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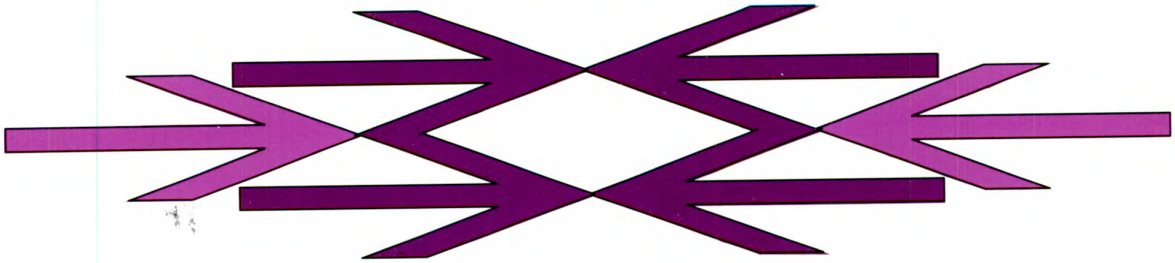
Perspectives on Migration Analysis



Comparing Migration Measures Having Different Intervals
Longitudinal Migration Data From the Survey of Income and Program Participation
Creating Annual State-to-State Migration Flows With Demographic Detail

U.S. Department of Commerce
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Preface

Migration, the movement of people from one geographic area to another, is a phenomenon that is fundamental to the study of demography. Migration is a determinant of differential population growth within the United States both in terms of geographic residential settlement patterns and among various demographic subgroups within the total population. The spatial distribution of people across the United States also influences the character of the social and economic interactions between kin.

There are several different sources of information about migration that are used to estimate overall population movement. The papers in this report present different methodologies and data sources available for detecting and monitoring migration trends. John Long and Celia Boertlein's paper explores the difficulties inherent in working with data based on different migration intervals and offers a proposal for overcoming those difficulties as well as for measuring repeat migration. Diana DeAre's paper addresses possibilities for migration analysis using data from the Census Bureau's longitudinal Survey of Income and Program Participation. Finally, the paper by Signe Wetrogan and John Long discusses a multiple data source approach for estimating annual State-to-State migration flows.

A.J. Norton

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Comparing Migration Measures Having Different Intervals

John F. Long and Celia G. Boertlein

Introduction

A lot of confusion in interpreting migration results is due to a failure to notice that migration data for different-length intervals really measure different aspects of the migration phenomenon. Short intervals count practically all moves and tend to be heavily affected by chronic movers. Long intervals are a better measure of the pervasiveness of geographic mobility through the entire population.

The differences in emphasis created by length of the interval mean that for most measures of migration, data from short and long intervals are not comparable. The measure of the number (or proportion) of persons living in a different area at the beginning and end of the migration interval is of particular interest since it is the most commonly used measure of migration frequency in the United States. When used with a 1-year migration interval (as is done for most survey data including recent U.S. Current Population Surveys), this measure emphasizes the movement of those persons who move repeatedly. But, used with a 5-year interval (as is done for the U.S. decennial census question), this measure puts relatively more emphasis on the migration of the less frequent movers since a maximum of one move can be counted. This difference in emphasis is a hindrance in comparing intervals of different length, but it can be used to advantage in determining the degree of repetition in migration.

A synthetic measure of repeat migration can be constructed by multiplying the 1-year mobility rate by five and dividing the product by the 5-year mobility rate. The result of this calculation is an approximation of the actual number of moves per non-return mover. With this synthetic measure of repeat migration, researchers can, for the first time, explore the effects of repeat migration in data sets which did not specifically ask questions on repeat migration.

In this paper, we first outline the problems arising from differing intervals, explore their causes and effects, and give some guidelines for dealing with these differences. Then, we propose a method that takes advantage of the idiosyncrasies of migration measures of different lengths to produce a measure of repeat migration.

Problems of Differing Length Migration Intervals

The frustrations arising from differing length migration intervals can be illustrated. One-year mobility data from the Current Population Surveys are not comparable to 5-year data from the decennial censuses (Bogue, 1979: 791-793). Data for 10-year intervals using residual methods prove difficult to reconcile with 5-year data from direct questions (Vaidyanathan, 1969: 233-243). Populations which appear highly mobile relative to others using 1-year data may reveal relatively low 5-year mobility (Ladinsky, 1967: 479-481). Migration data from the 1970's Current Population Surveys, which have variable-length migration intervals, are difficult to compare with each other or with other data sets. Confusion over how to handle these different intervals leads to short-cut methods which grossly distort the migration data, to indiscriminate use of data for a short interval rather than a long interval, and, worst of all, to the neglect of useful data simply because of uncertainty over proper methods of comparison.

Nowhere is this confusion more evident than in the practice of dividing migration values for a multi-year period by the number of years in the period to get an average annual migration rate (Fabricant, 1970: 20; Rogers, 1975: 70,71). This strategy works for some migration measures, but for others it leads to a gross underestimate of annual migration (Shryock, 1964: 25). Only a full explanation of the differences between migration data of differing intervals and the effect of those differences on each of the major types of migration measures can dispel this present confusion.

Partial explanations of the effects of different intervals have been set forth previously. Ladinsky (1967: 479-81) attributed the differences to return migration while Bogue (1969: 791-793) laid the blame on other repeat migration. A full explanation requires a scheme which can handle the effects of both of these types of migration. Such a scheme is the move-mover distinction (Courgeau, 1973; Rees, 1977). The distinction made is between the usual conceptualization of migration as the number of moves made and the actual measurement of migration as the number of movers during the period. The number of moves includes all types of moves: primary, return, and other repeat. The total number of moves will increase linearly with time if the underlying migration process remains unchanged. However, the number of movers does not increase linearly since return and repeat moves do not increase the number of movers.

The effect of the move-mover distinction on migration measures is related to the length of the migration interval. For all intervals, standard migration measures compare present and past residences and thus approximate the number of movers rather than the number of moves. For short migration intervals such as 1 year, the migration results give a fairly accurate approximation of the number of moves since few movers are likely to move more than once in a short interval (Courgeau, 1973). As the interval lengthens, the probability of return and other repeat migration increases and the measured number of movers increasingly diverges from the actual number of moves. Relatively long intervals such as 5 years produce migration data on the number of movers which may differ markedly from the actual number of moves.

The increasing difference between the number of moves and the actual number of movers as the migration interval lengthens affects each type of migration measure differently. For some measures, in particular net migration for an area, return and other repeat moves

cancel out. In such cases, the results obtained by counting the number of moves or by counting the number of movers are equivalent and the interval of migration has a simple linear effect on the migration measure. On the contrary, data pertaining to the volume of migration (e.g., gross migration for an area or migration flows between areas) are not directly comparable because of complications arising from the move-mover distinction. An examination of each type of migration measure is necessary to reveal the exact reasons for these differing effects and the opportunities for further research that result from recognizing the differences.

Number of Persons Residing in a Different Area

Perhaps the most cited measure of the volume of geographic mobility is the number of persons currently living in a different house, county, or state compared to some previous point in time. Any difference in residence between these two dates is measured as migration whereas the same residence at both dates indicates no migration. This observation plan underlies most survey questions on migration used by the U.S. Census Bureau as well as the decennial census question on residence 5 years ago. In effect, this method counts the number of surviving non-return movers over the migration interval and not the actual number of moves—although results are often so misinterpreted.

The choice of the migration interval has a marked effect under this observation plan. Traditionally, national statistical offices have chosen either a 1-year or a 5-year migration interval. Recently, there has been a trend toward using more than a single migration interval. During the 1970's, the migration interval in the Current Population Surveys varied so that data on 1-, 2-, 3-, 4-, and 5-year intervals are available for surveys between 1970 and 1980. Since 1980, 1-year rates are available for each year and 5-year rates were tabulated for 1980-85 and 1981-86.

Table A.
Mobility and Migration Rates for the Intervals Used in Current Population Reports

Interval and rate	1970-75		1975-80		1980-85		Post-1985	
	Period	Rate	Period	Rate	Period	Rate	Period	Rate
Mobility (different house) rates:								
1-year interval	(1970-71)	17.3	(1975-76)	16.6	(1980-81)	16.2	(1985-86)	17.5
					(1981-82)	16.0	(1986-87)	17.6
					(1982-83)	15.6	(1987-88)	17.1
					(1983-84)	16.3		
					(1984-85)	19.1		
2-year interval	(1970-72)	25.1	(1975-77)	26.0	(NA)	(NA)	(NA)	(NA)
3-year interval	(1970-73)	32.7	(1975-78)	34.1	(NA)	(NA)	(NA)	(NA)
4-year interval	(1970-74)	38.9	(1975-79)	40.5	(NA)	(NA)	(NA)	(NA)
5-year interval	(1970-75)	44.5	(1975-80)	45.9	(1980-85)	40.6	(1981-86)	42.7
Migration (different county) rates:								
1-year interval	(1970-71)	6.3	(1975-76)	6.2	(1980-81)	6.1	(1985-86)	6.6
					(1981-82)	6.1	(1986-87)	6.4
					(1982-83)	5.9	(1987-88)	6.2
					(1983-84)	6.3		
					(1984-85)	6.4		
2-year interval	(1970-72)	9.5	(1975-77)	10.2	(NA)	(NA)	(NA)	(NA)
3-year interval	(1970-73)	12.9	(1975-78)	13.7	(NA)	(NA)	(NA)	(NA)
4-year interval	(1970-74)	15.6	(1975-79)	17.2	(NA)	(NA)	(NA)	(NA)
5-year interval	(1970-75)	18.4	(1975-80)	19.7	(1980-85)	18.1	(1981-86)	17.1

Source: Tabulations consistent with U.S. Bureau of the Census, Current Population Reports, Series P-20, various reports on Geographical Mobility and unpublished tabulations.

Table B.
Ratios Between Mobility (Different House) Rates in CPS: 1975-80 and 1970-75
(1970-75 ratio in parentheses)

Denominator interval in years	Numerator interval in years				
	1	2	3	4	5
1	1.00	1.56	2.05	2.44	2.77
	(1.00)	(1.45)	(1.89)	(2.25)	(2.57)
2	.64	1.00	1.31	1.56	1.77
	(.69)	(1.00)	(1.30)	(1.55)	(1.77)
3	.49	.76	1.00	1.19	1.35
	(.53)	(.77)	(1.00)	(1.19)	(1.36)
4	.41	.64	.84	1.00	1.13
	(.44)	(.65)	(.84)	(1.00)	(1.14)
5	.36	.56	.74	.88	1.00
	(.39)	(.56)	(.74)	(.88)	(1.00)

Source: Calculated from table A.

The 1971 through 1988 Current Population Surveys provide the opportunity for examining two sets of varying-length interval mobility (change of residence to a different house) and migration (change of county of residence) data. The upper portion of Table A presents the mobility rates obtained for various periods. The percentage of the population living in a different house ranges from 15.6 to 19.1 percent for 1-year intervals and 40.6 to 45.9 percent for 5-year intervals. Migration rates between counties are shown in the lower portion of Table A. The pattern is similar to that for mobility rates, although

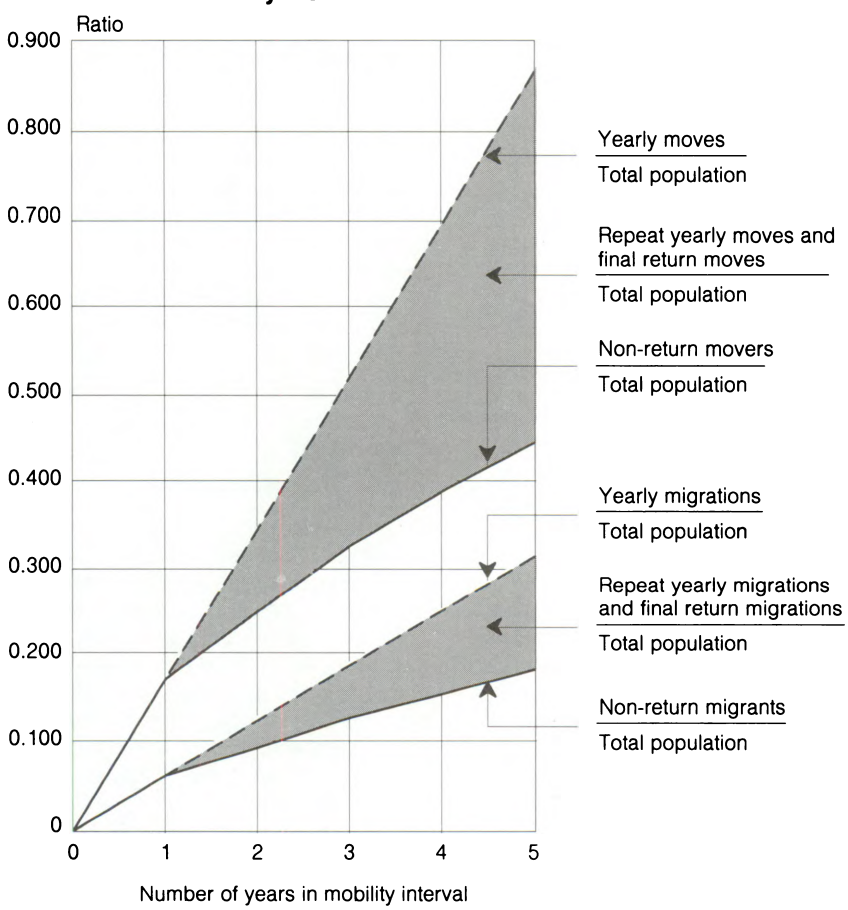
Table C.
Ratios Between Migration (Different County) Rates in CPS: 1975-80 and 1970-75

(1970-75 ratios in parentheses)

Denominator interval in years	Numerator interval in years				
	1	2	3	4	5
1	1.00	1.64	2.21	2.76	3.16
	(1.00)	(1.52)	(2.05)	(2.48)	(2.93)
2	.61	1.00	1.35	1.69	1.93
	(.69)	(1.00)	(1.30)	(1.55)	(1.77)
3	.46	.74	1.00	1.25	1.43
	(.49)	(.74)	(1.00)	(1.21)	(1.43)
4	.36	.59	.84	1.00	1.15
	(.40)	(.61)	(.83)	(1.00)	(1.18)
5	.32	.52	.70	.87	1.00
	(.34)	(.52)	(.70)	(.85)	(1.00)

Source: Calculated from table A.

Figure 1.
Observed CPS Mobility and Migration Rates Compared With the Ratio of Number of Yearly Moves: 1970-75



the rates are much smaller, ranging from 5.9 to 6.6 percent for 1-year intervals and 17.1 to 19.7 percent for 5-year intervals.

Users of different length interval migration data have often requested a conversion chart between varying intervals that would permit data obtained using one interval to be compared to data obtained using a different interval. A universally applicable conversion chart is not possible since the relationship depends on particular characteristics of each population. However, Tables B and C provide ratios for mobility (different house) and migration (different county) rates, respectively, that could be used in such a conversion if the user is willing to assume the population was similar to the total U.S. population in its degree of return and repeat movement. Ratios for both the 1975-80 and 1970-75 (shown in parentheses) periods are shown to illustrate the degree of stability of the ratios. The discrepancies appear in conversion of 1-year rates to longer rates—perhaps the result of the higher statistical errors of 1-year rates or in temporal instabilities that are less likely to be smoothed out with 1-year intervals.

These tables provide only a rough empirical set of conversion factors between different length intervals—and even that is specific to the given population and to the given periods. What is necessary to provide an explanation for the observed ratios is a formulation of the data in terms of the move-mover distinction. Figure 1 provides a graphical presentation of these different results using Current Population Survey data from 1970 through 1975 on the observed proportion of persons 5 years old and over living in a different house and in a different county for migration intervals of 1-, 2-, 3-, 4-, and 5-years (solid lines). These lines represent the approximate proportion of movers for each of the migration intervals. A more exact description of the actual coverage of this migration measure is the proportion of the population which consists of non-return movers during the interval.

If the n-year mobility rate were equal to n times the 1-year rate, these observed values would have followed the dashed

lines extended from the 1-year mobility rates. Such a linear increase with the length of the mobility period would be expected from a plot of the ratio of the number of moves (more precisely, the number of years with moves) in the interval to the total population. Since the number of moves and the number of movers diverge as the migration interval lengthens there is an increasing difference between n times the 1-year rate and the n-year rate. By the end of 5 years, the ratio of moves to total population projected from the 1970-71 1-year mobility rate is 87 per 100 while the actual ratio of movers to total population represented by the 5-year rate for 1970-75 is only 44 per 100. The inter-county 1-year migration rate shows a similar behavior with an projected ratio of migrations to total population of 31 per 100 but an actual 5-year migration rate of only 18 per 100. Later in this paper the number of moves and movers will be compared to extract information on the extent of chronic movement in the population, but first it is important to specify clearly the exact mechanism responsible for the differences in migration coverage.

Differences in the number of persons indicated as residing in a different residence using different length migration intervals are primarily due to return and other repeat moves. A set of hypothetical residence histories over a 2-year period illustrates the exact reasons for the different results found when using different mobility intervals (Table D). For the sake of simplicity, this set of residence histories refers to migrations between areas, but similar arguments apply to moves between residences. In this set, X represents the initial area of residence, Y represents the second area, and Z represents the third area. If we assume that the proportion of the population which dies during the interval is negligible, if no age groups which could have been born during the interval are included, and if each individual makes no more than one migration in any 1-year period, then the possible residence histories over a 2-year period are XXX (no move), XXY (single move in the second year), XYY (single move in first year), XYX (return migration), and XYZ (other repeat migration). Table D indicates the particular patterns of residence counted as migration during the two 1-year periods and during the 2-year interval. As the last column shows, the differences between the combined 1-year migration values and the migration measured by a 2-year interval is not zero but is equal to two times the number of return migrants (XYX) plus the number of other repeat migrants (XYZ).

Table D.
Comparison of Categories of Migration Patterns Counted by Residence Change Migration Volume Measures for 1- and 2-Year Periods

(X first area of residence; Y second area of residence; Z third area of residence)

Subject	First 1-year period	Second 1-year period	Combined 1-year periods	2-year period	Difference between combined 1-year and 2-year periods
Migration volume: Number of persons living in a different area.	XYX + XYY + XYZ	XXY + XYZ + XYX	2 XYX + XYY + 2 XYZ + XXY	XXY + XYY + XYZ	2 XYX + XYZ

Similar results are obtained for longer migration intervals. Given the above assumptions, the number of years in the interval multiplied by the average 1-year rate should equal the ratio of the total number of migrations during the interval to the total population. The n-year residence change rate represents the proportion of the population which consists of all migrants excluding the final return migrants (since they are in the same area of residence at the beginning and at the end of the period). Thus, the difference between n times the 1-year value and the n-year value represents all of the repeat migrations plus the number of final return migrants. However, the repeat migrations include both the final return migrations and the other repeat migrations. Since the number of final return migrants equals the number of final return migrations, the difference between the two methods of measuring migration is twice the number of final return migrants plus the other repeat migrations. Equation 1 expresses this finding in terms of migration rates.

$$np - u = 2f + g \qquad (1)$$

where:

- n is the number of years in the interval
- p is the average 1-year migration rate
- u is the n-year migration rate
- f is the ratio of final return migrants to the total population
- g is the ratio of all other repeat migrations to the total population

So far, we have only discussed the difference in migration counts using a measure of migration volume, the number of persons living in a different area n years earlier. Differences in intervals have idiosyncratic effects for each of the other measures of migration (gross and net migration balances and gross and net migration flows). We cover these effects in appendix A.

Choice of Migration Intervals

Of the five commonly used measures of migration only one, the net migration balance for an area, gives the same results for one period of n years and n periods of 1 year. With any of the other migration measures, data from one interval are not comparable with data from intervals of other lengths. Furthermore, even when only one length of interval is to be used, the length of the chosen migration interval may affect the results. The implicit or explicit decision as to which migration interval to use is thus quite important.

Migration periods of different lengths emphasize different aspects of migration phenomena, and thus comparisons between measures of different lengths can provide the opportunity to increase our depth of understanding of migration. For example, the usual measure of the volume of residential mobility from census and CPS surveys indicates that approximately 20 percent of the population moved in the 1-year periods from 1948-71, and about 45 percent moved in the 5-year periods from 1955-60, 1965- 70, and 1970-75. The 1-year rate counts any difference in residence between the beginning and the end of the 1-year interval as a move and, thus, counts most of the total moves made. Given a choice of interval, migration scholars often use the 1-year rate since it counts almost all moves (Weeden, 1973: 49-51). However, for some purposes the 1-year rate is overly influenced by chronic movers (Goldstein, 1954: 540) and the 5-year rate better approximates the mobility rate affecting most of the population. Hence, over a 5-year period, the aggregate of five 1-year rates would count almost all moves while the 5-year rate would count almost all movers with each mover being counted only once. Determination of the best interval depends on the exact question to be answered.

In multi-regional demographic analysis this problem can be especially severe since most of the other vital rates (births and deaths) are measured on an annual basis while migration is often measured on a 5-year basis. While considerable effort has gone into obtaining 1-year migration data or converting 5-year rates to 1-year rates, the advisability of such an approach seems questionable. Suppose the objective of a multi-regional model is to explain (or predict) population changes over a 10-year period. The use of 1-year rates with their emphasis on the moves of chronic migrants (whose patterns of return and repeat migration are often influenced by previous residence patterns) represents a substantial violation of the Markov assumption that future residence is dependent on the present residence and not on any previous patterns of residence change. The cumulative effects of these violations of the Markov assumption over 10 iterations of the multi-regional Markov model using 1-year rates may be substantial. Since 5-year rates de-emphasize the effects of chronic movers and correct for return and repeat migration, the violations of the Markov assumption after two iterations of a 5-year model should be much less. Perhaps the best way to take account of the effects of chronic movement is to include it specifically into the multi-regional model along the lines of research by Kitsul and Philipov (1980).

Comparing relative migration levels for different years or different groups can give different results if 1-year data are used instead of 5-year data. Ladinsky's (1967: 479) comparison of migration levels by occupation revealed that in terms of 1-year migration rates from 1964-65, farm laborers and foremen moved as often as professionals (10 percent migration a year). However, 5-year migration rates for 1955 to 1960 indicated that professionals are almost twice as mobile (30 percent over 5 years) as farm laborers and foremen (17 percent over 5 years). There are two possible reasons for the differing results other than the unlikely chance that migration rates might have changed drastically between the two time periods. A portion of the relatively lower 5-year migration rate for farm laborers may be due to a greater tendency to return to the place of origin. More than likely the main reason is the higher level of repeat migration for farm laborers caused by a small group of highly mobile farm workers who are likely to move each year inflating the 1-year rates. Since the majority of farm laborers are more sedentary, the actual number of migrants (and consequently the 5- year migration rate) will be relatively lower than that for professionals where the mobility is more widely dispersed throughout the occupation group.

