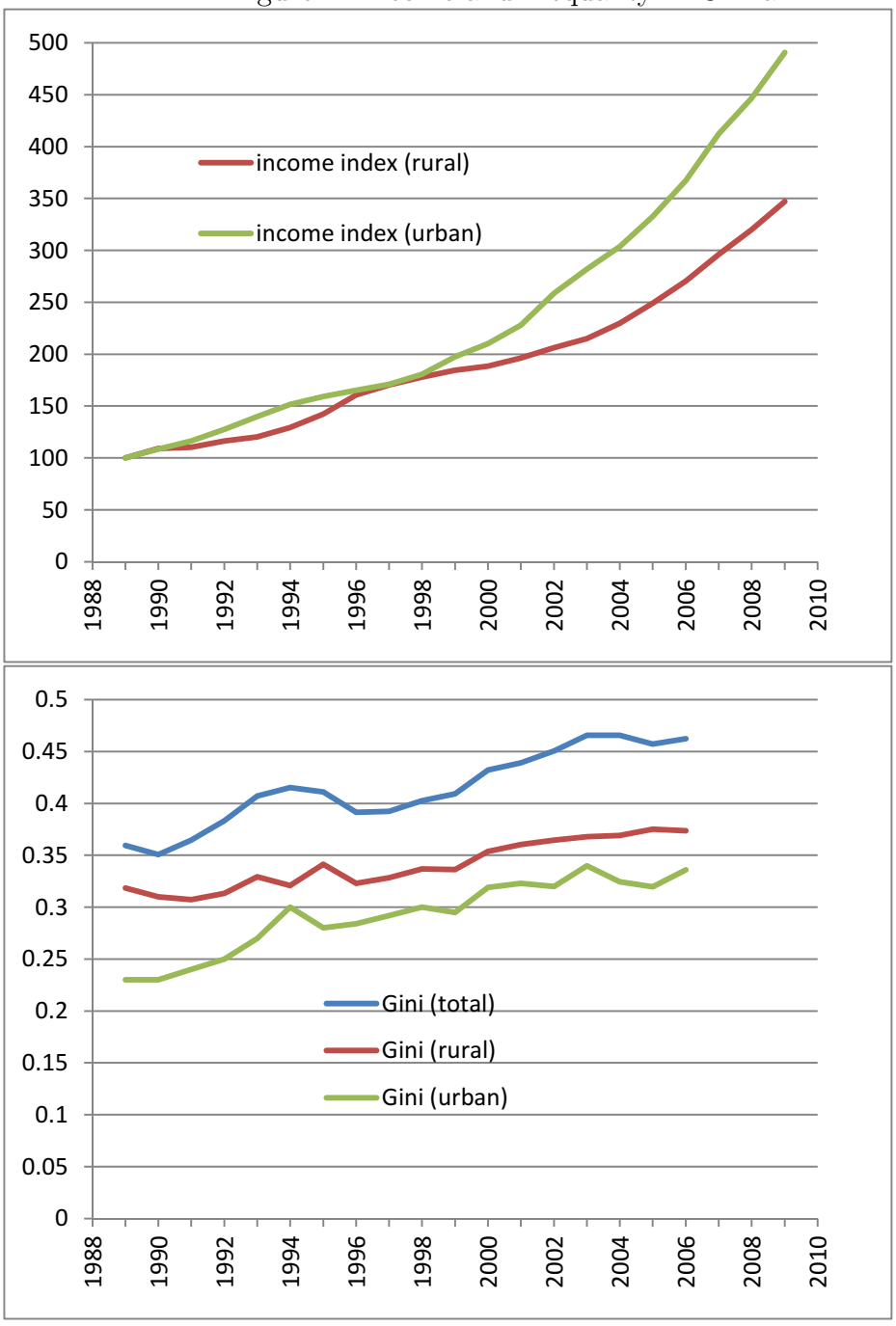
This paper uses the China Health and Nutrition Survey (CHNS).[4] As its name suggests, this survey is designed to track the effects of the health, nutrition, and family planning policies and programmes implemented by national and local governments. However, the survey also collects information on households' economic circumstances and this has been used in a number

[2] An overview of some of the issues of mobility in China is provided by Fields and Zhang (2007).

[3] For example, mobility in rural China is examined in Shi, Nuetah, and Xin (2010), Shi, Liu, Nuetah, and Xin (2010) and in Zhang et al. (2007), while Khor and Pencavel (2006) and Yin et al. (2006) focus on urban China. Intergenerational mobility is discussed in Bian (2002), Guo and Min (2008) and Gong et al. (2012).

[4] http://www.cpc.unc.edu/projects/china

Figure 1: Income and inequality in China



Note: income index given by $100y_t/y_{1989}$.

Sources (1) China Statistical Yearbook, (2) Chen et al. (2010).

of studies to provide evidence on mobility in China (Wang 2005, Ding and Wang 2008).

3.1 The survey

Over two decades the CHNS has been carried out periodically in nine provinces of China: Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Liaoning and Shandong. For the present study we had available the survey waves for 1989, 1991, 1993, 1997, 2000, 2004, 2006 and 2009.[5] The basic unit of analysis here is the household: apart from immediate family a household may contain members of the extended family, including relations by marriage and others not related to the household head.

Although the focus is principally on health and nutrition, data on income are routinely collected. The income concept used in this study is equivalised total household income valued in terms of 2009 Yuan. Total household income is the sum of all sources of income and revenue minus expenditures incurred in generating that income; nine sources of income are identified in the questionnaires: business, farming, fishing, gardening, livestock, non-retirement wages, retirement income, subsidies, and other income.[6] Where a component is missing, an attempt is made to impute the appropriate value. To equivalise incomes we use the widely accepted square-root form of the Buhmann et al. (1988) scale.

3.2 Summary statistics

Table 1 gives a brief description of the history of the CHNS sample from the point of view of income distribution. The substantial increase in inequality noted in section 2.1 is reflected in the Gini coefficient, the ratio of 90th to 10th percentile and the coefficient of variation.

For a visual overview of how the income distribution changed during the period see Figures 2to 4. In each panel the horizontal axis is income scaled by the contemporaneous median. Clearly rural incomes are much more skewly distributed than rural incomes and, as we noted in Table 1, inequality increases from 1989 to 2000 and from 2000 to 2009, shown here by the increase in spread.

[5]Not all provinces are available in all waves – see the Appendix for details.

[6]Because expenditures are deducted some households' measured total income is negative.

