A Measure of Income Mobility with an Empirical Application

Satya Paul

University of Western Sydney

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Abstract

This paper develops an aggregate income mobility measure based on income transition matrices. The proposed measure satisfies certain desirable properties and captures different facets of mobility. It is additively decomposable into upward and downward mobility components which help us in understanding the nature of mobility. The proposed measure is also additively decomposable into income sub-group mobility components that enable us to see whether mobility among lower income groups is different from that among higher income groups. An empirical illustration with data for China and the United States is presented.

Contact details:

Satya Paul
Professor of Economics
School of Economics and Finance
Room EDG 136, Parramatta Campus
University of Western Sydney
Locked bag 1797, Penrith South DC, NSW 1797
Australia.
Email: s.paul@uws.edu.au
Tel (Office): + 61-2-96859352, Mob: +61-404816145

1. Introduction

The term 'income mobility' refers to the movements of individuals/households on income scale over a period of time. Income mobility has implications for long run income inequality and poverty persistence. A given extent of income inequality in a rigid society in which each individual/ household stays in the same position in each period is more a cause of concern than the same degree of inequality due to mobility. In a rigid society, absolute poverty, if it exists, is likely to be chronic. On the other hand, in a society that exhibits high income mobility, the absolute poverty is expected to be of a temporary nature. Thus, a proper understanding of mobility is required for analysing the dynamic aspects of poverty and inequality.

In contrast to the voluminous theoretical and applied literature on income inequality, research on the measurement and understanding of income mobility is limited. In the terminology of Cowell and Schluter (1998), the existing measures of income mobility can be classified into categories of first-stage and second-stage indices. The first stage indices are constructed using individual/ household level panel data on income distribution for two years. In the case of two-stage indices, the individual/ household level data are first transformed into a transition matrix, which is then used to develop summary measures of mobility. With the availability of panel survey data both at the individual and household levels in the recent past, researchers have developed a variety of first-stage indices capturing different facets of mobility (eg. Shorrocks, 1978a; King, 1983; Chakravarty, Dutta and Weymark, 1985; Maasoumi and Zandvakili, 1986, Fields and Ok, 1996, 1999; Fields, 2009. Relatively few attempts are made to construct mobility indices based on transition matrices (eg. Prais, 1955; Bartholomew, 1973; Bibby, 1975). These indices are statistical in nature and no serious efforts, exception of Shorrocks (1978b), are made to explore their axiomatic properties. Shorrocks developed some axiomatic properties but encountered inconsistencies between few of them.

The present paper suggests a consistent set of axiomatic properties that a good measure of mobility should possess. A new measure of mobility that satisfies these properties is proposed and used to investigate the extent of income mobility among urban individuals in China and the United States. China represents an economy which has moved from state-owned highly regulated and planned system to a decentralised market system and unlike the transformation in Eastern Europe and Soviet Union this transformation has taken place without any loss of output. Moreover, the Chinese labour market is characterised by the absence of Western style state independent labour unions. The private sector employment is increasing and state enterprises have greater autonomy over whom to hire and what to pay in terms of wages and subsidies. While the urban inequality in china is still lower than the US and other Western economies, it has shown a rising trend over the years (Khor and Pencavel, 2006). If the rising income inequality is accompanied by some degree of mobility then changes in annual income inequalities may not be of serious concern. It would be of interest to see how income mobility in urban China compares with the United States, which represents a highly democratic and mature capitalist system where market forces are known to generate more turbulence and year-to-year changes in the economic status of workers.

The paper is organised as follows. Section 2 briefly reviews the existing two-stage indices of mobility. Section 3 discusses the axiomatic properties and Section 4 proposes a new measure of mobility that satisfies all such properties. An empirical illustration based on data for China and the US is shown in Section 5. Concluding remarks are made in Section 6.

2. A Review of Mobility Measures based on Transition Matrices

Consider a transition matrix P of n x n dimension where each cell p_{ij} is the proportion of individuals who move from income group i to income group j over a period of s years (where $s \geq 1$). For the sake of convenience, the income groups are ordered from lowest to highest. The income groups could be quintiles, deciles or percentiles so that each group contains equal number of persons. The income groups could also be constructed in such a way that each group has different number of persons. Fields and Ok (1999) show that matrices of income groups having radically different numbers can lead to paradoxical outcome. To avoid this and other expositional problems, we assume that there are equal numbers of persons in each income group. The elements on the diagonal (p_{ii}) represent stayers and the off-diagonal terms p_{ij} represent movers. If everyone stays in the same class, the trace of matrix P is n. The trace is less than n if some individuals move away from their income group. A simple measure of mobility built on trace has been proposed in Prais (1955) and Bibby (1975).