A similar type of confusion might occur when comparing migration trends over time. For example, the 1-year CPS total mobility rate (including movers from abroad) was significantly lower in 1976 than it was in 1971. From such evidence one might suspect that mobility declined over the 5 years from 1971 to 1976. However, the 2-year CPS mobility rate including movers from abroad was significantly higher in 1977 than it was in 1972. This seems to imply that mobility increased over the 5 years from 1972 to 1977. These contradictory findings might be due to some change in mobility in the last half of the 2-year periods, but they could also be due to the change in emphasis from the number of moves to the number of movers as the periods become longer. It could well be that over the 5 years the number of moves declined while the number of movers increased. Such a trend would indicate a decline in the proportion of chronic movers in the population and a decline in the number of moves per mover.

Migration intervals should always be chosen with care, even when only one interval is to be used for the entire analysis. All too often the student of migration accepts any length of migration interval for which data are readily available with no thought as to the effect on the results. There is a qualitative as well as a quantitative difference between 1-year data, influenced as they are by chronic movers, and 5-year data that better represent the degree to which the entire population is mobile.

Using Different Intervals to Determine the Extent of Repeat Migration

Recognition of these differences in emphasis of short and long migration intervals provides the opportunity to extract data on repeat migration by combining information from different intervals. Traditional migration measures obscure a major element of the set of migration phenomena—the extent of repeat mi-

Table E.
Comparison of Migrations and Migrants from the Canadian Census and U.S. Current Population Survey

(Numbers are from actual questions on the Canadian census; percentages are inferences from 1- and 5-year questions on the CPS)

Age of migrant	Canada (number)					United States (percent of end-year population)		
	Migrations excluding abroad (thous.)	Migrants excluding abroad (thous.)	Migrations per migrant	Non-return migrants excluding abroad (thous.)	Migrations per non-return migrant	Average 1-year CPS different county rate*	5-year 1975 CPS different county rate**	Migrations per non-return migrant
5 to 64 years old	8,218	4,278	1.92	3,703	2.22	7.30	20.38	1.79
5 to 14 years	1,806	1,017	1.78	892	2.03	6.77	20.55	1.65
15 to 19 years	710	400	1.78	354	2.01	4.70	14.91	1.58
20 to 24 years	1,693	725	2.33	610	2.78	11.93	29.91	2.00
25 to 29 years	1,449	650	2.23	542	2.67	14.51	39.18	1.85
30 to 34 years	783	410	1.91	353	2.22	9.39	28.95	1.62
35 to 44 years	905	530	1.71	467	1.94	5.73	18.22	1.57
45 to 64 years	871	546	1.59	486	1.79	3.06	10.53	1.45

* Age-adjusted average of 1970-71 and 1975-76 CPS different county migration rates.

**As noted earlier, this estimate of migrations per migrant assumes that no one enters or leaves the specified population during the 5-year migration period. For age specific migration rates this assumption is not met without further standardization. The problem arises since persons 20-24 at end of the period report 1-year migration data during times in which they may have been anywhere from 19 to 24. However the 5-year migration data for the same group refers to persons aged anywhere from 16 to 24 at the time of migration. A standardization can be performed by weighting 1-year migration data for single years of age by a factor corresponding to the likelihood of the migration period of that age group to be represented in the migration interval. Those 20 years old at the end of the period were 16, 17, 18, 19, or 20 during the previous 5 years, while those 21 were 17, 18, 19, 20, or 21, those 22 were 18, 19, 20, 21, or 22, those 23 were 19, 20, 21, 22, or 23, and those 24 at the end of the period were 20, 21, 22, 23, or 24. Standardizing the 1-year rate for this group requires taking the following weighted average:

$$\frac{1}{25}(P_{16} + 2P_{17} + 3P_{18} + 4P_{19} + 5P_{20} + 4P_{21} + 3P_{22} + 2P_{23} + P_{24})$$

where P_x is the 1-year migration rate for persons aged x. Standardized 1-year rates of this form are used in this table.

Sources: Statistics Canada, 1974: table 18; special tabulations consistent with U.S. Bureau of the Census, 1972; 1975; 1977.

grations. A number of researchers (Morrison, 1971; Goldstein, 1954) have noted the importance of repeat migration as a factor in migration rates and have lamented the lack of data on repeat migration in U.S. Census and Current Population Survey data. Without much data from the Census and CPS, researchers have had to be content with data on repeat migration for selected subpopulations covered by residence histories, special surveys, and administrative records.

One of the principal methods for measuring the amount of repeat migration has been to ask two questions on migration within the same survey. One question collects data on the number of moves by migrants during the period and the other obtains information on whether the residence at the end of the period is the same as that at the beginning of the period. These two questions permit a measure of the influence of repeat migration by dividing the number of moves by the number of movers. Populations which have a large amount of repeat migration will have a higher move per mover ratio than those populations with little repeat migration. One of the most extensive uses of this method to measure repeat migration was in the 1971 Census of Canada (Statistics Canada, 1974).

How can the effect of repeat migration be measured in the absence of specific questions on the number of moves and of complete residence histories? The very factors which create such problems in comparing migration intervals of different length can be quite useful in estimating the extent of repeat migration. Since short mobility intervals approximate the total number of moves while longer intervals approximate the number of movers during the interval, an approximate measure of the number of moves per mover is possible whenever one has mobility data for different length intervals for the same population.

For various populations in the U.S., data from the decennial censuses and the March Current Population Surveys can often be compared to provide an estimate of the amount of repeat mobility which could not otherwise be determined. As this paper showed earlier, five times the average 1-year mobility rate approximates the ratio of the number of yearly moves to the total population during the 5-year period. On the other hand, the 5-year mobility rate is the ratio of the number of movers during the period who are not return movers to the total population. Dividing the quantity five times the 1-year mobility rate by the 5-year mobility rate thus gives the number of yearly moves per nonreturn mover (2).

$$\frac{5 \times \text{1-year mobility rate}}{\text{number of yearly moves}} = \frac{\text{5-year mobility rate}}{\text{number of non-return movers}} \qquad (2)$$

This assumes that no births, deaths, or immigration occurred during the interval—an appropriate assumption with

CPS data for those persons 5 years old and older living in the U.S. at both the beginning and end of the migration interval.

How close is this approximation of the number of yearly moves per non-return mover to a more traditionally measured value of moves per mover? Ideally an answer to this question would involve a test where the same population was asked questions on migration change for two different intervals and a question on the number of moves during the longer interval. Unfortunately such a study is not readily available; so the best alternative is to compare two related populations which use the different methods. The 1971 Census of Canada provides data on the number of migrations per migrant for the 1966-71 period and these results can be compared with U.S. data obtained with the synthetic method of constructing migrations per migrant from CPS data for differing length migration intervals during the 1970 to 1975 period.

The Canadian data include all migrations between municipalities per migrant (columns 1-3 of table E). Since the synthetic method divides by the number of non-return migrants rather than all migrants, it may be useful to see what effect such a change would have on the Canadian data. Column 5 of table E shows that the number of migrations per non-return migrant ranges from 12 to 20 percent higher than the number of migrations per migrant in column 3. However, roughly the same relative degree of repeat migration by age is shown in both methods. Another difference between the two methods is that the synthetic method only counts the one move in a year while the direct method counts all moves. This will create some difference but the general effect should not be very great since the proportion of all moves which are made by the same person within the same calendar year is fairly small (Courgeau, 1973). The effect of this and other differences between the two methods can be seen by comparing the estimates of Canadian data using the direct method and synthetic method estimates for the U.S. CPS. Even though there are differences in the type of geographical units used in the two countries and perhaps in the social determinants of the age-mobility relationship as well, the U.S. data using the synthetic method (column 8, table E) show roughly the same pattern of repeat migration by age as do the Canadian data using the direct method. Thus, the synthetic estimates can provide a reasonably adequate measure of repeat migration in terms of moves per non-return mover whenever 5-year and 1-year rates can be obtained for the same population. This method opens up a large number of data sets or pairs of data sets which previously provided no obvious information on repeat migration (e.g., 1971 Census of Great Britain, 1970 Census and 1966-70 CPS Surveys of U.S., 1975 CPS and 1971 and 1976 CPS of U.S., 1970 Census of Japan, 1971 Census and Survey of Australia).

Illustrative Comparisons of Synthetic Estimates of Migrations per Migrant

In this article there is space for only a few illustrative examples of the amount of data which can be extracted from existing sources by use of the synthetic method of estimating moves per mover or migrations per migrant. The 1-year migration data for the 1971 and 1976 March CPS and the 5-year data from the 1975 CPS provide one excellent source for extracting data on repeat migration by age, occupation, metropolitan residence, and years of school completed.

The synthetic estimates by age calculated in the previous section (table E), indicate that the number of migrations per non-return migrant during the 5 years from 1970-1975 ranged from 1.45 for the ages 45 to 64 to 2.00 for ages 20 to 24. The higher rates of repeat migration occur in the middle age groups: 20 to 24 and 25 to 29. These are the ages of early labor force involvement when moves are often to temporary residences while in college, the Armed Forces, or working at short-term jobs. Residential stability becomes much more pronounced in the middle years of life so that those aged 35 to 44 and 45 to 64 and their dependent children aged 5 to 14 and 15 to 19 have considerably lower rates of repeat migration than persons in their twenties.

An earlier section illustrating the differing results which can be obtained using 5-year mobility rates instead of 1-year rates postulated that the relative differences in the two rates for various occupational categories could be due to differing amounts of repeat migration. Just how true this is can be seen from the synthetic estimates of migrations per non-return migrant by occupational group for employed males 16 years and over (table F). Some occupations—notably farmers and farm managers—had both low yearly mobility rates (1.9 percent) and low ratios of moves per non-return mover (about 1.00). The most highly mobile group—professional, technical, and kindred occupations—also had a moderately low rate of repeat migration with 1.35 migrations per migrant. This probably indicates that while a large proportion of the people in this occupation were mobile, each individual was likely to stay a fairly long time in a given place before moving again and the proportion of persons who moved virtually every year is quite small. The behavior of other groups such as operatives and non-farm laborers further illustrates how the synthetic estimate of repeat migration can provide a new perspective on the mobility process. Although each of these two groups had a considerably lower average yearly migration rate than do professionals, their estimated number of migrations per non-return mover is higher, ranging from 1.79 to 2.03. The large proportion of chronic movers in these occupational groups tend to increase the rate of repeat migration.

This synthetic method of measuring repeat migration may even help answer such controversies as whether or not managers and administrators actually behave like highly mobile "organization

Table F.
Estimates of Yearly Migrations per Non-Return Migrant, by Selected Characteristics
(Numbers in thousands. Percent of ending population)

Characteristic	Average 1-year different county rate*	5-year 1975 CPS different county rate	Estimated number of yearly migrations per non-return migrant**
AGE OF THE POPULATION			
Total, 5 to 64 years old	7.30	20.38	1.79
5 to 13 years	6.98	21.42	1.63
14 to 17 years	4.55	13.69	1.66
18 to 19 years	4.96	16.86	1.47
20 to 24 years	11.93	29.91	1.99
25 to 29 years	14.51	39.18	1.85
30 to 34 years	9.39	28.95	1.62
35 to 44 years	5.73	18.22	1.57
45 to 64 years	3.06	10.53	1.45
METROPOLITAN RESIDENCE			
Total, 5 years old and over	6.49	19.14	1.69
In metropolitan areas	5.89	18.14	1.62
In central cities	5.02	14.72	1.71
Balance of metropolitan areas	6.55	20.68	1.58
Nonmetropolitan areas	7.65	21.25	1.80
MAJOR OCCUPATIONAL GROUP			
Employed males, 16 years and over	6.39	19.97	1.60
Professional, technical, and kindred workers	8.37	31.04	1.35
Managers and administrators, except farm	7.37	21.85	1.69
Salesworkers	6.96	25.35	1.37
Clerical and kindred workers	5.81	18.58	1.56
Craftsmen and kindred workers	5.71	16.80	1.70
Operatives	5.57	15.58	1.79
Service	5.77	17.39	1.66
Farmers and farm managers	1.88	9.88	0.95
Laborers, except farm	6.69	16.50	2.03
Farm laborers and supervisors	7.05	20.00	1.76
YEARS OF SCHOOL COMPLETED			
Total, 25 years old and over	5.07	17.75	1.43
Elementary: 0 to 8 years	3.00	10.04	1.50
High school: 1 to 3 years	4.42	13.45	1.64
4 years	5.11	16.78	1.52
College: 1 to 3 years	6.36	24.86	1.28
4 years or more	8.35	31.23	1.34

* Average of 1970-71 and 1975-76 CPS different county migration rates. Age-specific rates have been standardized.
**5 (1-year rate)/(5-year rate) for different county migration.
Sources: Special tabulations consistent with the U.S. Bureau of the Census, 1972, 1975, and 1977.

men" (Whyte, 1957; Ladinsky, 1967). While managers and administrators are not the most mobile of all occupational groups due perhaps to a large proportion of self-employed people, those who do move are likely to have a fairly high ratio of repeat to total migration (1.69) corresponding to the traditional image of the "organization man".

Many other examples of the surprises to be found by using the synthetic ratio of migrations per migrant can be found. For example, suburbs of metropolitan areas are sometimes characterized as areas of high mobility, but the synthetic migrations per non-return mover for 1970-1975 is only 1.58 for the suburbs of metropolitan areas, compared with 1.80 for nonmetropolitan areas. By educational level the number of migrations per migrant for the highly mobile groups with at least some college training is about 1.3 indicating that although a large proportion of the group are likely to move at least relatively few of them will move more than once. Even though the population with less than a high school education have a much smaller proportion of migrants, those who do move are more likely to move again than are those in the college groups and thus have higher ratios of migrations per migrant (1.5 to 1.6).

These results give only a few examples of a rather large amount of additional information which could be extracted from existing migration data using the synthetic method of measuring return and repeat migration. In many cases an entire rethinking of our description of the migration process may be necessary as we take into account the additional information on return and repeat migration which may tend to contradict some previous conceptions of the migration process.

Conclusion

With the synthetic measure of repeat migration developed in this paper, researchers can, for the first time, explore the effects of repeat migration in data sets which did not specifically ask questions on repeat migration. A whole range of questions is opened to investigation. Regardless of the annual level of mobility, which groups of the population have the highest proportion of movers who are chronic movers? To what extent are high annual mobility rates in certain groups due to a small proportion of the population moving many times during a 5- year period rather than a large proportion of the population moving only once during the 5-year period? Can specific problems in economic and social adjustment be found in those populations with high rates of repeat migration rather than in populations with high rates of one-time mobility? These and other questions should now be

amenable to research using the synthetic measure of repeat migration.

Migration is a complex, multi-faceted set of phenomena for which different measures emphasize different aspects. Any researcher who treats it as one simple process which can be measured by any method with any interval does so at considerable risk to the validity of the research findings. But a researcher who recognizes the complexity of the phenomenon and makes use of that complexity by creative comparison of different migration measures or intervals should be able to extract a considerable amount of hidden information on the migration process from traditional data sources.

Appendix

So far, we have only discussed the difference in migration counts using a measure of migration volume, the number of persons living in a different area n years earlier. Differences in intervals have idiosyncratic effects for each of the other measures of migration (gross and net migration balances and gross and net migration flows).

Gross Migration Balance for an Area

Data which compare present residence with residence at some previous date also permit measurement of the amount of gross migration to or from an area during the intervening period. Again this method only measures the gross number of migrations to the area when the migration interval is quite short. For longer migration intervals, the method measures the number of migrants to the area (except for those who have left the area again by the end of the interval). Another hypothetical set of residence histories illustrates the difference between the measured value for a given migration interval and a linear extrapolation of the 1-year interval. In this case, A represents the area of interest and W represents any other area. The possible residence patterns over a 2-year period are: AAA, AAW, AWA, AWW, WAA, WAW, WWA, and WWW. The difference between the combined 1-year values of gross migration to an area and the 2-year measure of gross migration is equal to the return migrants (AWA) and other repeat migrants (WAW) (table 1, row 1).

For longer migration intervals the difference between the number of migrations to A obtained from a linear extrapolation of the 1-year migration values and the measured number of migrations using an n-year interval is the number of repeat migrations to A, the number of final return migrants, and the number of repeat migrants in A at some time during the period but outside of A at both the beginning and end of the period. Only in the unlikely event that there are zero cases in all of these groups will the gross migration to an area over an n-year period equal n times the gross migration for the area over 1 year.

Net Migration Balance for an Area

Measures of net migration for an area provide the one instance in which the complications arising from measuring the number of migrants rather than the

Table 1.
Comparison of Categories of Migration Patterns Counted by Residence Change Migration Balances and Flows Measures for 1- and 2-Year Periods

(A area of interest; B area of interest; W all other areas)

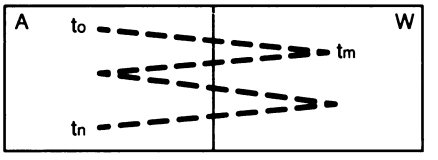
Migration pattern	First 1-year period	Second 1-year period	Combined 1-year period	2-year period	Difference between combined 1-year and 2-year periods
Migration balances:					
Gross migration into area A	WAA + WAW	AWA + WWA	AWA + WAA + WAW + WWA	WAA + WWA	AWA + WAW
Gross migration out of area A	AWA + AWW	AAW + WAW	AAW + AWA + AWW + WAW	AAW + AWW	AWA + WAW
Net migration to area A	WAA + WAW - AWA - AWW	AWA + WWA - AAW - WAW	WAA + WWA - AAW - AWW	WAA + WWA	
Migration flows:					
Gross migration from area A to area B	ABA + ABB + ABW	AAB + BAB + WAB	AAB + ABA + ABB + ABW + BAB + WAB	AAB + ABB + AWB	ABA + ABW + BAB +WAB - AWB
Gross migration from area B to area A	BAA + BAB + BAW	ABA + BBA + WAB +	ABA + BAA + BAB + BAW + BBA + WBA	BAA + BBA + BWA	ABA + BAB + BAW + WBA - BWA
Net migration from area A	ABA + ABB + ABW - BAA - BAB - BAW	AAB + BAB + WAB - ABA - BBA - WBA	AAB + ABB + ABW + WAB - BAA - BAW - BBA - WBA	AAB + ABB +AWB - BAA - BBA - BWA	ABW + BWA + WAB - AWB - BAW - WBA

number of migrations cancel out. Table 1, row 3 shows that gross migration to A minus gross migration from A gives the value of net migration for A. In this case, the combined 1-year migration values are equal to the results of the 2-year interval and either method will give identical values of net migration.

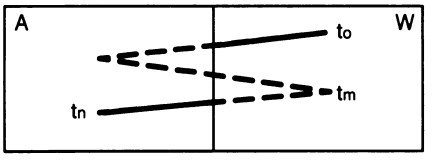
Likewise, for longer intervals, the net migration balance for an area will be the same whether an n-year interval or n times the average 1-year interval is used. A simple illustration should indicate why this is the case (figure 2). If area A is the area of interest and W is any other area, the net migration for A is the number of migrations to A minus the number of migrations from A. No matter how many actual migrations to or from A an individual makes, the difference between moves into and moves out of A can only be zero or one since for any migration to be counted it must cross the boundary between W and A. This is true whether the migration interval is a relatively short 1-year interval or a longer n-year interval. For each individual there are only three possible outcomes: residence within the same area at both dates (t_o and t_n) with no measured net migration (figure 2-A), residence outside of A at t_o and inside A at t_n exhibiting net inmigration (figure 2-B), or residence inside A at t_o and outside A at t_n showing net outmigration (figure 2-C). In any case the intermediate moves in and out of A have no effect on the resulting measurement of net migration since each additional move cancels out a previous move in the opposite direction. Consequently, given any point t_m between t_o and t_n the amount of net migration from t_o to t_m plus the net migration from t_m to t_n will equal the net migration from t_o to t_n. For example, the net migration for an area from 1970 to 1974 can be subtracted from net migration from 1970 to 1975 in order to obtain the net migration from 1974 to 1975. By the same token, the combined 1-year data on net migration for n years is equal to the measured value of net migration using the n-year interval.

Figure 2.
Net Migrations Between Area A and the Balance of the Country (W) During Time Periods $t_o - t_m$ and $t_m - t_n$

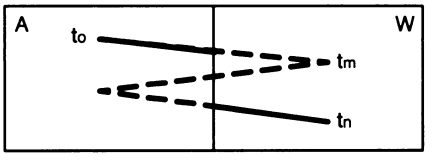
A–Case of zero net migration to and from A



B–Case of net inmigration to A



C–Case of net outmigration from A



Since net migration balances for an area are measured both directly through survey methods and indirectly by the census survival ratio method (CSR) and the vital statistics method, comparisons of data using the two types of methods for different length migration intervals should not present complications arising from repeat and return migration. Contrary to Vaidyanathan's (1969: 236) contention, the impact of multiple moves is not greater for the CSR method than for direct methods. Provided that complicating factors such as births, deaths, and differences in the direct and indirect methods of measuring net migration during the interval can be effectively controlled for (Shryock, Siegel, et al, 1973: 623-637), indirect measures of net migration for one interval can be compared with direct measures for another interval simply by dividing the total amount of net migration by the number of years in the interval to get an average annual net migration rate. Other applications arise from the ability to subtract the net migration obtained from a direct m-year question from the indirect net migration results from a longer n-year period to give the resultant net migration for the period n - m. For example, it would be theoretically possible to obtain the net migration from April 1, 1960, to April 1, 1965, for those persons 10 years old and older in 1970 by subtracting the net migration from April 1, 1965, to April 1, 1970, of that group (obtained from the 1970 census question on residence in 1965) from the indirect measures of net migration between April 1, 1960, and April 1, 1970, (obtained from applying the CSR method to the 1960 and 1970 population censuses). In practice, however, the resulting estimate will differ from actual migration due to differences in the accuracy of data used in the two methods, deviations from the assumptions of the CSR method, and deaths occurring during the period.

Gross Migration Flows Between Two Areas

The measure of gross migration from A to B is derived from a direct question on place of residence at a given time in the past. A set of residence histories for three points in time which consists of all possible combinations of three residences A, B, and W is used in the fourth row of table 1 to show the set of residence histories which are measured by two 1-year periods versus one 2-year period. Here, A and B represent the areas of interest and W represents all other areas. Note that the difference between these two measures is a rather complicated set of terms including return migration to A and to B (ABA and BAB) plus repeat migration which includes an AB move (ABW and WAB) less repeat migration beginning in A and ending in B (AWB). For longer time periods, the situation becomes even more complicated with the number of moves from A to B diverging sharply from the number of movers who are at A at the beginning of the period and at B at the end of the period, so that substantial differences exist between n times the 1-year rate and the n-year rate.