Table 1: CHNS: Summary statistics

	1989	*1991*	*1993*	*1997*	*2000*	*2004*	*2006*	*2009*
no. of obs.	3,791	3,607	3,428	3,838	4,307	4,339	4,374	4,433
maximum income	235,233	51,054	76,006	97,159	184,317	129,204	368,813	493,791
minimum income	-8,679	-1,057	-1,174	-8,785	-1,682	-20,020	-7,817	-335,006
mean income	5,552	5,371	6,172	7,453	9,452	11,730	13,681	19,418
median income	4,752	4,689	4,898	6,068	7,450	8,491	9,446	13,938
Gini (total)	0.40	0.37	0.41	0.41	0.44	0.47	0.50	0.49
Gini (rural)	0.43	0.40	0.42	0.42	0.45	0.48	0.51	0.50
Gini (urban)	0.31	0.29	0.37	0.37	0.41	0.45	0.47	0.47
90-10 ratio (total)	7.80	6.89	8.09	8.55	10.75	13.50	13.84	13.11
90-10 ratio (rural)	9.37	7.62	8.94	9.40	11.35	12.87	13.69	13.32
90-10 ratio (urban)	3.94	4.49	6.43	6.66	8.05	12.40	12.69	10.89
coeff of var (total)	1.10	0.72	0.86	0.84	1.02	1.01	1.32	1.27
coeff of var (rural)	1.24	0.80	0.86	0.87	1.06	1.02	1.35	1.27
coeff of var (urban)	0.87	0.56	0.83	0.78	0.94	0.95	1.25	1.24