Prais-Bibby index: $M_T = 1 - (\text{trace } P)/n$ (1)

It takes zero value when no one moves from their income groups and unity when all move away from their groups. All other values of the index lying between zero and unity reveal different 'mobility ratios' or 'mover count ratios' This measure ignores the distances travelled by the movers. The further away they move from the diagonal, the greater is the mobility. Since the difference between the row and column subscripts represents the distance from the diagonal, Bartholomew (1967) expresses mobility in terms of average income boundaries crossed over from year t (initial year) to year t+s (destination year) as

Bartholomew index: $M_B = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n}|i-j|\,p_{ij}$ (2)

The value of this index depends on the order of income transition matrix. Clearly, the value of index based on matrix consisting of quintile income groups will be different from that based on a matrix consisting of, say, decile groups. Hence, the index will not be comparable across studies based on transition matrices of different orders.

These mobility measures are purely statistical in nature and no attempt, except Shorrocks (1978b), has been made to understand their welfare properties. Shorrocks presents some axiomatic properties/conditions but encounters conflicts between few of them. One way to avoid conflicts is to drop the problematic/undesirable conditions and add some plausible ones. This is what we do in the next section.

3. Axiomatic Properties

We begin with a mobility function, m (i, j), which is required to evaluate movements of individuals across income groups. Four regulatory conditions can be imposed on this function.

1. Non-negativity: $m(i, j) > 0$ for all $i \neq j$; $m(i, j) = 0$ for all $i = j$.

This says that the cross over of at least one income boundary by an individual should count towards mobility. Staying in the same income class makes no contribution to mobility.

The larger the number of income boundaries crossed over by an individual, the greater is the contribution to mobility. Therefore, the following monotonicity condition must be imposed on a mobility function.

2. Monotonicity: For $j > k$, $m (i, i+j) > m (i, i+k)$ and $m (i, i-j) > m (i, i-k)$.

Since we are concerned with the absolute moves, k downward moves should be valued equal to k upward moves. So the following symmetric condition has to be satisfied by the mobility function.

3. Symmetry: $m (i, i + k) = m (i, i-k)$

From the welfare point of view, the interpretation of downward moves is different from the upward moves, to which we shall return latter. At this stage, we note that moving upward or downward is not cost free. It is much harder to make two upward income moves by one individual than to make one upward income move by two individuals. Similarly, it is more depressing for one individual to slip two steps down on income scale than to slip one step down by two individuals. Then, it is reasonable to say that k ($k > 1$) moves by one individual should count more towards mobility than one move by k individuals. This larger move bias can be expressed as:

4. Larger Move Bias: $m (i, i + k) > k\, m (i, i + 1)$; and $m (i, i - k) > k\, m (i, i - 1)$.

Having described the regulatory conditions/ axioms to be imposed on a mobility function, we turn to the discussion of other desirable properties that an aggregate measure of mobility should satisfy. It may be worthwhile to restrict the range of the measure to the interval [0, 1], the lowest value (0) associated with perfect immobility and the highest value (1) with maximum mobility.

5. Normalisation: $0 \leq M \leq 1$.

This does not impose any significant constraint on the construction of an index. Even if a mobility measure crosses these boundaries, it is possible to make transformations by changing the origin such that normalised values lie within a chosen interval.

Before we search for matrix structures that could exhibit complete immobility and maximum mobility, we would like to discuss a monotonicity axiom proposed by Shorrocks (1978b) which is different from our monotonicity axiom 2. The axiom 2 is concerned with the number of boundary cross over by individuals, whereas Shorrocks' (1978b) is concerned with the increase in the off-diagonal elements in the transition matrix. Shorrocks' monotonicity axiom (listed below as axiom 6) says that if one of the off-diagonal elements in the transition matrix increases at the expense of the diagonal component then we may regard the new structure as indicating higher level of mobility and require the index to reflect this change accordingly.

