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Mobility in China

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Abstract

The evidence on rank and income mobility in China reveals an important change around the year 2000. Using panel data from the China Health and Nutrition Survey we show that rank mobility fell markedly from the decade immediately preceding the millennium to the decade immediately following: in this respect China is becoming markedly more rigid. By contrast income mobility has carried on increasing; so has income inequality. The simultaneous increase in rigidity and inequality presents China with a challenging policy problem.

Keywords: Mobility Measurement, Income Distribution

JEL codes: D63

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1 Introduction

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 at the evidence on mobility over different time spans 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.

It is well known that income distribution in China has changed dramatically in recent times. During the period 1989-2011 real per-capita rural income grew to 3½ times its 1989 value; urban incomes grew fivefold; inequality increased enormously (Chen et al. 2010, Ravallion and Chen 2007, Wu and Perloff 2005). However, analysing the dynamics of distribution presents a challenge because there is no nationally representative long-run annual panel dataset for incomes in China,[1] although work has been done on short-run mobility using data for specific subsets of the population.[2] 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). It has been argued that, because of the pattern of income mobility, the inequality of current income overstates long-run inequality – in some sense high income mobility "counteracts" rising income inequality (Wang 2005). Although some authors claim that short-run income mobility in China has been increasing (Nichols 2010), others claim that, after a sustained increase in the 1990s, mobility may have stabilised towards the end of the millennium (Ding and Wang 2008, Sun et al.

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[1] For an overview of some of the issues of mobility in China see Fields and Zhang (2007).

[2] 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).

2007, Yin et al. 2006) and that the rise in inequality may have been accompanied by a rise in inequality of opportunity (Zhang and Eriksson 2010).

We throw new light on the relationship between mobility and inequality over the period 1989-2011 and highlight an important change that has occurred in in China that has not previously been discussed. The paper is organised as follows: Section 2 introduces the data and considers briefly the issues of data quality; Section 3 describes the analytical tools that we will use and Sections 4 and 5 present our mobility estimates using the tools from section 3; Section 6 concludes.

2 The Data

This paper uses the China Health and Nutrition Survey (CHNS).[3] 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 of studies to provide evidence on mobility in China (Wang 2005, Ding and Wang 2008).

2.1 The survey

Over two decades the CHNS has been carried out periodically in nine Chinese provinces: 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, 2009 and 2011.[4] 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. From time to time, new households and communities are added.[5]

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

[4] Not all provinces are available in all waves and three additional provinces were added in the 2011 wave – see the Appendix for details.

[5] "The 1989 CHNS surveyed 15,917 individuals, and the 1991 CHNS surveyed only individuals belonging to the original sample households, which resulted in a total of 14,778 individuals. For the 1993 CHNS, all new households formed from sample households who resided in sample areas were added to this sample, resulting in a total of 13,893 individuals. For the CHNS 1997, all newly formed households who resided in

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 2011 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.

2.2 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 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 1 to 3. In each panel the horizontal axis is income scaled by the contemporaneous median. Clearly rural incomes are more skewly distributed than urban incomes and, as we noted in Table 1, inequality increases from 1989 to 2000 and from 2000 to 2011, shown here by the increase in spread.

2.3 Attrition

With such a lengthy panel substantial attrition is to be expected. Figure 4 gives an overview of attrition for the two main periods examined in this paper, 1989-2000 and 2000-2011. Clearly attrition is substantially higher for urban households than rural households. While the attrition pattern

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sample areas (and additional households to replace those no longer participating) were added to the sample. New communities were also added to replace communities no longer participating, and Heilongjiang province replaced Liaoning province. A total of 14,426 individuals participated in 1997. In the 2000 CHNS, newly formed households, replacement households, and replacement communities were again added, and Liaoning province returned to the study. A total of 15,648 individuals participated in 2000." See http://www.cpc.unc.edu/projects/china/about/design/sample.

[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*	*2011*
no. of obs.	3,791	3,607	3,428	3,838	4,307	4,339	4,374	4,433	5,770
maximum income	110,077	55,132	83,107	103,261	191153	135,331	386,312	540,613	450,435
minimum income	-10,996	-1,158	-3,289	-8,841	-1,722	-20,152	-8,733	-357,359	-176,570
mean income	6,046	5,846	6,642	7,974	10,172	12,595	14,783	20,957	25,429
median income	5,294	5,130	5,292	6,513	8,021	9,179	10,284	15,057	19,964
Gini (total)	0.39	0.37	0.41	0.41	0.44	0.47	0.50	0.49	0.46
Gini (rural)	0.42	0.39	0.43	0.42	0.52	0.47	0.51	0.50	0.48
Gini (urban)	0.30	0.29	0.37	0.37	0.41	0.45	0.47	0.46	0.42
90-10 ratio (total)	7.87	6.72	8.39	8.54	10.81	13.43	13.77	12.71	13.60
90-10 ratio (rural)	9.43	7.47	9.46	9.31	11.47	12.61	13.74	13.27	14.18
90-10 ratio (urban)	3.89	4.47	6.40	6.63	7.87	12.19	11.10	10.53	9.36
coeff of var (total)	0.83	0.72	0.86	0.84	1.02	1.01	1.31	1.27	1.07
coeff of var (rural)	0.85	0.80	0.86	0.87	1.05	1.02	1.33	1.27	1.13
coeff of var (urban)	0.76	0.56	0.83	0.78	0.94	0.95	1.24	1.23	0.96