Note: incomes are annual household incomes before tax, measured in 2009 Yuan

Figure 2: CHNS: Income distribution in 1989

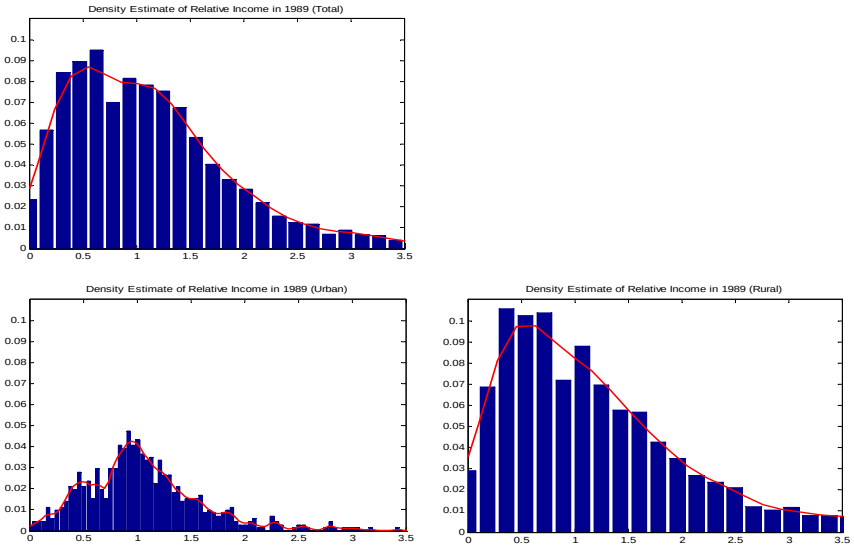


Figure 3: CHNS: Income distribution in 2000

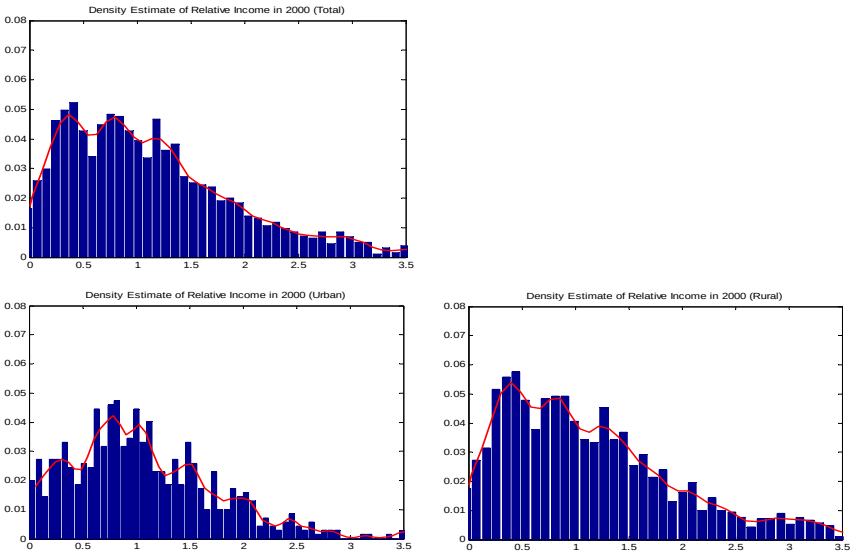


Figure 4: CHNS: Income distribution in 2009

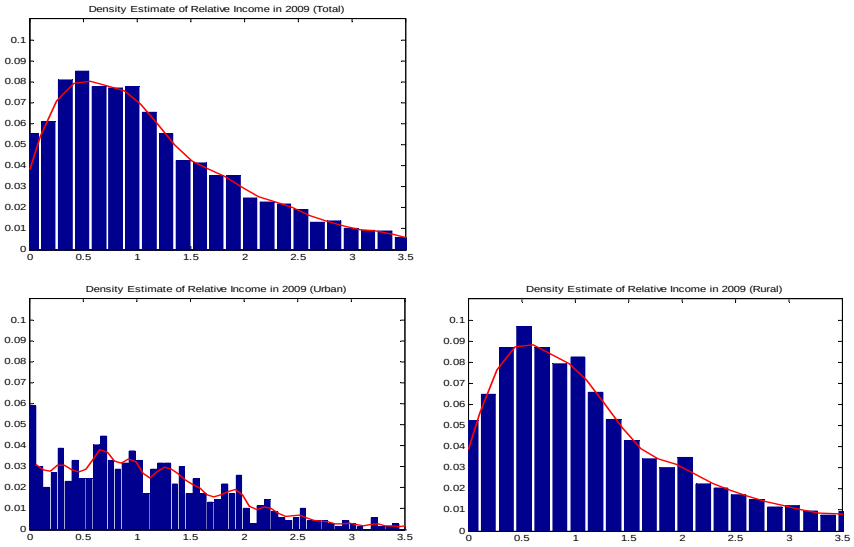
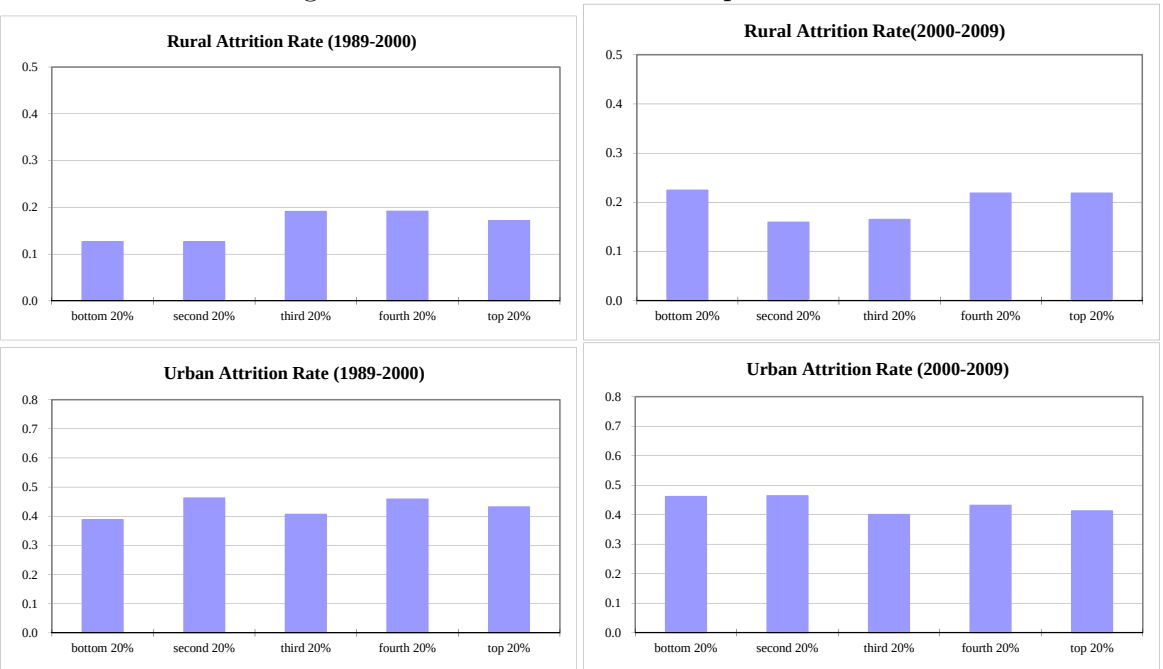


Figure 5: Attrition from the sample



3.3 Attrition

With such a lengthy panel substantial attrition is to be expected. Figure 5 gives an overview of attrition for the two periods which we examine in this paper, 1989-2000 and 2000-2009. Clearly attrition is substantially higher for urban households than rural households. While the attrition pattern changes slightly from the first decade to the second decade in the case of rural households, overall it remains stable across the two periods. It is also clear that attrition is not heavily biased toward any one of the five groups in the income distribution.

4 Mobility measurement

4.1 Approaches to mobility

Mobility can be interpreted in a variety of ways:[7] as simple income variability, as an extension of familiar ordering principles for income distributions (Dardanoni 1993) or as an aspect of multiperiod welfare Gottschalk and Spolaore 2002. Some approaches use explicit decomposition into mobility components such as exchange and structural mobility.[8]

Here we adopt a unified approach that covers that the principal economic interpretations of mobility. Let us assume that there is agreement on the concept of income and of the household (income receiver). Then we may distinguish two principal ways of capturing the mobility of households between points in time. Each can be thought of as a way of aggregating information about changes in household status from over time: they differ only in the interpretation of "status". *Income mobility* involves tracking the income-movements of households through time: here status is income. By contrast *rank mobility* involves tracking changes in households' position in the income distribution over the period or periods concerned: here status is ordinal rank. We will be concerned with both forms of mobility.

In our approach we focus only on single-period mobility although we do allow for periods of differing length.[9] Each period can be thought of as a time interval $[t_0, t_1]$. We use a variety of forms of summarising the status movements over the period, as explained in the next two subsections.

4.2 Transition matrices

First, we will describe our standard tool for presenting information about rank mobility. Let the set of all possible status values be S; if we define a household's *status* as its rank in the distribution then $S = [0, 1]$.[10] Let us define subsets $S_1, ..., S_K \subset S$ such that $\cup_{k=1}^{K} S_k = S$ and $S_k \cap S_{k'} = \emptyset$. Let

[7] For a survey of approaches to mobility see Fields and Ok (1999).

[8] See Van Kerm (2004), Tsui (2009).

[9] Although multiple-period mobility indices are available they are difficult to interpret where the length of the periods varies (as in CHNS) and so we have not used them here. For example we do not consider the income-stability approach of Shorrocks (1978a).

[10] One can use a similar approach for the case of income mobility; in this case S would be some subset of the real line.

$n_{k\ell}$ be the number of households that are in S_k at time t_0 and in S_ℓ at time t_1. The transition matrix P is the $K \times K$ array with typical element

$$p_{k\ell} := \frac{n_{k\ell}}{\sum_{j=1}^{K} n_{kj}}.$$

A convenient summary statistic to capture mobility the mobility implied by P is:

$$m(P) := \frac{K - \sum_{k=1}^{k} p_{kk}}{K - 1} \tag{1}$$

– see Formby et al. (2004), Prais (1955), Shorrocks (1978b) and Trede (1999).

The transition matrix is a convenient way of providing a simple snapshot of rank-movements in the sample. But one has to admit that it is a crude aggregation in the same sort of way that a histogram provides a rather crude snapshot of an income distribution. For this reason it is useful to employ indices that take into account more of the information available in the income history of households.

4.3 Mobility indices

Denote the status of household i at the beginning and at the end of a given period by u_i and v_i respectively, where $u_i, v_i \in S$ and $S = [0, 1]$ in the case of rank mobility, $S = \mathbb{R}_+$ for income mobility. In an n-household society all the information about mobility for a given the definition of status is contained in the following profile:

$$\mathbf{z} := \left\{ (u_i, v_i)_{i=1,..,n} \right\}.$$

We need a set of tools that will aggregate the information in $\mathbf{z}$ in a way that appropriately characterises income mobility in an n-household society.