Net Migration Flows Between Two Areas

Unlike net migration balances for an area, net migration flows from one specific area to another are affected by the complications which arise from measuring migrations rather than migrants. Since data on both origin and destination of migrants are necessary, indirect methods of migration measurement are not sufficient to show net migration flows. The necessity of asking residence at some given time in the past leads to omission of some return and repeat moves which may not necessarily cancel out when outmigration flows are subtracted from inmigration flows.

The last row of table 1 illustrates the lack of comparability between net migration flow data from two 1-year migration questions and a 2-year question. Net migration flows between A and B are equivalent for the two intervals only in the unlikely event that the population with migration patterns ABW, BWA, and WAB is equal to the population with patterns WBA, BAW, and AWB. For longer periods, the complications increase dramatically and the likelihood of exact equivalence between the values of net migration flows from an n-year period and from n times the 1-year period is quite small.

Choice of Migration Intervals

Of these five common measures of migration only one, the net migration balance for an area, gives the same results for one period of n years and n periods of 1 year. With any of the other migration measures, data from one interval are not comparable with data from intervals of other lengths. Furthermore, even when only one length of interval is to be used, the length of the migration interval chosen may affect the results. The implicit or explicit decision as to which migration interval to use is thus quite important.

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Longitudinal Migration Data From the Survey of Income and Program Participation

Diana DeAre

Most efforts to analyze mobility behavior have been static in nature, looking at a cross-section of activity in space and time and making inferences from the resulting "snapshot." Comparisons of the characteristics of origins and destinations have led to conclusions about the importance of climate in the moving decision, the draw of higher wages in other labor markets, and the push of undesirable areas. Comparisons of the age and sex profiles of movers and nonmovers have led to generalizations about the interrelationships of moving and the life cycle and even speculations about the total number of lifetime moves (Long, 1988). But most conclusions and generalizations from cross-sectional data are based on aggregate information about a population at two points in time, rather than information about the mobility behavior of individuals over time.

The nature of the data available for research purposes has often dictated a static approach to residential mobility analyses. The decennial census and large household surveys such as the Current Population Survey and the American Housing Survey provide very good coverage but are cross-sectional. They do not follow individuals over time and they do not ask detailed retrospective questions about mobility history. On the other hand, small local samples may be designed to ask probing questions about reasons for moving and residential history, but the results are not usually generalizable to other geographic areas. National longitudinal surveys such as the Panel Survey of Income Dynamics and the National Longitudinal Survey track movers over time and collect a variety of social and economic characteristics of respondents at each interview. These surveys are also hampered by small sample sizes, however, which can make a relatively rare event like migration difficult to analyze. In addition, the interviews are generally conducted a year or more apart, with the number of moves recorded during the period restricted to one. As a result, a substantial number of moves may be missed even though a longitudinal design is employed.

For these reasons, the availability of the longitudinal Survey of Income and Program Participation (SIPP) should be of great interest to mobility researchers. The SIPP includes about 20,000 households who are contacted every 4 months and asked detailed questions about each of the preceding 4 months. The purpose of this article is to evaluate the usefulness of this new national survey for migration research. Data quality will be considered first in determining the SIPP's utility, including comparisons with other migration data sources. Rates of moving will be calculated from the SIPP data, based on characteristics of persons at the beginning of the survey. A few variables will be analyzed with age controls. Finally, selected characteristics of movers at the beginning of the survey will be compared with the same characteristics at the end of the survey in order to examine some of the correlates of moving.

Survey of Income and Program Participation (SIPP)

First implemented by the Census Bureau in October 1983, the SIPP is a longitudinal survey of the noninstitutionalized resident population of the United States. The goal is to provide detailed monthly information on the economic status of the population through questions about such topics as receipt of cash and noncash income from different sources, and eligibility and participation in various government transfer programs. An overview of the survey is provided by Nelson, McMillen, and Kasprzyk (1985).

The first SIPP panel of respondents, referred to as the 1984 panel, was interviewed from October 1983 through July 1986. The panel was divided into four rotation groups, each of which was interviewed every 4 months and was asked about activities during the preceding 4 months. The 1985 SIPP panel was first interviewed in February 1985, thus overlapping the first panel. Each year a new panel has been introduced, so that data are being collected simultaneously from different panels of respondents. The total number of interviews was 8–9 for the 1984 panel and 7–8 for subsequent panels.

The interviews consist of a battery of core questions asked during each visit to the household, plus topical modules which might be asked at one or two times during the life of the panel. The core questions obtain information about labor force participation, sources of income and noncash benefits, wage and salary earnings, self-employment earnings, and earnings from assets. Basic social, demographic, and housing characteristics, including the housing unit address identification, are recorded on a control card and updated at each interview. Topical modules have covered pension and retirement plans, tax-related information, welfare history, energy usage, child care arrangements, marital history, and migration history. The survey is designed to follow movers, i.e., a person is not dropped from the sample upon moving, but continues to be interviewed at the new residence location. This article will focus on the longitudinal features of SIPP; the topical module on past mobility will be discussed only briefly.

1984 SIPP Panel Longitudinal File

The longitudinal file links the information for individuals and households from all the interviews of the first SIPP panel. It contains data for each individual who was a member of an interviewed household at any time during the 1984 panel—about 64,500 persons in all. Each record contains one-time variables such as sex and race, variables with 8 observations (obtained from the control card at each of the eight interviews but not for intervening months), and variables with 32 observations corresponding to the 32 months covered

during the 8 interviews of the survey.[1] Different person weights are included to allow estimates over the life of the panel or for the individual calendar years 1984 and 1985.

A subfile of the full longitudinal file was created for this study of mobility behavior. The subfile is restricted to persons present for the first interview, since they are the only ones who were followed when they moved and they are the only ones with longitudinal weights assigned.[2] The variables include sex and race, and a selection of items with eight observations such as state of residence, metropolitan-nonmetropolitan status,[3] school attendance, and highest grade completed. The remaining variables are those for which 32 observations are available. These include an address identification (used to determine whether a person moved), age, marital status, housing information, and labor force participation. Data for just 8 of the 32 observations are included for each of these items, however; only the information about the month prior to each interview is used. For example, figure 1 shows that rotation group 1 was initially interviewed in October 1983. One-time variables such as race and sex would have been determined then, as well as control card items like school attendance, educational attainment, and state of residence, which are updated at each subsequent interview. However, the respondent's age, marital status, and address identification (as well as other variables) would have been collected for each of the four months preceding the interview, i.e., June, July, August, and September of 1983. As noted in figure 1, it is the last of these dates only that is used as the reference month in this study. The month prior to the interview date was picked because it should provide the closest correspondence to the control card items updated at each interview, and also because it should be recalled more accurately by the respondent than earlier months.

Figure 1.
Reference Month by Interview Date for the 1984 SIPP Longitudinal Panel

Rotation Group	Interview Date	Reference Month
Interview 1		
1	10/83	9/83
2	11/83	10/83
3	12/83	11/83
4	1/84	12/83
Interview 2		
1	2/84	1/84
2	3/84	2/84
3	4/84	3/84
4	5/84	4/84
Interview 3		
1	6/84	5/84
2	7/84	6/84
3	8/84	7/84
4	9/84	8/84
Interview 4		
1	10/84	9/84
2	11/84	10/84
3	12/84	11/84
4	1/85	12/84
Interview 5		
1	2/85	1/85
2	3/85	2/85
3	4/85	3/85
4	5/85	4/85
Interview 6		
1	6/85	5/85
2	7/85	6/85
3	8/85	7/85
4	9/85	8/85
Interview 7		
1	10/85	9/85
2	11/85	10/85
3	12/85	11/85
4	1/86	12/85
Interview 8		
1	2/86	1/86
2	3/86	2/86
3	4/86	3/86
4	5/86	4/86

Identifying Movers

All persons in the original sample were assigned an address code of 11. When a person moves, the first digit of this code changes to the number of the interview following the move. The second digit remains a 1 unless the members of an original household split into two or more households as a result of the move, in which case one household would remain a 1, a second would get a 2, etc.

Persons were identified as movers if the first digit of their address ID changed between any two interviews from any non-zero number to another non-zero number. A zero address ID indicates that the person missed an interview or dropped out of the survey. There is no additional information on the file to determine whether a person who missed an interview moved or not, so those cases were excluded from any interview-to-interview comparisons involving the interviews they missed.

The total number of movers over the 28-month period (the amount of time between the reference month for interview 1 and the reference month for interview 8) is shown in table A, as is the total number of moves. The nonmover category is a residual; it includes all persons in the file who were not defined as movers. The maximum number of moves per person is seven, since the subfile includes address information for just eight points in time. Note that it is possible to obtain month-to-month changes in address ID (as well as interview-to-interview changes) from the full

[1]Two of the four rotation groups had nine interviews rather than eight; the ninth interview was excluded from the longitudinal file.

[2]When an original sample person moves in with other persons, or vice versa, the new people are added to the sample and are interviewed as long as they are living with the original sample person. If the new people leave the household, they are not followed, and if the original sample person leaves the household, the other household members are no longer interviewed.

[3]Metropolitan-nonmetropolitan status is not analyzed here because the first interview was miscoded, with the net result of showing too many persons living in central cities of metropolitan areas and too few in the suburbs. Metropolitan-nonmetropolitan status is coded correctly for the second and subsequent interviews.

longitudinal file, since address ID is recorded for each of the 32 months covered by the survey. The subfile was restricted to eight observations in time, however, because some of the other variables of interest—such as state of residence and metropolitan status—were only available for the 8 interview months.

The proportion of the population who changed residence during the 28-month period covered by the survey was 26.5 percent (table A). The proportion making two or more moves was 8.8 percent. A total of 90.1 million moves were made by 61.4 million movers. Two-thirds of the movers made only one move, 23 percent made two moves, and 10 percent made three or more moves.

In order to compare the rate of moving in the SIPP with 1-year data from the Current Population Survey (CPS), estimates were made of the number of persons who moved during each 12-month period that elapsed over the course of the SIPP. As can be seen by reading down within each column of figure 1, 12 months elapsed between the reference dates for interviews 1 and 4, 2 and 5, 3 and 6, 4 and 7, and 5 and 8. The 1-year moving rates for each of these five periods are given in table B; they average about 15 percent. These 12-month rates are lower than the annual rates of moving from the CPS over the 1983-86 period, which ranged from 16.9 to 19.7 percent.

Table A.
Moves and Movers in the 1984 SIPP Panel

(October 1983 to May 1986 approximately. Numbers in thousands)

Subject	Number	Percent of total
Total persons	231,379	100.0
Nonmovers	169,989	73.5
All movers	61,389	26.5
One move	40,846	17.7
Two moves	14,333	6.2
Three moves	4,485	1.9
Four or more moves	1,725	0.7
Total number of moves	90,121	(NA)
State-to-State movers	7,738	3.3
Total State-to-State moves	9,069	(NA)

NA Not applicable.
Note: Movers are persons who changed their address between months 4 and 32 of the survey. Addresses were compared at 4-month intervals.

Table B.
Comparison of Population Moving Over a 12-Month Period: SIPP and CPS

(Includes all persons 1 year and older at end of period; excludes movers from abroad)

Source	Migration period	Percent of population	
		All movers	State-to-State movers
SIPP	Sept./Dec. 1983-Sept./Dec. 1984 (Interviews 1 and 4)	14.9	1.6
	Jan./Apr. 1984-Jan./Apr. 1985 (Interviews 2 and 5)	15.3	1.5
	May/Aug. 1984-May/Aug. 1985 (Interviews 3 and 6)	15.0	1.6
	Sept./Dec. 1984-Sept./Dec. 1985 (Interviews 4 and 7)	15.0	1.7
	Jan./Apr. 1985-Jan./Apr. 1986 (Interviews 5 and 8)	14.9	1.6
CPS	March 1983-March 1984	16.9	2.8
	March 1984-March 1985	19.7	3.0
	March 1985-March 1986	18.1	3.0

Differences in State-to-State rates are also shown in table B. An average of 1.6 percent of the population made an interstate move during a 12-month period in the SIPP, compared with about 3 percent in the CPS. All moves between states may not have been identified in the SIPP, however, because a few of the states were combined on the file into two state-groups for confidentiality reasons. The state groups include Mississippi-West Virginia and Idaho-New Mexico-South Dakota-Wyoming. Any interstate moves within state-groups would be identified as within state moves, but the number of moves missed as a result is unlikely to raise the rate of State-to-State flows significantly.[4]

The SIPP rates were expected to be lower than those found in the CPS because of the attrition problems of longitudinal surveys. The total loss of households for all reasons (e.g., no one at home, refused to give information, moved to an unidentified location) over the nine interviews of the 1984 SIPP panel was 22 percent (Nelson, Bowie, and Walker, 1987). The estimated proportion of households who left the 1984 SIPP because they moved to an undetermined location[5] was almost 6 percent by the end of the survey (Jean and McArthur, 1987). The reason for noninterview was recorded for each person, but the variable was not included on the full longitudinal file of the 1984 SIPP. If it had been included, persons who left the panel because they moved to an unidentified location could have been specified as movers in the present study, and the resultant rate of moving would have been closer to the CPS estimates.

Results from the migration history topical module also show a significant underestimate of the number of movers in the SIPP (DeAre, January 7, 1988). The migration history questions were asked in the eighth interview, by which time most of the attrition from the survey had already taken place.[6] The

[4]Matched tax returns from the Internal Revenue Service for filing years 1984-85 showed that the number of State-to-State moves made by filers within the state groups designated in the SIPP accounted for less than .15 percent of all State-to-State moves.

[5]Persons who moved more than 100 miles from a SIPP sampling area were followed by telephone rather than a personal visit. If they could not be reached by telephone, they were included in the same nonresponse category as movers to unknown addresses.

[6]Most sample loss occurred at the time of the first interview (4.9 percent), primarily due to refusals. The increase in sample loss generally declined between each succeeding interview so that by the end of the panel, the cumulative sample losses from interviews 8 and 9 differed by less than one percentage point (22.0 vs. 22.3 percent). Sample loss is described in detail in Nelson, Bowie, and Walker, 1987.

number of movers 15 years of age and over estimated from the SIPP topical module for the period April 1985 to March 1986 was about 14 percent lower than the estimate from the March 1986 CPS for the same period. The shortfall in SIPP movers was most apparent for men in their twenties. Data from the 1985 and 1986 SIPP panels lend support to the suggestion that attrition is a major cause of the underestimate of movers in the 1984 panel. The migration module was asked in the fourth interview in the 1985 panel, rather than in the eighth, and the shortfall in the number and rate of movers—as compared with the CPS—was cut in half. The number of movers for the April 1985 to March 1986 period was significantly higher in the 1985 panel than in the 1984 panel, although still about 7 percent lower than the CPS estimates (DeAre, June 22, 1988). The migration module was asked in the second interview in the 1986 panel, and the number of movers and rate of moving were not statistically different from the CPS estimates at the 90 percent confidence level (DeAre, June 29, 1989).

Earlier work by McArthur and others with an abbreviated version of the 1984 longitudinal file found a rate of moving of 20 percent over 16 months—seemingly more in line with rates from the CPS than the data presented here from the full file (McArthur, 1986; Jean and McArthur, 1987; Dahmann and McArthur, 1987). Their methodology for identifying movers differed from the methodology used here, however. They included as movers: (1) persons whose address ID changed at any time during the 16 months, and (2) persons who left the survey because they moved without leaving an address, and (3) persons whose state of residence code changed at any time during the 16 months. Their first group corresponds to the methodology of the present study. Their second group could not be included in the present study because the identifying reason-for-noninterview code is not carried on the longitudinal file. It is likely that the inclusion of this group would have had a significant effect on the number of movers. Persons in the third group, those whose state of residence changed without a corresponding change in address ID, were not counted as movers in the present study. An investigation of individual records from the SIPP file showed that a change in state code for an interview month (compared with the previous interview) did not always correspond with a change in address ID between reference months. This was partly the result of including the last month of each wave of interviewing, i.e., months 4, 8, etc., on the subfile for the monthly variables like address ID. State of residence was collected only at each interview and refers to the residence at the time of the interview. Since the interviews took place in months 5, 9, etc., there is a time gap between the items on the subfile so that a state change can precede an address change. There is also some noise on the file such that sometimes the state code changes but the address code does not. These variables were not made to agree with each other in the editing process. Including persons whose state code changed but address ID remained the same would raise the percent of movers slightly from 26.5 to 27.0, a change which is not statistically significant.

Characteristics of Movers Before Moving

The SIPP file offers the opportunity to examine characteristics of movers both before and after the move, unlike many data sources which only obtain information after the move. Sandefur and Tuma (1987) used the Panel Study of Income Dynamics to show that characteristics measured after a move can give a misleading picture of pre-move

Table C.
Rates of Moving, by Selected Characteristics: 1984 SIPP Panel

(October 1983 to May 1986 approximately. Persons 16 years and over, unless otherwise specified. Numbers in thousands)

Characteristic	Total	Percent who moved	Percent of movers who moved— Once	Percent of movers who moved— Two or more times
Age:				
Less than 16 years	55,235	29.8	68.0	32.0
16-24 years	36,273	44.7	54.8	45.2
25-34 years	39,886	38.0	68.8	31.3
35-44 years	29,540	20.6	72.3	27.7
45-54 years	22,318	13.3	76.2	23.8
55-64 years	21,997	9.6	78.7	21.3
65 years and over	26,128	9.1	84.8	15.2
Family status:				
Family member	148,991	24.3	67.2	32.8
Nonfamily	27,153	32.2	61.1	38.9
Tenure:				
Owner	124,245	16.0	68.7	31.3
Renter	51,898	48.3	63.9	36.1
Marital status:				
Married	105,240	20.9	71.1	28.9
Widowed	12,953	12.1	84.2	15.8
Divorced, separated	15,804	35.9	63.2	36.8
Never married	42,146	37.4	58.0	42.0
Employment status:				
With a job, not looking	105,509	28.5	66.3	33.7
Job or no job, looking for work	10,307	38.1	58.7	41.3
No job, not looking	60,325	18.1	67.7	32.3

Note: Characteristics refer to the time of the first interview. Movers are persons who changed their address between months 4 and 32 of the survey. Addresses were compared at 4-month intervals.

characteristics, especially in the case of labor force and household composition.

The first task here is to examine the characteristics of movers before the move (i.e., at the time of the first interview of the 1984 SIPP Panel) as shown in table C. To see if movers differ by number of moves made, the mover category is divided into those who moved just once during the life of the panel and those who made more than one move. Since no migration history was obtained at the first interview, the categories of nonmovers and movers are not as distinct as would be preferred. Some nonmovers as well as one-time movers may have moved just before the survey. The topical module obtained recent migration histories for adults in the survey and thus could be used to identify persons who made recent moves before the start of the survey. Unfortunately it was not asked until interview eight in the 1984 panel—by which time many persons had been lost by attrition—so it was not used to supplement the present analysis. In the 1985 panel, the migration history module was asked midway through the period in interview four. For the 1986 and later panels the migration history module is asked in interview two, which should make it very useful for analyzing the longitudinal data obtained in later interviews.

Movers are likely to be young; the median ages are not shown in table C but are 23.6 years for movers and 35.1 years for nonmovers.[7] The highest proportions of movers are found in the age groups under 35 years (table C). About 45 percent of persons who were in their late teens and early twenties (16–24 years old) at the time of the first interview moved at least once during the life of the panel, and nearly half of those who moved did so two or more times. Similarly, about 38 percent of persons 25 to 34 years old moved, with approximately one-third of them making more than one move. The median age of multiple movers is 22.1 years, a little lower than the median of 24.7 years for one-time movers.

[7]Statements of comparison have passed a hypothesis test at the 0.10 level of significance or better.

The remaining characteristics in table C are shown for persons 16 years and over. The SIPP gathers complete information for all adults 15 years and over. Age 16 was chosen as a cutoff point here because in the past, many labor force studies have used 16 as a minimum age for defining labor force participants. It was also selected because persons who are 16 years old have a higher likelihood than 15-year-olds of moving as individuals, rather than as dependent family members. In the 1984 SIPP panel, only 8 percent of movers who were 15 years old at the beginning of the survey showed a change in household relationship classification from a dependent status—child or relative of householder—at the first interview to a status reflecting independence—householder, spouse of householder, or unrelated individual—by the eighth interview. In comparison, 30 percent of movers who were 16 years old at the beginning of the survey changed from a dependent household status to an independent one.

Adults in nonfamily households are more likely to move than those in families. About 32 percent of nonfamily household members 16 years and older moved compared with 24 percent of family members. The proportion of movers who made more than one move is likewise higher among nonfamily members (39 percent) than family members (33 percent).

The moving rate for renters is substantially higher than the rate for homeowners; at 48 percent it is three times the rate of moving among homeowners. The proportion of movers who made additional moves is also higher for those who were living in rental housing at the beginning of the survey than for those in owner-occupied units (36 vs. 31 percent). Surveys based on characteristics after the move have also found higher rates of moving among renters than owners. The March 1987 Current Population Survey, for example, found that renters were 3 1/2 times as likely

Table D.
Rates of Moving, by Tenure Before Move, by Age: 1984 SIPP Panel
(October 1983 to May 1986 approximately. Numbers in thousands)

Tenure and age	Total	Percent who moved	Percent of movers who moved— Once	Percent of movers who moved— Two or more times
16-24 years:				
Owned	22,494	33.5	55.7	44.3
Rented	13,777	63.1	54.0	46.0
25-34 years:				
Owned	23,244	24.2	71.7	28.3
Rented	16,642	57.3	67.0	33.0
35-44 years:				
Owned	22,358	12.0	75.7	24.3
Rented	7,181	47.2	69.6	30.4
45-54 years:				
Owned	18,092	8.4	80.3	19.8
Rented	4,226	34.2	72.1	28.0
55-64 years:				
Owned	18,322	6.5	84.1	15.9
Rented	3,677	25.4	71.9	28.1
65 years and over:				
Owned	19,736	6.7	88.3	11.8
Rented	6,389	16.6	80.5	19.5

to have moved during the preceding year than homeowners (Hansen, 1988). Since tenure is related to age, the owner–rental differential may be attributable to the higher proportion of young adults in the mover population. This will be examined in a later section which deals with differentials by age.

Change in marital status is likely to result in a move. In a study using the National Longitudinal Survey, Maxwell (1988) found no evidence that young men and women who married and moved across county lines did so for economic reasons. Marrying appeared to be the reason for moving. Speare and Goldscheider (1987) found that age had no independent effect on mobility in the year of a marital status change for a sample of Rhode Island residents over a 12-year period. But marriage may in turn inhibit further migration. Studies that look at marital status after a move have generally found that movers are less likely to be married than nonmovers and are more likely to be never married. In the March 1987 CPS, for example, 49 percent of movers 16 years and over were married, compared with 59 percent of nonmovers, and 31 percent of movers were never married compared with 24 percent of nonmovers (Hansen, 1988).