6. Shorrocks' Monotonicity (Shorrocks, 1978b): If we write $P \succ P'$ when $p_{ij} \geq p'_{ij}$ for all $i \neq j$ and $p_{ij} > p'_{ij}$ for some $i \neq j$, then monotonicity is expressed as: $M(P) > M(P')$.

This axiom plays an important role in the choice of matrix structures that can be associated with extreme values of a mobility index. An identity matrix shows that no one has moved away from their original income classes. Shorrocks' monotonicity axiom implies that all other structures will rank higher than an identity matrix. Thus, based on this and our a priori notions, an identity matrix representing immobile structure can be associated with a zero value of the index.

7. Immobility: $M(I) = 0$

At the other end of the scale, we hunt for a matrix or matrices, which could supposedly exhibit maximum mobility. We know from the existing literature that a matrix with identical rows (for example, Matrix P_1), so that the probability of moving to any class is independent of that originally occupied, reveals perfect mobility. In the context of intergenerational mobility, where equality of opportunity is socially desirable, perfect mobility may be taken to represent maximum mobility (Prais, 1955). But in the case of intra-generational mobility, perfect mobility may not be socially desirable as individuals in different stages of their life cycle exhibit specific patterns of earnings. Moreover, the representation of maximum mobility by a perfectly mobile structure conflicts with Shorrocks' monotonicity axiom 6. Hence, a perfectly mobile structure does not exhibit maximum mobility.

Can we assign maximum mobility to a matrix which is exact reversal of an identity matrix? Matrix P_2 represents one such structure in a two state system. In view of monotonicity axiom 6, all other structures of state two with even one non-zero diagonal element will rank lower than matrix P_2. Thus, exact reversal ensures maximum mobility in a two state system. Does the mechanism of exact reversal ensure maximum mobility in the case of three or more states? Matrix P_3 which is exact reversal of an immobile structure of three classes, has one non-zero (positive) cell on the main diagonal, and hence will not exhibit maximum mobility. This will be true for all exactly reversed structures of higher order.

Thus exact reversal rule does not generate structures exhibiting maximum mobility except for two state system.

$$P_1 = \begin{bmatrix} 0.5 & 0.5 \\ 0.5 & 0.5 \end{bmatrix}; P_2 = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}; P_3 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}; P_4 = \begin{bmatrix} 0 & 0 & 1 \\ \lambda & 0 & 1-\lambda \\ 1 & 0 & 0 \end{bmatrix} \text{ where } 0 \le \lambda \le 1.$$

We explore another route to find out matrix structures, which could reveal maximum mobility. Consider a situation where each individual from each income group moves either to the lowest or highest income class ensuring maximum number of income boundary cross over. For example, in matrix P_4, which is of the order three, all individuals from lowest income strata have moved to highest income strata and all those from the highest income strata moved to lowest income strata by crossing over of two income boundaries. An individual in the middle-income strata had the choice of moving either to the lowest or highest income strata by crossing one income boundary. From the mobility point of view, it does not matter whether an individual moves to the lowest or highest income class as far as such moves involve equal numbers of boundary cross over. For this reason, a proportion λ ($0 \le \lambda \le 1$) of individuals from the middle group are shown to have moved to the lowest income group and rest to the highest income group. The monotonicity axiom 6 suggests that any other structure of order three will rank lower than matrix P_4. Hence matrix P_4 exhibits maximum mobility.

The maximum boundaries cross over (MBC) rule is applicable to matrices of any order to obtain structures that can be associated with maximum mobility. We make two statements to identify such structures.

Statement 1: A matrix structure of the order of even number will exhibit maximum mobility if it shows all individuals from the lower half of income groups to have moved to highest income group and all those from the upper half of income groups to have moved to lowest income group.

Statement 2: A matrix of the order of odd number will exhibit maximum mobility if it shows all individuals from the lower (n-1)/2 income groups to have moved to the highest income group, all those from the upper (n-1)/2 income groups to have moved to the lowest income group, and all individuals from the middle group to have moved to the lowest and highest income groups in any proportion.