Note: incomes are annual household incomes before tax, measured in 2011 Yuan

Figure 1: CHNS: Income distribution in 1989

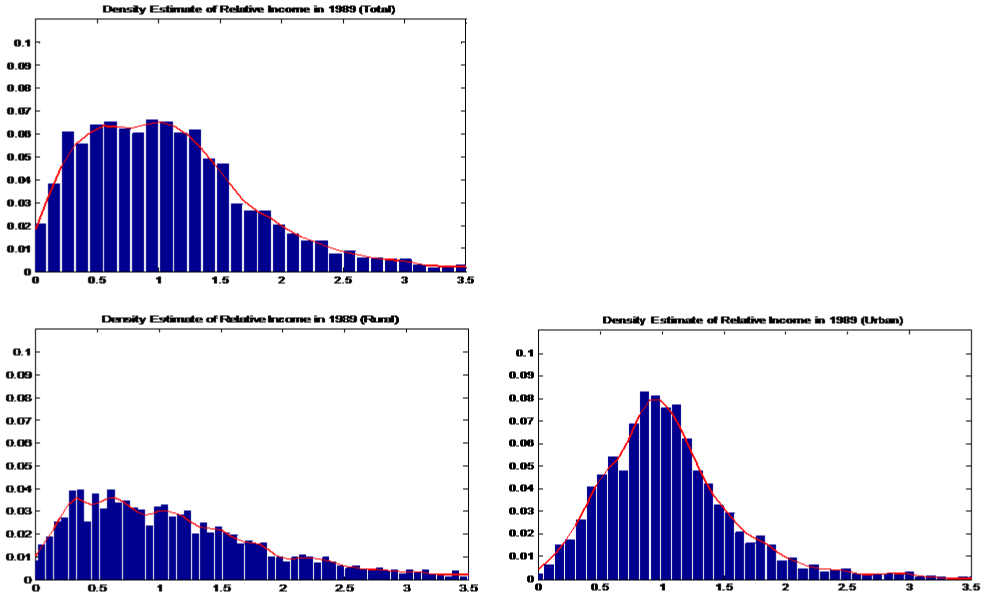


Figure 2: CHNS: Income distribution in 2000

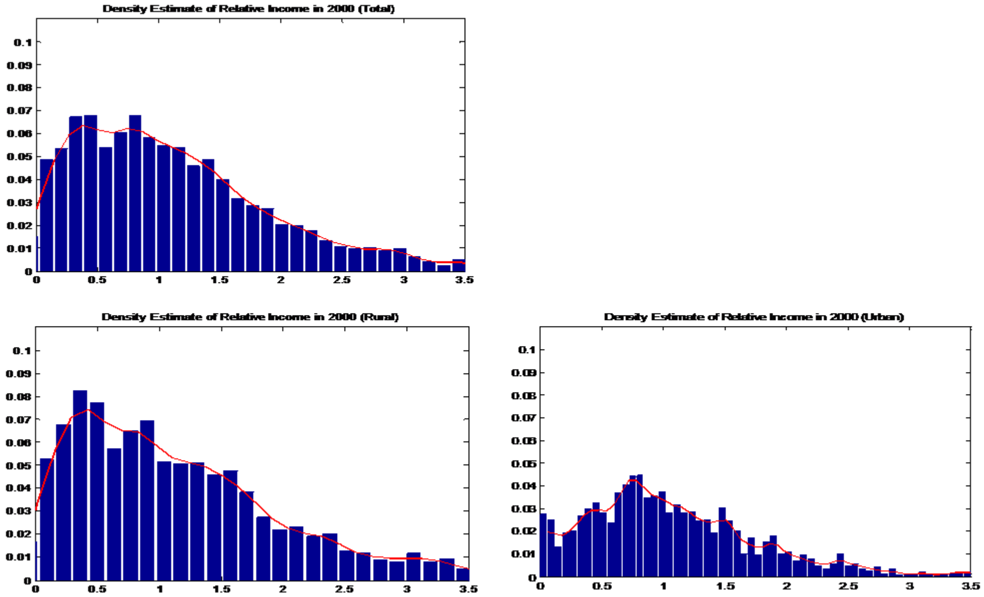
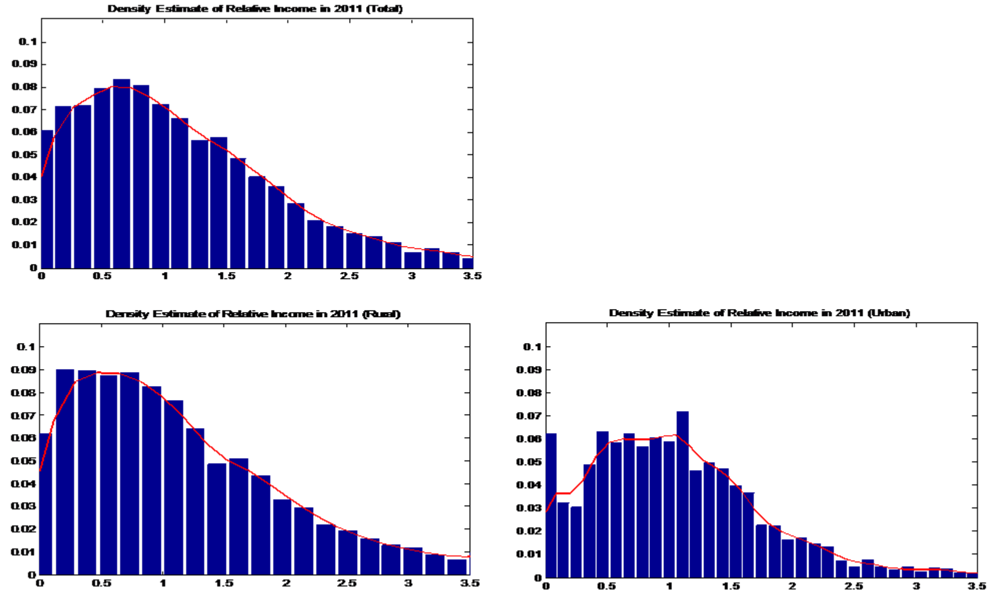


Figure 3: CHNS: Income distribution in 2011



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.

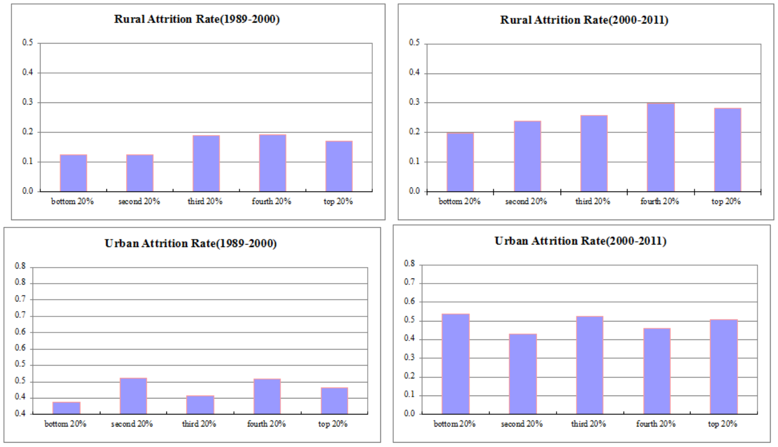
3 Mobility measurement

3.1 Approaches to mobility

Mobility can be interpreted in a variety of ways: 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 (Van Kerm 2004, Tsui 2009).

Here we adopt a unified approach that covers that the principal economic interpretations of mobility. Let us assume that there is agreement on the

Figure 4: Attrition from the sample



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.[7] 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.

3.2 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 $S = [0, 1]$.[8] Let us

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[7] 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.

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

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 $n_{k\ell}$ 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 (1978) 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.

3.3 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 mobility profile $\left\{(u_i, v_i)_{i=1,..,n}\right\}$. We need a set of tools that will aggregate the information in any such profile in a way that appropriately characterises income mobility within an n-household society.

Using a set of basic axioms on mobility orderings[9] over the set of all possible profiles, Cowell and Flachaire (2011) derive the following class of

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[9] 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).

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 4 and 5 we will apply M_α to the two principal status concepts that are of economic interest: rank and income.

4 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.