The SIPP data in table C show that persons 16 years and over who were never married or were divorced/ separated at the beginning of the survey have the highest rates of moving. Thirty-six to 37 percent of persons in these two categories moved at least once, and about 30–40 percent of those persons went on to make another move. About 21 percent of persons who were married and just 12 percent of persons who were widowed made a move during the survey period. The differences in migration rates by marital status are probably due at least in part, again, to age differences. A higher proportion of movers are in the young adult ages when the likelihood of getting married and making a related change in residence is highest.

The relationship between employment and migration is complicated. DaVanzo (1978) and Sandefur and Tuma (1987) found that based on pre-move characteristics, the unemployed are more likely to move than the employed. The latter study found that the difference became insignificant when employment status was measured after the move. This was explained by the unemployed changing residences and finding jobs.

The employment status categories for the SIPP data shown in table C are a little different from other studies. The SIPP file includes an economic status recode that covers a range of statuses based on the amount of time a person worked during the month and whether the person spent time looking for a job or on layoff. Categories were combined for this research such that everyone with a job the entire month or with a job one or more weeks but with no time spent looking for work was classified as "with a job, not looking." Persons who spent 1 or more weeks looking for a job or on layoff were classified as "looking for work," even if they had a job for part of the month. The remaining people, who had no job and spent no time looking for one, were considered "not in the labor force."

The SIPP data show that based on pre-move characteristics, the unemployed (looking for work) are more likely to move than the employed (with a job,

Table E.
Rates of Moving, by Marital Status Before Move, by Age: 1984 SIPP Panel
(October 1983 to May 1986 approximately. Numbers in thousands)

Marital status and age	Total	Percent who moved	Percent of movers who moved— Once	Percent of movers who moved— Two or more times
16-24 years:				
Married	7,307	58.2	58.5	41.5
Widowed	26	(B)	(B)	(B)
Divorced, separated	825	76.0	47.8	52.2
Never married	28,113	40.3	53.7	46.3
25-34 years:				
Married	26,817	34.3	71.7	28.3
Widowed	155	66.5	68.0	33.0
Divorced, separated	4,550	51.7	61.6	38.4
Never married	8,366	42.0	65.9	34.0
35-44 years:				
Married	23,139	17.8	73.9	26.1
Widowed	272	14.7	(B)	(B)
Divorced, separated	4,132	34.0	65.4	34.7
Never married	1,997	25.5	78.8	21.2
45-54 years:				
Married	17,622	11.3	78.1	21.9
Widowed	810	21.5	75.3	25.3
Divorced, separated	2,739	24.3	69.6	29.9
Never married	1,147	11.8	81.5	18.5
55-64 years:				
Married	16,547	8.2	78.2	21.8
Widowed	2,392	12.5	89.9	10.1
Divorced, separated	2,121	18.1	69.5	30.5
Never married	936	8.0	90.7	10.7
65 years and over:				
Married	13,807	7.5	84.4	15.6
Widowed	9,298	10.1	86.6	13.3
Divorced, separated	1,439	16.5	78.5	21.9
Never married	1,585	10.9	86.1	13.9

B Base is less than 75,000.

not looking). The rates of moving are 38 percent for those looking for work at the first interview, 29 percent for employed persons who were not looking for work, and 18 percent for persons not in the labor force. Persons who were looking for work and made one move are also more likely to make another move (41 percent) than either movers who had a job before the move or those not in the labor force (both about 33 percent).

Differentials by Age

Since many of the differences noted between characteristics of movers and nonmovers appear to be a function of age, tables D through F were prepared to show selected characteristics for age groups.

Controlling for age does not affect the tenure differences of movers and nonmovers (table D). Within every age group, the rates of moving are significantly higher (at the 90 percent confidence level) for persons living in rented housing. The panel moving rates for renters peak at 63 percent for persons 16- 24 years of age and then decline to 17 percent for those 65 years and over. The highest rate for persons living in owner-occupied housing is also shown by the 16-24 age group, but the rate is just 34 percent, considerably lower than for renters. The rates for non-renters also decline with age, reaching about 7 to 8 percent for persons 45 years and over. The likelihood of making additional moves appears higher among movers living in rental than in owner-occupied housing but the differences are not statistically significant for any of the age groups.

Rates of moving by marital status and age are shown in table E. Moving rates for persons in the divorced/separated category are high across all age groups, although only statistically higher than the other rates for the youngest age group. The individual marital status categories have some very low bases when divided into age groups, and as a result, some of the rates have high standard errors. For 25-34 year olds, the rate for the divorced/separated group is higher than the rates for the married and never married but not statistically different from the rate for the numerically small widowed category. For the age groups above 34 years, the rates for the divorced/separated appear consistently highest, but they are not statistically different from the next highest rates.

The higher rate of moving for persons in the never married category is a function of their age. Their moving rates are not particularly high within the individual age groups (table E). The overall rate is weighted upward by a very high proportion of young people in the never married category. About 87 percent of the never married are 16-34 years old, compared with one-third or less for the other marital status categories. The proportion of multiple movers does not vary significantly between the different marital status categories for any of the age groups.

The overall pattern—where persons looking for work appear to have the highest moving rates—is repeated in general for all age groups except the youngest (table F). In the youngest age group, persons who had a job and were not looking for work at the beginning of the survey have a slightly higher rate of moving (50 percent) than those who were looking for work (46 percent). The rates for 25-34 year olds and persons 65 and over who were looking for work appear highest but are not statistically different from the rates for persons with a job. For ages 35 through 64, the

Table F.
Rates of Moving, by Employment Status Before Move, by Age: 1984 SIPP Panel
(October 1983 to May 1986 approximately. Numbers in thousands)

Employment status and age	Total	Percent who moved	Percent of movers who moved— Once	Percent of movers who moved— Two or more times
16-24 years:				
With a job, not looking	20,650	50.2	55.1	44.9
Job or no job, looking for work	4,085	46.2	52.3	47.7
Not in the labor force	11,537	34.4	55.3	44.7
25-34 years:				
With a job, not looking	30,410	38.1	69.6	30.4
Job or no job, looking for work	2,748	41.3	62.1	37.9
Not in the labor force	6,728	36.2	67.8	32.2
35-44 years:				
With a job, not looking	22,945	20.4	74.2	25.9
Job or no job, looking for work	1,654	27.9	62.6	37.2
Not in the labor force	4,940	18.8	67.8	32.2
45-54 years:				
With a job, not looking	16,127	12.2	77.0	23.0
Job or no job, looking for work	1,017	28.1	68.9	31.1
Not in the labor force	5,176	13.9	77.0	23.0
55-64 years:				
With a job, not looking	12,006	9.4	78.8	21.2
Job or no job, looking for work	647	18.4	81.5	18.5
Not in the labor force	9,344	9.3	78.1	21.9
65 years and over:				
With a job, not looking	3,371	10.1	88.2	11.8
Job or no job, looking for work	155	21.9	(B)	(B)
Not in the labor force	22,601	8.9	84.2	15.8

B Base is less than 75,000.

rates of moving are statistically highest for persons looking for work. Movers who had been looking for work appear more likely than other labor force statuses to make additional moves for all age groups below age 55, but the differences are not statistically significant.

Before and After Characteristics

The SIPP panel makes it possible to monitor a wide variety of social and economic characteristics at one-month intervals preceding and following a residential move. The approach here is to focus on a few characteristics collected in the first interview and the eighth interview.

Tables G through I show the before (interview one) and after (interview eight) views for the three variables examined in the previous section—tenure, marital status, and employment status. The before totals in tables G-I are lower than those on which tables D-F were based, even though they all came from interview one, because only persons who responded to the variable in question in both interviews are included in the latter three tables. Most of the differences are due to persons leaving the survey before the last interview, although in a few instances no response was obtained for a particular question in the last interview from persons who remained in the survey. The missing persons reduced the number of overall respondents 16 years and over for this before/after analysis by 4.6 percent—about 5.6 percent of nonmovers and 2.0 percent (not statistically significant) of movers are missing.

It is likely that many of the 5.6 percent of "nonmovers" who did not respond to the last interview not only left the panel but also changed residences and thus are actually movers over the life of the panel. Clark and Speare (1988) used the first four interviews of the 1984 SIPP panel and estimated, using the reason-for-noninterview code that is not on the full longitudinal file, that the proportion of movers among adults with noninterviews was 31 percent. Restricting the analysis (as in the present study) to persons who remained in the panel thus has the effect of "purifying" the nonmover category but at the expense of losing some definite movers. This process probably biases the mover category somewhat by excluding people who dropped out of the longitudinal survey.

Table G.
Movers and Nonmovers Who Lived in Owned or Rented Housing Units at First and Last Interview of the Migration Interval, by Age

(Persons 16 years and over. Numbers in thousands. Migration interval approximately October 1983 to May 1986)

Age and tenure	Interview one		Interview eight	
	Nonmovers	Movers	Nonmovers	Movers
All ages	123,844	44,032	123,844	44,032
Owned	80.8	44.5	80.4	44.3
Rented	19.2	55.5	19.6	55.7
16-24 years	18,634	15,878	18,634	15,878
Owned	76.6	46.9	75.6	* 34.6
Rented	23.4	53.1	24.4	* 65.4
25-34 years	23,782	14,928	23,782	14,928
Owned	72.8	37.3	72.8	* 48.1
Rented	27.2	62.7	27.2	* 51.9
35-44 years	22,914	6,030	22,914	6,030
Owned	84.9	44.4	85.1	50.0
Rented	15.1	55.6	14.9	50.0
45-54 years	18,899	2,932	18,899	2,932
Owned	86.4	51.1	86.1	54.2
Rented	13.6	48.9	13.9	45.8
55-64 years	19,183	2,043	19,183	2,043
Owned	86.7	56.1	86.6	54.0
Rented	13.3	43.9	13.4	46.0
65 years and over	20,432	2,221	20,432	2,221
Owned	78.6	56.5	77.2	50.8
Rented	21.4	43.5	22.8	49.2

* Differences between percentages for interview one and interview eight are statistically significant at the 90-percent confidence interval.
Note: Movers are persons who changed their address between months 4 and 32 of the survey.

The tenure of movers before and after moving is shown in table G. There is no difference in the overall proportion of movers who rent—about 56 percent before and after moving. The proportion changed significantly among 16- to 24-year-olds, however, with an increase in renting from 53 to 65 percent. This probably reflects young people leaving the parental home for apartment life. Persons 25-34 years old show a significant change in the opposite direction following the move. The proportion of renters dropped from 63 to 52 percent as more young people purchased their own homes. The homeownership proportions appear to have risen a little after moving for the age groups 25-54 and then appear to have declined slightly, but the changes for age groups over age 34 are not significant at the 90 percent confidence level. In summary, although the overall proportions of movers owning and renting were unaffected by the move, for persons under age 25 the move resulted in a net redistribution from owning to renting of 12 percent of the total. And for young people 25-34 years old, the proportion of owners went up by 11 percentage points following the move.

Marital status before and after moving is shown in table H. The only significant changes among movers occurred

Table H.
Marital Status of Nonmovers and Movers at the First and Last Interview of the Migration Interval, by Age

(Persons 16 years and over. Numbers in thousands. Migration interval approximately October 1983 to May 1986)

Marital status and age	Interview one		Interview eight	
	Nonmovers	Movers	Nonmovers	Movers
All ages	123,926	44,066	123,926	44,066
Married	64.8	49.3	63.8	* 56.6
Widowed	7.9	3.3	*9.0	3.8
Divorced, separated	7.6	12.6	8.1	* 14.7
Never married	19.7	34.8	19.1	* 25.0
16-24 years	18,634	15,879	18,634	15,879
Married	15.9	26.4	16.6	* 44.5
Widowed	0.1	0.1	0.1	0.1
Divorced, separated	1.0	3.9	1.7	* 6.7
Never married	83.1	69.7	81.7	* 48.7
25-34 years	23,789	14,936	23,789	14,936
Married	72.1	61.1	72.5	* 65.9
Widowed	0.2	0.7	0.3	0.7
Divorced, separated	8.6	15.4	9.8	17.0
Never married	19.0	22.8	17.4	* 16.4
35-44 years	22,930	6,031	22,930	6,031
Married	81.6	67.9	80.8	66.3
Widowed	1.0	0.7	1.2	1.0
Divorced, separated	11.2	23.3	12.0	25.0
Never married	6.2	8.1	6.0	7.6
45-54 years	18,899	2,934	18,899	2,934
Married	81.5	67.9	80.7	64.6
Widowed	3.2	5.8	4.1	6.8
Divorced, separated	10.2	22.3	10.2	24.5
Never married	5.1	4.1	5.0	4.1
55-64 years	19,187	2,048	19,187	2,048
Married	76.7	64.7	74.5	62.2
Widowed	10.4	13.6	12.4	15.3
Divorced, separated	8.6	18.0	8.9	18.8
Never married	4.3	3.7	4.3	3.7
65 years and over	20,487	2,238	20,487	2,238
Married	55.5	44.0	* 52.0	37.8
Widowed	33.9	38.3	* 37.4	43.6
Divorced, separated	4.9	10.0	4.9	10.9
Never married	5.7	7.7	5.7	7.7

* Differences between percentages for interview one and interview eight are statistically significant at the 90- percent confidence level.
Note: Movers are persons who changed their address between months 4 and 32 of the survey.

in the two youngest age groups. For persons 16–24 years of age, the proportion married shifted rather dramatically from 26 percent before the move to 45 percent after the move. An equally large decline occurred in the never married category for that age group, and the divorced/separated category registered a slight increase after moving. The marital status of the youngest age group of nonmovers, in comparison, did not change significantly over the course of the panel, which means that marital status changes in young adults are nearly always accompanied by residence changes. The other age group of movers with significant changes in marital status is the 25- to 34-year-olds. Here the proportion married increased from 61 to 66 percent with a corresponding drop in the never married category.

Employment status before and after moving is shown in table I. This variable shows significant changes for most age groups for nonmovers as well as movers. Changes in proportion that are significantly larger for movers than for nonmovers include declines in persons 16–24 years old and 45–54 years old looking for work, a decline in persons 65 years and over with a job, and an increase in persons 65 years and over who are not in the labor force. There is no clear relationship between moving and a decline in proportion unemployed, since in the age groups other than 16–24 and 45–54, the declines are either equal for movers and nonmovers or greater for nonmovers. The large changes among movers in the oldest age group indicate that a residential move often accompanies the transition from work to retirement.

Summary and Conclusions

The SIPP offers ample opportunities to research various aspects of the residential changes people make. The first SIPP panel provides information on residence and other characteristics on a monthly basis over a 2 1/2 year period. Beginning with the 1986 panel, the monthly data obtained over the life of the panel will be enriched with information from a topical module placed in an early interview, rather than at the end of the survey, that asks about recent moves occurring before the beginning of the panel. The result is a data source that provides migration data for short intervals over a fairly long timespan. This will enable the pinpointing in time of when a move occurred in relation to other changes that appear to be correlated with moving, for example, completing school, getting married or divorced, having a child, or taking a new job. There is a tradeoff, however, in using data for short time periods, since the number of movers over a 1-month or a several-month period will be much lower than the number over a 1-year or 5-year period and may not provide enough cases to permit stringent analysis.

Table I.
Employment Status of Nonmovers and Movers at the First and Last Interview of the Migration Interval, by Age

(Persons 16 years and over. Numbers in thousands. Migration interval approximately October 1983 to May 1986)

Employment status and age	Interview one		Interview eight	
	Nonmovers	Movers	Nonmovers	Movers
All ages	123,839	44,030	123,839	44,030
With a job, not looking	59.1	67.3	59.3	* 70.9
Job or no job, looking for work	4.8	8.7	* 3.9	* 5.9
No job, not looking	36.1	24.0	* 36.8	23.3
16-24 years	18,635	15,873	18,635	15,873
With a job, not looking	51.8	63.9	* 65.6	* 73.6
Job or no job, looking for work	10.8	11.6	* 9.3	* 7.9
No job, not looking	37.4	24.5	* 25.1	* 18.5
25-34 years	23,777	14,928	23,777	14,928
With a job, not looking	76.7	76.5	* 78.7	* 78.9
Job or no job, looking for work	6.4	7.4	* 5.0	* 5.3
No job, not looking	17.0	16.2	16.3	15.8
35-44 years	22,913	6,029	22,913	6,029
With a job, not looking	78.0	77.2	* 79.6	78.5
Job or no job, looking for work	4.9	7.4	* 3.9	* 5.3
No job, not looking	17.1	15.3	16.5	16.2
45-54 years	18,900	2,935	18,900	2,935
With a job, not looking	73.9	67.1	72.9	68.8
Job or no job, looking for work	3.5	9.3	3.3	* 4.9
No job, not looking	22.5	23.6	* 23.8	26.3
55-64 years	19,183	2,041	19,183	2,041
With a job, not looking	55.4	54.2	* 44.5	* 42.2
Job or no job, looking for work	2.6	5.8	* 1.4	4.0
No job, not looking	42.0	39.9	* 54.1	* 53.8
65 years and over	20,431	2,224	20,431	2,224
With a job, not looking	13.9	15.0	* 9.6	* 5.5
Job or no job, looking for work	0.6	1.5	* 0.3	0.6
No job, not looking	85.5	83.5	* 90.1	* 93.8

* Differences between percentages for interview one and interview eight are statistically significant at the 90-percent confidence level.
Note: Movers are persons who changed their address between months 4 and 32 of the survey.

A major drawback of the SIPP for migration research is its attrition rate. Moving is one of the ways of leaving the survey and it appears that many movers are lost from the SIPP. Data from the migration history topical module of the 1984 SIPP panel, which was asked at the end of the panel, showed a shortfall of 14 percent in the number of recent movers 15 years and over in the SIPP compared with the CPS estimate for the same 12-month period. A comparison of 1-year rates of moving from the SIPP longitudinal file and the CPS for about the same periods in time showed the SIPP rates between 13 and 25 percent lower. The total loss of households from the 1984 SIPP panel has been reported as 22 percent. The present analysis shows that after the longitudinal weights are applied to the file, the percent of adults who were in the survey in the first interview but missing by the eighth interview was just 4.6 percent. Weighting can ameliorate some of the effects of attrition but may add other biases. Determining the characteristics of persons who leave the SIPP and the effects of their leaving are topics well worth exploring and are essential for migration analyses. Future SIPP longitudinal files will be improved by including the reason-for-noninterview variable to aid in such research.

The analysis of the SIPP data began with a comparison of rates of moving by selected characteristics. The data were "before" characteristics measured at the time of the first interview. Movers were younger than nonmovers and were more likely to be in nonfamily households. Rates of moving were higher for persons living in rented housing than in owner-occupied housing, regardless of age. Persons who were separated or divorced at the beginning of the survey showed high rates of moving for every age group, but the differences are generally not statistically significant at the 90 percent confidence level. Rates of moving also appeared highest for persons who were looking for work at the beginning of the survey, but again the differences are not statistically significant for all age groups.

About one-third of movers moved two or more times during the 28-month period. Multiple movers were younger than one-time movers; they accounted for nearly half of all movers aged 16-24 years and about one-third of movers 25-34 years old. Movers in nonfamily households at the beginning of the survey were more likely to make additional moves than those in families.

The final section examined differences between movers and nonmovers for three characteristics—tenure, marital status, and employment status—both before and after the move. Only persons who remained in the survey for all eight interviews were included in this analysis. Whether measured before or after the move, movers showed a higher proportion renting than nonmovers. And the overall proportion of movers who rent was the same (44 percent) both before and after the move. But the proportion of renters changed significantly among movers under 35 years following the move. The proportion renting increased from 53 to 65 percent for the 16-24 year olds, probably as they left their parental homes for apartment life. The proportion dropped from 63 to 52 percent for the

next age group, the 25–34 year olds, as young adults left rental housing and purchased their own homes.

The marital status of movers under age 35 showed significant changes after moving. The proportion of young movers 16–24 who were married rose from 26 percent before the move to 45 percent after. The proportion of movers 25–34 who were married increased from 61 to 66 percent. Changes in marital status appear clearly associated with moving; nonmovers in these ages did not show any significant changes in marital status.

The employment status variable showed many changes among age groups between the first and eighth interviews, but most of the changes occurred for nonmovers as well as movers. Changes that appear to be correlated with moving include a decline in employment among persons 65 years and over and a corresponding increase in the proportion of that age group who were not in the labor force. Retirement seems to be accompanied frequently by a residential move.

The before–after analysis briefly touches on some of the important relationships between residential change and life cycle changes. There are many more variables included in the longitudinal SIPP file than the few looked at here, and there are more possible observation points in time than the 8 selected. The longitudinal file includes many variables of interest to migration research; it is particularly thorough with respect to information related to income and earnings, participation in government transfer programs, and employment behavior. Most of the variables, including address ID, are available for a consecutive 32-month period. Future research should take advantage of the opportunity the SIPP provides to pinpoint the leads and lags between changes in social and economic variables and changes in residence.

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Creating Annual State-to-State Migration Flows With Demographic Detail

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For States, counties, and small geographical areas, internal migration is the most important and complex component of population change. Frequent shifts in population distribution trends make up-to-date and demographically and geographically disaggregated migration data a necessity for population analysis. With fertility and mortality rates in the United States becoming stable at historically low levels, internal migration has assumed critical importance in determining the growth or decline of counties and States. Moreover, long-range plans for public infrastructure (including schools), pollution control, commercial developments and housing all require accurate population projections and therefore, reliable migration statistics (Subcommittee on Migration Statistics, 1988).

To meet the needs of monitoring and projecting internal migration, an ideal migration data set should provide timely mobility information for demographic and geographic disaggregations of the total population. Although a number of sources of migration data exist, none is really complete. Past migration data sets have often included only measures of net migration. However, recent demographic accounting theory has revealed the hazard of relying on net rather than gross migration (Rogers et al, 1983). Moreover, for preparing annual State population estimates and projections, annual State-to-State (or at least gross in and out) migration data by age, race, and sex are recommended for multistate demographic techniques and demographic accounting (Land and Rogers, 1982).

More specifically, in order to use "state-of-the art" methods of population projection and to examine "sophisticated" models of migration theory, we need a migration data set that meets the following conditions:

(1) Migration data should indicate both origin and destination of migrants.

(2) Each of these streams should be disaggregated by the major demographic dimensions of age, sex, and race.

(3) The migration data should be available for a 1-year migration interval.

(4) The data should be available on an annual basis for a substantial number of time periods.

(5) The data (or some procedure to update them) must be available on a timely basis.

(6) The migration data must be consistent with the population base so rates can be calculated.

Unfortunately, no single U.S. data source currently meets all six of the above conditions. Individual data sets provide only partial descriptions of the migration phenomena. With little hope for new annual migration surveys, census questions, or registration systems, we must rely on the long demographic tradition of devising methods to deal with limited data. Just as model life tables (United Nations, 1982), model fertility schedules (Coale and Trussel, 1974) and model migration schedules (Castro and Rogers, 1979) have been used to extract the maximum information from available data, we propose a method in this paper of combining the existing migration data sets to produce a "synthetic" migration data set meeting the six conditions above.

