THE SURVEY OF INCOME AND
PROGRAM PARTICIPATION

RESIDENTIAL MOBILITY OF ONE-PERSON HOUSEHOLDS

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U. S. Department of Commerce BUREAU OF THE CENSUS

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PREFACE

The increase in the number of persons living alone and the patterns of residential mobility among one-person households can only be understood in light of the transitions between one-person and multi-person households. The likelihood of a change in dwelling or household composition varies among one-person households, most obviously with the age of the person living alone. This paper presents exploratory research on one-person households, the processes leading to their formation and dissolution and the residential mobility associated with such households. The analysis is based on panel data collected over a two year time period in the United States and the Federal Republic of Germany.

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1 INTRODUCTION

The current population of one-person households is made up of persons of different ages, at varying stages in their family careers. Young persons who have left the parental household but have not yet formed a family of their own are one significant component of the population of one-person households. Other persons living alone are somewhat older: persons who left the parental household some time ago and never formed a family of their own, as well as those who have only recently begun living alone. Some individuals in the latter group continued to live with their parents longer than most persons of their generation. Others are divorced, widowed or separated from their spouses, and still others began living alone after having lived with other relatives or non-related persons. The largest bloc of one-person households are elderly. Many of these persons only began to live alone recently, after long years of living with others, while a few have not lived with other persons since leaving the parental household long ago. The underlying premise of the research presented below is that the residential mobility of one-person households is inseparable from the processes by which such households are formed and dissolved at different stages in the lives of individuals.

Moverover, along with the different age related patterns of transitions between one-person households and multi-person households the economic forces of labor and housing markets also influence the character and frequency of residential mobility over the course of individuals' lives. Young persons, relatively free from family obligations, are ideal candidates for employment-related residential mobility. Once an individual has found a more or less stable position in the labor market, the decision to move is more likely to be a response to the cost and quality of housing. In later years several contradictory factors come into play. On the one hand, the individual, no longer bound by the responsibilities of employment, is free to move. In addition, financial considerations or physical impairment may force the person to find smaller quarters. On the other hand, the social ties to a particular place and dwelling, acccumulated during the preceeding years of relative immobility, may hold over into this phase of a person's life. In short, observable patterns of residential mobility are the joint product of economic and social forces that combine and interact in different ways at different phases of people's lives.

In part, our research concentrates on one-person households because the complex process of household mobility is simplified when the household consists of one person rather than many. More importantly, however, one-person households have assumed a critical role in the overall household structure at both the macro and micro levels. This can be seen in the increasing number of persons living alone. In the past twenty-five years the number of one-person households in the Federal Republic of Germany (FRG) has more than doubled--from just over 4 million in 1961 to 8.8 million in 1985 (Statistisches Bundesamt 1987). The proportion of one-person households among all households in the FRG thereby increased from 20.6% in 1961 to 33.6% in 1985. In the United States (US) the number of one-person households rose even more dramatically from 6.9 million in 1960 to 20.6 million in 1985 and the proportion of one-person households among all households in the US increased from 13.1% in 1960 to 23.7% in 1985 (U.S. Bureau of the Census 1987a). This

means that in a quarter of a century the proportion of one-person households in the FRG increased by 63.1% and in the US by 80.9%; a vast change in living arrangements over a particularly short period of time. Similar rates of change can be found in other European and Scandinavian countries (Roussel 1985).

The increasing proportion of one-person households among all households is linked to concrete economic and technological developments--in particular the rising standard of living, the improved income and labor market position of women, and improved birth control techniques. At the same time there has been a shift in popular values, norms and ideals, which by no means are unrelated to changing economic circumstances. Independence, individual freedom and self-realization are the catchwords for these changes in contemporary culture's normative framework. Demographic analysis or econometric analysis based on aggregate data, or models built around how individuals have acted in the past are not sufficient to explain this change or to consider its consequances. The increasing proportion of one-person households can only be understood by considering the changing behavioral patterns of individuals.

This papee describes recent developments in the population of one-person households in the Federal Republic of Germany and the United States. In the following section the data used in the analysis is discussed and a framework for describing the coincidence of changes in household composition and residential mobility is introduced. Based on representative panel data on one-person households in the US and the FRG, the empirical part of the paper concentrates on those households which acquire additional members or change dwellings and the extent to which both types of change occur simultaneously. The formation of new one-person households is similarly discussed and the two processes are then examined in combination to consider how they interact to determine the aggregate number of one-person households in each of the two countries. Finally, methods to include the formation and dissolution of one-person households in models of residential mobility are discussed and exploratory results using a logit regression model are presented.

2 SOURCES OF DATA AND ANALYTICAL FRAMEWORK

2.1 The Analysis of Comparative Panel Data

Our research on one-person households is based on two sets of panel data: the German Sozio-okonomisches Panel (SOP) and the 1984 Panel from the Census Bureau's Survey of Income and Program Participation (SIPP) (1). These panel studies are similar in many respects. This fact greatly aids comparative research, for there is always the risk that differences between two societies are confounded with differences in study design and research methodology. Perhaps the most important difference between the two studies is the shorter time period between SIPP waves, four months as opposed to the year-long interval between SOP waves. For some research questions, for example the exact amount of program benefits received, more frequent interviews would

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(1) An overview of the SOP Panel may be found in Hanefeld (1984) and of SIPP in U.S. Bureau of the Census (1987b).

reduce recall error. However for something as salient as changes in household composition, the longer time span between SOP waves is of less significance. Owing to our concern for the mobility of one-person households it is more important that both panels use essentially the same following rules (2).

The following rules adopted by both SIPP and SOP have one particularly important implication for the study of one-person households. A dynamic approach is necessary to determine which households give rise to one-person households, as well as those that absorb persons who previously lived alone. Both panels share this advantage and yet bind it by the same restrictions: persons not selected in the original sample who subsequently enter the sample (because they enter a household with an adult member of the original sample) are no longer interviewed when they stop living with a member of the original sample. This means, by definition, that all persons in one-person households in both studies are members of the original sample. By limiting one's analysis to members of the original sample some of the more complicated problems rooted in panel data, in particular those related to missing data and weighting, are simplified.

Our analysis of German one-person households is based on the first three waves of the SOP, interviews that took place in the spring of 1984, 1985, and 1986. A one-person household is defined as one in which a person is found to be living alone on at least one of the interview dates. In this way a discrete time structure is imposed on a process that is essentially continuous; just because the interviews fall in a regular cycle does not mean that changes in household composition follow the same rhythm. As a result some information concerning the exact timing of changes in household composition is lost and short spells of living alone may go unobserved. As the purpose of this paper is primarily exploratory, the decision was made to sacrifice a measure of precision to simplify the problem. However, it should be emphasized that both panels date changes in household membership, as well as a number of other processes, more precisely. Later work can adopt a more accurate and realistic time structure.

Given a discrete time framework, the subsequent changes in household structure experienced by persons in a panel are considerably simplified. At each of the three points, an individual belongs to either a one-person or a multi-person household. Panel members in one-person households in 1984 (TI) fall into one of four categories in 1985 (T2): 1) those continuing to live alone, 2) those now living with other persons in a multi-person household, 3) those who have died, emigrated or moved into an institution and thus left the population, 4) and those who have left the panel (wave nonresponse), whereby their status regarding population membership is open. The same four possibilities exist between 1985 (T2) and 1986 (T3). Other panel members in multi-person households in 1984 (T1) or 1985 (T2) stopped living in multi-person households between 1984 and 1985 or between 1985 and 1986 and represent newly formed

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(2) In a panel the following rules are just as important as the original sample design itself (Kalton and Lepkowski 1985). Based on theoretical concerns (such as the boundaries of the population of inference) and practical concerns (such as following mobile members of the original sample) they provide an ongoing definition of who will be interviewed and the population represented by the longitudinal sample.

one-person households. In this manner data is available for persons continually living in one-person households during this time period, as well as for persons who have begun to live alone and those who have begun living in households with other persons. Data concerning American one-person households from the 1984 SIPP Panel was then organized in a similar manner (3).

Weighting presents a problem for a longitudinal analysis of this type using the SIPP public-use cross-sectional files. The Census Bureau's recommendation is that the initial Wave 1 weights may be used if, as is the case here, the analysis is solely based on members of interviewed Wave 1 households. However, the Census Bureau also stresses that the weights do not account for sample attrition (Census Bureau 1987b). In the course of developing longitudinal weights for the SOP project it has become apparent that sample attrition is associated with changes in household composition and residential mobility and that their influence is particularly strong in the case of one-person households (Rendtel 1987). To compensate for this problem a simple strategy proposed by Little and David (1983) was adopted. All persons in one-person households at T1 but no longer in the panel at T2 were identified and the reasons for their departure from the panel were explored using the public-use cross-sectional files for the intervening time period. Persons who left the sample due to death, emigration or institutionalization were thus distinguished from cases of nonresponse.

The T1 weights of one-person households who remained in the panel at T2 were then weighted-up using an adjustment factor equal to the inverse of the response rate for one-persons households. Likewise persons in multi-person households at T1 who subsequently formed one person households, but then become nonrespondents by T2 were used to adjust the weights of persons who began to live alone after T1 and remained in the panel at T2. The same procedure was then performed to further adjust the weights to compensate for nonresponse between T2 and T3. The adjustment factors for the T2 and T3 time period also included those cases leaving the sample due to the 15% reduction in the SIPP sample that took place between T2 and T3. While a number of more sophisticated techniques have been developed (Little and David 1983; Kalton 1987; Rendtel 1988) these adjustment factors are adequate for the exploratory analysis presented here and produce estimates of the population of one-person households very close to cross-sectional estimates

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(3) Three time points--September 1983 (T1), September 1984 (T2) and September 1985 (T3)--were selected. The public release cross-sectional files for the first eight panel waves were then read to identify persons who lived in one-person households at any time between T1 and T3. Based on the respondent's rotation group the appropriate waves and reference months were then used to determine the type of household to which individuals belonged at each of these time points. Cases where the entire interview was imputed for one or more of these time points were dropped, owing to the particular problems associated with imputed data in analyses of change. (Census Bureau, 1987b).

prepared by the Census Bureau using the SIPP data (4).

2.2 Residential Mobility and Changes in Household Composition

Panel studies are designed to measure change, but collecting individual mobility data is never easy, even in the context of projects like SIPP and SOP, where special efforts are made to follow mobile sample members. Some of the problems are concrete questions of measurement and sample selection and the related costs and benefits. In addition, complex analytical and conceptual issues are unavoidable in the study of changes in household composition, such as the question of the proper operationalization and definition of households and the relationship of individuals to households over time (McMillen and Herriot 1985; Duncan 1985). Residential mobility is often a question of individual and not household mobility; yet it is affected by the stability or instability of household composition. Changes in household composition alter housing needs and thus often lead to residential mobility (5).

Figure 1 describes five different degrees of household mobility (A through E) that may result from different combinations of residential mobility and changes in household composition. Case A, immobility, is the simplest, household composition remains unchanged and all persons remain the the same dwelling. Case B, pure residential mobility, occurs when the household moves to a different dwelling and there is no change in household composition. Mobility of this type is typically rooted either in the households living situation (in the dwelling or the neighborhood) or labor market factors, whereby one or more members may be "pushed out" of an area due to poor labor market conditions, and/or "pulled to" another area due to the prospects of a better labor market position.

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(4) For example, the monthly average of one-person households July to September 1983 is given as 19.71 million (US Bureau of the Census 1984) and for the same time period 1984 as 20.78 million (US Bureau of the Census 1985) an increase of 5.4% in the number of one-person households. The same rate of increase between 1984 and 1985 would yield 21.91 million one-person households and increase of 11.2% over the two year period. Our results for September 1983 yield 20.3 million one-person households and for September 1985 22.6 million - an increase of 11.3%.

(5) These events need not be simultaneous: a time lag in either direction is possible. The existing members of a household may move in anticipation of a change in household composition or after the change has occurred. Moverover, the perception of housing needs, as well as the possibility to fulful perceived needs, are subject to the full gamut of social and economic constraints and necessities.

Figure 1: Relatiuonships between Changes in Household Composition and Residential Mobility

Case	Change in Household Composition	Residential Mobility Yes	Residential Mobility No	Type of Mobility	Effect on one-person household
A	No change		X	Immobility	No change
B	No change	X		Pure residential	New dwelling
C1	Individuals enter household (including births)		X	Latent	Transition to multi-purpose household
C2	Individuals leave household (including death and emigration)		X	Latent	Dissolution
C3	Individuals enter and leave		X	Latent	Dissolution
D1	Individuals enter household (including births)	X		Complex	Transition to multi-person household
D2	Individuals leave household (including death and emigration)	X		Complex	Dissolution
D3	Individuals enter and leave	X		Complex	Dissolution
E	All individuals leave population	-	-	Household dissolution	Dissolution

Cases C1 through C3 result when there is a change in household composition--the addition of new members and/or the loss of old members--whereby one or more old members of the household remains in the dwelling. We refer to such changes as latent mobility, since addition or loss of members often results in changed housing needs but a move may not be desirable or possible at the time. A move may subsequently follow or may have presiously occurred, if the change in household composition was anticipated. Cases D1 through D3 involve the same types of changes in household composition, but are coupled with residential mobility and are referred to as complex mobility. Either the move or the change may precipitate the other: larger or smaller quarters may be found to adjust to the change in household composition. The move to smaller quarters may force someone to leave the housheold; or a larger dwelling may allow or necessitate the addition of household members. Empirically the distinction between latent and complex mobility depends on how close together a change in household composition and dwelling need to be in order to be defined as simultaneous. For the analysis presented below a yearly cycle has been chosen: complex mobility means that both household composition and dwelling change between T1 and T2 or between T2 and T3. An important question to consider is the extent to which cases of pure residential mobility are lagged responses to or anticipations of changes in household composition.