Using a set of basic axioms on mobility orderings[11] over the set of all possible profiles of pairs $\mathbf{z}$, Cowell and Flachaire (2011) derived the following

[11]The key assumptions here are that mobility rankings should have an independence property that ensures subgroup decomposability (this is particularly important if one needs to ensure consistency under disaggregation by provinces, for example) and that mobility rankings should be invariant under scale transformations of $\mathbf{z}$ (so that, for example, mobility comparisons based on position do not depend on whether one use absolute numbers below/above a given household or the proportion of the sample below/above a given household).

class of mobility measures:

$$M_\alpha := \frac{1}{\alpha\left[\alpha-1\right]n}\sum_{i=1}^{n}\left[\left[\frac{u_i}{\mu_u}\right]^\alpha\left[\frac{v_i}{\mu_v}\right]^{1-\alpha}-1\right], \alpha\in\mathbb{R}, \alpha\neq 0,1 \tag{2}$$

where μ_u, μ_v are the means of the u and v values respectively and α is a sensitivity parameter that characterises any particular member of the class. A high positive α produces an index that is particularly sensitive to downward movements and a negative α produces an index that is sensitive to upward movements. We have the following limiting forms for the cases $\alpha = 0$ and $\alpha = 1$, respectively

$$M_0 = -\frac{1}{n}\sum_{i=1}^{n}\frac{v_i}{\mu_v}\log\left(\frac{u_i}{\mu_u}\Big/\frac{v_i}{\mu_v}\right), \tag{3}$$

$$M_1 = \frac{1}{n}\sum_{i=1}^{n}\frac{u_i}{\mu_u}\log\left(\frac{u_i}{\mu_u}\Big/\frac{v_i}{\mu_v}\right). \tag{4}$$

In fact equations (2)-(4) represent a class of classes – a "superclass" – of mobility indices, since each M_α is defined for an arbitrary definition of status and, for any given data set we can extract more than one status concept. In sections 5 and 6 we will apply M_α to the two principal status concepts that are of economic interest: rank and income.

5 Rank mobility

We now use these tools to set about comparing the mobility history of the 1990s with that of the 2000s. We begin by concentrating only on rank mobility. Here household i's status at date t is given by its position in the distribution:

$$s_i = F_t\left(y_{it}\right), \tag{5}$$

where $F_t\left(\centerdot\right)$ is the distribution function at date t and y_{it} is household i's income at t; we estimate F_t using the empirical distribution function.

5.1 Mobility pre/post millennium – a first look

Tables 2 and 3 present our "decade" transition matrices pre and post millennium (actually, because of constraints in the data, the periods involved

are 11 years and 9 years, respectively). Groupings 1,...,5 are equal-sized twenty-percent slices of the distribution at the beginning and the end of each period.[12]

Table 2: Transition Matrix 1989-2000

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.276**	0.250	0.194	0.160	0.120
	2	0.260	**0.234**	0.216	0.167	0.123
	3	0.190	0.231	**0.206**	0.231	0.143
	4	0.135	0.163	0.221	**0.202**	0.278
	5	0.137	0.123	0.162	0.241	**0.337**

Table 3: Transition Matrix 2000-2009

		2009				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.337**	0.256	0.192	0.125	0.090
	2	0.256	**0.246**	0.210	0.163	0.125
	3	0.195	0.192	**0.204**	0.237	0.172
	4	0.122	0.170	0.206	**0.253**	0.249
	5	0.090	0.136	0.188	0.222	**0.362**

The diagonal elements in Tables 2 and 3 (highlighted in bold) tell a clear story: we can see that rank mobility appears to have fallen from the pre-millennium to the post-millennium decade. If a household were in the bottom 20% in 1989 then the probability that it would still be in the bottom 20% a decade later was a little over a quarter (27.6%); but if a household were in the bottom 20% in 2000 then the probability that it would still be in the

[12]Note that Tables 2 and 3 exclude Heilongjiang which was only incorporated into the CHNS survey in 2000. See section 5.2 for a discussion of how the results are affected by including this province.

same group a decade later had risen to more than one third (33.7%). It is clear that, with the exception of the middle group, the same story holds for each of of the five groups – the probability of a household staying within its original group rises.

Furthermore, this conclusion is broadly supported if we look at a more detailed breakdown of the sample into rural and urban subsamples – see Tables 10 and 11 in the Appendix. For the rural subsample there is an increase in the probability of immobility in quintile groups 1, 4 and 5; for urban households in the top quintile group the probability of immobility remains unchanged, but it increases for the other four groups. Table 4 shows the results for the statistic $m(P)$ (1) that confirms the reduction in rank mobility for the combined sample and for the rural and urban subsamples separately.

Table 4: The $m(P)$ index

	1989-2000	*2000-2009*
Total	0.9363	0.8995
	[0.9274, 0.9451]	[0.8903, 0.9087]
Rural	0.9315	0.9098
	[0.9212, 0.9418]	[0.8992, 0.9203]
Urban	0.8965	0.8588
	[0.8783, 0.9147]	[0.8396, 0.8779]

Note: 95% confidence intervals in [.]

5.2 Rank mobility – robustness checks

Length of period

An obvious problem is that the length of period is arbitrary – why choose a decade as the basis for comparison? Unfortunately because the survey is not carried out every year we cannot carry out robustness checks for periods of arbitrary length. However it is possible to look at 6-year periods pre- and post-millennium The matrices for the periods 1993-2000 and 2000-2006

show that, except for groups 2 and 3, it is still true that the probability of staying within your own group rises as one moves from the period before the millennium to the period after the millennium.

Table 5: Transition Matrix 1993-2000

		2000				
		1	*2*	*3*	*4*	*5*
1993	*1*	**0.343**	0.264	0.177	0.114	0.103
	2	0.264	**0.233**	0.229	0.157	0.117
	3	0.164	0.200	**0.216**	0.265	0.155
	4	0.148	0.166	0.197	**0.240**	0.249
	5	0.081	0.137	0.182	0.223	**0.377**

Table 6: Transition Matrix 2000-2006

		2006				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.346**	0.279	0.202	0.108	0.065
	2	0.223	**0.215**	0.255	0.197	0.110
	3	0.184	0.223	**0.206**	0.235	0.152
	4	0.123	0.170	0.199	**0.257**	0.252
	5	0.123	0.113	0.139	0.202	**0.422**

Inclusion of missing province

As a further check we examine the effect of including the missing province referred to in footnote 12.[13] Heilongjiang was unavailable before 2000; the effect of including this province in the computations of 2000-2009 is shown in Table7. The conclusion that rank mobility fell after the millennium remains unaffected. If we examine the breakdown into rural and urban households

[13]As Table 9 shows province 21 (Liaoning) was not available in 1997; however this does not does not affect any of our computations.