4.1 Mobility pre/post millennium – a first look

Table 2 presents our “decade” transition matrices pre and post millennium (1989/2000 and 2000/2011). Groupings 1,...,5 are equal-sized twenty-percent

Table 2: Decade rank transition matrices

		2000							**2011**				
		1	*2*	*3*	*4*	*5*			*1*	*2*	*3*	*4*	*5*
1989	*1*	**0.29**‡	0.23	0.21	0.15	0.12	**2000**	*1*	**0.34**‡	0.26	0.18	0.13	0.08
	2	0.25	**0.25**	0.21	0.17	0.12		*2*	0.24	**0.25**	0.23	0.16	0.13
	3	0.18	0.23	**0.21**	0.23	0.15		*3*	0.18	0.23	**0.22**	0.2	0.17
	4	0.14	0.15	0.21	**0.22**‡	0.27		*4*	0.13	0.14	0.22	**0.27**‡	0.24
	5	0.13	0.14	0.16	0.22	**0.34**		*5*	0.11	0.13	0.15	0.24	**0.37**
		$m(P) =$	0.9225						$m(P) =$	0.8875			
			[0.9107, 0.9343]							[0.8748, 0.9002]			

Notes: ‡: significant change in transition probability at 1% level. Numbers in [ ] are 99%-confidence interval of estimate.

slices of the distribution at the beginning and the end of each period.[10] The diagonal elements in Table 2 (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 29%; but if a household were in the bottom 20% in 2000 then the probability that it would still be in the same group a decade later had risen to more than one third. The summary statistic $m(P)$ also shows a reduction in mobility, significant at the one percent level. Furthermore, these conclusions are supported if we look at a more detailed breakdown of the sample into rural and urban subsamples – see Table 11 in the Appendix.

It is also interesting to see *where* the change in mobility seems to have occurred. Let us divide the provinces up into two regions, Coastal (Liaoning, Shandong and Jiangsu) and Inland region (Guangxi, Guizhou, Hubei, Hunan and Henan). From Tables 3 and 4 it is clear that in both regions mobility for the bottom 20% group is lower for urban households than for rural households and that, for the inland provinces, mobility at the bottom of the distribution

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[10] Note that Table 2 excludes Heilongjiang which was only incorporated into the CHNS survey in 2000. See section 4.2 for a discussion of how the results are affected by including this province.

Table 3: Mobility pre/post millennium: Coastal provinces

				2000			***Rural***				**2011**		
		1	*2*	*3*	*4*	*5*			*1*	*2*	*3*	*4*	*5*
1989	*1*	**0.31**	0.19	0.19	0.20	0.10	**2000**	*1*	**0.32**	0.22	0.24	0.12	0.10
	2	0.29	**0.23**	0.20	0.19	0.09		*2*	0.17	**0.28**	0.25	0.16	0.14
	3	0.17	0.21	**0.23**	0.20	0.18		*3*	0.26	0.19	**0.21**	0.17	0.17
	4	0.13	0.23	0.17	**0.19**	0.28		*4*	0.14	0.20	0.17	**0.26**	0.24
	5	0.10	0.13	0.19	0.23	**0.35**		*5*	0.11	0.12	0.14	0.28	**0.35**
				2000			***Urban***				**2011**		
		1	*2*	*3*	*4*	*5*			*1*	*2*	*3*	*4*	*5*
1989	*1*	**0.42**	0.19	0.22	0.06	0.08	**2000**	*1*	**0.45**	0.25	0.15	0.08	0.08
	2	0.14	**0.16**	0.24	0.27	0.19		*2*	0.20	**0.35**	0.18	0.20	0.08
	3	0.11	0.22	**0.22**	0.27	0.19		*3*	0.20	0.13	**0.28**	0.23	0.18
	4	0.22	0.19	0.22	**0.16**	0.22		*4*	0.10	0.15	0.23	**0.30**	0.23
	5	0.11	0.24	0.11	0.22	**0.32**		*5*	0.05	0.10	0.18	0.20	**0.45**

fell dramatically (i.e. p_{11} rose) from the pre-millennium period to the post-millennium period. If we compare the $m(P)$ statistic pre-millennium and post-millennium we find that overall mobility fell for rural and for urban households in each of the two regions; in each case this fall is significant at the 1% level with the exception of rural households in the coastal provinces, where the fall is significant at the 5% level.

4.2 Rank mobility – robustness checks

Length of period

We can also examine the change in short-run mobility in China over the two decades. The CHNS data permit us to look at two-year mobility at four points during the period: 1989/91, 1991/93, 2004/06, 2009/11. The upper

Table 4: Mobility pre/post millennium: Inland provinces

Rural

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.24**	0.20	0.24	0.17	0.15
	2	0.23	**0.23**	0.24	0.17	0.14
	3	0.19	0.25	**0.18**	0.22	0.16
	4	0.16	0.20	0.19	**0.23**	0.23
	5	0.17	0.13	0.15	0.21	**0.33**

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.31**	0.24	0.18	0.15	0.12
	2	0.16	**0.26**	0.25	0.17	0.16
	3	0.20	0.18	**0.22**	0.20	0.20
	4	0.19	0.15	0.21	**0.24**	0.21
	5	0.14	0.17	0.14	0.24	**0.31**

Urban

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.34**	0.27	0.19	0.12	0.08
	2	0.21	**0.25**	0.25	0.21	0.08
	3	0.17	0.18	**0.20**	0.22	0.24
	4	0.12	0.18	0.21	**0.24**	0.25
	5	0.15	0.13	0.15	0.22	**0.34**

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.49**	0.24	0.13	0.08	0.06
	2	0.21	**0.28**	0.22	0.18	0.11
	3	0.17	0.20	**0.21**	0.27	0.13
	4	0.05	0.15	0.20	**0.25**	0.35
	5	0.08	0.13	0.23	0.23	**0.33**

part of Table 5 shows the short-run rank-mobility transition matrices at these four points. We may summarise the change in mobility by looking at three key statistics: p_{11}, the probability that someone starting in the lowest 20% group stays in the same group, p_{55}, the probability that someone starting in the highest 20% group stays in the same group and $m(P)$, defined in equation (1). The lower part of Table 5 shows, for each of these statistics, the significance level of the change in mobility as we go from any one of these four points to any other point. So, for example if we compare 1989/91 with 1991/93, the change in p_{11} and p_{55} is not significant but there is a rise in $m(P)$, significant at the 10% level. But if we compare 1989/91 with 2009/11 we find that p_{11} and p_{55} rise and $m(P)$ falls, all significant at the 1% level; the same is true if we compare 1991/93 with 2009/11. The overall message is clear: there is some evidence of a rise in short-run rank mobility a decade before the millennium, but there is overwhelming evidence of a reduction in mobility thereafter.