The final type of mobility, household dissolution (Case E), occurs when all members of the household simultaneously leave the dwelling and are no longer part of the population. Theoretically household dissolution only occurs upon the death of all household members, but in empirical research the incidence of household dissolution is determined by the following rules and definition of the population of inference. In the SIPP and SOP studies household dissolution occurs through the institutionalization, emigration or death of all household members.

One-person households are an appropriate starting point for the study of the relationship between changes in household composition and residential mobility, because the different types of mobility are logically simplified. The possibilities C2, C3, D2 and D3 exist only for multi-person households; for with one-person households, household dissolution results when the one and only member leaves the household. The three types of latent mobility (C1, C2, and C3) and complex mobility (D1, D2, and D3) each reduce to a single form (when a person enters the household), the transition to a multi-person household. The household does not leave the population, but ceases to exist as a one-person household. As a case of latent mobility, the transition to a multi-person household means that the individual involved has remained at his or her old address and additional persons have joined the household. In the event of complex mobility either the individual has moved in with another person or persons, who remain at their old address, or both parties change addresses and together occupy a common dwelling at a new address.

In addition, the study of one-person households within a panel design touches on the important but difficult question of household formation. Household formation is inextricably tied to the processes described as latent and complex mobility. The departure of a household member from any type of household and the subsequent formation of a one-person household by this person is a case of the formation of a one-person household through complex mobility. A child leaving the parental dwelling to establish his or her own household is perhaps the most simple example of this type of complex mobility. The formation of a one-person household takes the form of latent mobility when all but one member of the household leave the dwelling. Those leaving the dwelling may form one or more one-person households of their own, while the individual remaining in the old dwelling defaults to a one-person household, as long as no additional persons occupy the dwelling.

3 EMPIRICAL RESULTS

3.1 Immobile One-Person Households

Previous research indicates a number of associations between living alone and patterns or clusters of socio-economic traits. The sex-specific difference in life expectancy and the lower average marriage age of women leaves a number of women alone at the end of married life in many industrial countries (Spiegel 1987). This pattern is further strengthened in the FRG due to the great number of women who were divorced or widowed during the war years, a time when the remarriage rates for women were much lower than today (Witte 1988). Table 1 presents univariate distributions for several socio-economic variables (age, sex, marital status, employment status, income and minority status) for immobile one-person households in the FRG and the US between 1983 and 1986. The immobile households, persons living alone for the entire observation

	Socio-economic Panel (SOP)						Survey of Income and Program Participation (SIPP) - 1984 Panel					
	54 years and older		34 to 53 years		16 to 33 years		54 years and older		34 to 53 years		16 to 33 years	
	female	male	female	male	female	male	female	male	female	male	female	male
	in percent						in percent					
Age (=100%)	60.7	10.1	8.2	7.7	7.1	6.2	53.4	14.8	8.7	10.4	5.6	7.1
Minority status 2)												
white (=100%)	-	-	-	-	-	-	55.1	14.6	8.4	9.7	5.5	6.7
non-w. (=100%)	-	-	-	-	-	-	41.5	16.2	11.1	15.1	6.3	9.8
Marital status 3)												
married, living apart	0.8	0.5	2.9	5.6	1.8	1.5	2.7	2.4	3.8	6.1	1.8	2.5
single	10.9	1.5	26.8	26.8	46.6	44.5	8.4	4.4	20.2	23.8	35.6	40.0
divorced	6.9	2.6	13.8	13.3	4.7	0.9	9.8	5.7	16.4	22.5	5.1	13.4
widowed	67.0	9.8	8.5	2.3	-	-	57.4	9.2	5.4	1.8	1.6	-
Employment status 3)												
employed	11.1	3.2	44.6	39.4	43.3	39.1	16.3	6.0	38.2	46.5	40.5	47.6
not employed	76.4	9.3	7.2	8.6	9.7	7.9	62.1	15.6	7.5	7.8	3.6	8.3
Income 3)												
lower tercile	31.7	2.7	6.2	8.1	19.9	11.3	34.9	6.4	10.7	10.5	6.3	13.1
middle tercile	34.0	3.8	12.3	9.0	15.5	13.5	30.3	7.7	12.6	7.4	17.7	11.9
upper tercile	19.9	7.9	33.2	31.2	18.5	21.3	13.1	7.6	22.4	36.4	20.1	30.9
Weighted population (thousands)	4,106		918		771		8,976		2,509		1,671	
Observed cases	417		119		125		1,545		414		274	

1) That is, without changes in household composition or dwelling. 2) Alien residents in the FRG are excluded from this table. 3) Based on the start of the observation period.

The data is based on waves 1 - 3 of the SOP and on waves 1 - 8 of the 1984 SIPP panel public release files.

Table 1
Socio-economic Characteristics of One-Person Households
Immobile 1) Households T1 - T3

period without an address change, correspond to the typical image of elderly one-person households. Women 54 years of age and older make up over 60% of the immobile one-person households in the FRG and 53% in the US. If one considers male one-person households in this age group as well, approximately 70% of the total number of immobile one-person households in both countries are made up of persons 54 years of age or older. Characteristically these persons are not members of the labor force--14% of the German respondents were employed at the beginning of the observation period as compared to 22% of these American one-person households. Despite the lower employment rate in the FRG, older immobile one-person households in the FRG are relatively better-off than their American counterparts. Using terciles based on monthly income of all one-person households in each country, just about a third of all German but over 40% of American households in this age group fall into the lowest income group.

In the two younger age groups in both countries more than 80% of the persons in immobile one-person households are employed. The lowest employment quota is found among the youngest German one-person households of this type, which is presumably explained by the longer period of education in the FRG. Similarly while over half of the youngest American one-person households fall into the highest income category only 40% of Germans in this group have this level of income. On the other hand, among persons 34 to 53 years of age, 64% of Germans in immobile one-person households have incomes in the upper tercile as compared to 59% of the Americans.

Perhaps the most striking difference, however, between the immobile one-person households in the two younger age groups is to be found in their marital status. Over 90% of the persons in the youngest immobile one-person households in the FRG have never been married, as compared to 76% in the US. Correspondingly only 6% of the Germans in this group had been divorced, as compared to 18% of the Americans. Among those older than 34 and younger than 54 years of age, divorce is more common among persons in immobile one-person households in the FRG (27%). Nonetheless a far greater proportion of persons in this group in the US have been divorced (39%).

3.2 Pure Residential Mobility

Cases of pure residential mobility are a subset of those persons who lived alone for the entire observation period. Pure residential mobility occurs when persons move in the absence of a change of household composition. There is little difference between the US and the FRG in the proportion of cases of residential mobility to the total population of stable one-person households--12.5% in the FRG and 14.6% in the US. In both countries, as Table 2 shows, mobility of this type is clearly associated with age and gender. As a rule, moving from the oldest to the youngest age group the proportion of persons changing addresses increases, whereby within each age group men are more mobile than women. The gender-specific difference is weaker in the US, not only in the middle age group (where women are slightly more mobile than men), but also in the oldest and the youngest age categories. In the FRG the gender-specific difference declines, moving from the oldest to the youngest age groups, but even among one-person households younger than 34 men are still move likely to change addresses than women. Otherwise in the FRG, within the individual age groups, there is nothing in the socio-economic characteristics of those who move that sets them apart from the

	54 years and older	34 to 53 years	16 to 33 years	Total
FRG				
Total	7.2	13.7	31.9	12.5
Male	12.9	17.9	39.0	22.[illegible]
Female	6.2	9.4	24.2	8.[illegible]
US				
Total	8.2	14.4	38.0	[illegible].6
Male	12.3	13.5	40.0	20.7
Female	6.9	15.5	35.2	11.3

Based on waves 1-3 of the SOP and waves 1-8 of the SIPP 1984 panel public release files. (FGR: n = 661, estimated weighted population = 6.1 million; US: n = 2,604, estimated weighted population = 14.4 million)

Table 2
Mobility of Stable One-Person Households According to Age
Percentage Moved in the Course of 2 Year Observation Period

immobile one-person households. Similarly in the US, apart from age and gender, the cases of pure residential mobility do not drastically differ from the immobile one-person households. In the youngest age group, stable one-person households who moved are less likely to be divorced and are less well-off financially than those who remained in the same dwelling during the observation period. These differences, however, can be traced back to an age difference between the two groups (6).

Extensive information regarding housing quality, satisfaction with housing and housing costs is an important element of the SOP data. The hypothesis that pure residential mobility of one-person households is connected principally with their housing situation may be more closely examined in the light of this data. To begin with, those who move are questioned regarding the reason for the move. Table 3 presents the reasons given by all household reference persons, regardless of household size, and compares these with the reasons given in the cases of pure residential mobility of one-person households. For the latter group the responses are further broken down according to age. Among all household reference persons the move to a new dwelling is most often (42%) related to housing concerns. A slightly greater proportion (45%) of the persons living alone attributed the move to such concerns--in particular the desire for a dwelling of the appropriate size, more comfort, a better location or rent, or the purchase

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(6) The mean age among the movers is 36, two years younger than those remaining at the same address (T-value = 7.35 with 605 df). This difference fits with the results presented below and in section 3.6 where we find that in the youngest age group in the FRG, mobility is most common among those not yet settled into occupational careers.

of a house or condiminium. Among all households changing addresses, 12% of the household reference persons described the move as occupation or employment related, as compard to 19% of the one-person households. Nearly one third of all moves were described as family-related. However, as one would expect, such reasons are far less common for stable one-person households (13%). Presumably these persons moved to be closer to family members in other households or the move was a lagged response to a change in household composition that took place prior to the observation period. When one considers the three age groups separately, the importance of occupational placement for residential mobility among young persons becomes apparent. Housing related reasons were named least commonly (39%) and occupational and employment related reasons most commonly (26%) among the youngest age group (6).

	Improvement of dwelling situation	Asked to leave by landlord	Employment related reasons	Family related reasons	Other
			in percent		
One-Person Households	45.4	5.5	18.8	13.1	17.2
Age					
≥ 54 years	41.5	4.2	9.9	12.6	31.8
53-34 years	67.1	9.4	14.7	7.9	.9
33-16 years	39.2	4.8	26.5	15.2	14.3
All Households	41.8	5.9	12.2	32.3	7.9

Based on waves 1-3 of the SOP (observed cases = 826 including 92 one-person households)

Table 3
Reasons Given for Moving in the FRG
All Households Compared to Stable One-person Households

A difficulty with the design of this question is that it forces respondents to name a single most important reason for the move and thereby obscures the fact that a variety of factors may be involved. This becomes apparent when one compares the characteristics of previous dwellings with those of new dwellings (see Table 4). The housing situation of one-person households in the youngest age group is generally improved through a move. Thus the size of the dwelling and the number of rooms increased. The average rent also increased considerably, whereby in most cases the increased rent is deemed appropriate. Surprisingly the assessment of the need for renovation of the building in which the dwelling is located indicates a decline in

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(6) The mean age among the movers is 36, two years younger than those remaining at the same address (T-value = 7.35 with 605 df). This difference fits with the results presented below and in section 3.6 where we find that in the youngest age group in the FRG, mobility is most common among those not yet settled into occupational careers.

	In the event of pure residential mobility 1)						In the event of immobility 2)		
	1984			1986					
	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years
	in percent						in percent		
Need for renovation of the building									
completely	1.2	0.7	4.2	1.5	0.9	4.4	3.2	1.1	1.1
somewhat	5.4	4.5	14.4	4.7	6.3	16.7	10.2	9.1	11.8
not at all	20.9	12.8	25.9	30.9	10.1	24.5	22.0	23.7	17.8
Facilities									
with bath, with central heating	27.7	9.8	31.3	35.6	13.2	33.3	51.0	13.3	10.5
with bath, without central heating	7.5	4.5	4.1	1.6	3.2	9.2	15.9	1.8	2.0
without bath, with central heating	2.2	2.4	1.3	-	-	0.6	1.3	0.5	0.5
without bath, without central heating	0.2	0.6	8.4	0.2	1.1	2.0	2.8	0.1	0.3
Number of rooms									
1	2.4	7.9	19.2	7.7	2.2	14.2	6.4	3.3	6.7
2	24.9	5.3	19.6	15.4	7.8	16.1	24.0	7.3	7.6
3	8.4	3.1	6.0	14.0	5.8	8.5	22.6	5.5	3.8
4 and more	2.2	0.6	0.4	1.4	1.6	5.3	10.0	2.0	0.8
Size of dwelling m^2									
0 - 40	6.0	10.0	24.4	8.7	0.9	16.7	7.5	2.0	5.1
41 - 60	13.8	6.0	13.3	15.0	5.4	16.8	29.1	6.8	5.7
61 - 80	11.6	0.7	3.0	12.1	7.9	5.0	20.3	3.2	1.7
81 and more	5.8	1.6	3.6	1.4	3.1	7.1	13.8	3.9	0.9
Rent (DM)									
1 - 200	6.1	4.5	7.4	3.8	1.5	6.9	8.7	2.0	4.1
201 - 300	7.4	3.3	15.5	5.3	2.2	13.1	16.9	4.6	7.4
301 - 400	13.6	4.6	7.5	13.8	3.1	9.5	16.3	3.3	5.6
401 and more	10.8	5.5	13.8	11.6	10.5	18.7	14.5	9.3	7.3
Satisfaction with housing costs									
favourable	11.9	7.2	17.1	12.0	2.9	15.3	19.7	7.3	6.3
appropriate	11.6	6.0	13.3	12.8	13.8	24.7	33.2	5.7	7.4
too high	12.7	3.8	16.4	9.8	0.1	8.6	12.9	4.0	3.5
Satisfaction with housing									
very satisfied	20.3	5.2	20.9	28.4	18.3	31.6	60.8	12.5	9.1
satisfied	8.4	5.5	7.6	5.4	0.3	6.2	7.6	2.0	2.0
dissatisfied	7.1	7.6	17.4	3.1	-	6.7	2.2	1.6	2.2

The data is [illegible] 1 - 3 of SOP. 1) Those who moved; observed cases n = 92 (estimated weighted population = 826 thousands). 2) Those who remained at the same address; observed cases n = 661 (estimated weighted population = 5,795 thousands).