(Appendix Tables 12 and 13) then again the reduction in mobility after the millennium is confirmed with the exception of the topmost group in the urban subsample.

Table 7: Transition Matrix 2000-2009 (Heilongjiang included)

		2009				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.334**	0.262	0.193	0.123	0.088
	2	0.248	**0.245**	0.218	0.168	0.122
	3	0.195	0.193	**0.209**	0.240	0.163
	4	0.124	0.161	0.199	**0.252**	0.263
	5	0.099	0.137	0.181	0.219	**0.364**

5.3 Attrition issues

One of the drawbacks of the CHNS is that not all provinces in China are covered by the sample. This means that we do not have direct evidence of income mobility within the omitted provinces and that there is attrition from the sample because of migration out of the nine provinces included in CHNS. However, we can use the detail of the attrition data confirm the picture of a reduction in mobility.

We can characterise households who leave the sample as broadly consisting of two contrasting types. We may imagine that in any given year n_1 people leave the sample for economic reasons, for example to get a job in a part of China not covered by the sample; this process clearly represents potential income mobility. Also in the same year n_2 people leave the sample for other reasons – they die, retire, go to live with their family elsewhere; of course this does not represent income mobility. The problem is that we do not know what the values of n_1 and n_2 and there is no direct way of estimating them.

However, at any age τ, we can observe the sum $n(\tau) := n_1(\tau) + n_2(\tau)$, the number of those aged τ or less who leave the sample. Those whose heads are aged 35 or below are not interesting since very few leave the sample.

Table 8: Households leaving the sample by age

	Rural			Urban		
Age, τ	1989-2000	2000-2009	ratio	1989-2000	2000-2009	ratio
≤ 40	71	35	0.49	30	13	0.43
≤ 45	133	82	0.62	80	43	0.54
≤ 50	180	140	0.78	137	122	0.89
≤ 55	216	204	0.94	182	177	0.97

Note: Number in each cell gives the number of households with heads at or below the given age who leave the sample during each period

Those whose age is greater than 55 are also not likely to be relevant: it is unlikely that many in this upper age group will migrate out of the sample for economic reasons. Furthermore, it is likely that $n_1(\tau)/n(\tau)$ decreases with τ: you are more likely to move for economic reasons if you are young.

It is clear from Table 8 that, with the trivial exception of the under-35 urban households, $n(\tau)$ decreases between the 1990s and the 2000s for both rural and urban subsamples. If we make the reasonable assumption that n_2 remains fairly stable over time this must mean that n_1 has fallen: "mobility" from inside to outside the sample must have decreased.

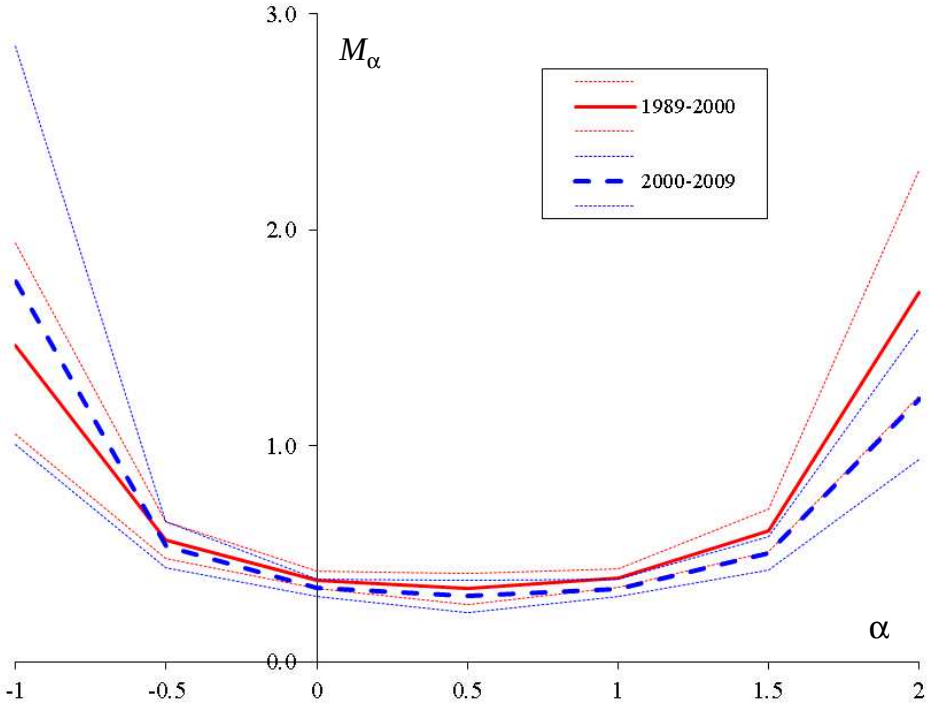
Now consider the "ratio" columns in Table 8. This ratio is smaller for the lower ages – the reduction in $n(\tau)$ is much greater among younger people. This is consistent with the points that $n_1(\tau)/n(\tau)$ decreases with τ and with the claim that reduction in movement is due to n_1 rather than n_2.

In China there is substantial internal migration that is driven by economic incentives. If geographical mobility is indeed associated with rank (positional) mobility then it is clear that the change in the attrition pre/post millennium reinforces the conclusions of a reduction in rank mobility that we drew from the first pass at the data in section 5.1.

5.4 Mobility indices

To examine the detail of the change in rank mobility pre/post millennium we use the M_α family of indices in equations (2)-(4) with status determined

Figure 6: Rank mobility M_α before and after the millenium



as in (5). The evidence for the periods 1989-2000 and 2000-2009 is presented in Figure 6 which plots M_α for $\alpha \in [-1, 2]$ along with 95-percent confidence bands.[14] It is clear that the conclusions drawn from the transition-matrix analysis in section 5.1 are broadly confirmed. With the exception of the extreme case $\alpha = -1$ the point estimates of 2000-2009 are less than those for 1989-2000; for $\alpha \geq 1$ this decrease in mobility is significant. Rank mobility remains unchanged or falls from the first decade to the second decade.

6 Income mobility

Now, instead of rank mobility, we focus on income variability over the same periods.

First let us use a graphical device for a simple visual representation of income mobility. Each panel in Figure 7 adapted from the suggestion by Trede (1998) provides information similar to that in the transition matrix.[15] shows where people in the distribution move to at the end of a period conditional on a particular starting point at the beginning of the period. The horizontal axis is beginning-of-period income relative to the median; the vertical axis is relative income at the end of the period. The six panels cover the periods 1989-2000 and 2000-2009 for the whole sample, for the rural subsample and the urban subsample. In each panel we plot the 0.1, 0.3, 0.5, 0.7 and 0.9

[14] Table 14 in the Appendix provides the detail underlying Figure 6.