This paper 1) examines the current sources of migration data in the United States and addresses their advantages and limitations in meeting the above six conditions; 2) examines the consistency between these data sets; 3) explores a method for combining these data to create annual State-to-State migration flows by major demographic characteristics; and 4) presents preliminary results from the application of the method.

Sources of Migration Data in the United States

Although there are three major types of migration data sources in the United States—national household surveys, administrative records data sets, and the decennial census,—none meets all the above criteria for a complete data set (Wetrogan and Engels, 1982; Bilsborrow and Akin, 1982; Nakosteen, 1983; Rees and Rees, 1977). This section of the paper discusses in more detail the current sources of migration data in the United States and addresses their advantages and limitations in meeting the above six conditions and their potential utility as components of our proposed method for making synthetic migration estimates.

Decennial Census Migration Data

The decennial census question on place of residence 5 years earlier represents the migration data set with the most complete universe and the most extensive demographic and geographic disaggregations. These data are based on responses to the question:

Did this person live in this house five years ago? If the response is 'no, different house':

Where did this person live 5 years ago?

(1) State, foreign country, Puerto Rico, Guam_____

(2) county_____

(3) city, town, village, etc._____

(4) inside the incorporated (legal) limits of that city, town, village, etc.?

o yes o no, in unincorporated area

The census universe includes the total resident population in the United States. Military personnel stationed within the United States and college students, two of the most mobile segments of the population, also are part of the census universe. Military personnel are counted at their current place of residence. College students residing at school are tabulated at their student address. While the census universe is almost complete, in 1980 because of budget constraints, the migration questions were coded for only a sample of those asked the migration question. The migration sample consisted of approximately 10 percent of the U.S. population. This coding gives the current and previous residence of the respondents. Resulting tabulations produce migration flows between counties by detailed demographic characteristics.

In the decennial data, the responses to place of residence 5 years earlier are

compared to the April 1980 residence to develop the migration data. In this 5-year time frame, multiple moves of a respondent during the 5-year period are not detected. Even if a migrant moves more than once during the period, the migrant would be tabulated as an outmigrant from the 1975 place of residence and an inmigrant to the 1980 place of residence. However, if the migrant made multiple moves during the 5-year period, but by 1980 had returned to their initial place of residence; the migrations would cancel out and the respondent would not be tabulated as a migrant (Long and Boertlein, 1990).

Decennial migration data are subject to the problems of recall that bedevil any retrospective question. Respondent's memory loss, differing perceptions, and lack of knowledge about geographical and political boundaries all contribute to the overall data quality. Most of the Census data is collected using the mail-out, mail-back technique. Most respondents do not have personal contact with an interviewer.

While the decennial data have been the traditional backbone for all migration analysis, the data set lacks frequency and timeliness of release. The migration data from the residence five years ago question on the decennial census are available once every 10 years and are often not released until 3 to 5 years after the most recent census date. At present, we have the decennial data covering the years 1935-40, 1955-60, 1965-70, and 1975-80; and it will be 1993 or later before we receive the migration data for the 1985-90 period. No comparable demographic and geographic detail are available on gross or place-to-place migration for any of the intervening periods.

The decennial data provide the information to satisfy the first, second, and sixth conditions of a complete migration data set outlined in the introduction. The data can be shown for origin-destination flows (condition 1). Each of these flows can be disaggregated by the major demographic dimensions (eg. age, sex, and race) (condition 2). The migration data from the census universe are consistent with many of the data used in projection and other explanatory models (condition 6). However, the decennial data do not meet conditions 3, 4 and 5. The migration data are not available for a 1-year migration interval (condition 3). The migration data are not available on an annual basis for a substantial number of periods (condition 4). The migration data from the census are not available on a timely basis and can only be updated once every 10 years (condition 5).

Current Population Survey

National household survey data are one of the major sources of migration data by demographic characteristics. While several such surveys contain migration data including the Census Bureau's American Housing Survey (AHS) and the Survey of Income and Program Participation (SIPP), and the University of Michigan's Panel Study on Income Dynamics, we shall confine our attention here to the best known migration survey, the March supplement to the Current Population Survey (CPS). The CPS is a monthly survey of approximately 57,000 households. In the March supplement, we ask each member of the household for their place of residence 1 year earlier. The CPS question is analogous to the one asked on the decennial census form. As in the decennial census, the comparison of responses to the previous and current place of residence provides a measure of migration. While it is theoretically possible to tabulate the responses to obtain migration flows for states, the size of the sample limits accurate geographic disaggregations to the four census regions.

Although the CPS migration information cannot be disaggregated to small geographic areas, the migration information can be combined with selected demographic and socioeconomic information about the respondent. For large geographic areas (eg., the four census regions), we can examine the migration data for various demographic subgroups.

In the CPS data, the time frame for migration is usually a 1-year period. However, for several periods during the 1970's, the migration interval varied from 1 to 4 years (Long and Bortlein, 1990). For the 1-year interval migration data, the problems of return and repeat migration that confound the decennial data are minimized. As in the decennial data, the responses to the migration questions may be influenced by the problems of recall that affect all retrospective questions. The respondent's differing perceptions and lack of knowledge about official geographical and political boundaries will also contribute to the overall data quality. Unlike the census environment, the CPS involves some personal interaction between an interviewer and the household.

Other concerns arise from the special nature of the CPS universe. Unlike the census universe, most military personnel are not included in the survey and most college students are counted at home rather than at their student residence. Because of the special nature of the CPS universe, the migration of these persons may not be well represented by the data.

While the CPS data may not provide the geographic disaggregations of the decennial data, they do provide the frequency and timeliness lacking in the decennial data. These survey data are released within 18 months of the survey date and are available for most periods from 1947 to the present.

The CPS migration data provide information to satisfy the second, third, fourth, and fifth conditions of a complete migration set outlined in the introduction. The data can be disaggregated by the major demographic dimensions (condition 2). They are available for a 1-year migration interval (condition 3). The data are available on an annual basis for a substantial number of time periods (condition 4). Finally, the CPS data are available on a timely basis (condition 5).

Administrative Records

In recent years, the Bureau of the Census has developed a new migration data set based on administrative re-

cords from the Internal Revenue Service Federal Income tax returns. In developing the migration data, the Bureau of the Census utilizes the mailing address on the tax return and a coding algorithm to assign the appropriate place, county, and state geographical code. By matching tax returns for consecutive years, we can obtain annual gross and place-to-place migration for counties and states. The geographical classification of the earlier year's return designates the place of origin while the geographical classification of the later year's return designates the destination (U. S. Bureau of the Census, 1988).

These migration data are generated for tax filers using the information on the IRS return. Approximations of the migration of the total population require weighting each return by the number of exemptions on the return.

The major questions about this data set revolve around whether migration rates calculated from this set of data are representative of the total population's rate of movement and whether the geographic coding of tax returns can give good data on actual residence. The administrative records universe is limited primarily to wage earners who file tax returns in two consecutive years. The system excludes non-wage earners and persons recently entering or leaving the work force who would have filed tax returns in only one of the two periods.

The assignment of residence geography has several potential problem areas. The mailing address on the tax return is the basis for the assignment of geographical codes. In some instances, the address on the tax return may not correspond to the residence of the tax filer. Tax filers may use a business address or the address of their tax accountant, tax preparer, or bank. Another potential problem involves the accuracy of the algorithm to assign the place, county, and State geography. For small geographical areas, the use of the coding guide to assign the geography can be unreliable.

During the last 10 years, this set of migration data has been available on an annual basis. These administrative data are available for each year 1975 through 1988 enabling the Census Bureau to develop migration data for each annual period 1975-76 through 1987-88. The greatest benefit of these data is their timeliness and geographic coverage. These data at the place level are generally available within one year of the reference period. At present, the IRS migration data set provide no information on the demographic characteristics of the migrants.

In terms of our six conditions for a complete migration data set, the administrative data set meets the first, third, fourth, and fifth conditions. The migration data are available as place-to-place flows for a 1-year migration interval on an annual basis from 1975 through 1988 within one year from the last observation.

Extended Administrative Records

In recent years, the Bureau of the Census has investigated the feasibility of extending the basic administrative records from the Internal Revenue Service federal income tax to include some race and age detail (U.S. Bureau of the Census, 1978 and Word, 1989). The Census Bureau receives from the Social Security Administration (SSA) selected demographic characteristics for a systematic 20-percent sample of all Social Security numbers issued between 1935 and the present. The sample data on individuals from SSA consists of the Social Security number and four items of demographic information—surname, race, sex, and date of birth. This information enables the Census Bureau to carry the basic administrative records information one step further and attach demographic characteristics of the tax filer on to a 20-percent sample of tax returns. This crucial step allows the Census Bureau to subdivide the internal migration data developed from the basic administrative records by age, sex, race, and Hispanic origin and differentiates this experimental approach from the standard administrative records information. Since this approach is still in the early stages, we chose to not incorporate these added data into our synthetic measure of migration.

Other Data Sources

Two additional sources of migration data deserve special mention. One source is data on migration obtained from the Continuous Work History Sample (CWHS). This data set resulted from the comparison of changes of place of work (with some limited corrections for commuting) as registered under the administrative reporting of the Social Security System (Cartwright,

Table A.
Percentage of Population 5 Years Old and Over With a Different State or County of Residence 5 Years Earlier

Age at end of period	Different State			Different county		
	1980 CPS	1980 census	Difference, CPS-census	1980 CPS	1980 census	Difference, CPS-census
All ages	9.1	9.7	-0.6	19.3	19.5	-0.2
5-14 years	9.9	9.9	-	20.6	19.5	*1.1
15-19 years	7.1	9.3	*-2.2	14.4	18.9	*-4.5
20-24 years	12.9	15.5	*-2.6	28.5	32.7	*-4.2
25-29 years	16.8	16.9	-0.1	35.8	34.1	*1.7
30-34 years	13.8	13.8	-	28.8	27.7	1.1
35-44 years	9.2	9.6	-0.4	18.9	18.4	0.5
45-54 years	5.8	5.6	0.2	12.1	11.1	*1.0
55-64 years	4.6	4.9	-0.3	11.0	9.7	*1.3
65 years and over	4.2	4.4	-0.2	8.9	9.0	-0.1

* Statistically significant at the 90-percent confidence level.
Source: 1980 Census of Population, *Geographical Mobility for States and the Nation*; and Current Population Reports, *Geographical Mobility: March 1975 to March 1980.*

1976: Renshaw et al.,1978; Wardwell and Gilchrist, 1979). Substantial questions have been raised about the reliability of the migration coding and subsequent accuracy and stability of resulting annual migration flow data (Isserman et al. , 1982; Clark, 1982; Nelson, 1975). Combined with the fact that the most recent data from this system are for 1975, this inaccuracy makes the data set unusable for our purposes.

Another source of migration data is residual net migration (White et al., 1987; Bowles et al.,1975; Bowles and Tarver, 1965). Residual net migration methods are often used to produce migration data for intercensal periods by attributing the differences in census counts or estimates between two dates (after accounting for births and deaths during the period) as due to net migration (Shryock and Siegel, 1971). In some instances, this method provides acceptable net migration data, although it cannot provide the information on migration flows.

For the 1970–80 period, the use of residual net migration techniques and the resulting net migration data are subject to considerable error. For the United States, the rate of net undercount appears to be lower in 1980, compared with 1970, 1.0 percent in 1980 compared to 2.8 percent in 1970 (U.S. Bureau of the Census, 1988). Given the substantial variations geographically in the extent of coverage improvement between 1970 and 1980, the usefulness of traditional residual net migration methods is greatly reduced (U.S. Bureau of the Census, 1983). Even for estimates and for census years with similar undercount levels, net migration accumulates many of the possible errors made in the estimation process. Because the uncertainty in the level of net migration can be large, we did not incorporate measures of residual net migration into our "synthetic measure".

Comparison of Migration Data From Census, CPS, and IRS Sources

Different methods of measuring migration and even the same or similar methods using different sources can produce data that are quite varied and difficult to compare. If we are going to develop a synthetic measure of migration that combines aspects of each of the major data sets, it is useful to compare various measures of migration from the different data sets. In this section we compare results from the three main sources of migration data—Census, CPS, and IRS. For the first time, the 1975–80 period represents a common migration period for all three sources, therefore much of our analysis is concentrated on this time period.

Census and CPS Data

Table A shows a comparison between the April 1, 1980, census question on residence 5 years earlier and the March 1980 CPS question on residence 5 years earlier. The questions are similarly worded and cover the same time horizon. As discussed in section 1, the census and CPS utilize different interview techniques, population coverage, and sampling techniques. However, despite the difference in population coverage, sampling techniques, and interview method, the two data sets give roughly similar results at the national level for all ages. The only statistically significant difference in the percent living in a different state occurs at ages 15 to 19 and 20 to 24. In both cases, the rate of interstate migration is higher in the census than in the CPS. These ages comprise many military and college students who are usually quite mobile and are omitted from the CPS tabulations.

Table A also compares the intercounty migration rate from the census and the CPS. Similar to the interstate migration rates, the largest differences occur for ages 15 to 19 and 20 to 24. For these age groups, the rate of intercounty migration is higher in the Census than in the CPS.

Table B compares the migration rates for regions as derived from the CPS and census data. In the Northeast, the CPS tends to understate the rate of outmigration and inmigration. In the Midwest, the CPS understates the rate of outmigration and in the South, the CPS tends to understate the rate of inmigration.

Table C shows a further disaggregation of the migration data from the census and CPS. These disaggregations show the region-to-region migration rates developed from the census and CPS data bases. With the exception of

Table B.
Migration Rates for Regions: 1975-80
(CPS and census data. Rates per 100 1975 base population)

Region	Inmigration rates			Outmigration rates			Net migration rates		
	CPS	Census	Difference, CPS-census	CPS	Census	Difference, CPS-census	CPS	Census	Difference, CPS-census
Northeast	2.4	2.7	* -0.3	5.6	6.5	* -0.9	-3.2	-3.8	* 0.6
Midwest	3.7	3.8	-0.2	5.9	6.3	* -0.5	-2.2	-2.5	* 0.3
South	6.7	7.1	* -0.4	3.9	4.1	-0.2	2.8	3.0	-0.2
West	8.1	8.4	-0.3	5.5	5.2	0.3	2.5	3.2	*-0.6

* Statistically significant at the 90-percent confidence level.
Source: 1980 Census of Population, *Geographical Mobility for States and the Nation;* and Current Population Reports, *Geographical Mobility: March 1975 to March 1980.*

migration from the Northeast to the South and migration from the Midwest to Northeast and "Regional stayers" in the Northeast and Midwest, the two distributions are similar. As mentioned above, the CPS universe excludes a large portion of the military population. A large portion of the military installations are located in the South and military personnel tend to be quite mobile. Since the CPS universe excludes many of the military personnel while the census universe includes military personnel, the inmigration rates to the South developed from the CPS data may be low compared to the rates developed from census data.

Table C.
Region-to-Region Migration Rates: 1975-80
(CPS and census data. Rates per 100 1975 population)

Residence in 1975	Residence in 1980							
	Northeast		Midwest		South		West	
	CPS	Census	CPS	Census	CPS	Census	CPS	Census
Northeast	94.4	93.5	0.9	1.0	3.2	3.9	1.6	1.7
Midwest	0.5	0.6	94.2	93.7	3.1	3.4	2.2	2.3
South	0.9	1.0	1.5	1.5	96.1	95.9	1.4	1.6
West	0.7	0.7	1.8	1.7	3.0	2.8	94.5	94.8

Source: 1980 Census of Population, *Geographical Mobility for States and the Nation*; and Current Population Reports, *Geographical Mobility: March 1975 to March 1980.*

Census and 5-Year Match IRS Data

In order to compare migration information developed from the IRS data with the migration information developed from the 5-year census data, we have developed a special match of the 1975

Table D.
Gross Outmigration Rates From Census and IRS Exemptions in 1980: 1975-80
(Rates per 100 population)

Region, division, and State	Outmigration rate		Difference, IRS-census	Region, division, and State	Outmigration rate		Difference, IRS-census
	Census	IRS			Census	IRS	
United States	9.9	10.8	0.9	District of Columbia	25.9	33.2	7.3
Northeast	9.8	10.1	0.3	Virginia	13.1	14.8	1.7
Midwest	9.4	10.0	0.6	West Virginia	8.4	9.1	0.7
South	9.6	11.2	1.6	North Carolina	8.4	9.8	1.4
West	11.2	12.3	1.1	South Carolina	9.5	11.1	1.6
New England	10.9	11.1	0.2	Georgia	9.3	11.0	1.7
Maine	10.3	9.7	-0.6	Florida	12.0	14.9	2.9
New Hampshire	14.2	14.2	-	East South Central	8.4	10.1	1.7
Vermont	13.1	12.8	-0.3	Kentucky	8.4	9.8	1.4
Massachusetts	9.9	10.4	0.4	Tennessee	8.4	10.2	1.8
Rhode Island	10.5	11.1	0.7	Alabama	7.7	9.4	1.7
Connecticut	11.7	11.7	-0.1	Mississippi	9.4	11.6	2.3
Middle Atlantic	9.4	9.7	0.3	West South Central	7.8	9.0	1.1
New York	10.1	10.4	0.3	Arkansas	10.1	11.8	1.7
New Jersey	10.9	11.4	0.4	Louisiana	7.4	8.3	0.9
Pennsylvania	7.4	7.7	0.3	Oklahoma	10.1	12.0	2.0
East North Central	8.9	9.3	0.4	Texas	7.1	8.0	0.9
Ohio	9.0	9.6	0.6	Mountain	15.9	17.1	1.1
Indiana	9.1	9.7	0.6	Montana	15.0	15.7	0.8
Illinois	10.1	10.8	0.7	Idaho	15.8	16.7	0.9
Michigan	7.9	8.0	0.1	Wyoming	19.6	19.8	0.2
Wisconsin	7.5	7.5	-	Colorado	17.0	18.0	1.0
West North Central	10.6	11.5	0.8	New Mexico	15.6	17.3	1.8
Minnesota	8.4	8.7	0.3	Arizona	16.0	17.9	1.9
Iowa	10.0	10.6	0.6	Utah	11.6	12.4	0.8
Missouri	9.9	10.9	1.0	Nevada	19.9	21.0	1.1
North Dakota	14.4	16.0	1.6	Pacific	9.6	10.5	1.0
South Dakota	13.9	15.4	1.5	Washington	9.9	10.7	0.8
Nebraska	12.4	13.4	1.0	Oregon	11.0	12.1	1.1
Kansas	13.3	14.9	1.6	California	8.6	9.5	0.9
South Atlantic	11.1	12.9	1.8	Alaska	32.9	32.9	0.1
Delaware	14.9	15.6	0.7	Hawaii	20.2	20.3	0.1
Maryland	12.3	13.7	1.4	Average absolute difference	(X)	(X)	1.1

- Represents zero.
X Not applicable

to the 1980 IRS tax return data. Because of the 5-year time span, the match rate between the 1975 and 1980 data is lower than in any of the annual match periods. However, this is the only way to examine separately the discrepancies in gross migration data between the IRS and census data sets. We generated the migration data for tax filers by weighting each matched return by the number of exemptions claimed in 1980.

Table D shows the outmigration rates derived from the 5-year Census question and the 5-year IRS match. In light of the conceptual differences between the decennial census and the IRS migration data, the similarities in the two sets of gross migration data are remarkable. For most States in the United States, the IRS administrative records data set tends to overstate the level of interstate migration during the 5-year period compared to the census data set. Among the rates of outmigration, the largest differences are in the South Atlantic and East South Central States. The outmigration rate from the South Atlantic developed using the IRS data is 12.9 percent, compared with a census outmigration rate of 11.1 percent (an excess of 1.8 percentage points). In the East South Central, the IRS outmigration rate is 10.1, compared with the census rate of 8.4, a difference of 1.7 percentage points. Among the 50 States and the District of Columbia, the largest difference in the outmigration rates is in the District of Columbia. The IRS outmigration rate is 33.2 percent, compared with a census rate of 25.9. Among the 50 states, the largest differences between the two sets of rates are in Florida, Mississippi, and Oklahoma. The average absolute difference in the rates of outmigration is 1.1 percentage points.

In terms of the inmigration rates for almost all states (table E), the rates of inmigration developed from the IRS data set tend to be larger than the comparable rates developed from the census data base. The largest differences are in the East South Central and West South Central States. The

Table E.
Gross Inmigration Rates From Census and IRS: 1975-80
(Rates per 100 population)

Region, division, and State	Inmigration rate		Difference, IRS-census	Region, division, and State	Inmigration rate		Difference, IRS-census
	Census	IRS			Census	IRS	
United States	9.9	10.8	0.9	District of Columbia	14.9	15.6	0.7
Northeast	6.0	6.4	0.4	Virginia	14.4	15.9	1.5
Midwest	6.9	7.5	0.6	West Virginia	8.7	11.1	2.4
South	12.5	14.3	1.8	North Carolina	10.1	11.0	0.9
West	14.4	15.3	0.9	South Carolina	11.9	13.5	1.6
New England	9.2	9.4	0.2	Georgia	12.0	13.5	1.5
Maine	10.9	12.6	1.7	Florida	22.2	25.1	2.9
New Hampshire	19.7	22.8	3.1	East South Central	9.7	11.8	2.1
Vermont	14.7	15.4	0.7	Kentucky	9.1	10.9	1.8
Massachusetts	6.9	6.2	-0.7	Tennessee	10.9	12.6	1.7
Rhode Island	8.8	8.4	-0.4	Alabama	9.1	11.3	2.2
Connecticut	9.2	9.8	0.6	Mississippi	9.3	12.7	3.4
Middle Atlantic	4.9	5.4	0.5	West South Central	11.7	13.7	2.0
New York	3.7	3.8	0.1	Arkansas	12.8	15.7	2.9
New Jersey	7.7	8.7	1.0	Louisiana	8.6	10.9	2.3
Pennsylvania	5.1	5.4	0.3	Oklahoma	14.5	17.0	2.5
East North Central	5.9	6.3	0.4	Texas	11.8	13.5	1.7
Ohio	5.5	5.9	0.4	Mountain	23.1	24.4	1.3
Indiana	7.5	7.8	0.3	Montana	15.2	18.0	2.8
Illinois	5.9	6.3	0.4	Idaho	21.4	24.4	3.0
Michigan	5.0	5.4	0.4	Wyoming	32.3	37.3	5.0
Wisconsin	6.6	7.0	0.4	Colorado	22.1	22.9	0.8
West North Central	9.4	10.3	0.9	New Mexico	18.2	22.5	4.3
Minnesota	7.6	7.6	0.0	Arizona	27.1	27.9	0.8
Iowa	7.8	8.4	0.6	Utah	17.2	16.0	-1.2
Missouri	9.4	10.7	1.3	Nevada	38.4	40.7	2.3
North Dakota	12.6	13.9	1.3	Pacific	11.4	12.0	0.6
South Dakota	10.9	12.8	1.9	Washington	18.0	19.7	1.7
Nebraska	10.4	11.5	1.1	Oregon	18.5	20.4	1.9
Kansas	12.7	14.1	1.4	California	9.0	9.0	0.0
South Atlantic	14.2	15.6	1.4	Alaska	28.5	38.1	9.6
Delaware	13.3	12.4	-0.9	Hawaii	17.4	16.0	-1.4
Maryland	10.4	11.8	1.4	Average absolute difference	(X)	(X)	1.7

- Represents zero.
X Not applicable.

inmigration rate to the East South Central developed using the IRS data is 11.8 percent compared to a census inmigration rate of 9.7 percent (an excess of 2.1 percentage points). In the West South Central, the IRS inmigration rate is 13.7 compared to the census rate of 11.7, a difference of 2.0 percentage points. Among the States, the largest differences between the two sets of rates are in New Hampshire, Mississippi, Idaho, Wyoming, New Mexico, and Alaska. The average absolute differences between the inmigration rates tend to be larger than the average absolute differences in the outmigration rates. For the inmigration rates, the average absolute difference between the two sets of rates is 1.7 percentage points.