Table 4
Change in Dwelling Characteristics of One-Person Households

housing quality, i.e., the proportion of respondents describing the building as in need of renovation increased after the move. This decline in more general indicators of housing quality (condition of the building, including heating and bath facilities) indicates that an improvement in housing quality is not the principal aim of residential mobility among persons in this age group.

On the other hand, persons in the oldest age group who moved and lived alone for the entire observation period thereby attained an improvement in their housing according to these general indicators of housing quality, 89% of these persons judged the buildings in which their new dwellings were located as not in need of renovation--as compared to only 69% of persons in the youngest age group. Likewise persons in the oldest age group improved the facilities of their dwellings as a result of moving. 95% of these persons had central heating and a bath or shower in their own dwellings, as compared to 74% of those in the youngest age group. Based on these measures of housing quality, persons in the youngest age group acquired dwellings with facilities comparable to the average for the FRG, while those in the oldest age group acquired better than average housing (7).

Over 75% of all stable older one-person households occupied dwellings with two or three rooms in addition to the kitchen and 20% lived in one-room apartments. Only half the youngest one-person households occupied dwellings with two or three rooms, while a third occupied one-room apartments. Among those who moved, those in the youngest age group tended to move to larger dwellings and those in the oldest to smaller dwellings. Economic considerations most likely played a role here; as those moving to smaller dwellings were primarily widows with low monthly incomes.

On the whole, persons in the oldest age group paid higher rents after moving than beforehand. Apparently for these persons a better-equipped dwelling was worth the price; the majority of those who moved judged their new rent to be appropriate. Surprisingly, however, the proportion of persons in this age group who judged their rent as "much too high" was not decreased through residential mobility. Presumably this is related to the supply of afforable smaller dwellings. Studies have shown that dissatisfaction with the rent for a dwelling is primarily a judgement of the rent in relation to available income (Lahmann 1988). Persons who find their rent to be "much too high" are concentrated in the lowest income category and among those persons not in the labor force. Also among the youngest age group the proportion of persons who judge their rent to be excessive is relatively high (9%) owing to the low incomes available to some of these households.

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(7) In this context it should be mentioned that a well-equipped dwelling is a necessary prerequisite for the existence of a one-person household. These persons need a technically well-equipped and efficient dwelling to reduce the effort associated with housework and thereby acquire the time necessary for labor market and recreational activities.

Stable one-person households older than 33 and younger than 54 years of age are generally comprised of persons who have found their place on the labor market. Strick data confidentiality procedures preclude the use of the SOP data for research regarding the distances and places associated with residential mobility. However recent research using other data has shown that the rate of employment-related residential mobility is greatest between the ages of 20 and 24 and thereafter steadily decreases (Wagner 1987). Keeping in mind that the analysis here is limited to households without changes in household composition, one would expect that one-person households in this age group primarily move to improve their housing situation. More than 20% of the persons in this age group said the reason for their move was the purchase of a house or codominium. Moverover, 93% of the respondents in this group were satisfied with their housing after the move. The high level of satisfaction is also linked to an improvement in the housing quality (according to objective measures such as heating and bath facilities) as well as an increase in the average dwelling size. The average rent has increased as well, however it is generally viewed as an appropriate increase. Among the stable one-person households in this age group there is a clear difference in housing quality between those who move and those who remain in the same dwelling. Even though relatively high incomes are found among both groups those who move tend to occupy lower quality housing even after the move than those who remain in the same dwelling.

3.3 The Foundation of One-Person Households

The first distinction to consider by the formation of one-person households is whether or not the process is one of complex or latent mobility, that is, whether or not the person forming the household changes dwellings. Complex mobility is the more common type of formation of one-person households in both the FRG and the US. In the FRG 67% of the one-person households formed during the observation period involved complex mobility, as compared to 62% in the US (see Table 5). As with pure residential mobility among one-person households, the formation of one-person households through complex mobility most frequently involves persons in the youngest age group: in the FRG nearly 90% of the persons who formed one-person households in this manner were younger than 34, in the US 75% of these persons were in this age group. The formation of one-person households through latent rather than complex mobility is more common in the oldest age group--in the FRG and in the US nearly half (48%) of those persons who formed one-person households in this manner were older than 54 years of age.

The clearest difference between the FRG and the US is the greater proportion of one-person households formed by divorce in the US. The formation of one-person households through complex mobility among the youngest age group and the formation of one-person households through latent mobility among the oldest age group contain the largest number of cases and are most suitable for comparison between the two countries. In both instances the proportion of divorced persons is greater in the US than in the FRG.

	Complex Mobility			Latent Mobility			Complex Mobility			Latent Mobility		
	Socio-economic Panel (SOP)						Survey of Income and Program Participation (SIPP) - 1984 Panel					
	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years
	in percent						in percent					
Age (=100%)	2.3	8.3	89.4	48.8	32.0	19.2	7.2	17.4	75.4	48.7	22.7	28.6
Minority status												
white (=100%)							6.9	17.6	75.5	49.2	21.8	29.0
non-w. (=100%)							9.0	16.8	74.2	46.2	27.5	26.3
Sex												
male	12.1	70.0	55.0	33.6	77.5	54.2	50.2	70.9	60.7	29.9	50.9	65.2
female	87.9	30.0	45.0	66.4	22.5	45.8	49.8	29.1	39.3	70.1	49.1	34.8
Marital status 2)												
married, living apart	12.1	68.5	4.9	-	24.1	20.2	25.0	40.4	12.9	13.3	19.1	17.7
single	-	-	87.4	-	24.4	75.6	8.0	11.1	75.0	6.2	16.1	61.1
divorced	23.7	28.3	7.6	1.5	50.3	4.2	15.3	44.9	11.9	12.0	52.9	19.6
widowed	64.2	3.2	-	98.5	1.2	-	51.7	3.6	0.2	68.5	11.9	1.6
Employment status 2)												
employed	34.4	100.0	69.5	16.2	63.6	95.7	37.3	83.5	73.7	29.3	76.2	86.4
not employed	65.6	-	30.5	83.8	36.4	4.3	62.7	16.5	26.3	70.7	23.8	13.6
Income 2)												
lower tercile	64.2	26.2	43.4	29.9	29.6	37.6	46.1	38.5	35.7	34.9	30.5	37.9
middle tercile	35.8	16.6	26.8	23.4	43.9	21.1	33.4	18.4	33.3	40.3	24.6	20.8
upper tercile	-	57.2	29.8	46.7	26.5	41.3	20.4	43.1	31.0	24.8	44.9	41.4
Weighted population (thousands)	35	129	1,378	370	243	145	365	888	3,840	1,528	712	897
Observed cases	6	17	133	47	25	26	76	192	799	352	165	194

1) Formation is the transition from a multi-person household to a one-person household. This transition is considered complex mobility when it occurs in conjunction with a change in address and latent mobility when the person remains at the same address. 2) Marital status after the change in household composition is used. Income and employment status are based on the start of the observation. Alien residents in the FRG are excluded from this table.

The data is based on waves 1 - 3 of the SOP and on waves 1 - 8 of the SIPP panel public release files.

Table 5
Socio-economic Characteristics of One-Person Households
Household Formation 1)

The social processes commonly leading to the formation of one-person households--children leaving the parental household, divorce and death of a spouse--vary in their relative importance between the FRG and the US. This may be seen by considering the type of household individuals lived in prior to the formation of a one-person household and changes in marital status that accompany the transition from a multi-person to a one-person household (see Table 6). Over 40% of the one-person households formed in the FRG between 1984 and 1986 were established by children leaving the parental household. In the US this process accounts for only a quarter of all new one-person households. Death of a spouse also plays a more important role in the formation of one-person households in the FRG than in the US--widows and widowers made up 15% of the new one-person households in the FRG as compared to 10% in the US.

In the US, on the other hand, divorce, separation and the dissolution of households comprised of two unrelated persons were more frequently associated with the formation of one-person households than in the FRG. The departure of a distant relative of the head of household (a person other than the child or spouse of the head of household) accounts for only 5% of the newly formed one-person households in the FRG. In the US, however, 21% of the one-person households were formed by a more distant relative of the head of household. Some of these cases may involve the departure of children brought into the household by the current partner of the head of household. This would account for some of the differences between the US and the FRG in the proportion of one-person households created by children leaving the parental household. However, only 32% of these "distant relatives" were under the age of 34 as compared to 92% of children who left the parental household. Finally, a larger proportion of the one-person household in the FRG (17%) were formed by persons leaving households that contained more than one other unrelated person than in the US (7%). The proportion of one-person households formed by each of these processes and the manner in which this varies between the FRG and the US clarifies which processes are more or less important for the formation of one-person households in each country. One should also consider the significance of the newly formed one-person households in relation to the number of one-person households existing at the start of the observation period. The final two columns of Table 6 presents the estimated number of households formed in this manner as a percentage of the total estimated number of oneperson households at the start of the observation period. Taking all of these processes together, total number of one-person households formed in the FRG during the observation period equals 30% of the number at the start of the observation period, while in the US this proportion amounts to over 40%. While the number of one-person households in each country grew considerably during this time period, the rate of growth was by no means this high and was, in fact, greater in the FRG than in the US. However, the increasing number of one-person households is not simply a function of the formation of one-person households. To understand this process one must consider the dissolution of one-person households and transitions to multi-person households as well.

3.4 The Transition to a Multi-Person Household

At this point it is important to recall the distinction made above between the transition of one-person households into multi-person households and household dissolution, when all members of the households leave the population.

The socio-economic characteristics of persons in the FRG and the US who stopped living alone and formed a household with other persons are presented in Table 7. In the case of complex mobility transitions to multi-person households predominantly involve persons in the youngest age category in both countries. In the event of latent mobility, whereby a one-person household stays at the same address but becomes a multi-person household, in both countries a greater proportion of persons in the two older age groups are involved. In the US over 30% of the individuals who stopped living alone and remained at the same address were over the age of 53.

As with the formation of one-person households, the transition to multi-person households may occur through one of several distinguishable social processes. A person living alone may marry, a period of marital separation may end, a child may return to the parental household, or a person may begin living with other unrelated persons. In Table 8 four processes leading to the transition to a multi-person household are described and for each country the proportion of changed one-person households attributable to each is presented. The individuals marital status before and after the transition, as well as the individual's relationship to the head of household and other members of the household were used to categorize the observed transition of one-person households.

In both countries approximately one-third of all instances of transition to a multi-person household took place through marriage or the end of a period of marital separation. In the US, 36% of the transitions to multi-person households involved the individual forming a household with relatives other than his or her spouse, whereby over one-third of these involved children returning to the parental household (8). In the FRG the proportion of one-person households dissolved through the formation of a multi-person household with relatives other than one's spouse is only half as large. The principle process leading to the transition to a multi-person household in the FRG was the formation of a two person household with a person (not necessarily of the other sex) not related by blood or marriage--45% of all transitions to multi-person households. In more than 75% of these cases the persons described their relationship as an unmarried couple ("Lebensgemeinschaft"). Changes of this type were less often associated with the transition to a multi-person household in the US (25%). In both countries the number of persons living alone who subsequently formed a household with more than one other unrelated individual only plays a minor role.

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(8) It may be assumed that an even greater proportion of these cases involved the return of a child to the parental household, that is, when the one-person household being observed was the parent and the new household member was the child. Unfortunately the data sets used for this analysis were not structured so as to easily identify changes in this type.

Process leading to the formation of a one-person household	One-person households formed during the observation period		Weighted number of households formed relative to weighted total of one-person households at the start of the observation period 4)	
	FRG	US	FRG	US
	in percent			
Child leaving parental household 1)	41.0	24.7	12.2	10.0
Separation or divorce	12.2	17.9	3.6	7.2
Death of spouse	14.9	9.8	4.4	3.9
Person leaving household containing two unrelated persons	10.0	19.4	3.0	7.8
Person leaving household with related family members 2)	5.1	21.5	1.5	8.7
Person leaving household with more than two unrelated persons 3)	16.8	6.8	5.0	2.7
Total	100.0	100.0	29.7	40.3
Observed cases	296	1,778		

1) Only when one-person household formed by the child. Cases where a child moves out and a remaining single parent thus becomes a one-person household are treated as "Person leaving household with related family members". 2) The person leaving is related to one or more persons who remain, but is not the child or spouse of the head of household. 3) The person leaving is related to no one in the household though they may be related to one another. 4) The total number of weighted households formed is slightly, less here than in Table 9 due to 5 % of the cases in the FRG and 1% in the US where the process leading to formation could not be precisely identified.

The data is based on waves 1 - 3 of the SOP and waves 1 - 8 of the 1984 SIPP panel public release files.