[15] Consider any row h of the transition matrix as a vector. This vector $\left(\hat{f}_{h1}, \hat{f}_{h2}, ..., \hat{f}_{hK}\right)$ gives the empirical frequency distribution over the sets $S_1, ..., S_K$ at time 1 *conditional* on the individuals being in set S_h at time 0. Let $\hat{F}_{h1} := \hat{f}_{h1}, \hat{F}_{h\ell} := \hat{F}_{h\ell-1} + \hat{f}_{h\ell}, \ell = 2, ..., K$. Then $\left(\hat{F}_{h1}, \hat{F}_{h2}, ..., \hat{F}_{hK}\right)$ gives a simple estimate of the distribution function for time 1, conditional on being in set S_h at time 0. If we know F_0 and F_1 the (unconditional) distribution function of income for the whole population at at time 0 and at time 1 we can convert from proportions of the population to quantiles. For example if $S_1 = [0, 0.1]$, the bottom 10 percent, then $x_{0.1} = F_0^{-1}(0.1)$ .is the 10-percent quantile where F_0^{-1} denotes the inverse of the time-0 distribution function F_0. In general

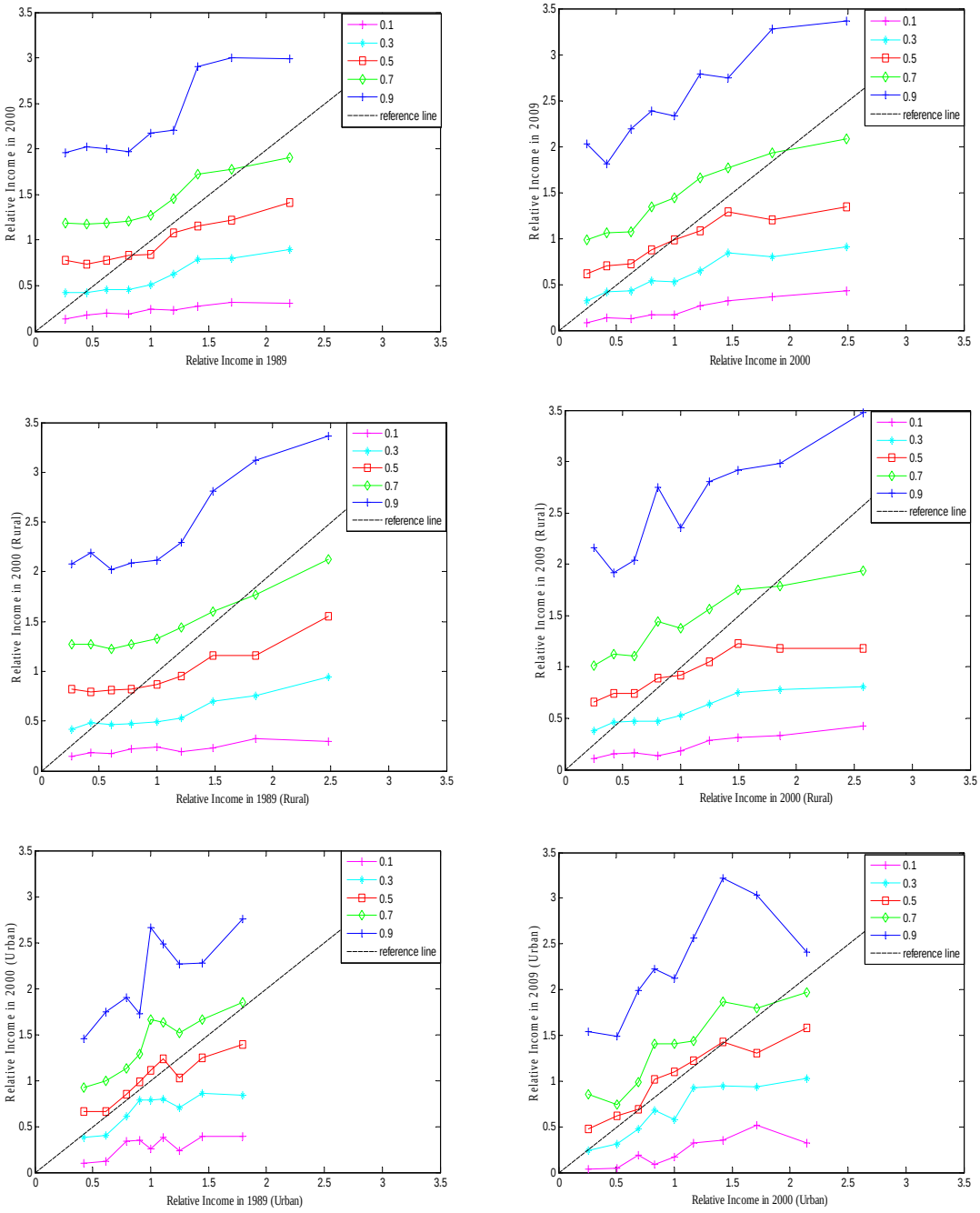
$$x_p = F_0^{-1}(p), p \in [0, 1].$$

We do the same thing at time 1:

$$y_q = F_1^{-1}(q), q \in [0, 1].$$

In this way we can convert from $S_k = [q_{k-1}, q_k)$ to income intervals $[y_{k-1}, y_k)$.

Figure 7: Conditional quantiles



quantiles of the end-of-the period distribution conditioned on relative income at the beginning of the period. The flatter are these profiles, the greater is mobility – if they were completely flat then there would be perfect mobility because the end-of period distribution would be independent of income at the beginning of the period; roughly speaking, the further apart are the profiles then the greater is end-of-period inequality. By contrast if all the profiles were 45-degree lines then clearly relative income at the beginning of the period would predict the same relative position at the end of the period. If $y_{t'} = \phi(y_t)$, where ϕ is some determinate monotonic increasing function then we may have increasing or decreasing inequality, according as the function ϕ causes the profiles to fan out or cluster; whether that inequality change should be considered as "mobility" is a moot point.