Table 5: Two-year rank transition matrices (total)

1991

1989	1	2	3	4	5
1	**0.41**	0.26	0.16	0.10	0.07
2	0.25	**0.29**	0.19	0.15	0.11
3	0.16	0.23	**0.27**	0.21	0.13
4	0.10	0.13	0.23	**0.32**	0.22
5	0.07	0.09	0.15	0.23	**0.46**

$m(P) = \ 0.8135$

2006

2004	1	2	3	4	5
1	**0.44**	0.26	0.14	0.09	0.07
2	0.23	**0.30**	0.25	0.15	0.08
3	0.17	0.22	**0.28**	0.22	0.12
4	0.10	0.14	0.22	**0.31**	0.23
5	0.06	0.09	0.11	0.24	**0.50**

$m(P) = \ 0.7923$

1993

1991	1	2	3	4	5
1	**0.41**	0.26	0.15	0.11	0.06
2	0.26	**0.28**	0.21	0.16	0.09
3	0.16	0.23	**0.25**	0.20	0.16
4	0.10	0.14	0.23	**0.30**	0.22
5	0.07	0.10	0.14	0.23	**0.46**

$m(P) = \ 0.8223$

2011

2009	1	2	3	4	5
1	**0.46**	0.23	0.16	0.10	0.06
2	0.24	**0.32**	0.23	0.13	0.08
3	0.15	0.24	**0.28**	0.21	0.12
4	0.07	0.13	0.23	**0.33**	0.24
5	0.08	0.08	0.10	0.23	**0.51**

$m(P) = \ 0.7756$

Significance levels of mobility statistics

	p_{11}			p_{55}			$m(P)$		
	1991/93	2004/06	2009/11	1991/93	2004/06	2009/11	1991/93	2004/06	2009/11
1989/91	[ ]	10%	1%	[ ]	5%	1%	10%	1%	1%
1991/93		10%	1%		5%	1%		1%	1%
2004/06			[ ]			[ ]			1%

Note: [ ] means change in statistic is not significant. Underline indicates mobility *increase*; all others indicate mobility decrease.

Inclusion of missing province

As a further check we examine the effect of including the missing province referred to in footnote 10.[11] Heilongjiang was unavailable before 2000; the effect of including this province in the computations of 2000-2011 is shown in Table6. The conclusion that rank mobility fell after the millennium remains unaffected. If we examine the breakdown into rural and urban households (Appendix Tables 14 and 15) then again the reduction in mobility after the millennium is confirmed.

Table 6: Transition Matrix 2000-2011 (Heilongjiang included)

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.333**	0.259	0.187	0.134	0.087
	2	0.232	**0.261**	0.221	0.168	0.118
	3	0.194	0.225	**0.218**	0.194	0.167
	4	0.132	0.137	0.223	**0.261**	0.247
	5	0.110	0.118	0.149	0.244	**0.379**
		$m(P) =$	0.8875			
			[0.8799, 0.8951]			

Notes: ‡: significant change in transition probability at 1% level. Numbers in [ ] are 99%-confidence interval of estimate.

Age correction

When comparing long periods such as 1989-2000 and 2000-2011 it is clear that through attrition (discussed below), addition of replacement households to the sample and the passage of time the age composition of the sample may have changed and that this may affect the mobility estimates.[12] We can tackle this by reweighting the data to take account of the changing age structure. Let $n_{ak\ell}$ be the number of households of age a that are in S_k at time t_0 and in S_ℓ at time t_1. Let A be the set of all types (for example all

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[11] As Appendix Table 8 shows province 21 (Liaoning) was not available in 1997; however this does not does not affect any of our computations.

[12] For additions to the sample see note 5 above; Tables 9 and 10 in the Appendix show the sample characteristics at the beginning and end of periods.

the different age groups). For a household of type a let the probability of inclusion in the sample be proportional to w_a. The estimate of the probability that a household in in S_k at time t_0 will be in S_ℓ at time t_1 is

$$p_{k\ell} := \frac{\sum_{a\in A} w_a n_{ak\ell}}{\sum_{a\in A}\sum_{j=1}^{K} w_a n_{akj}}. \tag{6}$$

The transition matrix P is the $K \times K$ array with typical element $p_{k\ell}$. Notice that (6) becomes $p_{k\ell} := \frac{n_{k\ell}}{\sum_{j=1}^{K} n_{kj}}$. if w_a is the same for all $a \in A$.

Accordingly we recomputed the 2000-2011 transition matrices using the age-weights from 1989 . As we can see in Table 16 (in the Appendix) this reweighting does not change the conclusion that rank mobility reduced when comparing 2000-2011 with 1989-2000.

4.3 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 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. Those whose age is greater than 55 are also not likely to be relevant: it is

Table 7: Households leaving the sample by age

	Rural			**Urban**		
	$n(\tau)$	$n(\tau)$		$n(\tau)$	$n(\tau)$	
Age, τ	1989-2000	2000-2011	ratio	1989-2000	2000-2011	ratio
≤ 40	71	22	0.31	29	8	0.28
≤ 45	133	61	0.46	79	35	0.44
≤ 50	180	156	0.87	136	104	0.76
≤ 55	215	218	1.01	181	162	0.89

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

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 7 that, with the trivial exception of the over-55 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 (the non-mobility component of attrition) remains fairly stable over time this must mean that n_1 has fallen: "mobility" from inside to outside the sample must have decreased.

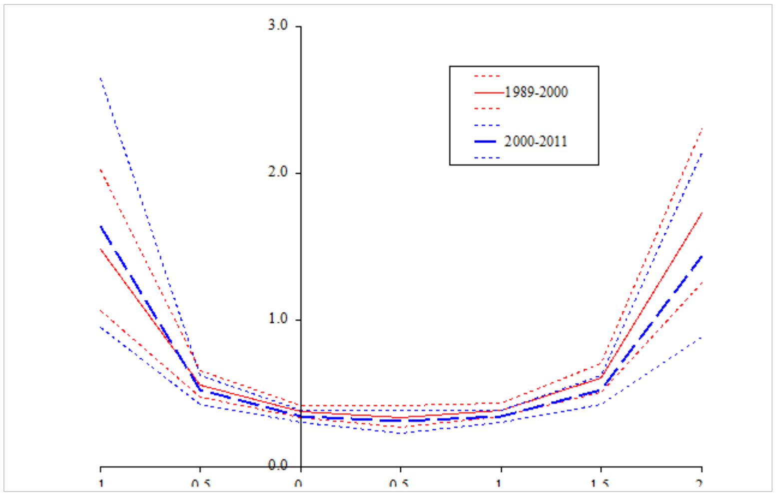
Now consider the "ratio" columns in Table 7. This ratio is smaller for the lower ages – the reduction in $n(\tau)$ is much greater among younger people. This is consistent with the points that $n_1(\tau)/n(\tau)$ decreases with τ and with the claim that reduction in movement is due to n_1 rather than 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 4.1.

4.4 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 5: Rank mobility M_α before and after the millennium



as in (5). The evidence for the periods 1989-2000 and 2000-2011 is presented in Figure 5 which plots M_α for $\alpha \in [-1, 2]$ along with 95-percent confidence bands.[13] The conclusions drawn from the transition-matrix analysis in section 4.1 are broadly confirmed: with the exception of the extreme case $\alpha = -1$ the point estimates of 2000-2011 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.