Table 6
Processes Leading to the Formation of One-Person Households in the Federal Republic of Germany (FRG) and the United States (US)

	Socio-economic Panel (SOP)						Survey of Income and Program Participation (SIPP) - 1984 Panel					
	Complex Mobility			Latent Mobility			Complex Mobility			Latent Mobility		
	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years
	in percent						in percent					
Age (=100%)	-	18.9	81.1	14.7	22.3	63.0	11.5	16.3	72.2	30.2	29.8	40.0
Minority status												
white (=100%)	-	-	-	-	-	-	11.3	16.5	72.2	30.4	27.7	41.9
non-w. (=100%)	-	-	-	-	-	-	12.8	14.9	72.3	28.7	41.1	30.2
Sex												
male	-	75.7	50.3	31.2	42.2	42.4	32.3	58.2	57.6	24.6	56.3	68.2
female	-	24.3	49.7	68.8	57.8	57.6	67.7	41.8	42.4	75.4	43.7	31.8
Marital status 2)												
married, living together	-	49.6	27.6	4.8	20.2	43.2	19.7	35.7	31.4	16.3	39.7	47.6
married, living apart	-	-	1.4	-	4.2	-	4.7	5.8	3.6	5.3	10.6	0.5
single	-	9.6	69.0	10.9	19.1	52.7	3.6	9.3	56.9	5.0	8.5	43.7
divorced	-	20.7	2.0	-	41.3	4.1	10.5	43.6	8.3	14.6	36.9	8.2
widowed		20.1	-	84.2	15.1	-	61.5	5.8	-	58.8	4.4	-
Employment status 2)												
employed	-	100.0	96.3	5.9	100.0	73.8	25.2	85.5	80.8	37.5	84.5	89.2
not employed	-	-	3.7	49.1	-	26.2	74.8	14.5	19.2	62.5	15.5	10.8
Income 2)												
lower tercile	-	-	28.2	10.9	16.5	33.9	46.0	33.3	34.2	34.8	29.4	18.3
middle tercile	-	30.0	21.3	53.2	4.2	26.2	40.0	21.9	30.3	44.1	21.9	33.9
upper tercile	-	70.0	50.5	35.9	79.3	39.9	14.0	44.8	35.5	21.1	48.7	47.8
Weighted population (thousands)	-	64	277	62	94	267	355	504	2,238	548	542	733
Observed cases	-	12	41	9	15	39	63	100	407	111	100	138

1) This transition is considered complex mobility when it occurs in conjunction with a change in address and latent mobility when the person remains at the same address. 2) Marital status after the change in household composition is used. Income and employment status are based on the start of the observation. Alien residents in the FRG are excluded from this table.

The data is based on waves 1 - 3 of the SOP and on waves 1 - 8 of the SIPP panel public release files.

Table 7
Socio-economic Characteristics of One-Person Households
Transition to a Multi-Person Household 1)

Table 8 also describes the importance of each of these processes of transition to multi-person households relative to the number of one-person households at the start of the observation period. Viewed from this perspective, each of these types of transition is relatively more important in the US than in the FRG. Taken as a whole, the weighted estimate of the number of one-person household is dissolved do to the transition from a one-person t a mu -person household equal to 24% of the weighted estimate of one-p son se-holds in the US at the start of the observation period. This port is considerably smaller in the FRG, amounting to just over 10% of ne tota number of one-person households in 1984.

Finally, one must consider persons living alone who left th opulation during the observation period. Death and institutionalization are the most common causes of household dissolution and, as one would ex ect, household dissolution occurs most frequently in the oldest age group in both countries. For the purposes at hand, household dissolution is most important as a further component of the aggregate number of one-person households. In this regard household dissolution is of relatively equal importance in the two countries: the weighted estimate of the number of one-person households leaving the population in the FRG amounts to 6%, and in the US 5%, of the weighted estimate of the total number of one-person households at the start of the observation period.

Process leading to the transition to a multi-person household	One-person households changed during the observation period		Weighted number of households changed 2) relative to weighted total of one-person households at the start of the observation period	
	FRG	US	FRG	US
	in percent			
Marriage or end of marital separation	32.4	32.5	3.5	7.9
Formation of household with other family members 3)	17.7	35.8	1.9	8.6
Formation of household with one unrelated person	45.5	25.4	4.9	6.1
Formation of household with more than one unrelated person	4.4	6.3	0.0	1.5
Total	100.0	100.0	10.3	24.1
Observed cases	142	919		

1) Includes only cases of dissolution of one-person households, when the individual forms a household with other persons and not the dissolution of the entire household, i.e., where a person living alone leaves the population through emigration, institutionalization or death. 2) The total number of weighted households dissolved is far lower here than in Table 9, which includes cases of household dissolution. 3) None of whom is the spouse of the person previously living alone.

The data is based on waves 1 - 3 of the SOP and waves 1 - 8 of the 1984 SIPP panel public release files.

Table 8
Processes Leading to the Transition to a Multi-Person Household in the Federal Republic of Germany (FRG) and the United States (US)

3.5 The Individual Components of Aggregate Change in the Number of One-Person Households

Using the results presented above it is possible to describe the manner in which the growth in the number of one-person households has taken place in the United States and the Federal Republic of Germany (see Table 9). The increasing number of one-person households can be decomposed into various components: an existing stock of one-person households, minus those one-person households dissolved through death, emigration, institutionalization or transition to a multi-person household, plus newly formed one-person households.

	FRG	US
One-Person Households T1	7,891	20,344
New One-Person Households Between T1 and T3	+ 2,464	+ 8,230
Dissolution of One-Person Households Between T1 and T3*	- 1,361	- 6,007
One Person Households T3	8,994	22,567
Percentage newly formed T1 - T3 relative to T1	+31.2	+40.5
Percentage dissolved T1 - T3 relative to T1	-17.2	-29.5
Growth in number of One-person Households T3 relative to T1	+13.9	+10.9

* includes persons leaving the population and transitions to multi-person households.

Table 9
Changes in the Population of One-Person Households in the Federal Republic of Germany and the United States

In the FRG the original stock of 7.9 million one-person households in 1984 grew to 8.9 million in 1986. This is the end result of processes of household formation, dissolution and transformation involving a far greater number of households. Nearly 2.5 million new one-person households were formed during this time, while an additional 1.4 million were dissolved: the persons living in these households either began living with other persons or left the population.

The 14% growth in the number of one-person households during this time period in the Federal Republic of Germany did not imply result from the formation of thirteen new one-person households for each hundred already existing. Instead for each hundred existing one-person households thirty new one-person households were formed, while seventeen, some of which were just formed within this time period, were dissolved.

In the US the growth in the number of one-person households between 1983 and 1985 was somewhat slower (11%), but the circulation of individuals within the population of one-person households was relatively higher. The number of new one-person households formed during this period (8.2 million) amounts to over 40% of the total number of one-person households at the start of the time period. However the larger number of newly formed one-person households in the US did not produce a greater growth in the number of one-person households than in the FRG, as the number of one-person households dissolved during this time period was also relatively higher in the US. The proportion of one-person households leaving the population was roughly the same in both countries relative to the number of one-person households at the start of the observation period, 5% in the US and 6% in the FRG. However, the number of one-person households that became multi-person households relative to the number of one-person households at the outset is much greater, 24% in the US and 10% in the FRG.

3.6 Modelling Residential Mobility of One-Person Households in the FRG

A wide variety of techniques have been used to develop models of residential mobility (see Rima and van Wissen 1987, for an overview of models developed in a number of countries). A crucial element of all such models are estimates of the transition rates between states--such as married/not married, same dwelling/new dwelling or living with parents/not living with parents. Even the most sophisticated model is limited by the accuracy with which these transition rates are estimated. The previous descriptive analysis of one-person households in the US and the FRG imply two general considerations that are necessary for an adequate estimate of these transition rates for one-person households. First, the model must address changes in household composition, for these are often associated with a change in dwellings. Secondly, one-person households constitute a heterogeneous population; a model of residential mobility must explicitly accomodate this variety. One-person households vary, most obviously with the age of the person living alone, as to the frequency of changes in household composition and dwelling. One-person households also differ as to the circumstances under which a person began living alone and the likelihood that the person will later begin living with other persons. Finally, they vary in the fit between the current dwelling and the individual along with his or her prospects for continuing to live alone.

The statistical techniques often referred to in the social sciences as event-history analysis seem especially appropriate for the analysis of residential mobility because these models explicitly address the duration spent in a particular state, such as the occupancy of a particular dwelling, and the influence of variables associated with leaving a state. An application of this class of models to the question of residential mobility in the FRG can be found in Wagner (1987). This study illustrates not only the strength of these methods but also the problems associated with this approach for the residential mobility of one-person households. Wagner's study is based on retrospective life history data, including migration and marital histories. As such it concentrates on changes in family status and dwellings as reported by a representative sample of selected birth cohorts--persons all born before 1952. However when one considers that the most mobile one-person households belong to the group of persons aged 33 to 16 in 1984, i.e., born

in 1951 or later, it becomes apparent that a particularly salient part of the current population of one-person households is excluded from this data.

The SOP and SIPP data include event-history data, such as marital and fertility histories, for all respondents; but this data, too, is inadequate. The crucial problem is that the formation of one-person households and the transition to multi-person households often fail to coincide with the catalogue of events included in these event-histories. Marriage accounts, for example, for only about one-third of the transitions to multi-person households in the FRG and the US. Periods of living with an unrelated person play a crucial role in the formation and dissolution of one-person households in both countries, yet such changes in household composition constitute non-events in the retrospective components of these data sets. Retrospective data of this sort is a rich supplement to a traditional panel design, nonetheless it does not provide the information necessary for the study of spells of living alone prior to the start of the observation period. Even if one confines the analysis to one-person households existing at the start of the panel, the problem of left-censoring (the inability to accurately date the formation of one-person households already existing at T1) poses a serious problem for the application of event-history techniques (9).

Analyses of this sort for the FRG will first be possible when a sufficient number of spells of living alone have begun during the course of the SOP. Owing to its larger sample size, analyses of this sort may be possible with the SIPP data, though the panel's design allows only for the analysis of very short periods of living alone. On the other hand, for the analysis of one-person households in the US, the Panel Study of Income Dynamics (PSID) represents a valuable supplement to SIPP, as this panel can provide data on very long spells of living alone. An example of the use of proportional and nonproportional hazard rate models to evaluate the importance of mortgage rates on household mobility using data from the PSID is found in Quigley (1987).

For these reasons another approach was needed to explore our hypothesis that the determinants of residential mobility of one-person households vary according to the type of one-person household under consideration. For this analysis we restricted our sample to persons living alone at the start of the panel and defined the outcome of interest as a dichotomy: moved in the next two years/remained at the same address. Rima and van Wissen (1987) use a logit regression model as one component of their "dynamic household relocation model" for the city of Amsterdam. They derive coefficients for measures of change in household composition and characteristics of the dwelling as predictors of a households "willingness-to-move." They use a different outcome variable (willingness to move/unwilling to move) than ours (moved/remained at the same address), because only cross-sectional data was available. However, those households that had moved in the year prior to the interview were coded as willing to move (regardless of their stated

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(9) Even under the most herioc of assumptions the retrospective data available in the SOP data provides insufficient information to adequately date the formation of a sizeable portion (13%) of the one-person households existing at the start of the panel.

preference at the time of the interview), "...because then the effect of household, changes in the past year on the willingness to move is measured more precisely." As independent variables they used: age of the head of household, household size at time t, change of household size between time t and time t+1 dwelling size (number of rooms), tenure status of the dwelling (owner/renter) and dwelling type in the SOP data provides (apartment/single family unit). They describe their results as fitting the data well and capturing most of the variance in the dependent variable. All of their coefficients were "significantly different from zero" and have the expected sign, except for their indicator of changes in household structure (an increase in household size). Due to the similarity in the dependent variables and the inclusion of household size among the independent variables and the inclusion of household size among the independent variables, this model appears as a reasonable base model for considering residential mobility among one-person households using the SOP data (10).

Results for a model including the main effects for three independent variables are presented in column 1 of Table 10. The relatively large size and negative sign of the coefficient for the constant reflects the general lack of residential mobility found among one-person households. The positive coefficients for a change in household composition and a small number of rooms in a dwelling indicate that these factors are associated with a change of address, while the negative coefficients attached to persons in large dwellings and in the two oldest age categories indicate a greater likelihood that these persons will remain at the same address. The overall fit of the model is very good. In fact the fit is so good that at the .05 level of significance one can not reject the hypothesis that the expected logits produced by the model are different than those associated with a fully saturated model, a model including all possible interactions between the independent variables.

The normal strategy pursued in the case of a logit model that fits so well is to consider if any of the parameters in the model can be eliminated without a significant decrease in the overall fit of the model. The difference between two models can be tested by subtracting the L^2 values for the two models. The resulting sum is distributed approximately as a chi-square value with df equal to the difference in df's between the two models (Knoke and Burke, 1980). Columns 2 through 4 in Table 10 present the results obtained when each of the independent variables is eliminated from the model. In no case is the resulting increase in the number of degrees of freedom sufficient compensation for the increase in the L^2 ratio to justify excluding a parameter from the original model.

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(10) We have eliminated two of the variables used by Rima and van Wissen from our model because in the case of one-person households they are so closely correlated with other independent variables: owners are almost exclusively found in the oldest age group, while all single family units fall into the largest category of dwellings occupied by one-person households. Adding these variables does nothing to enhance the model and simply multiplies the number of cells containing few observations.