Thus, there will be a large number of matrix structures of the order of odd number exhibiting maximum mobility, whereas only one matrix structure of the order of even number will show maximum mobility. If we represent a matrix structure that exhibits maximum mobility by P_{max}, then the mobility index associated with this can be assigned a value of one.

8. Maximum Mobility: $M(P_{max}) = 1$

The matrices P_2 and P_4 are the examples of P_{max} structures. The P_{max} structure of order 4 will have $p_{14} = p_{24} = p_{31} = p_{41} = 1$ and all other cells will have zero values. The P_{max} matrix of order 5 will have the following entries: $p_{15} = p_{25} = p_{41} = p_{51} = 1$, $p_{31} = \lambda$, $p_{35} = 1-\lambda$, and all other cells will have zero values.

P_{max} matrices are not likely to be observed from the existing data and they may also not be socially desirable The situation is akin to Gini index which takes maximum value unity when only one person has income and every one else in the society has no income. This latter situation is socially undesirable and has never been observed in reality. However, the extreme situations or structures serve to provide the boundary values for inequality and mobility measures.

From policy perspective it is important to know how different income groups contribute to overall income mobility in the society. This will require the aggregate measure to be additively decomposable into income subgroup mobility components.

9. Subgroup Decomposability (SD): $M = \sum_{i=1}^{n} v_i m(i)$

The contribution of i-th income group to total mobility will be represented by $v_i m(i)$, where m(i) is the valuation of income movements in the i-th income group and v_i (i =1, 2…, n) serve as the weights. Income mobility among relatively poor groups is of particular interest as it rules out the possibility of chronic or long run poverty. We may accommodate this concern by assigning greater weights to income movements in these groups. Following Gini index, we can attach rank-based social weights (preferences) to mobility in different income groups. If income groups in the transition matrix are arranged from lowest to highest, the pro-poor social preferences may be represented by the following weights.

10. Pro-poor Social Preferences: $w_i = (n + 1 - i)$ $\quad i = 1, 2…, n.$

The highest weight of n is attached to mobility in the lowest income (poorest) group, n-1 to mobility in second lowest group and so on such that the lowest weight of 1 is attached to mobility in the richest group n. These weights can be normalised to lie between zero and one as

$$\tilde{w}_i = (n + 1 - i) / [n (n+1)/2] \quad i = 1, 2\ldots, n. \tag{3}$$

The pro-poor social preferences could also be generalised as

$$\tilde{w}_i(\varepsilon) = (n + 1 - i)^{\varepsilon} / \sum_{i=1}^{n} (n + 1 - i)^{\varepsilon} \text{ for } 0 < \varepsilon \leq 1, \tag{3a}$$

where ε is a pro-poor preference parameter. The higher the value of ε, the larger is the weight attached to income movements among the poor. If ε→0, the social preferences will be neutral to income groups. For the sake of simplicity, we prefer to stick to the pro-poor preference structure given by (3).

The upper off-diagonal cells in the transition matrix represent upward movers on the income scale whereas those in the lower off-diagonal cells are downward movers. It will be useful if the aggregate mobility can be decomposed into these directional components.

11. Directional Decomposability: $M = M_D + M_U$

where M_D and M_U denote respectively the downward and upward mobility components.

4. A Measure of Income Mobility

If m (i, j) is a mobility function and P a transition matrix of order n, then the expected mobility in the i-th income group is given by

$$m(i) = \sum_{j=1}^{n} m(i, j)\, p_{ij}\,. \tag{4}$$

Then the aggregate mobility may be defined as a weighted average of income group specific mobilities.

$$M_0(P) = \sum_{i=1}^{n} v_i m(i) = \sum_{i=1}^{n} \sum_{j=1}^{n} v_i m(i, j)\, p_{ij} \tag{5}$$

For an empirical application, the income mobility function, m (i, j), needs to be specified. A functional form that satisfies all the four desirable properties, namely, non-negativity, symmetry, monotonicity and larger move bias may be specified as

$$m(i, j) = |i - j|^{\alpha} \text{ for } i \neq j \qquad \alpha > 1$$
$$= 0 \quad \text{for } i = j \qquad (6)$$

where α serves as a larger move bias parameter. A higher value of α attaches greater weight to the larger distance travelled on the income scale. Note that the number of income boundaries crossed over measures the distance. The choice for values for $\alpha > 1$ is left to the subjective judgement of researchers.