5 Income mobility

Now, instead of rank mobility, we focus on income variability over the same periods. Each panel in Figure 6 (adapted from the suggestion by Trede 1998) provides information similar to that in the transition matrix.[14] It shows

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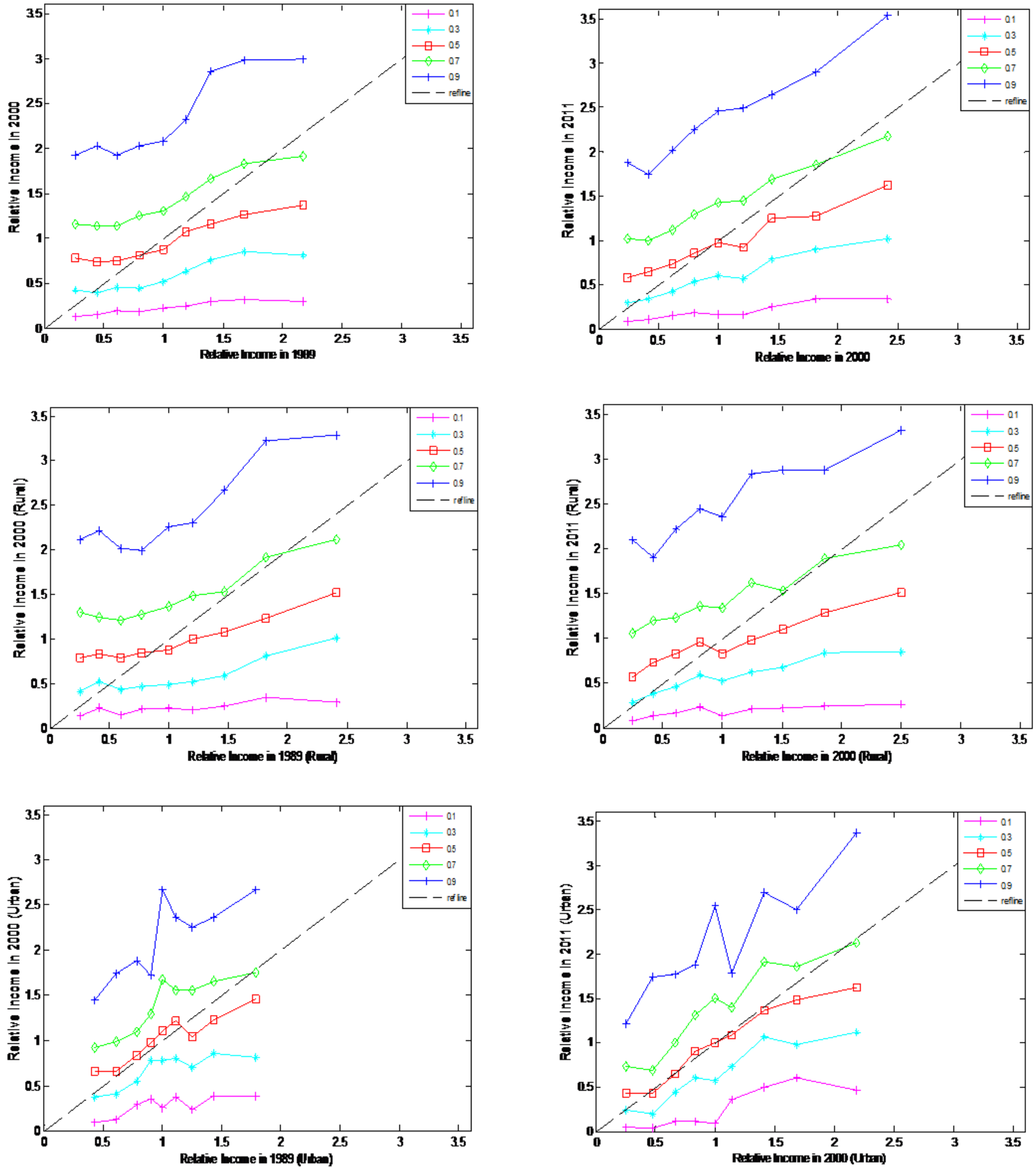
[13] Table 17 in the Appendix provides the detail underlying Figure 5.

[14] 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

Figure 6: Conditional quantiles



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 2000-2011 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 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 $y_{t'} = \phi\left(y_t\right)$, where ϕ monotonic increasing, 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 6 to get a picture of pre/post-millennium mobility for the whole sample (top), for rural households and for urban households (bottom). This graphical presentation 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 2000-2011 than in 1989-2000, but above 1.5 times the median the 0.9 profile is steeper in 2000-2011. 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 2000-2011 period; this means that the higher is one's income in rural households, the more uncertain have be-

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bottom 10 percent, then $x_{0.1} = F_0^{-1}\left(0.1\right)$.is the 10-percent quantile where F_0^{-1} denotes the inverse of the time-0 distribution function F_0. In general

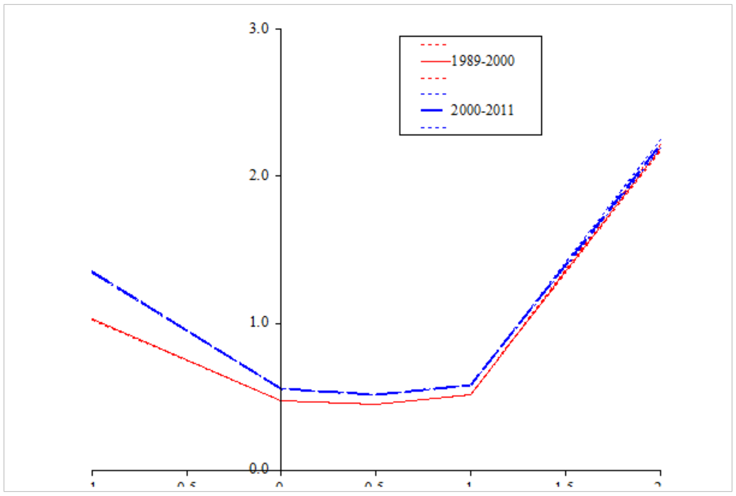
$$x_p = F_0^{-1}\left(p\right), p \in [0, 1].$$

We do the same thing at time 1:

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

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

Figure 7: Income mobility M_α before and after the millennium



come 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 3. But now household i's status at date t is given simply by income:

$$s_i = y_{it}. \tag{7}$$

Apply the M_α index once again but this time with status defined by (7) rather than (4) – 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 [15] and M_α is not defined for negative incomes and is not defined everywhere for zero incomes. For this reason we removed the zero and negative observations from the sample.

Figure 7 plots M_α for $\alpha \in [-1, 2]$ along with 95-percent confidence bands – it is the income-mobility counterpart to Figure 5. As we can see income

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[15] Among rural households 3.1 percent of had negative or zero incomes during 1989-2000, 2.58 percent during 2000-2011. The corresponding proportions of urban households with zero or negative incomes were 0.98 percent (1989-2000) and 1.44 percent (2000-2011).

mobility in the whole sample has *increased* throughout the parameter range:[16] comparing Figures 5 and 7 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 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.[17] One can 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.