	(1)	(2)	(3)	(4)
Constant	-.758	-.928	-.629	[illegible]
	(.082)	(.072)	(.068)	[illegible]
Change from one-person household to multi-person household	.307	-	.245	[illegible]
	(.072)	-	(.068)	[illegible]
Number of rooms in dwelling				
1-2	.306	.231	-	.394
	(.082)	(.077)	-	[illegible]079)
3	-.039	-.081	-	.084
	(.096)	(.093)	-	[illegible].093)
Age				
older than 53	-.362	-.441	-.412	-
	(.072)	(.068)	(.070)	-
34 - 53	-.074	-.073	-.071	-
	(.080)	(.079)	(.079)	-
Likelihood ratio chi-square	5.319	23.297	20.929	54.574
df	12	13	14	14
Difference relative to model 1	-	17.978*	15.610*	49.255*
Chi-square				
df	-	1	2	2

Based on Waves 1 - 3 of the SOP. N = 997. * indicates a difference from model 1 significant at the .001 level. (standard errors)

Table 10
Logit Models with Dependent Variable: Moved/Remained at Same Address
One-Person Households of All Ages in the FRG

Based on our descriptive analysis of one-person households and the variety of types of persons living alone, it appears somewhat implausible that such a model, despite its good statistical properties, is an adequ[illegible] representation of the process of residential mobility for one-person h[illegible]holds. It seems quite likely that this model fits well for the entire pop[illegible]tion of one-person households but is inadequate for particular subgroups [illegible] t[illegible] population. To consider this possibility the age group categorie[illegible]se above present a rough but simple categorizatio[illegible] of one-person hou[illegible]ol[illegible] Considerable heterogeneity remains within eac[illegible]e group. A more [illegible]ecise analysis would call for theoretically more int[illegible]ing categories [illegible]d a more sophisticated and efficient organization of the data regardi[illegible] the timing of changes. The intent here is not to produce a single, "[illegible]t" model for each of these age groups. Rather, we hope to demonstrate that [illegible]y treating subpopulations separately the underlying social processes may be more realistically portrayed.

The results presented in Table 11 use different combinations of variables for each age group to estimate the logits for residential mobility (11). These models do not fit the observed data as well as the previous model. On the other hand, the overall fit of these models (the probability that deviations as large as those observed would occur if the model were the true model) is within the range normally regarded as a good fit. Moreover taking away any of the variables in the models leads to a significantly worse fit, while the fit may be improved only by adding interaction terms that do not lend themselves to meaningful interpretation.

As presented in Table 11, however, the models suggest a number of interpretable results concerning the patterns of residential mobility among one-person households in each age group. To begin with, the decreasing absolute value of the constant term as one goes from the oldest to the youngest age group represents the successively increasing proportion of mobile persons. The transition from a one-person households to a multi-person household, though common in the population at hand, is relatively rare in the oldest age group and among members of our sample was never associated with residential mobility. Thus there is nothing to be gained by including this type of change in household composition in the model for the oldest age group. In the two younger age groups, on the other hand, the transition to a multi-person household is clearly positively related to residential mobility. To consider the possibility that mobility among the older group of persons could represent the lagged response to a change in household composition prior to the start of the observation period, a dummy variable was constructed indicating persons known to have been widowed or divorced in the previous three years. However, there was no clear cut relationship between this variable and residential mobility and it was not included in the model.

The coefficients for the number of rooms in the dwelling at T1 are a good example of the contrast between the age groups. In the two youngest age groups a small dwelling is positively associated with residential mobility. As discussed above, in the younger age groups residential mobility is in the direction of larger dwellings and in the oldest age group toward smaller dwellings. Accordingly, in the oldest age group we find a negative coefficient for persons in the smallest dwellings (these persons have already attained the desired dwelling size) and a positive coefficient for persons in the next largest size dwelling. This is the group of persons moving into smaller quarter. The coefficient for three-room dwellings is negative, as is the coefficient for the variable indicating older one-person households living in one or two family houses as opposed to multi-unit buildings. Presumably persons in the largest of dwellings are relatively immobile because they have the financial resources to continue to occupy such a dwelling. The inclusion of monthly household income in the model failed to capture this relationship, but this is a poor measure of financial resources for persons

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(11) The number of rooms occupied at the start of the observation period is the only variable common to all models and in each case this variable is coded somewhat differently: for the oldest age group we distinguish between 1 room, 2 room, 3 room and 4 room, or larger (omitted category) dwellings; and for the youngest age group between 2 room or smaller and 3 room or larger (omitted category) dwellings. For the middle age group between 1 room and 2 room or larger (omitted category) dwellings.

in this age group. A variable for whether the dwelling was owned or rented also failed to improve the model, primarily because in this age group nearly all property owners are owners of large dwellings and thus this variable is redundant. Substituting property ownership for either or both indicators of dwelling size only decreases the overall fit of the model.

For persons in the youngest age group we added a variable to consider our hypothesis that mobility among the youngest one-person households is concentrated among those persons who have not yet settled into occupational life. As expected we found a positive relationship between residential mobility and a dummy variable indicating that a person was still in school or occupational training at the start of the observation period. Moreover the overall fit for our model for persons in the youngest age group only became tolerable when we added an interaction term representing persons still in school or occupational training at T1 and living in 2 room or smaller dwellings. Here one can conclude that the relationship with residential mobility decreases when a person has already acquired a more desirable dwelling (in this age group more desirable means larger and not smaller as is the case with older persons) before completing his or her education.

	(1)	(2)	(3)
Age in Years	**≥ 54**	**53 - 34**	**33 - 16**
Constant	-1.516	-.642	-.206
	(.132)	(.149)	(.100)
Change from one-person household to multi-person household	-	.435	.293
	-	(.142)	(.087)
Number of rooms in dwelling			
1	-.149	.207	-
	(.254)	(.129)	-
2	.437	-	.207
	(.142)	-	(.102)
3	-.067	-	-
	(.170)	-	-
1 or 2 family house	-.133	-.010	-
	(.102)	(.132)	-
In school or vocational training at T1	-	-	.077
	-	-	(.098)
In school or vocational training <u>and</u> in dwelling with ≤ 2 rooms at T1	-	-	.179
	-	-	(.099)
Likelihood ratio chi-square	1.788	2.483	1.394
df	3	4	3
Probability	.618	.648	.707

Based on waves 1-3 of the SOP. n = 997 (standard errors)

Table 11
Logit Models with Dependent Variable: Moved/Remained at Same Address
Separate Model for Each Age Group

4 CONCLUSIONS

The findings presented above demonstrate how the growth in the number of one-person households can be interpreted by examining the social processes that are the constituent elements of this growth. In this context the comparison between the FRG and the US is particularly instructive. In the time period considered relatively more new one-person households were formed in the US than in the FRG. However the increase in the number of one-person households was relatively greater in the FRG than in the US, because relatively more one-person households were being dissolved in the US. Previous research using panel data has emphasized an important point in conjunction with the study of unemployment and poverty: the proportion of persons in a given state depends both on the rate at which people enter and leave the state. This principle also applies to type of households and stages of family life.

Typically one thinks of a young one-person household as a temporary living arrangement between the parental household and the formation of a household with a partner or spouse. However, our finding show that a great number of one-person households are formed, particulary in the United States, through the dissolution of a marriage or partnership. Sociologists of the family have described changing patterns of living-together, marriage, divorce and remarriage as "serial monogamy". The research presented above indicates that one-person households often serve as a stepping stone in the transition from one partnership to the next. On the other hand, the transition from a one-person household to a multi-person household often does not lead to the formation of a partnership but to a reintegration in the parental household. Our results indicate that this trend, noted by others in the US (Heer, Hodge and Felson 1985), is of far less importance in the FRG. The majority of transitions to multi-person households in the FRG lead to the formation of a household with a partner--more often without than with a marriage certificate.

The description of residential mobility among one-person households illustrates an important aspect of the process of residential mobility in general. In the course of their lives persons in the US change dwellings on the average far more frequently than those in the FRG, where the average person thirty years of age or younger has moved three times and those between thirty and sixty-five only four times. Greater residential mobility and more frequent changes in household composition and family status are not independent of one another, for these events in fact often accompany one another. The low rate of residential mobility among young one-person households without changes in household composition in the US provides strong support for this argument. In the absence of changes in household composition housing concerns and, for the youngest of persons, occupational placement are the most important determinants of residential mobility.

As the final section of the paper emphasizes, different types of one-person households exhibit different patterns of residential mobility. While we found no relationship between the transition to a multi-person household and residential mobility in the oldest age group, in the two younger age groups a change in household composition was positively associated with a change in household composition exhibited by different types of households is necessary to improve the accuracy of models of residential mobility. To the extent

that housing and labor market policies are aimed at the allocation of persons to specific areas the housing needs of young one-person households, the most mobile type of household, are worthy of special attention. Obviously this implies a sufficient number of adequate and affordable dwellings in the appropriate locations. Less obviously, however, attention must also be paid to the future housing needs of such persons; for many of these persons living alone is only a temporary situation, followed by marriage or the formation of a household with an unrelated person. Nothing is gained if persons are successfully attracted to an area, but they are then forced to move elsewhere because they are unable to find appropriate housing for a multi-person household.

The findings presented above, in part, rest on a relatively small number of observations. However they provide the foundation for more exact models of changes of household composition involving one-person households and the related processes of residential mobility. Fortunately the SIPP and SOP panel projects are such that these preliminary results may be built upon and research in this direction may be continued. The topical modules in the 1984 SIPP panel concerning migration and marital history promise a wealth of additional data. The ongoing nature of the SOP panel--data from the fourth wave will soon be available and the fifth wave is currently being collected--will alleviate some of the sample size problems associated with the study of changes in household composition in the FRG. Over the course of the panel, cases of the formation of one-person households and the transition from one-person households to multi-person households accumulate. Assuming that the processes involved have themselves not changed, observations from different points in time may be combined allowing for more detailed analysis. Finally, we hope our work will encourage others to undertake comparative panel research. Individual-oriented longitudinal data such as that offered by SIPP and SOP, and the software and hardware necessary to work with such data, have only recently become available. By drawing attention to the similarities and differences between processes in more than one society, a comparative approach can be a great aid in making sense of the wealth of information offered by data of this type.

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ABSTRACT

The increase in the number of persons living alone and the patterns of residential mobility among one-person households can only be understood in light of the transitions between one-person and multi-person households. The likelihood of a change in dwelling or household composition varies among one-person households, most obviously with the age of the person living alone. This paper presents exploratory research on one-person households, the processes leading to their formation and dissolution and the residential mobility associated with such households. The analysis is based on panel data collected over a two year time period in the United States and the Federal Republic of Germany.

KEYWORDS

residential mobility, one-person household, household composition, panel data

1 INTRODUCTION

The current population of one-person households is made up of persons of different ages, at varying stages in their family careers. Young persons who have left the parental household but have not yet formed a family of their own are one significant component of the population of one-person households. Other persons living alone are somewhat older: persons who left the parental household some time ago and never formed a family of their own, as well as those who have only recently begun living alone. Some individuals in the latter group continued to live with their parents longer than most persons of their generation. Others are divorced, widowed or separated from their spouses, and still others began living alone after having lived with other relatives or non-related persons. The largest bloc of one-person households are elderly. Many of these persons only began to live alone recently, after long years of living with others, while a few have not lived with other persons since leaving the parental household long ago. The underlying premise of the research presented below is that the residential mobility of one-person households is inseparable from the processes by which such households are formed and dissolved at different stages in the lives of individuals.

Moreover, along with the different age related patterns of transitions between one-person households and multi-person households the economic forces of the labor and housing markets also influence the character and frequency of residential mobility over the course of individuals' lives. Young persons, relatively free from family obligations, are ideal candidates for employment-related residential mobility. Once an individual has found a more or less stable position in the labor market, the decision to move is more likely to be a response to the cost and quality of housing. In later years several contradictory factors come into play. On the one hand, the individual, no longer bound by the responsibilities of employment, is free to move. In addition, financial considerations or physical impairment may force the person to find smaller quarters. On the other hand, the social ties to a particular place and dwelling, accumulated during the preceeding years of relative immobility, may hold over into this phase of a person's life. In short, observable patterns of residential mobility are the joint product of economic and social forces that combine and interact in different ways at different phases of people's lives.

In part, our research concentrates on one-person households because the complex process of household mobility is simplified when the household consists of one person rather than many. More importantly, however, one-person house-

holds have assumed a critical role in the overall household structure at both the macro and micro levels. This can be seen in the increasing number of persons living alone. In the past twenty-five years the number of one-person households in the Federal Republic of Germany (FRG) has more than doubled -- from just over 4 million in 1961 to 8.8 million in 1985 (Statistisches Bundesamt 1987). The proportion of one-person households among all households in the FRG thereby increased from 20.6% in 1961 to 33.6% in 1985. In the United States (US) the number of one-person households rose even more dramatically from 6.9 million in 1960 to 20.6 million in 1985 and the proportion of one-person households among all households in the US increased from 13.1% in 1960 to 23.7 in 1985 (U.S. Bureau of the Census 1987a). This means that in a quarter of a century the proportion of one-person households in the FRG increased by 63.1% and in the US by 80.9%; a vast change in living arrangements over a particularly short period of time. Similar rates of change can be found in other European and Scandinavian countries (Roussel 1983).

The increasing proportion of one-person households among all households is linked to concrete economic and technological developments -- in particular the rising standard of living, the improved income and labor market position of women, and improved birth control techniques. At the same time there has been a shift in popular values, norms and ideals, which by no means are unrelated to changing economic circumstances. Independence, individual freedom and self-realization are the catchwords for these changes in contemporary culture's normative framework. Demographic analysis or econometric analysis based on aggregate data, or models built around how individuals have acted in the past are not sufficient to explain this change or to consider its consequences. The increasing proportion of one-person households can only be understood by considering the changing behavioral patterns of individuals.

This paper describes recent developments in the population of one-person households in the Federal Republic of Germany and the United States. In the following section the data used in the analysis is discussed and a framework for describing the coincidence of changes in household composition and residential mobility is introduced. Based on representative panel data on one-person households in the US and the FRG, the empirical part of the paper concentrates on those households which acquire additional members or change dwellings and the extent to which both types of change occur simultaneously. The formation of new one-person households is similarly discussed and the two processes are then examined in combination to consider how they interact to determine the aggregate number of one-person households in each of the two countries. Finally, methods to include the formation and dissolution of one-person households in models of residential mobility are discussed and exploratory results using a logit regression model are presented.