Compare each pair of panels in Figure 7 to get a picture of pre/post-millennium mobility for the whole sample (top), for rural households and for urban households (bottom). As we can see this device suggests an ambiguous picture of the change in income mobility pre-millennium to post-millennium. For example, for those with incomes between the median and 1.5 times the median the 0.9 profile is flatter in 2000-2009 than in 1989-2000 but the 0.1 profile is steeper in 2000-2009. However inequality appears to have increased as one moves to the right-hand panels. Furthermore, for the whole sample and for the rural subsample the profiles become more "fanned out" in the 2000-2009 period; this means that the higher is one's income in rural households, the more uncertain have become one's future prospects after the year 2000.

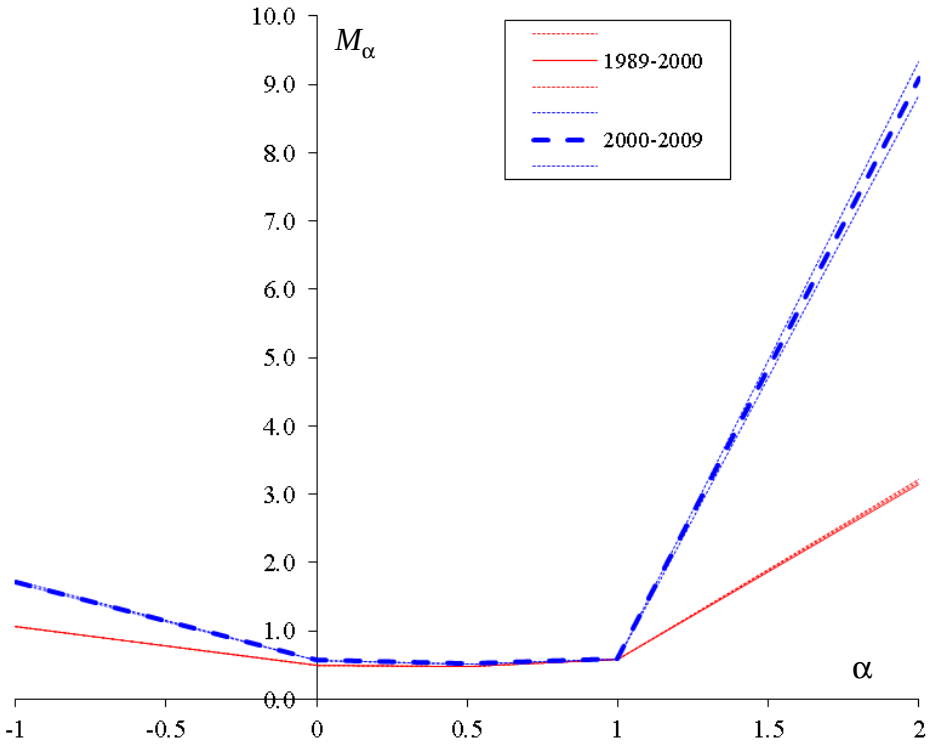
To obtain a clearer answer on how income mobility may have changed let us again make use of the mobility indices introduced in section 4. But now household i's status at date t is given simply by income:

$$s_i = y_{it}. \tag{6}$$

So we apply the M_α index once again but this time with status defined by (6) rather than (5) – in effect we extract another class of mobility indices from the superclass. However, there is a problem. As noted in footnote 6 there is a small proportion of the sample negative and zero incomes in the sample [16] and M_α is not defined for negative incomes and is not defined everywhere for

[16] Among rural households 3.34 percent of had negative or zero incomes during 1989-2000, 3.05 percent during 2000-2009. The corresponding proportions of urban households with zero or negative incomes were 0.89% (1989-2000) and 2.30% (2000-2009).

Figure 8: Income mobility M_α before and after the millennium



zero incomes. For this reason we removed the zero and negative observations from the sample.

Figure 8 plots M_α for $\alpha \in [-1, 2]$ along with 95-percent confidence bands – it is the income-mobility counterpart to Figure 6. As we can see income mobility in the whole sample has *increased* throughout the parameter range:[17] comparing Figures 6 and 8 it is clear that there is a remarkable contrast between the behaviour of income mobility and rank mobility as China moved into the new millennium. This is largely attributable to the very high values

[17]Table 15 in the Appendix presents the results underlying Figure 8. Note that the pattern of increased income mobility in the whole sample is confirmed in the rural and urban subsamples taken separately with just two exceptions ($\alpha = 1$ for rural households and $\alpha = 2$ for urban households).

for M_α for positive values of α and demonstrates the importance of careful choice of the status variable in interpreting mobility patterns.

We might wonder why income mobility goes the opposite way from rank mobility. It is not hard to see if we consider for a moment an artificial example. Again, if all that happens to incomes from time t to t' can be characterised as $y_{t'} = \phi(y_t)$, where ϕ is non-stochastic, then there is obviously no rank mobility (no household changes places in the distribution with any other) but the income growth will generate positive income mobility and possibly – depending on the nature of ϕ – an increase in income inequality too.[18] Hence it is possible to have a reduction in rank mobility coexisting with an increase in income mobility – this is what happened in China. This also mirrors a phenomenon noted in other economies: distributions with higher inequality tend to show lower rank mobility.

7 Conclusion

Our study has some things in common with previous research on China: for example, as with other studies, we find that rural mobility is higher than urban. However, we have shown something new: around the turn of the century process generating income distribution in China appears to have turned a corner.

Rank mobility decreased as China moved into the new millennium. It has now become more difficult for those on the bottom rungs of the economic ladder to move upwards and it has become easier for those on the top rungs to stay there. However, while there was a big slow-down in rank mobility around the time of the millennium, at the same time income variability kept on growing. This increase in income mobility occurred in both rural and urban areas and carried on right through our twenty-year period of study. The reason for these opposite movements in rank mobility and income mobility is that the rich have continued to become richer relative to the poor: old-fashioned inequality has increased and society may have become more polarised.

As she has moved into the new millennium China has seen income inequality continue on its path of rapid increase; but there is also evidence that the underlying dynamic has changed. China has become more rigid.

[18] Cf the discussion on the components of mobility in Van Kerm (2004).

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Appendix

Table 9 shows which provinces were present in which wave of the CHNS. Tables 10 and 11 are the counterparts to Tables 2 and 3 for the rural and urban subgroups. Tables 12 and 13 are the counterparts to Table 7 for the rural and urban subgroups. Tables 14 and 15 provide the estimates underlying Figures 6 and 8.