Substituting (6) and replacing v_i by normalised weights into (5), we get

$$M_0(P) = \sum_{i=1}^{n} \tilde{w}_i m(i) = \frac{2}{n(n+1)} \sum_{i=1}^{n} (n+1-i) \sum_{j \neq i}^{n} |i-j|^{\alpha} \; p_{ij} \qquad (7)$$

Note that $M_0(P)$ will assume maximum value based on P_{max} matrix created by MBC rule. Its expression will vary depending on whether n is an even or odd number. If n is even, then

$$M_0(P_{max}) = \frac{2}{n(n+1)} \sum_{i=1}^{n} (n+1-i) \sum_{j \neq i}^{n} |i-j|^{\alpha} \; p_{max\,ij} = \frac{2}{n(n+1)} \sum_{i=1}^{n/2} (n+1)|i-n|^{\alpha}$$
$$= (2/n) \sum_{i=1}^{n/2} |i-n|^{\alpha}. \qquad (8a)$$

If n is odd, then

$$M_0(P_{max}) = (2/n) \sum_{i=1}^{(n-1)/2} |i-n|^{\alpha} + (1/n) \left(\frac{n-1}{2} \right)^{\alpha} . \qquad (8b)$$

Dividing $M_0(P)$ by $M_0(P_{max})$, we have an aggregate normalised measure of mobility on a unit scale.

$$M = \sum_{i=1}^{n} \tilde{w}_i m(i) / M_0(P_{max)}) \qquad (9)$$

Note that $0 \leq M \leq 1$. M = 0 implies immobility (when P = I), M = 1 implies maximum mobility (when $P = P_{max}$) and all other values lying between zero and unity show different degrees of mobility.

The index M is additively decomposed, where $\tilde{w}_i m(i) / M_0(P_{max})$ reveals the contribution of i-th group to aggregate mobility. M can also be shown to be additively decomposable into downward and upward income mobility components. The downward mobility will be evaluated based on the lower off-diagonal cells and upward mobility based on upper off-diagonal cells respectively as

$$M_{0D}(P) = \sum_{i=2}^{n} \tilde{w}_i \sum_{j=1}^{i-1} (i-j)^{\alpha}\ p_{ij} \qquad (10)$$

$$M_{0U}(P) = \sum_{i=1}^{n-1} \tilde{w}_i \sum_{j=i+1}^{n} |i-j|^{\alpha} p_{ij} \qquad (11)$$

Since $M_0(P) = M_{0D}(P) + M_{0U}(P)$, we can express M as the sum of downward and upward income mobility components.

$$M = (M_{0D}(P) / M_0(P_{max})) + (M_{0U}(P) / M_0(P_{max}))$$
$$= M_D + M_U \qquad (12)$$

The proposed mobility index M satisfies all the desirable properties. Note that for $\alpha = 0$, $\tilde{w}_i = 1/n$ for all i, M reduces to Prais-Bibby index (M_T). The mobility function underlying this index is: m (i, j) = 1 all $i \neq j$ and 0 for all i = j. This function does not satisfy the axioms of monotonicity and larger move bias. The Bartholomew index (M_B) is based on based on the mobility function: m (i, j) = $|i- j|$ for $i \neq j$, 0 otherwise. This mobility function ignores the axiom of larger move bias. We may also note that both M_T and M_B do not accommodate pro-poor social preferences and the later is also not normalised making it completely non-comparable with indices based on matrices of different orders. Both the measures possess the properties of directional and sub-group decomposability.

5. The Extent of Income Mobility in China and the United States

The mobility M and other traditional mobility indices are computed based on income transition matrices (in quintile forms) for all individuals as well as for men and women separately for urban China and the United States. While the transition matrices are available in Khor and Pencavel (2006), we reproduce them here for a ready reference (see Appendix Tables A1 and A2). The transition matrices for Urban China are constructed based on panel data on income distribution for 1990 and 1995 for 10184 individuals aged 22 to 69 years in 1995. The data comes from the Chinese Household Income Project Survey conducted in 1996 which asks each individual to report their total income not only for 1995 but also for each of the previous five years. The income data for 1990 are expressed in 1995 Yuan by using the consumer price index as a deflator.