2 SOURCES OF DATA AND ANALYTICAL FRAMEWORK

2.1 The Analysis of Comparative Panel Data

Our research on one-person households is based on two sets of panel data: the German Sozio-ökonomisches Panel (SOP) and the 1984 Panel from the Census Bureau's Survey of Income and Program Participation (SIPP) (1). These panel studies are similar in many respects. This fact greatly aids comparative research, for there is always the risk that differences between two societies are confounded with differences in study design and research methodology. Perhaps the most important difference between the two studies is the shorter time period between SIPP waves, four months as opposed to the year-long interval between SOP waves. For some research questions, for example, the exact amount of program benefits received, more frequent interviews may well reduce recall error. However for something as salient as changes in household compo-

(1) An overview of the SOP Panel may be found in Hanefeld (1984) and of SIPP in U.S. Bureau of the Census (1987b).

sition, the longer time span between SOP waves is of less significance. Owing to our concern for the mobility of one-person households it is more important that both panels use essentially the same following rules (2).

The following rules adopted by both SIPP and SOP have one particularly important implication for the study of one-person households. A dynamic approach is necessary to determine which households give rise to one-person households, as well as those that absorb persons who previously lived alone. Both panels share this advantage and yet bind it by the same restriction: persons not selected in the original sample who subsequently enter the sample (because they enter a household with an adult member of the original sample) are no longer interviewed when they stop living with a member of the original sample. This means, by definition, that all persons in one-person households in both studies are members of the original sample. By limiting one's analysis to members of the original sample some of the more complicated problems rooted in panel data, in particular those related to missing data and weighting, are simplified.

Our analysis of German one-person households is based on the first three waves of the SOP, interviews that took place in the spring of 1984, 1985 and 1986. A one-person household is defined as one in which a person is found to be living alone on at least one of the interview dates. In this way a discrete time structure is imposed on a process that is essentially continuous; just because the interviews fall in a regular cycle does not mean that changes in household composition follow the same rhythm. As a result some information concerning the exact timing of changes in household composition is lost and short spells of living alone may go unobserved. As the purpose of this paper is primarily exploratory, the decision was made to sacrifice a measure of precision to simplify the problem. However, it should be emphasized that both panels date changes in household membership, as well as a number of other processes, more precisely. Later work can adopt a more accurate and realistic time structure.

Given a discrete time framework, the subsequent changes in household structure experienced by persons in a panel are considerably simplified. At each of the three time points, an individual belongs to either a one-person or a multi-person household. Panel members in one-person households in 1984 (T1) fall into one of four categories in 1985 (T2): 1) those continuing to live alone, 2) those now living with other persons in a multi-person household, 3) those who have died, emigrated or moved into an institution and thus left the population, 4) and those who have left the panel (wave nonresponse), whereby their status regarding population membership is open. The same four possibilities exist between 1985 (T2) and 1986 (T3). Other panel members in multi-person households in 1984 (T1) or 1985 (T2) stopped living in multi-person households between 1984 and 1985 or between 1985 and 1986 and represent newly formed one-person households. In this manner data is available for persons continually living in one-person households during this time period, as well as for persons who have begun to live alone and those who have begun living in households with other persons. Data concerning American one-person households from the 1984 SIPP panel was then organized in a similar manner (3).

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(2) In a panel the following rules are just as important as the original sample design itself (Kalton and Leplowski 1985). Based on theoretical concerns (such as the boundaries of the population of inference) and practical concerns (such as following mobile members of the original sample) they provide an ongoing definition of who will be interviewed and the population represented by the longitudinal sample.

(3) Three time points -- September 1983 (T1), September 1984 (T2) and September 1985 (T3) -- were selected. The public release cross-sectional files for the first eight panel waves were then read to identify persons who lived in one-person households at any time between T1 and T3. Based on the respondent's rotation group the appropriate waves and reference months were then used to determine the type of household to which an in-

Weighting presents a problem for a longitudinal analysis of this type using the SIPP public-use cross-sectional files. The Census Bureau's recommendation is that the initial Wave 1 weights may be used if, as is the case here, the analysis is solely based on members of interviewed Wave 1 households. However, the Census Bureau also stresses that the weights do not account for sample attrition (Census Bureau 1987b). In the course of developing longitudinal weights for the SOP project it has become apparent that sample attrition is associated with changes in household composition and residential mobility and that their influence is particularly strong in the case of one-person households (Rendtel 1987). To compensate for this problem a simple strategy proposed by Little and David (1983) was adopted. All persons in one-person households at T1 but no longer in the panel at T2 were identified and the reasons for their departure from the panel were explored using the public-use cross-sectional files for the intervening time period. Persons who left the sample due to death, emigration or institutionalization were thus distinguished from cases of nonresponse.

The T1 weights of one-person households who remained in the panel at T2 were then weighted-up using an adjustment factor equal to the inverse of the response rate for one-person households. Likewise persons in multi-person households at T1 who subsequently formed one person households, but then become nonrespondents by T2 were used to adjust the weights of persons who began to live alone after T1 and remained in the panel at T2. The same procedure was then performed to further adjust the weights to compensate for nonresponse between T2 and T3. The adjustment factors for the T2 to T3 time period also included those cases leaving the sample due to the 15% reduction in the SIPP sample that took place between T2 and T3. While a number of more sophisticated techniques have been developed (Little and David 1983; Kalton 1987; Rendtel 1988) these adjustment factors are adequate for the exploratory analysis presented here and produce estimates of the population of one-person households very close to cross-sectional estimates prepared by the Census Bureau using the SIPP data (4).

2.2 Residential Mobility and Changes in Household Composition

Panel studies are designed to measure change, but collecting individual mobility data is never easy, even in the context of projects like SIPP and SOP, where special efforts are made to follow mobile sample members. Some of the problems are concrete questions of measurement and sample selection and the related costs and benefits. In addition, complex analytical and conceptual issues are unavoidable in the study of changes in household composition, such as the question of the proper operationalization and definition of households and the relationship of individuals to households over time (McMillen and Herriot 1985; Duncan 1985). Residential mobility is often a question of individual and not household mobility; yet it is affected by the stability or instability of household composition. Changes in household composition alter

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dividual belonged at each of these time points. Cases where the entire interview was imputed for one or more of these time points were dropped, owing to the particular problems associated with imputed data in analyses of change. (Census Bureau 1987b).

(4) For example, the monthly average of one-person households July to September 1983 is given as 19.71 million (US Bureau of the Census 1984) and for the same time period 1984 as 20.78 million (US Bureau of the Census 1985) an increase of 5.4% in the number of one-person households. The same rate of increase between 1984 and 1985 would yield 21.91 million one-person households and increase of 11.2% over the two year period. Our results for September 1983 yield 20.3 million one-person households and for September 1985 22.6 million - an increase of 11.3%.

housing needs and thus often lead to residential mobility (5). Only in the case of pure residential mobility -- when an entire household moves from one dwelling to another -- are household mobility and individual mobility identical.

Figure 1 describes five different degrees of household mobility (A through E) that may result from different combinations of residential mobility and changes in household composition. Case A, immobility, is the simplest: household composition remains unchanged and all persons remain in the same dwelling. Case B, pure residential mobility, occurs when the household moves to a different dwelling and there is no change in household composition. Mobility of this type is typically rooted either in the households living situation (in the dwelling or the neighborhood) or labor market factors, whereby one or more members may be "pushed out" of an area due to poor labor market conditions, and/or "pulled to" another area due to the prospects of a better labor market position.

Case	Change in household composition	Residential mobility Yes	Residential mobility No	Type of mobility	Effect on one-person households
A	No change		X	immobility	no change
B	No change	X		pure residential	new dwelling
C1	Individuals enter household (including births)		X	latent	transition to multi-person household
C2	Individuals leave household (including death and emigration)		X	latent	dissolution
C3	Individuals enter and leave		X	latent	dissolution
D1	Individuals enter household (including births)	X		complex	transition to multi-person household
D2	Individuals leave household (including death and emigration)	X		complex	dissolution
D3	Individuals enter and leave	X		complex	dissolution
E	All individuals leave population	-	-	household dissolution	dissolution

Figure 1: Relationships between Changes in Household Composition and Residential Mobility

Cases C1 through C3 result when there is a change in household composition -- the addition of new members and/or the loss of old members -- whereby one or more old members of the household remains in the dwelling. We refer to such changes as latent mobility, since addition or loss of members often results in changed housing needs but a move may not be desirable or possible at the

(5) These events need not be simultaneous: a time lag in either direction is possible. The existing members of a household may move in anticipation of a change in household composition or after the change has occurred. Moreover, the perception of housing needs, as well as the possibility to fulfil perceived needs, are subject to the full gamut of social and economic constraints and necessities.

time. A move may subsequently follow or may have previously occurred, if the change in household composition was anticipated. Cases D1 through D3 involve the same types of changes in household composition, but are coupled with residential mobility and are referred to as complex mobility. Either the move or the change may precipitate the other: larger or smaller quarters may be found to adjust to the change in household composition. The move to smaller quarters may force someone to leave the household; or a larger dwelling may allow or necessitate the addition of household members. Empirically the distinction between latent and complex mobility depends on how close together a change in household composition and dwelling need to be in order to be defined as simultaneous. For the analysis presented below a yearly cycle has been chosen: complex mobility means that both household composition and dwelling change between T1 and T2 or between T2 and T3. An important question to consider is the extent to which cases of pure residential mobility are lagged responses to or anticipations of changes in household composition.

The final type of mobility, household dissolution (Case E), occurs when all members of the household simultaneously leave the dwelling and are no longer part of the population. Theoretically household dissolution only occurs upon the death of all household members, but in empirical research the incidence of household dissolution is determined by the following rules and definition of the population of inference. In the SIPP and SOP studies household dissolution occurs through the institutionalization, emigration or death of all household members.

One-person households are an appropriate starting point for the study of the relationship between changes in household composition and residential mobility, because the different types of mobility are logically simplified. The possibilities C2, C3, D2 and D3 exist only for multi-person households; for with one-person households, household dissolution results when the one and only member leaves the household. The three types of latent mobility (C1, C2 and C3) and complex mobility (D1, D2 and D3) each reduce to a single form (when a person enters the household), the transition to a multi-person household. The household does not leave the population, but ceases to exist as a one-person household. As a case of latent mobility, the transition to a multi-person household means that the individual involved has remained at his or her old address and additional persons have joined the household. In the event of complex mobility either the individual has moved in with another person or persons, who remain at their old address, or both parties change addresses and together occupy a common dwelling at a new address.

In addition, the study of one-person households within a panel design touches on the important but difficult question of household formation. Household formation is inextricably tied to the processes described as latent and complex mobility. The departure of a household member from any type of household and the subsequent formation of a one-person household by this person is a case of the formation of a one-person household through complex mobility. A child leaving the parental dwelling to establish his or her own household is perhaps the most simple example of this type of complex mobility. The formation of a one-person household takes the form of latent mobility when all but one member of the household leave the dwelling. Those leaving the dwelling may form one or more one-person households of their own, while the individual remaining in the old dwelling defaults to a one-person household, as long as no additional persons occupy the dwelling.

3. EMPIRICAL RESULTS

3.1 Immobile One-Person Households

Previous research indicates a number of associations between living alone and patterns or clusters of socio-economic traits. The sex-specific difference in life expectancy and the lower average marriage age of women leaves a number

of women alone at the end of married life in many industrial countries (Spiegel 1987). This pattern is further strengthened in the FRG due to the great number of women who were divorced or widowed during the war years, a time when the remarriage rates for women were much lower than today (Witte 1988). Table 1 presents univariate distributions for several socio-economic variables (age, sex, marital status, employment status, income and minority status) for immobile one-person households in the FRG and the US between 1983 and 1986. The immobile households, persons living alone for the entire observation period without an address change, correspond to the typical image of elderly one-person households. Women 54 years of age and older make up over 60% of the immobile one-person households in the FRG and 53% in the US. If one considers male one-person households in this age group as well, approximately 70% of the total number of immobile one-person households in both countries are made up of person 54 years of age or older. Characteristically these persons are not members of the labor force -- 14% of the German respondents were employed at the beginning of the observation period as compared to 22% of these American one-person households. Despite the lower employment rate in the FRG, older immobile one-person households in the FRG are relatively better-off than their American counterparts. Using terciles based on monthly income of all one-person households in each country, just about a third of all German but over 40% of American households in this age group fall into the lowest income group.

In the two younger age groups in both countries more than 80% of the persons in immobile one-person households are employed. The lowest employment quota is found among the youngest German one-person households of this type, which is presumably explained by the longer period of education in the FRG. Similarly while over half of the youngest American one-person households fall into the highest income category only 40% of Germans in this group have this level of income. On the other hand, among persons 34 to 53 years of age, 64% of Germans in immobile one-person households have incomes in the upper tercile as compared to 59% of the Americans.

Perhaps the most striking difference, however, between the immobile one-person households in the two younger age groups is to be found in their marital status. Over 90% of the persons in the youngest immobile one-person households in the FRG have never been married, as compared to 76% in the US. Correspondingly only 6% of the Germans in this group had been divorced, as compared to 18% of the Americans. Among those older than 34 and younger than 54 years of age, divorce is more common among persons in immobile one-person households in the FRG (27%). Nonetheless a far greater proportion of persons in this group in the US have been divorced (39%).