Table F shows the net impact of derived out and inmigration. In most cases, the differences between the census and IRS net migration rates are smaller than the differences in the out or inmigration rates. The largest discrepancy between the two sets of net migration rates is in Alaska where the net migration rate derived from the census is -4.3 percent while the net migration derived from the 5-year IRS match is +5.1. For Alaska, the IRS data indicate a net inmigration over the 5-year period while the census data base indicates a net outmigration. Almost all of this difference is due to the difference in the rates of inmigration. The two data sets have comparable rates of outmigration. The difference in net migration rates between the two data sets is also large in the District of Columbia. The net migration rate derived from the census is -11.0 per 100 population while the net migration rate derived from the 5-year IRS match is -17.6. In contrast to Alaska, almost all of this difference in net migration rates in the District of Columbia is due to the difference in the two sets of outmigration rates.

One of the major questions concerning the IRS data set is whether migration

Table F.
Net Migration Rates From Census and IRS: 1975-80
(Census and IRS 5-year match data. Rates per 100 population)

Region, division, and State	Net migration rate		Difference, IRS-census	Region, division, and State	Net migration rate		Difference, IRS-census
	Census	IRS			Census	IRS	
United States	-	-	-	District of Columbia	-11.0	-17.6	-6.6
Northeast	-3.8	-3.6	0.2	Virginia	1.3	1.1	-0.3
Midwest	-2.5	-2.5	-	West Virginia	0.3	2.0	1.7
South	3.0	3.2	0.2	North Carolina	1.6	1.1	-0.5
West	3.2	3.0	-0.1	South Carolina	2.4	2.5	0.1
New England	-1.7	-1.6	0.1	Georgia	2.7	2.6	-0.1
Maine	0.6	2.9	2.3	Florida	10.1	10.2	0.1
New Hampshire	5.6	8.6	3.0	East South Central	1.3	1.7	0.4
Vermont	1.6	2.6	1.0	Kentucky	0.7	1.1	0.4
Massachusetts	-3.1	-4.1	-1.1	Tennessee	2.5	2.4	-0.1
Rhode Island	-1.7	-2.7	-1.0	Alabama	1.3	1.9	0.6
Connecticut	-2.5	-1.9	0.6	Mississippi	-0.1	1.0	1.1
Middle Atlantic	-4.5	-4.3	0.2	West South Central	3.9	4.8	0.9
New York	-6.4	-6.6	-0.1	Arkansas	2.8	3.9	1.2
New Jersey	-3.2	-2.7	0.6	Louisiana	1.2	2.6	1.4
Pennsylvania	-2.3	-2.3	-	Oklahoma	4.4	5.0	0.6
East North Central	-3.0	-3.0	-	Texas	4.7	5.5	0.8
Ohio	-3.5	-3.7	-0.2	Mountain	7.1	7.4	0.2
Indiana	-1.6	-1.9	-0.3	Montana	0.2	2.3	2.0
Illinois	-4.2	-4.5	-0.3	Idaho	5.6	7.7	2.1
Michigan	-2.8	-2.6	0.3	Wyoming	12.7	17.5	4.8
Wisconsin	-0.9	-0.5	0.3	Colorado	5.2	5.0	-0.2
West North Central	-1.2	-1.2	0.1	New Mexico	2.7	5.1	2.5
Minnesota	-1.2	-1.1	0.1	Arizona	11.1	10.0	-1.2
Iowa	-2.2	-2.2	-	Utah	5.6	3.7	-2.0
Missouri	-0.5	-0.2	0.3	Nevada	18.4	19.7	1.3
North Dakota	-1.8	-2.1	-0.3	Pacific	1.8	1.4	-0.4
South Dakota	-3.0	-2.6	0.4	Washington	8.1	9.0	0.9
Nebraska	-2.0	-1.9	0.1	Oregon	7.5	8.3	0.8
Kansas	-0.6	-0.7	-0.1	California	0.5	-0.5	-0.9
South Atlantic	3.1	2.7	-0.4	Alaska	-4.3	5.1	9.5
Delaware	-1.7	-3.3	-1.6	Hawaii	-2.8	-4.2	-1.5
Maryland	-1.9	-2.0	-0.1				

- Represents zero.

rates calculated from this data set are representative of the total population. The administrative records universe is limited primarily to wage earners who file tax returns in two consecutive years. The "coverage rate" is a measure of the representativeness of migration data from the administrative records data set. This rate compares the number of tax filers and exemptions with the population total in each state for 1980. This coverage rate is only a partial measure because the tax filer universe is limited further to tax filers who file in two consecutive periods.

Table G shows the coverage rates of the IRS data in 1980. The South Atlantic and East South Central divisions have the lowest coverage rates, 88.8 and 86.0 respectively. No doubt the low coverage rates in these two divisions contribute to the large discrepancies in the two sets of outmigration rates. However, coverage rate levels are not the only factor contributing to differences in the migration rates. The differences between the rates for the District of Columbia are probably due more to geographic coding and residence identification than to coverage problems.

Annual IRS Data and Census Data

In order to compare the annual IRS data to the census data, we have developed an alternate set of net migration rates using the aggregated IRS data covering the 5-year period, 1975 through 1980. Although the IRS data are for each annual period 1975 through 1980, and the decennial census data relate to a 5-year horizon,

Table G.
Coverage Rate of Administrative Records Data: 1980
(Numbers in thousands)

Region, division, and State	Total exemptions, 1980	Census, April 1, 1980	Percent
United States	206,720	226,549	91.2
Northeast	44,746	49,136	91.1
New England	11,502	12,349	93.1
Middle Atlantic	33,244	36,787	90.4
Midwest	55,161	58,868	93.7
East North Central	39,102	41,683	93.8
West North Central	16,060	17,185	93.5
South	66,815	75,372	88.6
South Atlantic	32,819	36,959	88.8
East South Central	12,617	14,667	86.0
West South Central	21,379	23,746	90.0
West	39,998	43,173	92.6
Mountain	10,625	11,373	93.4
Pacific	29,373	31,800	92.4
New England:			
Maine	1,033	1,125	91.8
New Hampshire	886	921	96.3
Vermont	463	511	90.7
Massachusetts	5,254	5,737	91.6
Rhode Island	860	947	90.9
Connecticut	3,005	3,108	96.7
Middle Atlantic:			
New York	15,553	17,558	88.6
New Jersey	7,014	7,365	95.2
Pennsylvania	10,677	11,864	90.0
East North Central:			
Ohio	10,095	10,798	93.5
Indiana	5,174	5,490	94.2
Illinois	10,849	11,427	94.9
Michigan	8,549	9,262	92.3
Wisconsin	4,436	4,706	94.3
West North Central:			
Minnesota	3,867	4,076	94.9
Iowa	2,743	2,914	94.1
Missouri	4,481	4,917	91.1
North Dakota	624	653	95.5
South Dakota	647	691	93.6
Nebraska	1,500	1,570	95.5
Kansas	2,199	2,364	93.0
South Atlantic:			
Delaware	565	594	95.1
Maryland	3,995	4,217	94.7
District of Columbia	574	638	89.9
Virginia	4,849	5,347	90.7
West Virginia	1,629	1,950	83.5
North Carolina	5,278	5,882	89.7
South Carolina	2,733	3,122	87.5
Georgia	4,838	5,463	88.6
Florida	8,358	9,746	85.8
East South Central:			
Kentucky	3,109	3,661	84.9
Tennessee	4,051	4,591	88.2
Alabama	3,330	3,894	85.5
Mississippi	2,127	2,521	84.4
West South Central:			
Arkansas	1,951	2,286	85.4
Louisiana	3,657	4,206	86.9
Oklahoma	2,644	3,025	87.4
Texas	13,126	14,229	92.3
Mountain:			
Montana	750	787	95.3
Idaho	878	944	93.0
Wyoming	464	470	98.7
Colorado	2,724	2,890	94.3
New Mexico	1,221	1,303	93.7
Arizona	2,454	2,718	90.3
Utah	1,359	1,461	93.0
Nevada	774	800	96.7
Pacific:			
Washington	3,812	4,132	92.3
Oregon	2,392	2,633	90.9
California	21,877	23,668	92.4
Alaska	398	402	98.9
Hawaii	894	965	92.6

the annual net migration data from the IRS can be aggregated to derive a 5-year time horizon. Table H presents a comparison of the net migration developed using the census data with the net migration rates calculated from the aggregated 5-year IRS data. Because of the phenomena of return and repeat migration, we can not use this same approach to examine the separate components of outmigration and inmigration.

Despite the differences in population coverage, response techniques, and coding variations, the net migration rates for most states are roughly similar. Similar to the results shown in table F, the largest differences between the two sets of rates occur in Alaska and the District of Columbia. According to the census data, the net migration rate for Alaska for the 1975-80 period is -4.8 as compared with a net migration rate of +4.2 derived from aggregating the annual IRS data for the 5-year period, 1975 through 1980. It is not surprising that the District of Columbia has a large discrepancy between the two sets of rates. The discrepancies due to coding problems between data sets for a city like the District of Columbia are often large. For the District of Columbia, the net migration rate from the census is -11.0 compared to a rate of -14.4 from the IRS data. The rates for the 50 States are all more closely related.

IRS and CPS Data

Table I compares the annual rate of interstate migration as derived from the CPS data and IRS data. The analysis is limited to the annual periods 1980-81 through 1986-87. Prior to 1980, the CPS used a variable interval

Table H.
Rate of Net Migration: 1975-80
(Census and aggregate IRS migration data. Rate per 100 population)

Region, division, and State	Census	IRS	Difference, Census-IRS
United States	-	-	-
Northeast	-3.7	-3.7	-
New England	-1.7	-1.8	0.1
Middle Atlantic	-4.5	-4.4	-0.1
Midwest	-2.5	-2.7	0.2
East North Central	-3.0	-3.2	0.2
West North Central	-1.2	-1.4	0.2
South	3.0	3.3	-0.3
South Atlantic	3.1	3.3	-0.2
East South Central	1.3	1.5	-0.2
West South Central	3.9	4.6	-0.7
West	3.2	3.3	-0.1
Mountain	7.1	7.7	-0.6
Pacific	1.8	1.8	-
New England:			
Maine	0.6	2.2	-1.6
New Hampshire	5.6	7.1	-1.5
Vermont	1.6	2.4	-0.8
Massachusetts	-3.1	-3.8	0.7
Rhode Island	-1.7	-2.6	0.9
Connecticut	-2.5	-2.2	-0.3
Middle Atlantic:			
New York	-6.4	-6.3	-0.1
New Jersey	-3.2	-3.1	-0.1
Pennsylvania	-2.3	-2.4	0.1
East North Central:			
Ohio	-3.5	-3.7	0.2
Indiana	-1.6	-2.1	0.5
Illinois	-4.2	-4.5	0.3
Michigan	-2.8	-2.9	0.1
Wisconsin	0.9	0.8	0.1
West North Central:			
Minnesota	-1.1	-1.1	-
Iowa	-2.2	-2.3	0.1
Missouri	-0.5	-0.6	0.1
North Dakota	-1.8	-2.6	0.8
South Dakota	-3.0	-3.1	0.1
Nebraska	-1.9	-2.3	0.4
Kansas	-0.6	-1.3	0.7
South Atlantic:			
Delaware	-1.7	-2.9	1.2
Maryland	-1.9	-1.9	-
District of Columbia	-11.0	-14.4	3.4
Virginia	1.3	0.7	0.6
West Virginia	0.3	1.7	-1.4
North Carolina	1.6	1.1	0.5
South Carolina	2.4	2.2	0.2
Georgia	2.7	2.5	0.2
Florida	10.1	12.3	-2.2
East South Central:			
Kentucky	6.9	7.7	-0.8
Tennessee	2.5	2.2	0.3
Alabama	1.3	1.8	-0.2
Mississippi	-1.0	6.4	-7.4
West South Central:			
Arkansas	2.7	3.8	-1.1
Louisiana	1.2	2.2	-1.0
Oklahoma	4.4	4.6	-0.2
Texas	4.7	5.4	-0.7
Mountain:			
Montana	0.2	1.8	-1.6
Idaho	5.6	6.7	-1.1
Wyoming	12.7	15.3	-2.6
Colorado	5.2	5.6	-0.4
New Mexico	2.6	5.0	-2.4
Arizona	11.1	11.7	-0.6
Utah	5.6	3.9	1.7
Nevada	18.4	18.1	0.3
Pacific:			
Washington	8.1	8.3	-0.2
Oregon	7.5	7.9	-0.4
California	0.5	0.2	0.3
Alaska	-4.3	4.2	-8.5
Hawaii	-2.8	-3.2	0.4

- Represents zero.

to measure migration. Beginning in 1980, the CPS returned to an annual migration interval. Despite the conceptual differences in the measurement of migration in the CPS and IRS data sets, the overall rates of interstate migration are quite similar. With the exception of 1980–81, the interstate migration rates from the CPS and IRS are not statistically different.

Tables J and K examine a further disaggregation of the migration rates from the two sources. For two selected annual periods, 1980–81 and 1986–87, we can compare the region to region migration rates developed from each of the data sets. The region to region migration rates from the two data sets are quite similar. For 1980–81 with the exception of migration from the Midwest to the South, the inter-regional migration rates from the two data sets are not different. According to the IRS data set, between 1980 and 1981, 1 percent of the persons who lived in the Northeast in 1980 lived in the South in 1981. According to the CPS, this percentage was almost identical, 0.9 percent. Between 1986 and 1987, with the exception of migration from the Midwest to the Northeast and migration from the South to the Northeast, the two data sets are not different. The close similarity between the two data sets is somewhat surprising given the documented differences in the measurement of migration.

The estimates of migration in the CPS data are subject to sampling and nonsampling variability. The inability to obtain information about all cases in the sample, definitional difficulties, differences in the interpretation of questions, and the respondents' inability or unwillingness to provide correct information or to recall information all comprise nonsampling variability. In addition to these interview related errors, nonsampling variability includes errors made in data collection such as in recording or coding the data, errors made in processing the data, errors made in estimating values for missing data and failure to represent all units with the sample.

Table I.
Annual Geographical Mobility Rates, by Type of Movement for Selected 1-Year Periods: 1980-87

Period	Different State-		Difference, IRS-CPS
	CPS	IRS	
1980-81	2.8	3.0	*0.2
1981-82	3.0	3.1	0.1
1982-83	2.7	2.8	0.1
1983-84	2.8	3.0	0.2
1984-85	3.0	2.9	-0.1
1985-86	3.0	2.9	-0.1
1986-87	2.8	2.9	0.1

* Statistically significant at the 90-percent confidence level.
Source: Current Population Reports, *Geographical Mobility: March 1986 to March 1987;* and unpublished IRS tabulations.

Because the CPS is a sample of the U.S. population, the estimates of migration derived from the CPS are also subject to sampling variability. Sampling variability includes the variation that occurs by chance because a sample was surveyed rather than the entire population.

Combining Migration Data From Different Sources to Develop a Synthetic Data Set

Since none of the currently available sources of migration satisfies the six conditions of a complete migration data set outlined in the introduction, we must explore ways of combining selected characteristics from each of the data sets to create a "synthetic" data set. The similarities between the three main data sets outlined in section 2 simplify the combination process. In order to satisfy the six conditions discussed throughout this paper, the "synthetic" data set that is developed should be a full matrix of state-to-state migration data by age, sex, and race for each current year. The "synthetic" data set should combine the demographic and geographic detail of the decennial data series with the timeliness and frequency of the Current Population Survey and matched IRS tax returns. (figure 1)

In developing the most recent set of state population projections, we devised one method of combining the existing data to create the required "synthetic" data set—a set of State-to-State migration rates by age, sex, and race for each current year. The method we selected included two major steps: 1) developing the base year migration data; and 2) updating the migration matrix.

Developing the Base Year Migration Data

The first step in this process is to develop an appropriate beginning migration matrix of annual State-to-State migration rates by age, sex, and race. The 1975–80 decennial migration data provide a good beginning framework. However, while the census data provide good State-to-State data by age, sex, and race, these data cover a 5-year time period. The "synthetic" migration matrix, however, requires the equivalent migration rates for a 1-year time frame.

Given the effects of return and repeat migration, it is not appropriate to simply divide the 5-year rates by five (Long and Boertlein, 1989). Instead, it was necessary to develop an empirical relationship between the 1-year and 5-year migration data. Unfortunately, for our base estimation period 1975–1980, annual CPS data are not available for each year. However using the results of the questions on

Figure 1.
Dimensions of Underlying Migration Matrix

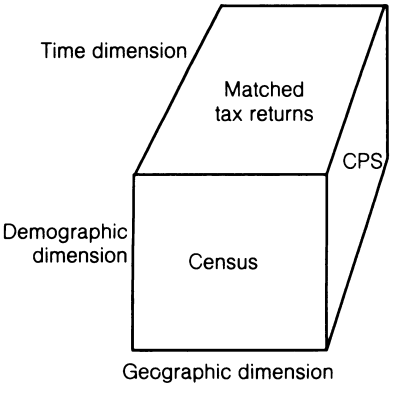

Table J.
Region-to-Region Migration Rates: 1980-81
(IRS and CPS data. Rates per 100 1980 population)

Residence in 1980	Residence in 1981							
	Northeast		Midwest		South		West	
	IRS	CPS	IRS	CPS	IRS	CPS	IRS	CPS
Northeast	98.5	98.5	0.2	0.2	1.0	0.9	0.4	0.4
Midwest	0.2	0.2	97.9	98.2	1.2	1.0	0.6	0.7
South	0.4	0.3	0.5	0.4	98.6	98.8	0.5	0.5
West	0.3	0.3	0.5	0.5	1.0	0.9	98.3	98.3

Source: Current Population Reports, *Geographical Mobility: March 1980 to March 1981*; and unpublished tabulations matched IRS data, 1980 to 1981.

Table K.
Region-to-Region Migration Rates: 1986-87
(IRS and CPS data. Rates per 100 1986 population)

Residence in 1986	Residence in 1987							
	Northeast		Midwest		South		West	
	IRS	CPS	IRS	CPS	IRS	CPS	IRS	CPS
Northeast	98.6	98.5	0.2	0.3	0.9	0.9	0.3	0.3
Midwest	0.2	0.1	98.3	98.3	0.9	1.0	0.5	0.6
South	0.4	0.3	0.5	0.6	98.6	98.6	0.5	0.5
West	0.3	0.2	0.5	0.6	0.8	0.8	98.5	98.4

Source: Current Population Reports, *Geographical Mobility: March 1986 to March 1987; and unpublished tabulation matched IRS data: 1986-87.*

residence 1 year earlier in the 1976 and 1981 CPS, we were able to develop an estimated average 1-year interstate migration rate for 1975-1980 by single years of age. To produce an aggregated 5-year cohort migration rate, the estimated average 1-year interstate migration rates for the appropriate single years of age groups are summed for the 5 years. A comparison of the aggregated cohort migration rate with the corresponding 5-year interval migration rate for the 1975-80 period from the 1980 CPS provides information by single years of age on the relationship of 1-year and 5-year migration data.

Once the relationship between the 5-year and 1-year interstate migration rates was established using the CPS data, it was relatively straightforward to apply this relationship to the decennial migration data. The ratios between the 5-year and 1-year interstate migration rates within a given age group were applied by age to each race-sex specific state-to-state migration rate from the decennial data. To carry out this computation, we made the assumption that the relationship between 5-year and 1-year interstate migration rates in the CPS data can be applied to those in the Census. The analysis of the CPS and census migration data discussed in section 2 of this paper supports this assumption.

Utilizing the above assumption together with the 1980 decennial census migration data, we were able to develop an appropriate beginning migration matrix of annual State-to-State migration rates by single years of age, sex, and race.

Updating the Migration Matrix

The next stages of development involve a method to update the beginning migration matrix to reflect the current shifts in migration patterns. The administrative data on migration from matched tax returns provide the best source of information about the change in migration trends since the 1975-80 period.

However, since the information from administrative records is available only for the total population, some of the changes in the migration rates for the total population since the 1975-80 period could be due to changes in the age structure of the population. To adjust each year's matrix of migration rates from tax returns for the changes due to the shift in age structure, we use indirect standardization.

The updating process adjusts for the change over time in each State-to-State flow. For each year, 1975-76 through 1987-88, a ratio of the current State-to-State rate to the average of the 1975-80 values is computed. We then fill in each cell of the updated matrix by applying the ratio developed from the change in the total rate to each corresponding set of State-to-State rates by single years of age, sex, and race in the beginning migration matrix. This computation requires the assumption that the changes in State-to-State migration implied by the changes in the tax return data apply to every age-sex-race group in the beginning migration matrix. The analysis of the IRS and Census data discussed in section 2 support this assumption.

This entire process yields a set of State-to-State rates by single years of age, sex, and race that incorporates the annual trends implied by the administrative data and the age, sex, and race distributions implied by the 1980 decennial data.

Illustrative Matrix of State-to-State Migration: 1985-86

Table 1 summarizes the results of this process for the 1985-86 period. Using the annualized initial migration matrix for 1975-80 and the IRS data for 1985-86, we can develop a synthetic matrix of State-to-State migration rates by age, sex, and race for 1985-86. In order to summarize the data and produce the implied numbers of state-to-state migrants, we completed the additional step of applying the synthetic matrix of state-to-state migration rates by single years of age, sex, and race to

a projected set of state populations by age, sex, and race. The results shown in table 1 are illustrative and subject to the assumptions and limitation of the 1) "synthetic" migration matrix and 2) projections of the state population by age, sex, and race.