The US transition matrices are constructed based on panel data on income distribution for 1847 urban Americans aged 17 to 63 in 1993. The data come from the Panel Study of

Income Dynamics (PSID), a primary longitudinal survey in the United States. The data relate to 1993 and 1998 and were collected in PSID surveys of 1994 and 1999. All incomes are expressed in 1996 dollars by using the personal consumption expenditure price deflators. The data for the US and China are quite comparable, see Khor and Pencavel (2006) for details.

The Prais-Bibby mobility indices show that about two third of Chinese individuals have moved away from their quintile groups over a period of five years; the corresponding figure for the US individuals is even less than 50 percent (Table 1). In the United States, about 60 percent of individuals from the lowest quintile have stayed there even after five years; the corresponding figure for China is 43 per cent (see Appendix Tables A1 and A2). If we assume that all individuals in the lowest quintile are 'poor' in each country, then 12 percent of poor in the United States and 8.5 per cent of poor in China have been found in the same state even after five years. This would imply that economic growth has not tricked down to a large section of poor in both the economies.

The Bartholomew indices indicate that the average quintile move in China is 1.07 whereas it is only 0.48 in the United States (Table 1). This reveals that the distance travelled on the income scale by individuals in China is double of that in the United States. The values of new mobility index M (at α =1.25) for China and the United States are respectively 0.257 and 0.141 (Table 2) These figures reveal that the extent of mobility in China is about 80 percent higher than that in the United States. Mobility in the lower two quintiles contributes about two-third of the aggregate mobility (Table 3). This may be taken to mean that poverty is largely of transitory nature in both the economies. The highest quintile contributes little to aggregate mobility in each economy. Another interesting finding is that upward mobility contributes about two-third to the aggregate mobility in each economy (Table 4). This may be taken to imply that the gains of upward mobility are larger than the losses caused by downward mobility.

Income mobility among women is somewhat higher than the men in both the economies. This may be due to differences in their responsibilities to their families. Men being the main bread earners tend to stick to stable jobs to avoid income turbulence. On the contrary, women not only change their jobs but also their labor force status more recurrently due to their child rearing and other household responsibilities. This makes females more mobile on the income scale.

In order to check the sensitivity of results to the choice of the larger move bias parameter α, we calculated the aggregate mobility measure M corresponding to $\alpha = 2.00$. While the values of M based on $\alpha = 2.00$ are slightly different from those based on $\alpha = 1.50$, our main conclusions remain unchanged.

6. Concluding Remarks

This paper has developed an aggregate income mobility measure based on income transition matrices. The proposed measure satisfies certain desirable properties. It is additively decomposable into upward and downward mobility components which help us in understanding the nature of mobility in the society. The proposed measure is also additively decomposable into income group mobility components that enable us to see whether mobility amongst the lower income groups is different from that among the higher income groups. An application of the new and traditional mobility measures to the Chinese and US data reveal some interesting points. Over a period of five years, China shows much higher income mobility than the US. In each economy, a large proportion of income mobility exits in the lower quintiles. This and the fact that upward mobility contributes most to the aggregate income mobility, rules out the possibility of chronic poverty in both the economies.

Table 1 Estimates of Prais-Bibby and Bartholomew indices of Mobility

Gender	Immobility Ratio (trace (P)/n) (%)	Prais-Bibby Index (Mover Count Ratio) (%)	Bartholomew Index (Quintile Move)
China (1990- 1995)			
All	33.42	66.58	1.05
Men	33.33	66.67	1.06
Women	33.92	66.08	1.07
US (1993-1998)			
All	52.26	47.76	0.48
Men	51.96	48.04	0.64
Women	49.24	50.76	0.70

Table 2: Estimates of Mobility index (M)

	At $\alpha = 1.5$	At $\alpha = 2.00$
China (1990- 1995)		
All	0.257	0.203
Men	0.257	0.202
Women	0.267	0.213
US (1993-1998)		
All	0.141	0.101
Men	0.144	0.104
Women	0.166	0.123

Table 3: The Quintile Contributions to Mobility based on the Index M (Percentages)