3.2 Pure Residential Mobility

Cases of pure residential mobility are a subset of those persons who lived alone for the entire observation period. Pure residential mobility occurs when persons move in the absence of a change of household composition. There is little difference between the US and the FRG in the proportion of cases of residential mobility to the total population of stable one-person households -- 12.5 % in the FRG and 14.6% in the US. In both countries, as Table 2 shows, mobility of this type is clearly associated with age and gender. As a rule, moving from the oldest to the youngest age group the proportion of persons changing addresses increases, whereby within each age group men are more mobile than women. The gender-specific difference is weaker in the US, not only in the middle age group (where women are slightly more mobile than men), but also in the oldest and the youngest age categories. In the FRG the gender-specific difference declines, moving from the oldest to the youngest age groups, but even among one-person households younger than 34 men are still more likely to change addresses than women. Otherwise in the FRG, within the individual age groups, there is nothing in the socio-economic characteristics of those who move that sets them apart from the immobile one-person households. Similarly in the US, apart from age and gender, the cases

	Socio-economic Panel (SOP)						Survey of Income and Program Participation (SIPP) - 1984 Panel					
	54 years and older		34 to 53 years		16 to 33 years		54 years and older		34 to 53 years		16 to 33 years	
	female	male	female	male	female	male	female	male	female	male	female	male
	in percent						in percent					
Age (=100%)	60.7	10.1	8.2	7.7	7.1	6.2	53.4	14.8	8.7	10.4	5.6	7.1
Minority status 2)												
white (=100%)	-	-	-	-	-	-	55.1	14.6	8.4	9.7	5.5	6.7
non-w. (=100%)	-	-	-	-	-	-	41.5	16.2	11.1	15.1	6.3	9.8
Marital status 3)												
married, living apart	0.8	0.5	2.9	5.6	1.8	1.5	2.7	2.4	3.8	6.1	1.8	2.5
single	10.9	1.5	26.8	26.8	46.6	44.5	8.4	4.4	20.2	23.8	35.6	40.0
divorced	6.9	2.6	13.8	13.3	4.7	0.9	9.8	5.7	16.4	22.5	5.1	13.4
widowed	67.0	9.8	8.5	2.3	-	-	57.4	9.2	5.4	1.8	1.6	-
Employment status 3)												
employed	11.1	3.2	44.6	39.4	43.3	39.1	16.3	6.0	38.2	46.5	40.5	47.6
not employed	76.4	9.3	7.2	8.6	9.7	7.9	62.1	15.6	7.5	7.8	3.6	8.3
Income 3)												
lower tercile	31.7	2.7	6.2	8.1	19.9	11.3	34.9	6.4	10.7	10.5	6.3	13.1
middle tercile	34.0	3.8	12.3	9.0	15.5	13.5	30.3	7.7	12.6	7.4	17.7	11.9
upper tercile	19.9	7.9	33.2	31.2	18.5	21.3	13.1	7.6	22.4	36.4	20.1	30.9
Weighted population (thousands)	4,106		918		771		8,976		2,509		1,671	
Observed cases	417		119		125		1,545		414		274	

1) That is, without changes in household composition or dwelling. 2) Alien residents in the FRG are excluded from this table. 3) Based on the start of the observation period.

The data is based on waves 1 - 3 of the SOP and on waves 1 - 8 of the 1984 SIPP panel public release files.

Table 1
Socio-economic Characteristics of One-Person Households
Immobile 1) Households T1 - T3

of pure residential mobility do not drastically differ from the immobile one-person households. In the youngest age group, stable one-person households who moved are less likely to be divorced and are less well-off financially than those who remained in the same dwelling during the observation period. These differences, however, can be traced back to an age difference between the two groups. (6)

	54 years and older	34 to 53 years	16 to 33 years	Total
FRG				
Total	7.2	13.7	31.9	12.5
Male	12.9	17.9	39.0	22.9
Female	6.2	9.4	24.2	8.5
US				
Total	8.2	14.4	38.0	14.6
Male	12.3	13.5	40.0	20.7
Female	6.9	15.5	35.2	11.3

Based on waves 1-3 of the SOP and waves 1-8 of the SIPP 1984 panel public release files. (FGR: n = 661, estimated weighted population = 6.1 million; US: n = 2,604, estimated weighted population = 14.4 million)

Table 2
Mobility of Stable One-Person Households According to Age
Percentage Moved in the Course of 2 Year Observation Period

Extensive information regarding housing quality, satisfaction with housing and housing costs is an important element of the SOP data. The hypothesis that pure residential mobility of one-person households is connected principally with their housing situation may be more closely examined in the light of this data. To begin with, those who move are questioned regarding the reason for the move. Table 3 presents the reasons given by all household reference persons, regardless of household size, and compares these with the reasons given in the cases of pure residential mobility of one-person households. For the latter group the responses are further broken down according to age. Among all household reference persons the move to a new dwelling is most often (42%) related to housing concerns. A slightly greater proportion (45%) of the persons living alone attributed the move to such concerns -- in particular the desire for a dwelling of the appropriate size, more comfort, a better location or rent, or the purchase of a house or condiminium. Among all households changing addresses, 12% of the household reference persons described the move as occupation or employment related, as compared to 19% of the one-person households. Nearly one third of all moves were described as family-related. However, as one would expect, such reasons are far less common for stable one-person households (13%). Presumably these persons moved to be closer to family members in other households or the move was a lagged response to a change in household composition that took place prior to the observation period. When one considers the three age groups separately, the importance of occupational placement for residential mobility among young persons becomes apparent. Housing related reasons were named least commonly (39%) and occupational and employment related reasons most commonly (26%) among the youngest age group. (6)

(6) The mean age among the movers is 26, two years younger than those remaining at the same address (T-vaue = 7.35 with 605 df) This difference fits with the results presented below and in section 3.6 where we find

Over 75% of all stable older one-person households occupied dwellings with two or three rooms in addition to the kitchen and 20% lived in one-room apartments. Only half the youngest one-person households occupied dwellings with two or three rooms, while a third occupied one-room apartments. Among those who moved, those in the youngest age group tended to move to larger dwellings and those in the oldest to smaller dwellings. Economic considerations most likely played a role here; as those moving to smaller dwellings were primarily widows with low monthly incomes.

On the whole, persons in the oldest age group paid higher rents after moving than beforehand. Apparently for these persons a better-equipped dwelling was worth the price: the majority of those who moved judged their new rent to be appropriate. Surprisingly, however, the proportion of persons in this age group who judged their rent as "much too high" was not decreased through residential mobility. Presumably this is related to the supply of affordable smaller dwellings. Studies have shown that dissatisfaction with the rent for a dwelling is primarily a judgement of the rent in relation to available income. (Lahmann 1988) Persons who find their rent to be "much too high" are concentrated in the lowest income category and among those persons not in the labor force. Also among the youngest age group the proportion of persons who judge their rent to be excessive is relatively high (9%) owing to the low incomes available to some of these households.

Stable one-person households older than 33 and younger than 54 years of age are generally comprised of persons who have found their place on the labor market. Strict data confidentiality procedures preclude the use of the SOP data for research regarding the distances and places associated with residential mobility. However recent research using other data has shown that the rate of employment-related residential mobility is greatest between the ages of 20 and 24 and thereafter steadily decreases (Wagner 1987). Keeping in mind that the analysis here is limited to households without changes in household composition, one would expect that one-person households in this age group primarily move to improve their housing situation. More than 20% of the persons in this age group said the reason for their move was the purchase of a house or condominium. Moreover, 93% of the respondents in this group were satisfied with their housing after the move. The high level of satisfaction is also linked to an improvement in the housing quality (according to objective measures such as heating and bath facilities) as well as an increase in the average dwelling size. The average rent has increased as well, however it is generally viewed as an appropriate increase. Among the stable one-person households in this age group there is a clear difference in housing quality between those who move and those who remain in the same dwelling. Even though relatively high incomes are found among both groups those who move tend to occupy lower quality housing even after the move than those who remain in the same dwelling.

3.3 The Formation of One Person Households

The first distinction to consider by the formation of one-person households is whether or not the process is one of complex or latent mobility, that is, whether or not the person forming the household changes dwellings. Complex mobility is the more common type of formation of one-person households in both the FRG and the US. In the FRG 67% of the one-person households formed during the observation period involved complex mobility, as compared to 62% in the US (see Table 5). As with pure residential mobility among one-person households, the formation of one-person households through complex mobility most frequently involves persons in the youngest age group: in the FRG nearly 90% of the persons who formed one-person households in this manner were younger than 34, in the US 75% of these persons were in this age group. The formation of one-person households through latent rather than complex mobility is more common in the oldest age group -- in the FRG and in the US nearly half (48%) of those persons who formed one-person households in this manner were older than 54 years of age.

	Complex Mobility			Latent Mobility			Complex Mobility			Latent Mobility		
	Socio-economic Panel (SOP)						Survey of Income and Program Participation (SIPP) - 1984 Panel					
	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years
	in percent						in percent					
Age (=100%)	2.3	8.3	89.4	48.8	32.0	19.2	7.2	17.4	75.4	48.7	22.7	28.6
Minority status												
white (=100%)							6.9	17.6	75.5	49.2	21.8	29.0
non-w. (=100%)							9.0	16.8	74.2	46.2	27.5	26.3
Sex												
male	12.1	70.0	55.0	33.6	77.5	54.2	50.2	70.9	60.7	29.9	50.9	65.2
female	87.9	30.0	45.0	66.4	22.5	45.8	49.8	29.1	39.3	70.1	49.1	34.8
Marital status 2)												
married, living apart	12.1	68.5	4.9	-	24.1	20.2	25.0	40.4	12.9	13.3	19.1	17.7
single	-	-	87.4	-	24.4	75.6	8.0	11.1	75.0	6.2	16.1	61.1
divorced	23.7	28.3	7.6	1.5	50.3	4.2	15.3	44.9	11.9	12.0	52.9	19.6
widowed	64.2	3.2	-	98.5	1.2	-	51.7	3.6	0.2	68.5	11.9	1.6
Employment status 2)												
employed	34.4	100.0	69.5	16.2	63.6	95.7	37.3	83.5	73.7	29.3	76.2	86.4
not employed	65.6	-	30.5	83.8	36.4	4.3	62.7	16.5	26.3	70.7	23.8	13.6
Income 2)												
lower tercile	64.2	26.2	43.4	29.9	29.6	37.6	46.1	38.5	35.7	34.9	30.5	37.9
middle tercile	35.8	16.6	26.8	23.4	43.9	21.1	33.4	18.4	33.3	40.3	24.6	20.8
upper tercile	-	57.2	29.8	46.7	26.5	41.3	20.4	43.1	31.0	24.8	44.9	41.4
Weighted population (thousands)	35	129	1,378	370	243	145	365	888	3,840	1,528	712	897
Observed cases	6	17	133	47	25	26	76	192	799	352	165	194

1) Formation is the transition from a multi-person household to a one-person household. This transition is considered complex mobility when it occurs in conjunction with a change in address and latent mobility when the person remains at the same address. 2) Marital status after the change in household composition is used. Income and employment status are based on the start of the observation. Alien residents in the FRG are excluded from this table.

The data is based on waves 1 - 3 of the SOP and on waves 1 - 8 of the SIPP panel public release files.

Table 5
Socio-economic Characteristics of One-Person Households
Household Formation 1)

The clearest difference between the FRG and the US is the greater proportion of one-person households formed by divorce in the US. The formation of one-person households through complex mobility among the youngest age group and the formation of one-person households through latent mobility in the oldest age group contain the largest number of cases and are most suited for a comparison between the two countries. In both instances the proportion of divorced persons is greater in the US than in the FRG.

The social processes commonly leading to the formation of one-person households -- children leaving the parental household, divorce and death of a spouse -- vary in their relative importance between the FRG and the US. This may be seen by considering the type of household individuals lived in prior to the formation of a one-person household and changes in marital status that accompany the transition from a multi-person to a one-person household (see Table 6). Over 40% of the one-person households formed in the FRG between 1984 and 1986 were established by children leaving the parental household. In the US this process accounts for only a quarter of all new one-person households. Death of a spouse also plays a more important role in the formation of one-person households in the FRG than in the US -- widows and widowers made up 15% of the new one-person households in the FRG as compared to 10% in the US.

In the US, on the other hand, divorce, separation and the dissolution of households comprised of two unrelated persons were more frequently associated with the formation of one-person households than in the FRG. The departure of a distant relative of the head of household (a person other than the child or spouse of the head of household) accounts for only 5% of the newly formed one-person households in the FRG. In the US, however, 21% of the one-person households were formed by a more distant relative of the head of household. Some of these cases may involve the departure of children brought into the household by the current partner of the head of household. This would account for some of the differences between the US and the FRG in the proportion of one-person households created by children leaving the parental household. However, only 32% of these "distant relatives" were under the age of 34 as compared to 92% of children who left the parental household. Finally, a larger proportion of the one-person households in the FRG (17%) were formed by persons leaving households that contained more than one other unrelated person than in the US (7%).

The proportion of one-person households formed by each of these processes and the manner in which this varies between the FRG and the US clarifies which processes are more or less important for the formation of one-person households in each country. One should also consider the significance of the newly formed one-person households in relation to the number of one-person households existing at the start of the observation period. The final two columns of Table 6 presents the estimated number of households formed in this manner as a percentage of the total estimated number of one-person households at the start of the observation period. Taking all of these processes together, the total number of one-person households formed in the FRG during the observation period equals 30% of the number at the start of the observation period, while in the US this proportion amounts to over 40%. While the number of one-person households in each country grew considerably during this time period, the rate of growth was by no means this high and was, in fact, greater in the FRG than in the US. However, the increasing number of one-person households is not simply a function of the formation of one-person households. To understand this process one must consider the dissolution of one-person households and transitions to multi-person households as well.