Table 9: Provinces in the sample

province	*1989*	*1991*	*1993*	*1997*	*2000*	*2004*	*2006*	*2009*
21(Liaoning)	*	*	*		*	*	*	*
23(Heilongjiang)				*	*	*	*	*
32(Jiangsu)	*	*	*	*	*	*	*	*
37(Shandong)	*	*	*	*	*	*	*	*
41(Henan)	*	*	*	*	*	*	*	*
42(Hubei)	*	*	*	*	*	*	*	*
43(Hunan)	*	*	*	*	*	*	*	*
45(Guangxi)	*	*	*	*	*	*	*	*
52(Guizhou)	*	*	*	*	*	*	*	*

Table 10: Transition Matrices, Rural (Heilongjiang excluded)

1989 \ 2000	1	2	3	4	5
1	**0.259**	0.231	0.205	0.169	0.136
2	0.239	**0.246**	0.221	0.176	0.117
3	0.212	0.226	**0.205**	0.216	0.141
4	0.150	0.176	0.225	**0.204**	0.244
5	0.139	0.120	0.144	0.235	**0.360**

2000 \ 2009	1	2	3	4	5
1	**0.303**	0.255	0.193	0.158	0.091
2	0.267	**0.229**	0.208	0.162	0.134
3	0.198	0.205	**0.208**	0.220	0.169
4	0.138	0.172	0.198	**0.253**	0.239
5	0.093	0.138	0.193	0.208	**0.368**

Table 11: Transition Matrices, Urban (Heilongjiang excluded)

1989 \ 2000	1	2	3	4	5
1	**0.373**	0.232	0.197	0.120	0.077
2	0.174	**0.264**	0.264	0.201	0.097
3	0.154	0.168	**0.189**	0.245	0.245
4	0.154	0.182	0.196	**0.238**	0.231
5	0.140	0.161	0.154	0.196	**0.350**

2000 \ 2009	1	2	3	4	5
1	**0.410**	0.309	0.151	0.058	0.072
2	0.223	**0.273**	0.223	0.151	0.129
3	0.180	0.115	**0.259**	0.273	0.173
4	0.086	0.122	0.237	**0.273**	0.281
5	0.100	0.179	0.129	0.243	**0.350**

Table 12: 2000-2009 Transition Matrix, Rural (Heilongjiang included)

		2009				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.306**	0.255	0.188	0.154	0.096
	2	0.242	**0.223**	0.229	0.176	0.131
	3	0.208	0.208	**0.197**	0.216	0.171
	4	0.135	0.173	0.208	**0.242**	0.242
	5	0.109	0.141	0.177	0.212	**0.361**

Table 13: 2000-2009 Transition Matrix, Urban (Heilongjiang included)

		2009				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.411**	0.316	0.152	0.044	0.076
	2	0.233	**0.270**	0.208	0.176	0.107
	3	0.151	0.145	**0.277**	0.258	0.170
	4	0.075	0.138	0.226	**0.411**	0.316
	5	0.127	0.133	0.139	0.233	**0.270**

Table 14: The M_α index: rank mobility

	Overall		Rural		Urban	
α	*1989-2000*	*2000-2009*	*1989-2000*	*2000-2009*	*1989-2000*	*2000-2009*
-1	1.4661	1.7639	1.5245	1.8726	0.8602	0.9774
	[1.0549, 1.9415]	[1.005, 2.8540]	[1.0376, 2.1143]	[1.0573, 3.0368]	[0.5315, 1.3109]	[0.4366, 1.8517]
-0.5	0.5626	0.5353	0.5897	0.5746	0.4430	0.4037
	[0.4777, 0.6502]	[0.4375, 0.6508]	[0.4909, 0.6969]	[0.4558, 0.7096]	[0.327, 0.5661]	[0.2687, 0.5622]
0	0.3779	0.3421	0.3945	0.3631	0.3382	0.2918
	[0.3392, 0.4186]	[0.3026, 0.3811]	[0.3464, 0.4435]	[0.3151, 0.4117]	[0.2745, 0.4103]	[0.2232, 0.3598]
0.5	0.3413	0.3057	0.3542	0.3212	0.3257	0.2743
	[0.2652, 0.4113]	[0.2276, 0.3786]	[0.2703, 0.4329]	[0.2379, 0.4096]	[0.1739, 0.4645]	[0.1208, 0.4326]
1	0.3880	0.3403	0.3999	0.3540	0.3878	0.3174
	[0.3452, 0.4309]	[0.3048, 0.3809]	[0.3521, 0.4493]	[0.3097, 0.3972]	[0.3023, 0.4772]	[0.2447, 0.401]
1.5	0.6086	0.5009	0.6254	0.5121	0.6234	0.5058
	[0.5132, 0.7065]	[0.4232, 0.5816]	[0.5165, 0.7484]	[0.423, 0.6039]	[0.4317, 0.8175]	[0.3224, 0.7224]
2	1.7125	1.2161	1.7825	1.2004	1.5924	1.4653
	[1.2291, 2.2761]	[0.9352, 1.5437]	[1.2452, 2.4022]	[0.8876, 1.5445]	[0.9733, 2.4166]	[0.6592, 2.6361]

Note: 95% confidence intervals in [.]

Table 15: The M_α index: income mobility

	Overall		Rural		Urban	
α	*1989-2000*	*2000-2009*	*1989-2000*	*2000-2009*	*1989-2000*	*2000-2009*
-1	1.0650	1.7238	1.1940	1.8567	0.65107	1.4046
	[1.0602, 1.0698]	[1.7106, 1.7369]	[1.1867, 1.2012]	[1.8362, 1.8772]	[0.6442, 0.6579]	[1.3768, 1.4325]
0	0.4965	0.5704	0.5254	0.5735	0.4139	0.56319
	[0.4956, 0.4975]	[0.5693, 0.5716]	[0.5241, 0.5268]	[0.5720, 0.5749]	[0.4111, 0.4167]	[0.5584, 0.5680]
0.5	0.4823	0.5173	0.5044	0.5159	0.42261	0.52049
	[0.4813, 0.4833]	[0.5165, 0.5181]	[0.5029, 0.5059]	[0.5149, 0.5169]	[0.4197, 0.4255]	[0.5170, 0.5240]
1	0.5816	0.5866	0.5965	0.5762	0.54099	0.61132
	[0.5797, 0.5835]	[0.5855, 0.5876]	[0.5936, 0.5994]	[0.5749, 0.5775]	[0.5357, 0.5462]	[0.6066, 0.6161]
2	3.1795	9.0842	2.6911	11.6380	4.0588	2.9708
	[3.149, 3.2101]	[8.8316, 9.3367]	[2.6496, 2.7327]	[11.225, 12.051]	[3.9463, 4.1713]	[2.9027, 3.0389]

Note: 95% confidence intervals in [.]