Quintiles	China (1990- 1995)			US (1993-1998)		
	All	Men	Women	All	Men	Women
At $\alpha = 1.5$						
I	37.90	37.42	38.38	39.34	35.46	41.60
II	25.72	25.83	26.19	26.53	28.00	24.37
III	18.14	17.91	17.19	20.02	20.08	18.49
IV	12.83	13.40	12.96	12.00	12.37	11.08
V	5.41	5.44	5.28	4.11	4.09	4.46
At $\alpha = 2.0$						
I	41.85	41.16	42.12	41.92	39.88	46.29
II	24.57	24.77	25.27	24.51	26.73	22.25
III	15.93	15.75	14.95	18.07	17.94	16.13
IV	12.05	12.73	12.25	11.26	11.32	10.41
V	5.59	5.59	5.40	4.24	4.13	4.92

Table 4: Estimates of Directional Mobility at α = 1.5 and 2.0

Gender	Downward Mobility	Upward Mobility	Contribution of Downward Mobility to Aggregate Mobility (%)	Contribution of Upward Mobility to Aggregate Mobility (%)
At α = 1.5				
China (1990- 1995)				
All	0.081	0.176	31.46	68.54
Men	0.081	0.176	31.60	68.40
Women	0.083	0.184	30.98	69.02
US (1993-1998)				
All	0.049	0.092	34.44	65.56
Males	0.049	0.095	33.88	66.12
Females	0.055	0.111	33.07	66.93
At α = 2.0				
China (1990- 1995)				
All	0.058	0.144	28.74	71.26
Men	0.059	0.143	29.07	70.93
Women	0.060	0.153	28.21	71.79
US (1993-1998)				
All	0.031	0.070	31.13	68.87
Men	0.032	0.072	30.29	69.71
Women	0.037	0.086	29.66	70.34

Appendix Table A1: Income Transition Matrix for China: All Individuals, Men and Women, 1990-95

All Individuals (10,184)						
Year 1995						
Year 1990	Quintiles	I	II	III	IV	V
	I	0.439	0.219	0.177	0.115	0.049
	II	0.277	0.260	0.203	0.161	0.099
	III	0.187	0.242	0.227	0.208	0.136
	IV	0.076	0.206	0.249	0.249	0.220
	V	0.021	0.073	0.144	0.266	0.496
All Men (5,372)						
Year 1995						
Year 1990	Quintiles	I	II	III	IV	V
	I	0.436	0.228	0.175	0.115	0.046
	II	0.274	0.268	0.187	0.174	0.097
	III	0.184	0.227	0.237	0.215	0.136
	IV	0.087	0.209	0.238	0.235	0.230
	V	0.020	0.067	0.162	0.262	0.491
All Women (4,812)						
Year 1995						
Year 1990	Quintiles	I	II	III	IV	V
	I	0.436	0.200	0.179	0.141	0.045
	II	0.266	0.264	0.186	0.164	0.119
	III	0.186	0.251	0.244	0.184	0.135
	IV	0.089	0.219	0.232	0.255	0.204
	V	0.023	0.067	0.159	0.256	0.497

Source: Khor and Pencavel (2006)

Appendix Table A2: Income Transition Matrix for the United States: All Individuals, Men and Women, 1993-98

All Individuals (1,147)						
Year 1998						
Year 1993	Quintiles	I	II	III	IV	V
	I	0.591	0.236	0.111	0.043	0.019
	II	0.290	0.417	0.192	0.076	0.024
	III	0.081	0.274	0.420	0.171	0.054
	IV	0.030	0.054	0.236	0.480	0.199
	V	0.008	0.019	0.041	0.230	0.704
All Men (1,038)						
Year 1998						
Year 1993	Quintiles	I	II	III	IV	V
	I	0.615	0.216	0.111	0.034	0.024
	II	0.269	0.428	0.183	0.082	0.039
	III	0.087	0.260	0.409	0.192	0.053
	IV	0.019	0.087	0.245	0.457	0.194
	V	0.010	0.010	0.053	0.236	0.689
All Women (809)						
Year 1998						
Year 1993	Quintiles	I	II	III	IV	V
	I	0.525	0.241	0.130	0.086	0.019
	II	0.315	0.395	0.185	0.068	0.037
	III	0.086	0.309	0.377	0.167	0.062
	IV	0.049	0.037	0.259	0.469	0.186
	V	0.025	0.019	0.049	0.210	0.696

Source: Khor and Pencavel (2006)

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