6 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 the 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.

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[16] Table 18 in the Appendix presents the results underlying Figure 7. 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).

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

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.

This change in rank mobility that has taken place is important for two reasons. First, a reduction in long-term mobility suggests that, along with the rise in income inequality, there has been a rise in inequality of opportunity which contributes to a perception of unfairness in the outcome of the economic system.[18] Second, it may be evidence of a policy failure in the management of the country's development process. China's leaders realised from the outset that the rapid growth in income around the turn of the century would be accompanied by a growth in income inequality: but it was envisaged that the inequality growth would eventually be reversed.[19] Here economic mobility can be seen to play an important role, as an effective mechanism for offsetting the effects of growing inequality; in a sense it substitutes for comprehensive redistribution programme and may forestall the public demand for state intervention.[20]

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, presenting its policy makers with a potentially serious challenge.

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[18] For the connection with inequality of opportunity see, for example, Stokey (1998, p.161).

[19] "Our policy is to let some areas and some people get rich first and then have them stimulate and help other regions, other people, and so gradually achieve common prosperity prosperity." (Deng Xiaoping, 1985)

[20] On this "substitution" role of mobility see for example Field and Ok's (1999) characterisation of the argument in Friedman (1962). This type of argument is clearly present in policy-makers' minds: "A just society allows the public to share the fruits of reform and development. Recently, I often read Adam Smith's Theory of Moral Sentiments. He actually talks about two invisible hands: one refers to the market, one is ethical. If, in the long run, only a few are wealthy and most are in poverty, this is unfair and such a society is doomed to instability. Therefore, I am concerned about solving the problem of the gap between rich and poor. We need to foster economic and social development, while also gradually narrowing the gap between rich and poor. This is our goal." (Wen Jiabao, 2009).

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Appendix

Table 8 shows which provinces were present in which wave of the CHNS. Tables 9 and 10 give the sample statistics at the beginning and end of each sample period. Table 11 gives the breakdown by rural and urban subgroups of the material presented in Table 2. Tables 14 and 15 are the counterparts to Table 6 for the rural and urban subgroups. Table 16 shows the estimates of the transition matrices with age-weighted corrections. Tables 17 and 18 provide the estimates underlying Figures 5 and 7.

Table 8: Provinces in the sample

province	*1989*	*1991*	*1993*	*1997*	*2000*	*2004*	*2006*	*2009*	*2011*
11(Beijing)									*
21(Liaoning)	*	*	*		*	*	*	*	*
23(Heilongjiang)				*	*	*	*	*	*
31(Shanghai)									*
32(Jiangsu)	*	*	*	*	*	*	*	*	*
37(Shandong)	*	*	*	*	*	*	*	*	*
41(Henan)	*	*	*	*	*	*	*	*	*
42(Hubei)	*	*	*	*	*	*	*	*	*
43(Hunan)	*	*	*	*	*	*	*	*	*
45(Guangxi)	*	*	*	*	*	*	*	*	*
52(Guizhou)	*	*	*	*	*	*	*	*	*
55(Chongqing)									*

Table 9: Sample summary statistics. For years 2000 onwards, includes Liaoning but excludes Heilongjiang

	(1989, 2000)		(1989, 1991)		(1991, 1993)		(2000, 2011)		(2004, 2006)		(2009, 2011)	
	1989	*2000*	*1989*	*1991*	*1991*	*1993*	*2000*	*2011*	*2004*	*2006*	*2009*	*2011*
no. of obs.	2843	2843	3600	3600	3358	3358	2600	2600	3400	3400	3442	3442
maximum income	85053.91	191153.30	85053.91	55132.02	55132.02	83106.52	131942.10	450435.20	135330.60	386312.30	540613.1	450435.20
minimum income	-10995.77	-1721.81	-10995.77	-1158.20	-895.29	-3288.70	-1721.81	-176570.10	-4092.03	-8733.39	-163238.20	-176570.10
mean income	5789.18	9763.40	5982.33	5846.91	5846.00	6639.53	9789.89	22793.47	12539.51	14495.02	20843.18	23249.78
median income	5023.10	7760.28	5220.76	5125.33	5108.58	5301.36	7820.90	17003.58	9174.86	10000.68	14983.76	18121.45
Gini coefficient(total)	0.40	0.44	0.39	0.37	0.37	0.41	0.44	0.49	0.47	0.50	0.49	0.47
Gini coefficient(rural)	0.43	0.45	0.42	0.39	0.39	0.42	0.43	0.50	0.47	0.51	0.48	0.49
Gini coefficient(urban)	0.30	0.42	0.30	0.29	0.29	0.37	0.43	0.47	0.45	0.46	0.47	0.44
ratio of 90th to 10th percentile(total)	8.39	11.40	7.99	6.72	6.68	8.24	10.07	16.20	12.82	13.37	12.10	15.10
ratio of 90th to 10th percentile(rural)	9.54	11.85	9.41	7.46	7.30	9.12	10.23	15.79	12.40	13.34	11.97	15.26
ratio of 90th to 10th percentile(urban)	4.20	8.93	3.97	4.47	4.43	6.27	8.58	16.91	12.35	11.38	10.73	12.00
coeff var (total)	0.82	1.02	0.79	0.72	0.72	0.85	1.01	1.27	1.00	1.26	1.27	1.16
coeff var (rural)	0.86	1.04	0.85	0.80	0.80	0.86	0.97	1.29	1.00	1.38	1.22	1.21
coeff var (urban)	0.70	0.95	0.67	0.56	0.56	0.83	1.04	1.19	0.95	1.03	1.30	1.05

Table 10: Sample summary statistics. Includes both Liaoning and Heilongjiang

	(2000, 2011)		(2004, 2006)		(2009, 2011)	
	2000	*2011*	*2004*	*2006*	*2009*	*2011*
no. of obs.	2915	2915	3827	3827	3882	3882
maximum income	131942.10	450435.20	135330.60	386312.30	540613.10	450435.20
minimum income	-1721.81	-176570.10	-20151.50	-8733.39	-163238.20	-176570.10
mean income	9654.74	22974.76	12609.73	14613.57	20918.22	23475.10
median income	7692.73	17091.33	9267.24	10121.59	15021.17	18133.12
Gini coefficient(total)	0.44	0.49	0.47	0.50	0.48	0.47
Gini coefficient(rural)	0.44	0.50	0.47	0.51	0.48	0.49
Gini coefficient(urban)	0.42	0.45	0.44	0.46	0.46	0.43
ratio of 90th to 10th percentile(total)	10.06	15.29	12.71	13.13	11.79	14.21
ratio of 90th to 10th percentile(rural)	10.09	15.06	12.29	13.21	11.92	14.68
ratio of 90th to 10th percentile(urban)	8.61	13.68	10.97	10.56	10.05	10.88
coefficient of variation(total)	1.00	1.23	0.99	1.25	1.25	1.15
coefficient of variation(rural)	0.97	1.27	1.00	1.36	1.20	1.20
coefficient of variation(urban)	1.00	1.12	0.92	1.05	1.26	1.04