Conclusion

This paper presents a description and compares the major current sources of migration data. It also presents the steps needed to create a synthetic migration matrix of State-to-State migration rates by age, sex, and race. The proposed method combines annual geographic information on recent migration from tax return data, information on the relationship between 1-year and 5-year migration rates from CPS, and data on interaction between geographical and demographic dimensions contained in the 5-year interstate migration data from the 1980 census. The method produces a time series of annual interstate migration data for 1-year migration intervals with detailed demographic characteristics for use in migration analysis and development of population projections.

Further research on the validity of the several assumptions made in this process of creating the synthetic migration matrix could improve the utility and quality of the "synthetic" data. We plan to continue to examine the development of improved methods for producing the synthetic migration data matrix. In addition, we plan to continue to check the validity of each of the assumptions with currently available data sources.

We have used some of these results to develop state population projections. These "synthetic" migration data have made it possible to use a "state of the art" multiregional model to develop the state population projections. In the future, we plan to extend our analysis to develop annual "estimates" of State-to-State migration by age, sex, and race.

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Table 1. **Projections of State-to-State Migration: 1985-86**

(Numbers rounded to hundreds)

State of residence in 1985	Total out-migrants from	State of residence in 1986											
		Alabama	Alaska	Arizona	Arkansas	California	Colorado	Con-nect-icut	Delaware	District of Columbia	Florida	Georgia	Hawaii
Alabama	106,200	3,867,500	700	900	1,100	4,600	1,100	600	100	200	16,600	19,900	700
Alaska	45,900	800	493,400	1,700	400	5,700	1,400	100	100	-	1,900	1,100	600
Arizona	137,300	900	1,100	3,006,900	1,100	31,500	6,900	700	100	100	4,400	1,900	1,000
Arkansas	79,300	1,300	500	1,300	2,247,500	5,100	1,300	200	100	100	3,700	2,000	300
California	507,900	4,700	5,100	37,500	5,400	25,804,400	19,500	5,800	800	1,700	24,200	10,500	15,400
Colorado	165,500	1,400	1,500	12,500	1,500	26,500	3,079,300	1,200	300	300	7,000	3,200	1,400
Connecticut	90,600	400	200	1,300	100	7,000	900	3,078,300	300	400	12,200	2,100	500
Delaware	21,900	100	100	200	100	900	200	200	593,700	100	1,900	600	100
District of Columbia	49,600	200	100	200	-	2,000	200	400	100	554,200	1,100	500	200
Florida	350,800	14,300	1,400	4,600	2,500	22,800	5,400	6,200	1,300	800	10,736,500	38,200	2,000
Georgia	169,000	14,800	1,000	1,700	1,200	8,700	2,100	1,200	400	500	30,300	5,757,900	1,600
Hawaii	56,900	900	500	1,300	200	16,200	1,400	500	100	200	2,300	2,100	1,046,500
Idaho	52,700	100	1,200	2,900	200	9,500	1,800	200	-	-	800	400	300
Illinois	304,600	3,400	900	13,500	4,100	33,400	7,300	2,800	500	600	31,700	9,600	1,300
Indiana	146,100	2,200	400	4,400	1,300	9,100	2,500	900	200	200	19,700	5,400	500
Iowa	98,700	500	300	6,900	1,400	7,000	5,300	300	100	100	4,500	1,700	300
Kansas	105,500	1,500	400	3,300	2,700	7,400	6,000	400	100	100	3,500	2,500	600
Kentucky	111,700	2,800	500	1,300	800	4,100	1,300	500	200	200	11,900	6,300	700
Louisiana	141,000	5,900	800	1,400	5,300	10,400	2,100	700	200	300	10,200	6,000	900
Maine	32,100	200	200	500	100	1,800	400	1,800	100	100	4,100	500	100
Maryland	133,900	1,100	500	1,300	300	8,500	1,600	1,600	4,300	17,100	12,200	3,400	1,400
Massachusetts	148,000	800	400	1,700	200	11,500	1,700	10,000	400	800	17,000	2,600	600
Michigan	178,500	2,400	800	7,100	1,500	16,300	3,700	1,500	400	400	29,900	5,900	900
Minnesota	95,800	400	900	5,700	500	9,900	4,100	700	100	200	5,500	1,800	400
Mississippi	80,400	7,200	300	800	2,700	4,300	900	200	100	100	7,000	4,400	300
Missouri	139,800	1,300	500	3,600	6,200	10,700	3,600	800	200	200	8,100	3,900	800
Montana	38,700	100	1,200	2,400	200	4,800	2,500	100	-	-	700	300	200
Nebraska	60,300	400	400	3,300	800	5,100	6,200	200	100	100	1,600	800	300
Nevada	57,000	300	400	4,200	300	21,200	1,600	200	100	-	2,400	600	500
New Hampshire	39,900	200	200	500	100	2,000	400	1,700	100	100	4,000	600	200
New Jersey	189,300	1,100	400	2,400	400	13,200	1,900	4,900	2,100	800	30,300	5,200	900
New Mexico	76,000	500	600	17,100	600	8,600	5,000	200	-	100	2,200	900	400
New York	388,700	2,500	800	6,000	800	30,300	4,100	23,700	1,600	2,100	72,000	9,000	1,500
North Carolina	166,600	3,500	900	1,800	1,000	9,500	1,700	1,800	700	1,200	17,100	13,200	1,900
North Dakota	32,300	200	400	1,600	100	2,500	1,800	100	-	-	800	300	100
Ohio	242,000	3,000	700	6,900	1,100	18,200	4,200	2,100	600	600	38,600	11,300	900
Oklahoma	141,800	1,600	1,000	3,700	8,700	11,600	4,800	400	300	100	5,100	3,100	800
Oregon	94,400	300	3,200	5,100	400	26,700	2,200	400	-	100	1,500	700	1,000
Pennsylvania	238,000	1,700	500	4,200	500	14,600	2,900	4,200	5,800	1,100	31,600	7,100	1,000
Rhode Island	27,800	100	100	300	100	2,100	200	2,500	-	100	3,400	300	200
South Carolina	102,500	2,500	500	900	500	4,300	800	1,200	500	500	10,900	15,000	900
South Dakota	29,200	200	300	1,700	200	2,400	2,000	100	-	-	600	300	100
Tennessee	136,900	8,000	500	1,300	3,700	7,000	1,400	600	200	200	14,000	17,100	700
Texas	470,100	10,500	3,300	14,500	16,500	60,000	16,800	3,500	900	800	30,800	16,100	3,600
Utah	65,400	400	600	7,000	200	14,400	4,400	300	-	-	1,500	700	400
Vermont	18,200	100	100	300	-	800	300	1,000	100	-	1,600	200	100
Virginia	211,000	3,200	900	2,200	900	16,700	2,700	2,900	1,200	6,800	20,200	7,800	3,200
Washington	155,700	1,500	5,400	6,300	800	35,600	3,700	800	100	300	4,100	2,500	3,200
West Virginia	62,800	600	100	500	200	1,500	500	300	400	100	8,100	2,200	100
Wisconsin	105,900	600	600	5,400	900	8,500	3,100	700	100	200	10,000	2,400	400
Wyoming	38,700	200	600	2,500	300	3,600	6,200	100	-	-	700	300	100
Total inmigrants to	(NA)	112,800	43,500	219,600	80,100	600,100	164,200	93,700	25,600	40,400	585,700	254,300	55,700

- Represents zero or rounds to zero.
NA Not applicable.
Source: These State-to-State migrants are the result of applying the projected set of State-to-State migration rates by age, sex, and race for 1985-86 to the 1985 base population of each State. See text for a more complete discussion.

Table 1. **Projections of State-to-State Migration: 1985-86—Continued**

(Numbers rounded to hundreds)

State of residence in 1985	State of residence in 1986—Continued												
	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky	Louisiana	Maine	Maryland	Massa-chusetts	Michigan	Minne-sota	Mississippi
Alabama	100	1,900	1,200	300	1,000	1,800	3,500	200	1,300	700	1,900	300	5,600
Alaska	1,100	700	300	200	500	500	600	300	600	400	600	800	300
Arizona	1,400	4,200	1,900	1,300	1,300	800	900	400	1,100	1,400	3,800	2,200	600
Arkansas	200	2,700	1,200	600	1,800	900	4,100	100	400	300	1,600	400	2,600
California	7,400	18,500	6,500	3,500	5,100	3,400	6,100	1,600	8,300	9,500	12,100	6,100	3,400
Colorado	1,500	4,800	2,100	2,000	5,000	1,200	1,400	500	2,000	1,900	4,300	2,700	900
Connecticut	200	1,600	700	200	300	400	400	2,200	1,800	10,200	1,300	500	300
Delaware	-	400	200	-	100	100	100	100	4,000	400	300	100	100
District of Columbia	-	400	200	100	-	100	100	100	25,800	700	300	200	100
Florida	800	11,000	8,800	1,300	1,800	6,000	5,400	2,600	8,500	7,900	13,900	2,600	4,500
Georgia	200	3,900	2,400	500	1,400	2,900	2,700	400	3,000	1,700	3,400	900	3,000
Hawaii	300	1,200	500	200	700	800	600	200	1,500	600	700	300	300
Idaho	953,000	600	200	200	300	200	200	100	200	200	400	400	100
Illinois	500	11,128,800	18,600	7,600	3,200	4,700	2,600	600	3,500	3,200	12,000	5,900	3,300
Indiana	300	14,700	5,300,400	1,100	1,300	9,600	1,300	300	1,300	1,100	10,600	1,600	900
Iowa	300	9,400	1,700	2,735,700	3,200	600	600	200	600	500	1,800	7,500	300
Kansas	300	3,100	1,400	1,600	2,306,000	1,200	1,000	200	1,100	600	1,700	1,300	600
Kentucky	100	3,900	11,300	400	1,200	3,571,900	1,200	200	1,300	600	3,400	600	1,000
Louisiana	200	3,200	1,500	500	1,400	1,500	4,247,200	300	1,600	900	2,500	600	12,200
Maine	-	400	200	100	100	200	200	1,119,900	500	3,800	500	200	100
Maryland	100	2,100	900	300	700	800	800	600	4,306,500	2,100	1,800	500	600
Massachusetts	-	2,500	900	300	400	500	600	6,700	3,000	5,591,500	1,800	700	300
Michigan	500	9,900	9,700	1,100	1,400	2,900	1,500	500	2,400	2,200	8,874,200	3,000	1,100
Minnesota	300	4,800	1,300	4,400	1,300	700	500	300	1,000	1,100	2,600	4,074,300	200
Mississippi	100	2,700	900	300	600	1,100	9,300	200	700	400	1,400	300	2,513,900
Missouri	400	15,000	2,700	3,600	18,900	1,900	1,700	200	1,300	1,100	3,100	1,900	1,200
Montana	1,900	500	200	400	300	100	200	100	200	200	600	1,200	100
Nebraska	400	2,100	700	6,000	4,100	300	500	200	400	300	1,100	1,600	500
Nevada	1,300	800	400	200	400	300	500	100	300	400	1,000	500	400
New Hampshire	-	500	300	-	100	200	200	5,100	500	9,900	400	200	100
New Jersey	200	3,600	1,100	300	700	1,000	800	1,200	5,600	5,600	2,300	1,000	500
New Mexico	400	1,100	500	400	1,000	300	700	200	500	300	800	400	400
New York	400	6,300	2,300	700	1,500	1,900	2,000	2,500	9,700	15,600	5,300	1,600	800
North Carolina	300	3,300	2,400	600	1,300	2,600	1,800	700	5,600	2,300	3,600	900	1,400
North Dakota	200	600	300	500	400	200	200	100	200	100	700	7,000	200
Ohio	300	8,800	12,100	1,000	1,800	11,400	1,800	600	4,700	3,200	15,900	2,000	1,100
Oklahoma	400	3,500	2,200	1,100	9,000	1,200	2,400	300	1,100	700	3,100	1,000	1,200
Oregon	4,100	1,000	400	400	500	300	300	200	500	600	700	800	200
Pennsylvania	300	4,700	2,800	600	1,100	1,800	1,500	1,100	16,400	5,000	4,700	1,100	800
Rhode Island	-	400	100	-	100	100	100	700	600	6,200	300	100	100
South Carolina	200	1,700	1,100	300	600	1,200	1,100	600	2,300	900	1,600	300	1,000
Douth Dakota	200	600	200	1,900	800	100	200	100	200	100	400	3,600	100
Tennessee	200	3,600	3,400	600	1,100	9,100	2,300	200	1,800	800	3,200	700	9,200
Texas	1,800	16,900	9,000	3,600	10,400	6,500	24,400	1,200	7,000	4,600	14,700	4,600	7,600
Utah	3,800	1,000	500	300	500	300	400	200	600	500	1,200	600	200
Vermont	-	100	100	100	100	100	100	600	300	2,300	100	100	-
Virginia	400	4,300	2,200	700	1,600	2,800	2,000	1,200	23,000	3,200	3,600	1,100	1,600
Washington	6,500	2,700	1,100	700	1,300	800	1,100	400	1,800	1,200	2,100	1,700	600
West Virginia	100	800	900	100	200	2,400	400	100	4,100	300	1,000	100	300
Wisconsin	300	14,400	2,700	2,400	900	900	600	200	1,000	1,600	5,500	12,200	700
Wyoming	1,200	600	300	300	700	200	200	100	200	100	700	600	100
Total inmigrants to	41,300	207,600	124,700	54,800	93,200	90,700	93,400	37,000	165,000	119,500	162,400	86,500	72,700

-Represents zero or rounds to zero.
NA Not applicable.
Source: These State-to-State migrants are the result of applying the projected set of State-to-State migration rates by age, sex, and race for 1985-86 to the 1985 base population of each State. See text for a more complete discussion.

Table 1. Projections of State-to-State Migration: 1985-86—Continued

(Numbers rounded to hundreds)

State of residence in 1985	State of residence in 1986—Continued												
	Missouri	Montana	Nebraska	Nevada	New Hampshire	New Jersey	New Mexico	New York	North Carolina	North Dakota	Ohio	Oklahoma	Oregon
Alabama	1,200	100	400	200	300	900	400	1,600	4,000	100	2,300	1,200	300
Alaska	700	900	300	600	200	400	700	900	900	300	700	700	3,200
Arizona	2,300	800	800	4,400	500	1,300	13,700	2,900	1,900	400	3,500	1,900	2,900
Arkansas	6,400	100	600	400	100	300	600	700	1,300	100	1,000	6,900	400
California	9,800	2,900	3,200	25,600	2,100	10,200	9,000	20,000	10,600	1,200	12,000	7,900	27,300
Colorado	4,200	1,700	3,300	2,700	800	2,100	6,200	3,900	2,100	700	3,400	3,500	2,700
Connecticut	700	100	100	300	2,600	4,400	300	12,300	2,400	-	1,700	400	300
Delaware	100	-	-	100	100	1,600	-	800	600	-	400	200	-
District of Columbia	100	-	-	100	100	700	100	1,700	1,000	-	400	100	100
Florida	4,400	400	900	2,300	2,700	11,800	2,000	23,800	19,300	300	16,800	2,500	1,100
Georgia	2,100	200	300	500	400	2,900	600	4,400	11,900	100	4,800	1,600	400
Hawaii	700	200	200	700	200	700	400	1,400	2,000	100	900	800	1,000
Idaho	400	1,600	200	2,000	100	200	600	400	200	100	400	300	5,100
Illinois	18,900	500	1,800	2,300	1,100	4,800	1,800	6,400	6,000	600	9,600	3,200	1,500
Indiana	3,700	200	500	700	300	1,300	600	2,100	3,800	200	11,600	1,600	500
Iowa	6,200	300	7,300	700	100	600	700	1,200	1,400	300	1,600	1,400	600
Kansas	17,900	300	3,000	600	200	900	1,400	1,500	1,700	300	1,900	7,900	600
Kentucky	2,300	100	200	300	200	800	300	1,900	4,900	100	12,400	900	300
Louisiana	2,500	200	500	700	300	1,800	900	2,600	3,400	100	2,500	2,600	500
Maine	200	-	100	100	5,000	700	200	1,800	800	-	400	200	200
Maryland	1,100	200	300	400	700	3,800	500	5,000	5,900	100	2,600	600	300
Massachusetts	900	100	200	400	27,900	4,500	500	11,300	3,000	100	2,400	500	500
Michigan	3,000	300	700	1,200	700	2,500	1,000	4,300	5,300	300	13,400	1,400	700
Minnesota	1,800	900	1,400	800	300	900	800	1,800	1,200	5,200	1,600	1,000	1,000
Mississippi	1,300	100	300	400	100	600	300	1,000	1,900	100	1,200	1,300	100
Missouri	4,823,900	200	2,100	900	200	1,400	900	2,000	2,500	300	3,100	5,000	800
Montana	500	783,300	500	1,000	100	100	500	400	300	1,300	400	500	1,900
Nebraska	2,800	300	1,523,500	500	200	300	700	600	800	500	800	1,200	400
Nevada	600	500	300	886,500	100	600	900	1,000	600	100	1,000	600	2,100
New Hampshire	200	100	100	200	963,400	800	100	1,900	600	100	500	200	200
New Jersey	1,300	200	200	900	1,400	7,357,000	600	33,500	6,500	100	3,200	600	400
New Mexico	900	300	400	1,300	200	400	1,385,500	1,100	700	100	1,100	1,900	800
New York	2,400	300	600	1,800	4,200	76,300	1,500	17,036,800	13,500	300	7,200	1,800	1,000
North Carolina	1,900	200	400	500	600	4,000	700	6,400	6,050,900	200	5,200	1,300	600
North Dakota	400	1,600	700	300	100	200	300	400	400	641,500	500	300	400
Ohio	3,200	300	800	1,200	900	4,100	1,100	7,000	9,500	300	10,419,600	1,900	700
Oklahoma	7,900	400	1,100	900	200	900	2,600	1,700	2,100	200	2,800	3,109,300	1,000
Oregon	800	1,200	300	2,700	100	400	1,100	800	700	200	600	700	2,596,500
Pennsylvania	1,800	300	400	900	1,600	30,600	900	16,600	9,200	200	13,400	1,200	600
Rhode Island	100	-	-	100	900	800	100	1,700	400	-	300	100	100
South Carolina	900	100	200	400	400	1,900	500	3,300	19,900	100	2,400	800	300
South Dakota	600	600	2,200	300	100	100	400	200	200	1,500	300	400	400
Tennessee	2,800	100	300	300	200	1,300	500	1,900	7,600	100	4,400	1,500	400
Texas	14,100	1,200	3,100	3,500	1,200	7,200	18,700	13,200	10,800	900	14,400	26,200	3,500
Utah	800	800	400	3,500	200	400	2,100	800	500	300	900	600	1,700
Vermont	100	100	-	100	3,200	400	100	2,300	400	-	200	100	100
Virginia	2,300	300	600	800	1,000	5,600	1,200	8,400	21,900	300	5,900	1,300	900
Washington	1,500	2,900	600	2,500	500	1,300	12,000	2,600	2,100	500	2,300	1,500	18,800
West Virginia	400	-	100	100	100	600	200	1,000	6,500	-	8,300	400	-
Wisconsin	1,800	300	600	1,100	300	1,000	700	1,700	1,900	500	3,000	600	700
Wyoming	600	2,300	1,200	800	100	100	1,100	300	200	400	400	700	900
Total inmigrants to	143,700	26,600	44,100	75,100	65,200	201,400	93,300	226,500	217,300	19,600	192,300	102,100	90,100

- Represents zero or rounds to zero.
NA Not applicable.
Source: These State-to-State migrants are the result of applying the projected set of State-to-State migration rates by age, sex, and race for 1985-86 to the 1985 base population for each State. See text for a more complete discussion.

Table 1. **Projections of State-to-State Migration: 1985-86—Continued**

(Numbers rounded to hundreds)

State of residence in 1985	State of residence in 1986—Continued												
	Pennsylvania	Rhode Island	South Carolina	South Dakota	Tennessee	Texas	Utah	Vermont	Virginia	Washington	West Virginia	Wisconsin	Wyoming
Alabama	1,100	100	2,700	100	8,700	8,400	300	-	3,500	1,100	200	500	100
Alaska	500	100	500	200	600	2,800	600	100	1,000	7,200	100	500	300
Arizona	2,400	200	1,100	600	1,500	10,100	3,500	300	2,400	4,300	300	1,600	700
Arkansas	600	-	800	100	5,100	17,200	300	-	1,300	800	200	600	200
California	10,300	2,000	4,700	1,300	6,800	47,200	9,900	900	17,600	35,500	1,000	4,800	1,900
Colorado	2,700	200	1,100	1,000	1,300	16,500	4,000	300	3,300	4,600	400	2,200	3,800
Connecticut	3,500	2,600	1,800	-	700	2,700	200	1,500	3,900	1,600	200	400	-
Delaware	4,400	100	400	-	300	800	100	-	1,200	200	100	100	-
District of Columbia	900	100	500	-	200	800	-	-	8,900	200	100	100	-
Florida	12,600	1,800	9,800	400	12,100	22,200	1,000	1,000	17,500	3,400	2,800	3,200	500
Georgia	3,400	300	11,600	100	11,700	10,200	500	100	7,300	1,700	800	900	200
Hawaii	900	100	900	100	800	3,600	600	100	3,500	3,100	100	300	100
Idaho	400	100	400	200	200	2,000	5,800	100	700	9,100	-	200	1,300
Illinois	5,100	500	3,100	500	7,300	24,700	1,100	200	7,000	3,800	700	16,900	500
Indiana	2,700	200	1,800	200	5,300	9,700	400	100	3,300	1,400	700	2,200	300
Iowa	900	100	500	2,000	1,000	8,900	400	100	1,400	1,300	100	3,700	500
Kansas	1,600	100	800	400	1,300	13,800	600	100	2,200	1,800	200	1,000	500
Kentucky	1,900	100	2,100	100	13,100	6,200	300	100	3,900	900	1,800	600	100
Louisiana	2,000	100	1,600	200	4,100	37,000	400	100	3,500	1,500	500	800	400
Maine	900	500	600	-	300	1,100	100	500	1,400	400	100	200	100
Maryland	11,400	400	2,500	100	1,600	4,800	300	200	21,500	1,200	3,200	500	100
Massachusetts	4,300	9,400	1,300	100	900	3,600	300	2,800	4,800	1,400	300	800	100
Michigan	3,700	300	2,400	300	5,000	11,100	800	300	5,000	2,300	600	4,800	400
Minnesota	1,200	100	500	3,200	800	7,200	500	100	1,600	2,700	100	9,500	400
Mississippi	700	100	1,600	100	9,100	9,700	200	100	2,100	600	200	700	200
Missouri	1,700	100	1,100	400	3,200	13,500	500	100	3,000	1,700	200	1,500	500
Montana	300	-	100	800	200	1,500	1,300	-	400	5,100	-	500	2,500
Nebraska	500	-	300	1,800	500	5,600	400	-	1,200	1,100	100	800	1,500
Nevada	600	100	300	100	400	2,700	2,400	-	800	2,000	100	300	400
New Hampshire	900	600	400	100	300	900	100	2,700	1,000	400	100	200	100
New Jersey	30,000	900	2,900	-	1,400	5,800	400	900	8,200	1,500	500	600	100
New Mexico	700	-	500	200	600	16,700	1,400	100	1,100	1,400	100	400	600
New York	22,200	2,300	6,500	200	2,900	13,300	700	3,400	16,300	3,000	800	1,300	300
North Carolina	5,000	400	19,300	200	6,100	7,700	500	300	19,300	1,700	1,800	1,100	200
North Dakota	300	-	200	1,900	200	2,000	400	-	400	1,100	-	700	900
Ohio	11,100	500	5,100	200	5,800	14,500	800	300	8,800	2,300	6,400	2,100	300
Oklahoma	1,700	200	900	400	2,600	39,200	800	100	2,100	1,800	400	900	600
Oregon	500	100	200	200	500	3,500	1,400	100	1,000	24,200	100	500	600
Pennsylvania	11,432,600	1,100	4,300	200	2,500	10,100	500	600	17,300	1,900	3,100	1,200	300
Rhode Island	800	922,300	400	-	200	600	-	300	1,900	300	-	200	-
South Carolina	2,500	400	3,217,800	100	3,400	4,400	200	100	6,800	1,200	600	500	100
South Dakota	200	-	200	667,800	200	1,800	300	-	300	700	-	500	1,300
Tennessee	1,800	100	3,300	100	4,583,300	9,200	300	100	6,700	1,300	600	1,000	200
Texas	9,500	800	5,000	1,000	11,600	15,704,000	2,900	1,200	13,400	8,800	1,900	4,000	2,500
Utah	700	-	300	400	400	3,700	1,588,300	100	1,000	3,300	100	400	2,200
Vermont	400	200	100	-	100	600	100	506,400	600	200	-	-	-
Virginia	9,600	1,600	6,900	300	6,700	9,600	700	400	5,513,000	2,600	4,700	1,100	200
Washington	1,700	200	1,100	500	1,200	7,700	2,300	200	3,500	4,274,000	200	1,000	800
West Virginia	3,700	100	2,500	100	1,400	2,200	200	-	9,100	300	1,850,000	200	100
Wisconsin	1,300	100	800	500	1,400	6,700	400	100	1,800	1,600	200	4,624,000	300
Wyoming	300	-	100	1,200	200	2,400	2,800	100	400	1,300	100	500	471,000
Total inmigrants to	187,900	29,300	117,800	22,400	153,400	468,300	53,700	20,900	255,800	162,900	37,100	78,600	29,400

-Represents zero or rounds to zero.
NA Not applicable.
Source: These State-to-State migrants are the result of applying the projected set of State-to-State migration rates by age, sex, and race for 1985-86 to the 1985 base population of each State. See text for a more complete discussion.