Table 11: Decade rank transition matrices: Rural and Urban breakdown

Rural

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.25**‡	0.24	0.21	0.17	0.13
	2	0.26	**0.23**	0.22	0.18	0.11
	3	0.21	0.21	**0.20**	0.21	0.15
	4	0.14	0.19	0.22	**0.19**†	0.25
	5	0.14	0.13	0.14	0.24	**0.35**

$$m(P) = \quad 0.9450$$

[0.9317, 0.9583]

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.32**‡	0.25	0.17	0.16	0.10
	2	0.21	**0.21**	0.26	0.18	0.14
	3	0.18	0.25	**0.19**	0.19	0.19
	4	0.16	0.15	0.22	**0.25**†	0.22
	5	0.12	0.14	0.15	0.22	**0.36**

$$m(P) = \quad 0.9175$$

[0.9033, 0.9317]

Urban

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.37**‡	0.24	0.2	0.11	0.08
	2	0.19	**0.25**	0.26	0.20	0.10
	3	0.15	0.17	**0.18***	0.25	0.24
	4	0.15	0.17	0.21	**0.23**	0.24
	5	0.13	0.17	0.15	0.20	**0.34**

$$m(P) = \quad 0.9075$$

[0.8837, 0.9313]

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.48**‡	0.26	0.11	0.07	0.07
	2	0.23	**0.28**	0.19	0.19	0.10
	3	0.16	0.2	**0.25***	0.27	0.12
	4	0.06	0.14	0.21	**0.26**	0.34
	5	0.06	0.13	0.24	0.20	**0.37**

$$m(P) = \quad 0.8400$$

[0.8133, 0.8667]

Notes: $\ddagger, \dagger, *$: significant change in transition probability at (respectively) 1%, 5%, 10% level.

Numbers in [ ] are 99%-confidence interval of estimate.

Table 12: Two-year rank transition matrices (rural)

1991

1989	*1*	*2*	*3*	*4*	*5*
1	**0.34**	0.24	0.17	0.14	0.10
2	0.29	**0.21**	0.24	0.14	0.12
3	0.17	0.26	**0.22**	0.20	0.14
4	0.12	0.17	0.18	**0.31**	0.21
5	0.08	0.11	0.18	0.21	**0.42**

$m(P) = \ 0.8718$

2006

2004	*1*	*2*	*3*	*4*	*5*
1	**0.40**	0.26	0.15	0.10	0.09
2	0.24	**0.28**	0.24	0.14	0.10
3	0.15	0.22	**0.27**	0.23	0.14
4	0.15	0.14	0.21	**0.29**	0.21
5	0.06	0.10	0.13	0.24	**0.46**

$m(P) = \ 0.8265$

1993

1991	*1*	*2*	*3*	*4*	*5*
1	**0.38**	0.25	0.19	0.12	0.06
2	0.24	**0.28**	0.21	0.18	0.09
3	0.17	0.23	**0.27**	0.17	0.17
4	0.14	0.13	0.20	**0.30**	0.23
5	0.07	0.12	0.13	0.22	**0.45**

$m(P) = \ 0.8300$

2011

2009	*1*	*2*	*3*	*4*	*5*
1	**0.43**	0.24	0.14	0.12	0.07
2	0.24	**0.28**	0.23	0.17	0.08
3	0.16	0.25	**0.28**	0.18	0.12
4	0.09	0.14	0.21	**0.32**	0.24
5	0.09	0.09	0.13	0.21	**0.48**

$m(P) = \ 0.8048$

Significance levels of mobility statistics

	p_{11}			p_{55}			$m(P)$		
	1991/93	2004/06	2009/11	1991/93	2004/06	2009/11	1991/93	2004/06	2009/11
1989/91	[ ]	1%	1%	[ ]	10%	1%	1%	1%	1%
1991/93		[ ]	5%	...	[ ]	[ ]		[ ]	1%
2004/06			[ ]	...		[ ]			1%

Note: [ ] means change in statistic is not significant.

Table 13: Two-year rank transition matrices (urban)

1991

		1	*2*	*3*	*4*	*5*
1989	*1*	**0.49**	0.25	0.10	0.10	0.06
	2	0.24	**0.29**	0.24	0.11	0.11
	3	0.13	0.26	**0.27**	0.20	0.14
	4	0.04	0.14	0.24	**0.33**	0.25
	5	0.09	0.06	0.15	0.26	**0.44**

$m(P) = \; 0.7955$

2006

		1	*2*	*3*	*4*	*5*
2004	*1*	**0.54**	0.24	0.10	0.09	0.04
	2	0.23	**0.33**	0.24	0.15	0.06
	3	0.09	0.27	**0.33**	0.24	0.09
	4	0.10	0.10	0.22	**0.32**	0.27
	5	0.05	0.07	0.12	0.21	**0.55**

$m(P) = \; 0.7355$

1993

		1	*2*	*3*	*4*	*5*
1991	*1*	**0.50**	0.21	0.12	0.09	0.07
	2	0.25	**0.29**	0.23	0.16	0.07
	3	0.11	0.23	**0.29**	0.25	0.12
	4	0.08	0.15	0.24	**0.27**	0.26
	5	0.05	0.11	0.14	0.22	**0.47**

$m(P) = \; 0.7925$

2011

		1	*2*	*3*	*4*	*5*
2009	*1*	**0.53**	0.27	0.09	0.08	0.03
	2	0.22	**0.37**	0.25	0.09	0.06
	3	0.11	0.21	**0.35**	0.23	0.10
	4	0.08	0.09	0.19	**0.38**	0.25
	5	0.06	0.06	0.11	0.21	**0.56**

$m(P) = \; 0.7020$

Significance levels of mobility statistics

	p_{11}			p_{55}			$m(P)$		
	1991/93	2004/06	2009/11	1991/93	2004/06	2009/11	1991/93	2004/06	2009/11
1989/91	[ ]	[ ]	[ ]	[ ]	1%	1%	[ ]	1%	1%
1991/93		[ ]	[ ]		10%	1%		1%	1%
2004/06			[ ]			[ ]			1%

Note: [ ] means change in statistic is not significant.

Table 14: 2000-2011 Transition Matrix, Rural (Heilongjiang included)

				2011		
		1	*2*	*3*	*4*	*5*
	1	**0.311**	0.248	0.177	0.148	0.116
2000	*2*	0.205	**0.214**	0.268	0.195	0.118
	3	0.189	0.236	**0.193**	0.182	0.200
	4	0.173	0.168	0.205	**0.239**	0.216
	5	0.122	0.134	0.156	0.236	**0.351**
		$m(P) =$	0.9250			
			[0.9165, 0.9335]			

Table 15: 2000-2011 Transition Matrix, Urban (Heilongjiang included)

				2011		
		1	*2*	*3*	*4*	*5*
	1	**0.472**	0.275	0.113	0.070	0.070
2000	*2*	0.231	**0.280**	0.196	0.182	0.112
	3	0.154	0.189	**0.259**	0.231	0.168
	4	0.063	0.147	0.182	**0.301**	0.308
	5	0.077	0.112	0.252	0.217	**0.343**
		$m(P) =$	0.8375			
			[0.8216, 0.8534]			

Table 16: Transition matrices: age-weighted data

Total

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.29**	0.23	0.21	0.15	0.12
	2	0.25	**0.25**	0.21	0.17	0.12
	3	0.18	0.23	**0.21**	0.23	0.15
	4	0.14	0.15	0.21	**0.22**	0.27
	5	0.13	0.14	0.16	0.22	**0.34**

$m(P) =$ 0.9225

[0.9107, 0.9343]

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.31**	0.27	0.19	0.13	0.10
	2	0.24	**0.23**	0.24	0.16	0.13
	3	0.17	0.20	**0.24**	0.20	0.18
	4	0.13	0.12	0.22	**0.29**	0.25
	5	0.09	0.14	0.16	0.22	**0.39**

$m(P) =$ 0.8855

[0.8727, 0.8983]

Rural

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.25**	0.24	0.21	0.17	0.13
	2	0.26	**0.23**	0.22	0.18	0.11
	3	0.21	0.21	**0.20**	0.21	0.15
	4	0.14	0.19	0.22	**0.19**	0.25
	5	0.14	0.13	0.14	0.24	**0.35**

$m(P) =$ 0.9450

[0.9317, 0.9583]

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.29**	0.25	0.15	0.17	0.14
	2	0.19	**0.21**	0.30	0.16	0.14
	3	0.17	0.21	**0.19**	0.21	0.22
	4	0.15	0.13	0.22	**0.27**	0.23
	5	0.10	0.15	0.17	0.21	**0.37**

$m(P) =$ 0.9218

[0.9076, 0.9359]

Urban

		2000				
		1	*2*	*3*	*4*	*5*
1989	*1*	**0.37**	0.24	0.20	0.11	0.08
	2	0.19	**0.25**	0.26	0.20	0.10
	3	0.15	0.17	**0.18**	0.25	0.24
	4	0.15	0.17	0.21	**0.23**	0.24
	5	0.13	0.17	0.15	0.20	**0.34**

$m(P) =$ 0.9075

[0.8837, 0.9313]

		2011				
		1	*2*	*3*	*4*	*5*
2000	*1*	**0.47**	0.26	0.10	0.09	0.08
	2	0.23	**0.26**	0.24	0.15	0.11
	3	0.14	0.19	**0.27**	0.27	0.13
	4	0.06	0.13	0.22	**0.26**	0.32
	5	0.06	0.12	0.22	0.21	**0.40**

$m(P) =$ 0.8358

[0.8091, 0.8624]

Table 17: The M_α index: rank mobility

	Overall		Rural		Urban	
α	*1989-2000*	*2000-2011*	*1989-2000*	*2000-2011*	*1989-2000*	*2000-2011*
-1	1.4839	1.6411	1.5343	1.7411	0.8570	0.7209
	[1.0672, 2.0223]	[0.9543, 2.6462]	[1.0486, 2.1694]	[0.9825, 2.8896]	[0.5218, 1.3149]	[0.4283, 1.1304]
-0.5	0.5612	0.5242	0.5886	0.5652	0.4379	0.3662
	[0.4761, 0.6537]	[0.4243, 0.6251]	[0.4832, 0.6899]	[0.4554, 0.9602]	[0.3165, 0.5688]	[0.2449, 0.5074]
0	0.3765	0.3418	0.3940	0.3675	0.3337	0.2699
	[0.3368, 0.4184]	[0.3008, 0.3829]	[0.3484, 0.4439]	[0.3198, 0.4180]	[0.2692, 0.4039]	[0.2035, 0.3389]
0.5	0.3400	0.3083	0.3536	0.3317	0.3208	0.2469
	[0.2667, 0.4146]	[0.2266, 0.3881]	[0.2678, 0.4389]	[0.2463, 0.4184]	[0.1842, 0.4651]	[0.0921, 0.4172]
1	0.3861	0.3464	0.3986	0.3751	0.3811	0.2653
	[0.3454, 0.4326]	[0.3050, 0.3860]	[0.3506, 0.4471]	[0.3277, 0.4249]	[0.2927, 0.4729]	[0.2026, 0.3318]
1.5	0.6066	0.5233	0.6215	0.5733	0.6124	0.3394
	[0.5113, 0.7088]	[0.4290, 0.6241]	[0.5164, 0.7385]	[0.4613, 0.6990]	[0.4275, 0.8042]	[0.2294, 0.4596]
2	1.7246	1.4362	1.7624	1.5475	1.5717	0.5532
	[1.2534, 2.2987]	[0.8863, 2.1385]	[1.2069, 2.3714]	[0.9871, 2.3238]	[0.9451, 2.3450]	[0.3940, 0.7466]

Note: 95% confidence intervals in [.]

Table 18: The M_α index: income mobility

	Overall		Rural		Urban	
α	*1989-2000*	*2000-2011*	*1989-2000*	*2000-2011*	*1989-2000*	*2000-2011*
-1	1.0257	1.3475	1.1705	1.3683	0.5861	1.2892
	[1.0211, 1.0304]	[1.3418, 1.3533]	[1.1634, 1.1775]	[1.3601, 1.3764]	[0.5804, 0.5917]	[1.2699, 1.3086]
0	0.4729	0.5555	0.5081	0.5578	0.3772	0.5490
	[0.4722, 0.4736]	[0.5545, 0.5566]	[0.5071, 0.5091]	[0.5564, 0.5591]	[0.3749, 0.3795]	[0.5444, 0.5537]
0.5	0.4489	0.5148	0.4777	0.5210	0.3749	0.4989
	[0.4483, 0.4494]	[0.5140, 0.5156]	[0.4769, 0.4785]	[0.5200, 0.5221]	[0.3728, 0.3769]	[0.4955, 0.5023]
1	0.5110	0.5796	0.5366	0.5930	0.4481	0.5470
	[0.5103, 0.5117]	[0.5787, 0.5805]	[0.5357, 0.5376]	[0.5917, 0.5942]	[0.4454, 0.4507]	[0.5435, 0.5505]
2	2.1943	2.2176	1.9123	2.6048	2.7176	1.3374
	[2.1756, 2.2130]	[2.1894, 2.2457]	[1.8880, 1.9366]	[2.5585, 2.6512]	[2.6450, 2.7903]	[1.3220, 1.3528]

Note: 95% confidence intervals in [.]