Appendix A.

Source and Accuracy of Estimates

Source of Data

Most estimates in the first and third papers come from data obtained in March of years 1970 through 1988 in the Current Population Survey (CPS). The Bureau of the Census conducts the survey every month, although this report uses only March data for its estimates. Also, some estimates come from 1970 and 1980 decennial census data and Internal Revenue Service data. The March survey uses two sets of questions, the basic CPS and the supplement.

The data for the second paper were collected during the first eight interviews of the 1984 panel of the Survey of Income and Program Participation (SIPP).

The universe for both surveys is the noninstitutionalized resident population living in the United States. This population includes persons living in group quarters, such as dormitories, rooming houses, and religious group dwellings. Crew members of merchant vessels, Armed Forces personnel living in military barracks, and institutionalized persons, such as correctional facility inmates and nursing home residents, were not eligible to be in either survey. Also, United States citizens residing abroad were not eligible to be in the surveys. Foreign visitors who work or attend school in this country and their families were eligible; all others were not eligible. With the exceptions noted above, persons who were at least 14 years of age for CPS and 15 years of age for SIPP at the time of the interview were eligible to be interviewed.

Basic CPS. The basic CPS collects primarily labor force data about the civilian noninstitutional population. Interviewers ask questions concerning labor force participation about each member 14 years old and over in every sample living quarter (LQ).

The present CPS sample consists of clusters of four LQ's systematically selected from the 1980 decennial census files with coverage in all 50 states and the District of Columbia. The sample is continually updated to account for new residential construction. It is located in 729 areas comprising 1,973 counties, independent cities, and minor civil divisions. About 59,500 occupied LQ's are eligible for interview every month. Interviewers are unable to obtain interviews at about 2,500 of these LQs because the occupants are not found at home after repeated calls or are unavailable for some other reason.

Since the introduction of the CPS, the Bureau of the Census has redesigned the CPS sample several times to improve the quality and reliability of the data and to satisfy changing data needs. The most recent changes were completely implemented in July 1985.

The following table summarizes changes in the CPS designs for the years for which data appear in this report.

Description of the Current Population Survey

Time period	Number of sample areas	Living quarters eligible[1]	
		Interviewed	Not interviewed
1986-88	729	57,000	2,500
1985	[2] 629/729	57,000	2,500
1982-84	629	59,000	2,500
1980-81	629	65,500	3,000
1977-79	614	55,000	3,000
1973-76	461	46,500	2,500
1972	449	45,000	2,000
1967-71	449	48,000	2,000

Excludes about 2,500 Hispanic living quarters added from the previous November sample. (See "March supplement.")

The CPS was redesigned following the 1980 Census of Population and Housing. During phase-in of the new design, living quarters from the new and old designs were in the sample.

March Supplement. In addition to the basic CPS questions, interviewers asked supplementary questions in March about migration.

To obtain more reliable data for the Hispanic population, the March CPS sample was increased by about 2,500 eligible LQ's, interviewed the previous November, that contained at least one sample person of Hispanic origin. In addition, the sample included persons in the Armed Forces living off post or with their families on post.

CPS estimation procedure. This survey's estimation procedure inflates weighted sample results to independent estimates of the civilian noninstitutional population of the United States by age, sex, race and Hispanic/non-Hispanic categories. The independent estimates were based on statistics from decennial censuses of population; statistics on births, deaths, immigration and emigration; and statistics on the size of the Armed Forces. The independent population estimates used from 1981 to the present were based on updates to controls established by the 1980 decennial census. Data previous to 1981 were based on independent population estimates from the most recent decennial census. For more details on the change in independent estimates, see the section entitled "Introduction of 1980 Census Population Controls" in an earlier report (Series P-60, No. 133).

The estimates in this report for 1985 and later also employ a revised survey weighting procedure for persons of Hispanic origin. In previous years, weighted sample results were inflated to independent estimates of the noninstitutional population by age, sex, and race. There was no specific control of the survey estimates for the Hispanic population. Since then, the Bureau of the Census developed independent population controls for the Hispanic population by sex and detailed age groups. Revised weighting procedures incorporate these new controls. The independent population estimates include some, but not all, undocumented immigrants.

1984 SIPP panel. The 1984 panel SIPP sample is located in 174 areas comprising 450 counties (including one partial county) and independent cities. Within these areas, clusters of two to four LQs were systematically selected from lists of addresses prepared for the 1970 decennial census to form the bulk of the sample. In addition, the sample was updated to account for new residential construction since the 1970 census.

The first cycle (i.e., wave) of interviewing of this panel was conducted during

October, November, and December 1983, and January 1984. Approximately one-fourth of the sample was interviewed in each of these months. Each sample person was visited every 4 months thereafter. At each interview the reference period was the four months preceding the interview month.

Approximately 26,000 LQs were originally designated for the sample. At the first contact, interviews were obtained from the occupants of about 19,900 of the 26,000 designated LQs. Most of the remaining 6,100 LQs were found to be vacant, demolished, converted to nonresidential use, or otherwise ineligible for the survey. However, approximately 1,000 of the 6,100 LQ's were not interviewed because the occupants refused to be interviewed, could not be found at home, were temporarily absent, or were otherwise unavailable. Thus, occupants of about 95 percent of all eligible LQ's participated in the first interview of the survey.

For subsequent interviews, only original sample persons (those interviewed in the first interview) and persons living with them were eligible to be interviewed. Original sample persons were followed if they moved to a new address, unless the new address was more than 100 miles from a SIPP sample area. Then, telephone interviews were attempted. All first interview noninterviewed households were automatically designated as noninterviews for all subsequent interviews. When original sample persons moved to remote parts of the country, moved without leaving a forwarding address or refused to be interviewed, additional noninterviews resulted.

A person was classified as interviewed or noninterviewed for the panel based on the following definitions. Interviewed sample persons were defined to be 1) those for whom self or proxy responses were obtained for each reference month of all eight interviews or 2) those for whom self or proxy responses were obtained for the first reference month of the panel and for each subsequent reference month until they were known to have died or moved to an ineligible address (foreign living quarters, institutions, or military barracks). Noninterviewed sample persons were defined to be everyone else.

SIPP topical modules. As part of most waves, subjects are covered that do not require repeated measurement during the panel and are of particular interest cross-sectionally for research purposes. A specific set of topical questions are referred to as a topical module. For this report the topical modules analyzed include questions on past mobility. It was implemented in Wave 8 of the 1984 panel.

SIPP longitudinal estimation procedure. The estimation procedure used to derive SIPP longitudinal person weights for the panel involved several sample stages of weight adjustments. Each person received a base weight equal to the inverse of his/her probability of selection. Two noninterview adjustment factors were applied. One adjusted the weights of interviewed persons in interviewed LQ's to account for LQ's which were eligible for the sample but were not interviewed at the first interview. The second was applied to compensate for person noninterviews occurring in subsequent interviews. (No special adjustment was made for noninterviews in group quarters.) Another factor was applied to each interviewed person's weight to account for the SIPP sample areas not having the same population distribution as the strata from which they were selected.

An additional stage of adjustment to persons' weights was performed to reduce the mean square error of the survey estimates by ratio adjusting SIPP sample estimates to monthly Current Population Survey (CPS) estimates[1] of the civilian (and some military) noninstitutional population of the United States by age, race, Hispanic origin, sex, type of householder (married, single with relatives, single without relatives), and relationship to householder (spouse or other). The control date for the person weights for this report was November 1, 1983. The CPS estimation process was explained earlier in this statement.

[1] These special CPS estimates are slightly different from the published monthly CPS estimates. The differences arise from forcing counts of husbands to agree with counts of wives.

Accuracy of Estimates

Since the CPS and SIPP estimates come from a sample, they may differ from figures from a complete census using the same questionnaires, instructions, and enumerators. A sample survey estimate has two possible types of error: sampling and nonsampling. The accuracy of an estimate depends on both types of error, but the full extent of the nonsampling error is unknown. Consequently, one should be particularly careful when interpreting results based on a relatively small number of cases or on small differences between estimates. The standard errors for CPS and SIPP estimates primarily indicate the magnitude of sampling error. They also partially measure the effect of some nonsampling errors in responses and enumeration, but do not measure systematic biases in the data. (Bias is the average over all possible samples of the differences between the sample estimates and the desired value.)

Nonsampling variability. Nonsampling errors can be attributed to many sources. These sources include the inability to obtain information about all cases in the sample, definitional difficulties, differences in the interpretation of questions, respondents' inability or unwillingness to provide correct information or to recall information, errors made in data collection such as in recording or coding the data, errors made in processing the data, errors made in estimating values for missing data, and failure to represent all units with the sample (undercoverage).

CPS and SIPP undercoverage results from missed LQ's and missed persons within sample LQ's. Compared to the level of the 1980 decennial census, overall CPS and SIPP undercoverage is about 7 percent. Undercoverage varies with age, sex, and race. Generally, undercoverage is larger for males than for females and larger for Blacks and other races combined than for Whites. As described previously, ratio estimation to

independent age-sex-race-Hispanic population controls partially corrects for the bias due to undercoverage. However, biases exist in the estimates to the extent that persons in missed LQs or missed persons in interviewed LQs have different characteristics from those of interviewed persons in the same age-sex-race-Hispanic group. Furthermore, the independent population controls have not been adjusted for undercoverage in the 1980 census.

For additional information on nonsampling error including the possible impact on CPS data when known, refer to Statistical Policy Working Paper 3, *An Error Profile: Employment as Measured by the Current Population Survey*, Office of Federal Statistical Policy and Standards, U.S. Department of Commerce, 1978 and Technical Paper 40, *The Current Population Survey: Design and Methodology*, Bureau of the Census, U.S. Department of Commerce. For additional information on nonsampling error found in the SIPP data, refer to the *Quality Profile for the Survey of Income and Program Participation*, SIPP Working Paper #8708, Bureau of the Census, July 1987.

Comparability of data. Data obtained from the CPS, SIPP and other sources are not entirely comparable. This results from differences in interviewer training and experience and in differing survey processes. This is an example of nonsampling variability not reflected in the standard errors. Use caution when comparing results from different sources.

Caution should also be used when comparing CPS estimates which reflect 1980 census-based population controls and estimates which reflect 1970 census-based population controls. This change in population controls had relatively little impact on summary measures such as means, medians, and percent distributions, but did have a significant impact on levels. For example, use of 1980 based population controls results in about a 2-percent increase in the civilian noninstitutional population and in the number of families and households. Thus, estimates of levels for data collected in 1981 and later years will differ from those for earlier years by more than what could be attributed to actual changes in the population. These differences could be disproportionately greater for certain subpopulation groups than for the total population.

Since no independent population control totals for persons of Hispanic origin were used before 1984, compare Hispanic estimates over time cautiously.

Note when using small estimates. Summary measures (such as medians and percentage distributions) are shown only when the base is 75,000 or greater for CPS, 200,000 or greater for SIPP. Because of the large standard errors involved, summary measures would probably not reveal useful information when computed on a smaller base. However, estimated numbers are shown even though the relative standard errors of these numbers are larger than those for corresponding percentages. These smaller estimates permit combinations of the categories to suit data users' needs. Take care in the interpretation of small differences. For instance, even a small amount of nonsampling error can cause a borderline difference to appear significant or not, thus distorting a seemingly valid hypothesis test.

Sampling variability. Sampling variability is variation that occurs by chance because a sample was surveyed rather than the entire population. Standard errors, as calculated by methods described in "Standard Errors and Their Use," are primarily measures of sampling variability, although they may include some nonsampling error.

Standard errors and their use. The sample estimate and its standard error enable one to construct a confidence interval, a range that would include the average result of all possible samples with a known probability. For example, if all possible samples were surveyed under essentially the same general conditions and using the same sample design, and if an estimate and its standard error were calculated from each sample, then approximately 90 percent of the intervals from 1.6 standard errors below the estimate to 1.6 standard errors above the estimate would include the average result of all possible samples.

A particular confidence interval may or may not contain the average estimate derived from all possible samples. However, one can say with specified confidence that the interval includes the average estimate calculated from all possible samples.

Some statements in the report may contain estimates followed by a number in parentheses. This number can be added to and subtracted from the estimate to calculate upper and lower bounds of the 90-percent confidence interval. For example, if a statement contains the phrase "grew by 1.7 percent (+/-1.0)," the 90-percent confidence interval for the estimate, 1.7 percent, is 0.7 percent to 2.7 percent.

Standard errors may also be used to perform hypothesis testing, a procedure for distinguishing between population characteristics using sample estimates. The most common type of hypothesis appearing in this report is that the population characteristics are different. An example of this would be comparing the migration rate of persons age 20-24 versus the migration rate of persons age 45-64.

Tests may be performed at various levels of significance where a significance level is the probability of concluding that the characteristics are different when, in fact, they are the same. All statements of comparison in the text have passed a hypothesis test at the 0.10 level of significance or better. This means that the absolute value of the estimated difference between characteristics is greater than or equal to 1.6 times the standard error of the difference.

Standard errors of estimated numbers. The approximate standard error, sx, of an estimated number shown in this report can be obtained using the formula

$$s_x = \sqrt{ax^2 + bx} \qquad (1)$$

Here x is the size of the estimate and a and b are the parameters in table A-1

Table A-1.
Standard Error Parameters for CPS Estimates

Characteristic	Prior to 1982		1982-88	
	a	b	a	b
Total, county, State, or regional mobility:				
U.S. or metropolitan:				
All races	-0.000021	5,963	-0.000038	6,685
Nonmetropolitan:				
All races	-0.000032	8,945	-0.000058	10,028
Educational attainment and labor force:				
All races	-0.000029	2,196	-0.000014	2,462

Note: Data are collected in March for the previous year. The years in the above column headings represent the data collection year. Therefore, a 1981-82 migration rate uses 1982 parameters.

or A-2 associated with the particular type of characteristic. When calculating standard errors for numbers from cross-tabulations involving different characteristics, use the set of parameters for the characteristic which will give the largest standard error.

Illustration. Suppose that there were 192,000 males 16 years or older employed as salesworkers who moved to a different county between 1970 and 1971. From table A-2, the appropriate CPS parameters are a = -0.000029 and b = 2,196. Using formula (1), the approximate standard error is

$$s_x = \sqrt{(-0.000029)\,(192{,}000)^2 + (2{,}196)\,(192{,}000)} = 21{,}000$$

The 90-percent confidence interval for males 16 years or older employed as salesworkers who moved to a different county between 1970 and 1971 is from 158,400 to 225,600, i.e., 192,000 ± (1.6 x 21,000).

Therefore, a conclusion that the average estimate derived from all possible samples lies within a range computed in this way would be correct for roughly 90 percent of all samples.

Table A-2.
SIPP Generalized Variance Parameters for Estimates
(1984 panel weights. Longitudinal migration data)

Characteristic	Persons	
	a	b
16+ income and labor force activity	-0.0000434	7,634
Other	-0.0001196	27,763

Standard errors of estimated percentages. The reliability of an estimated percentage, computed using sample data for both numerator and denominator, depends on the size of the percentage and its base. Estimated percentages are relatively more reliable than the corresponding estimates of the numerators of the percentages, particularly if the percentages are 50 percent or more. When the numerator and denominator of the percentage are in different categories, use the parameter from table A-1 or A-2 indicated by the numerator.

The approximate standard error, sx,p, of an estimated percentage can be obtained by use of the formula

$$s_{x,p} = \sqrt{bp(100 - p)/x} \qquad (2)$$

Here x is the total number of persons, families, households, or unrelated individuals in the base of the percentage, p is the percentage ($0 \leq p \leq 100$), and b is the parameter in table A-1 or A-2 associated with the characteristic in the numerator of the percentage.

Illustration. Table F of the second paper (SIPP) shows that of the 20,650,000 of the 16- 20-year-olds with a job, 50.2 percent moved between October 1983 and May 1986. Using formula (2) and b = 7,634 from table A-2, the approximate standard error is

$$s_{x,p} = \sqrt{\frac{7{,}634}{20{,}650{,}000}\,(50.2)\,(49.8)} = 1.0\ \textit{percent}$$

Consequently, the 90-percent confidence interval as shown by these data is from 48.6 to 51.8 percent, i.e., 50.2 ± (1.6 x 1.0).

Standard error of a difference. The standard error of the difference between two sample estimates is approximately equal to

$$s_{x-y} = \sqrt{s_x^2 + s_y^2 - 2rs_xs_y} \qquad (3)$$

where sx and sy are the standard errors of the estimates x and y. The estimates can be numbers, percentages, ratios, etc. The correlation between the characteristics estimated by x and y is represented by r. When the characteristics estimated by x and y are considered correlated, as seen in Tables G, H, and I in the second paper (SIPP), use a correlation coefficient of r = 0.364 in the above formula. This value is considered preliminary and should be used cautiously. For the difference between SIPP estimates of the same characteristic in two different areas, or for the difference between separate and uncorrelated SIPP characteristics in the same area, use a correlation coefficient of r = 0. For the difference between CPS estimates, use r = 0. When r is assumed to be zero and there is a high positive (negative) correlation between the two characteristics, the formula will overestimate (underestimate) the standard error.

Illustration. Table G of the second paper (SIPP) shows that for the 14,928,000 individuals aged 25-34 that moved between October 1983 and May 1986, 37.3 percent owned a home before they moved and 48.1 percent owned one after they moved. The apparent difference in the two percentages is 10.8 percent. Using b = 27,763 from table A-2 and formula (2), the standard error on the 37.3 percent who owned before moving is 2.1 percent. Similarly, the standard error on 48.1 percent is 2.2 percent.

Therefore, using formula (3) with a correlation coefficient of r = 0.364, the

standard error on the difference of 10.8 percent is

$$s^{x-y} = \sqrt{(2.1)^2 + (2.2)^2 - 2(0.364)(2.1)(2.2)}$$
$$= 2.4 \textit{ percent}$$

This means that the 90-percent confidence interval on the difference between the percent of movers who owned homes before and after they moved is from 7.0 to 14.6, i.e., 10.8 $\pm$ (1.6 x 2.4). Since this interval does not contain zero, we can conclude with 90-percent confidence that the percent of movers owning homes after a move is higher than the percent owning before a move.

Standard error of a ratio. Certain estimates may be calculated as the ratio of two numbers. The standard error of a ratio, x/y, may be computed using

$$s_{x/y} = \frac{x}{y}\sqrt{\left[\frac{s_x}{x}\right]^2 + \left[\frac{s_y}{y}\right]^2 - 2r\frac{s^x s^y}{xy}} \qquad (4)$$

The standard error of the numerator, sx, and that of the denominator, sy, may be calculated using formula (1) for estimated numbers and formula (2) for estimated percentages. In formula (4), r represents the correlation between the numerator and the denominator of the estimate.

For ratios in this report, assume r is zero. If r is actually positive (negative), then this procedure will overestimate (underestimate) the standard error of the ratio.

NOTE: For estimates expressed as the ratio of x per 100 y or x per 1,000 y, multiply formula (4) by 100 or 1,000, respectively, to obtain the standard error.

Illustration. Table A of the first paper (CPS) shows that the different county migration rate was 13.7 percent from 1975 to 1978 and 6.2 percent from 1975 to 1976. Table 3 shows that the ratio of the three year rate to the one year rate was 2.21. The standard error of this estimate is calculated as follows:

Compute sx and sy using formula (2).

$$s_x = \sqrt{\frac{5{,}963}{194{,}244{,}000}(13.7)(86.3)} = 0.1895$$

$$s_y = \sqrt{\frac{5{,}963}{194{,}546{,}000}(6.2)(93.8)} = 0.1335$$

Compute (sx/x) = 0.00019 and (sy/y) = 0.00046.

Using formula (4), the estimate of the standard error is

$$s_{x/y} = (2.21)\sqrt{0.00019 + 0.00046} = 0.06.$$

Therefore, the 90-percent confidence interval for the ratio of the three year rate to the one year rate is from 2.11 to 2.31, i.e., 2.21 $\pm$ (1.6 x 0.06).

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