3.4 The Transition to a Multi-Person Household

At this point it is important to recall the distinction made above between the transition of one-person households into multi-person households and household dissolution, when all members of the household leave the popula-

Process leading to the formation of a one-person household	One-person households formed during the observation period		Weighted number of households formed relative to weighted total of one-person households at the start of the observation period 4)	
	FRG	US	FRG	US
	in percent			
Child leaving parental household 1)	41.0	24.7	12.2	10.0
Separation or divorce	12.2	17.9	3.6	7.2
Death of spouse	14.9	9.8	4.4	3.9
Person leaving household containing two unrelated persons	10.0	19.4	3.0	7.8
Person leaving household with related family members 2)	5.1	21.5	1.5	8.7
Person leaving household with more than two unrelated persons 3)	16.8	6.8	5.0	2.7
Total	100.0	100.0	29.7	40.3
Observed cases	296	1,778		

1) Only when one-person household formed by the child. Cases where a child moves out and a remaining single parent thus becomes a one-person household are treated as "Person leaving household with related family members". 2) The person leaving is related to one or more persons who remain, but is not the child or spouse of the head of household. 3) The person leaving is related to no one in the household though they may be related to one another. 4) The total number of weighted households formed is slightly, less here than in Table 9 due to 5 % of the cases in the FRG and 1% in the US where the process leading to formation could not be precisely identified.

The data is based on waves 1 - 3 of the SOP and waves 1 - 8 of the 1984 SIPP panel public release files.

Table 6
Processes Leading to the Formation of One-Person Households in the Federal Republic of Germany (FRG) and the United States (US)

tion. The socio-economic characteristics of persons in the FRG and the US who stopped living alone and formed a household with other persons are presented in Table 7. In the case of complex mobility transitions to multi-person households predominantly involve persons in the youngest age category in both countries. In the event of latent mobility, whereby a one-person household stays at the same address but becomes a multi-person household, in both countries a greater proportion of persons in the two older age groups are involved. In the US over 30% of the individuals who stopped living alone and remained at the same address were over the age of 53.

As with the formation of one-person households, the transition to multi-person households may occur through one of several distinguishable social processes. A person living alone may marry, a period of marital separation may end, a child may return to the parental household, or a person may begin living with other unrelated persons. In Table 8 four processes leading to the transition to a multi-person household are described and for each country the proportion of changed one-person households attributable to each is presented. The individuals marital status before and after the transition, as well as the individual's relationship to the head of household and other members of the household were used to categorize the observed transition of one-person households.

In both countries approximately one-third of all instances of transition to a multi-person household took place through marriage or the end of a period of marital separation. In the US, 36 % of the transitions to multi-person households involved the individual forming a household with relatives other than his or her spouse, whereby over one-third of these involved children returning to the parental household (8). In the FRG the proportion of one-person households dissolved through the formation of a multi-person household with relatives other than one's spouse is only half as large. The principle process leading to the transition to a multi-person household in the FRG was the formation of a two person household with a person (not necessarily of the other sex) not related by blood or marriage -- 45% of all transitions to multi-person households. In more than 75% of these cases the persons described their relationship as an unmarried couple ("Lebensgemeinschaft"). Changes of this type were less often associated with the transition to a multi-person household in the US (25%). In both countries the number of persons living alone who subsequently formed a household with more than one other unrelated individual only plays a minor role.

Table 8 also describes the importance of each of these processes of transition to multi-person households relative to the number of one-person households at the start of the observation period. Viewed from this perspective, each of these types of transition is relatively more important in the US than in the FRG. Taken as a whole, the weighted estimate of the number of one-person households dissolved due to the transition from a one-person to a multi-person household is equal to 24% of the weighted estimate of one-person households in the US at the start of the observation period. This proportion is considerably smaller in the FRG, amounting to just over 10% of the total number of one-person households in 1984.

Finally, one must consider persons living alone who left the population during the observation period. Death and institutionalization are the most common causes of household dissolution and, as one would expect, household dissolution occurs most frequently in the oldest age group in both countries. For the purposes at hand, household dissolution is most important as a further component of the aggregate number of one-person households. In this re-

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(8) It may be assumed that an even greater proportion of these cases involved the return of a child to the parental household, that is, when the one-person household being observed was the parent and the new household member was the child. Unfortunately the data sets used for this analysis were not structured so as to easily identify changes of this type.

	Socio-economic Panel (SOP)						Survey of Income and Program Participation (SIPP) - 1984 Panel					
	Complex Mobility			Latent Mobility			Complex Mobility			Latent Mobility		
	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years	≥ 54 years	34-53 years	16-33 years
	in percent						in percent					
Age (=100%)	-	18.9	81.1	14.7	22.3	63.0	11.5	16.3	72.2	30.2	29.8	40.0
Minority status												
white (=100%)	-	-	-	-	-	-	11.3	16.5	72.2	30.4	27.7	41.9
non-w. (=100%)	-	-	-	-	-	-	12.8	14.9	72.3	28.7	41.1	30.2
Sex												
male	-	75.7	50.3	31.2	42.2	42.4	32.3	58.2	57.6	24.6	56.3	68.2
female	-	24.3	49.7	68.8	57.8	57.6	67.7	41.8	42.4	75.4	43.7	31.8
Marital status 2)												
married, living together	-	49.6	27.6	4.8	20.2	43.2	19.7	35.7	31.4	16.3	39.7	47.6
married, living apart	-	-	1.4	-	4.2	-	4.7	5.8	3.6	5.3	10.6	0.5
single	-	9.6	69.0	10.9	19.1	52.7	3.6	9.3	56.9	5.0	8.5	43.7
divorced	-	20.7	2.0	-	41.3	4.1	10.5	43.6	8.3	14.6	36.9	8.2
widowed		20.1	-	84.2	15.1	-	61.5	5.8	-	58.8	4.4	-
Employment status 2)												
employed	-	100.0	96.3	5.9	100.0	73.8	25.2	85.5	80.8	37.5	84.5	89.2
not employed	-	-	3.7	49.1	-	26.2	74.8	14.5	19.2	62.5	15.5	10.8
Income 2)												
lower tercile	-	-	28.2	10.9	16.5	33.9	46.0	33.3	34.2	34.8	29.4	18.3
middle tercile	-	30.0	21.3	53.2	4.2	26.2	40.0	21.9	30.3	44.1	21.9	33.9
upper tercile	-	70.0	50.5	35.9	79.3	39.9	14.0	44.8	35.5	21.1	48.7	47.8
Weighted population (thousands)	-	64	277	62	94	267	355	504	2,238	548	542	733
Observed cases	-	12	41	9	15	39	63	100	407	111	100	138

1) This transition is considered complex mobility when it occurs in conjunction with a change in address and latent mobility when the person remains at the same address. 2) Marital status after the change in household composition is used. Income and employment status are based on the start of the observation. Alien residents in the FRG are excluded from this table.

The data is based on waves 1 - 3 of the SOP and on waves 1 - 8 of the SIPP panel public release files.

Table 7
Socio-economic Characteristics of One-Person Households
Transition to a Multi-Person Household 1)

Process leading to the transition to a multi-person household	One-person households changed during the observation period		Weighted number of households changed 2) relative to weighted total of one-person households at the start of the observation period	
	FRG	US	FRG	US
	in percent			
Marriage or end of marital separation	32.4	32.5	3.5	7.9
Formation of household with other family members 3)	17.7	35.8	1.9	8.6
Formation of household with one unrelated person	45.5	25.4	4.9	6.1
Formation of household with more than one unrelated person	4.4	6.3	0.0	1.5
Total	100.0	100.0	10.3	24.1
Observed cases	142	919		

1) Includes only cases of dissolution of one-person households, when the individual forms a household with other persons and not the dissolution of the entire household, i.e., where a person living alone leaves the population through emigration, institutionalization or death. 2) The total number of weighted households dissolved is far lower here than in Table 9, which includes cases of household dissolution. 3) None of whom is the spouse of the person previously living alone.

The data is based on waves 1 - 3 of the SOP and waves 1 - 8 of the 1984 SIPP panel public release files.

Table 8
Processes Leading to the Transition to a Multi-Person Household in the Federal Republic of Germany (FRG) and the United States (US)

gard household dissolution is of relatively equal importance in the two countries: the weighted estimate of the number of one-person households leaving the population in the FRG amounts to 6%, and in the US 5%, of the weighted estimate of the total number of one-person households at the start of the observation period.

3.5 The Individual Components of Aggregate Change in the Number of One-Person Households

Using the results presented above it is possible to describe the manner in which the growth in the number of one-person households has taken place in the United States and the Federal Republic of Germany (see Table 9). The increasing number of one-person households can be decomposed into various components: an existing stock of one-person households, minus those one-person households dissolved through death, emigration, institutionalization or transition to a multi-person household, plus newly formed one-person households.

	FRG	US
One-Person Households T1	7,891	20,344
New One-Person Households Between T1 and T3	+ 2,464	+ 8,230
Dissolution of One-Person Households Between T1 and T3*	- 1,361	- 6,007
One Person Households T3	8,994	22,567
Percentage newly formed T1 - T3 relative to T1	+31.2	+40.5
Percentage dissolved T1 - T3 relative to T1	-17.2	-29.5
Growth in number of One-person Households T3 relative to T1	+13.9	+10.9

* includes persons leaving the population and transitions to multi-person households.

Table 9
Changes in the Population of One-Person Households in the Federal Republic of Germany and the United States

In the FRG the original stock of 7.9 million one-person households in 1984 grew to 8.9 million in 1986. This is the end result of processes of household formation, dissolution and transformation involving a far greater number of households. Nearly 2.5 million new one-person households were formed during this time, while an additional 1.4 million were dissolved: the persons living in these households either began living with other persons or left the population. The 14% growth in the number of one-person households during this time period in the Federal Republic of Germany did not simply result from the formation of thirteen new one-person households for each hundred already existing. Instead for each hundred existing one-person households thirty new one-person households were formed, while seventeen, some of which were just formed within this time period, were dissolved.

In the US the growth in the number of one-person households between 1983 and 1985 was somewhat slower (11%), but the circulation of individuals within the population of one-person households was relatively higher. The number of new one-person households formed during this period (8.2 million) amounts to over 40% of the total number of one-person households at the start of the time period. However the larger number of newly formed one-person households in the US did not produce a greater growth in the number of one-person households than in the FRG, as the number of one-person households dissolved during this time period was also relatively higher in the US. The proportion of one-person households leaving the population was roughly the same in both countries relative to the number of one-person households at the start of the observation period, 5% in the US and 6% in the FRG. However, the number of one-person households that became multi-person households relative to the number of one-person households at the outset is much greater, 24% in the US and 10% in the FRG.

3.6 Modelling Residential Mobility of One-Person Households in the FRG

A wide variety of techniques have been used to develop models of residential mobility (see Rima and van Wissen 1987, for an overview of models developed in a number of countries). A crucial element of all such models are estimates of the transition rates between states -- such as married/not married, same dwelling/new dwelling or living with parents/not living with parents. Even the most sophisticated model is limited by the accuracy with which these transition rates are estimated. The previous descriptive analysis of one-person households in the US and the FRG imply two general considerations that are necessary for an adequate estimate of these transition rates for one-person households. First, the model must address changes in household composition, for these are often associated with a change in dwellings. Secondly, one person households constitute a heterogeneous population; a model of residential mobility must explicitly accomodate this variety. One person households vary, most obviously with the age of the person living alone, as to the frequency of changes in household composition and dwelling. One-person households also differ as to the circumstances under which a person began living alone and the likelihood that the person will later begin living with other persons. Finally, they vary in the fit between the current dwelling and the individual along with his or her prospects for continuing to live alone.

The statistical techniques often referred to in the social sciences as event-history analysis seem especially appropriate for the analysis of residential mobility because these models explicitly address the duration spent in a particular state, such as the occupancy of a particular dwelling, and the influence of variables associated with leaving a state. An application of this class of models to the question of residential mobility in the FRG can be found in Wagner (1987). This study illustrates not only the strength of these methods but also the problems associated with this approach for the residential mobility of one-person households. Wagner's study is based on retrospective life history data, including migration and marital histories. As such it concentrates on changes in family status and dwellings as reported by a representative sample of selected birth cohorts -- persons all born before 1952. However when one considers that the most mobile one-person households belong to the group of persons aged 33 to 16 in 1984, i.e., born in 1951 or later, it becomes apparent that a particularly salient part of the current population of one-person households is excluded from this data.

The SOP and SIPP data include event history data, such as marital and fertility histories, for all respondents; but this data, too, is inadequate. The crucial problem is that the formation of one-person households and the transition to multi-person households often fail to coincide with the catalogue of events included in these event histories. Marriage accounts, for example, for only about one-third of the transitions to multi-person households in the FRG and the US. Periods of living with an unrelated person play a crucial role in the formation and dissolution of one-person households in both coun-

tries, yet such changes in household composition constitute non-events in the retrospective components of these data sets. Retrospective data of this sort is a rich supplement to a traditional panel design, nonetheless it does not provide the information necessary for the study of spells of living alone prior to the start of the observation period. Even if one confines the analysis to one-person households existing at the start of the panel, the problem of left-censoring (the inability to accurately date the formation of one-person households already existing at T1) poses a serious problem for the application of event history techniques.(9)

Analyses of this sort for the FRG will first be possible when a sufficient number of spells of living alone have begun during the course of the SOP. Owing to its larger sample size, analyses of this sort may be possible with the SIPP data, though the panel's design allows only for the analysis of very short periods of living alone. On the other hand, for the analysis of one-person households in the US, the Panel Study of Income Dynamics (PSID) represents a valuable supplement to SIPP, as this panel can provide data on very long spells of living alone. An example of the use of proportional and non-proportional hazard rate models to evaluate the importance of mortgage rates on household mobility using data from the PSID is found in Quigley (1987).

For these reasons another approach was needed to explore our hypothesis that the determinants of residential mobility of one-person households vary according to the type of one-person household under consideration. For this analysis we restricted our sample to persons living alone at the start of the panel and defined the outcome of interest as a dichotomy: moved in the next two years/remained at the same address. Rima and van Wissen (1987) use a logit regression model as one component of their "dynamic household relocation model" for the city of Amsterdam. They derive coefficients for measures of change in household composition and characteristics of the dwelling as predictors of a households "willingness-to-move". They use a different outcome variable (willingness to move/unwilling to move) than ours (moved/remained at the same address), because only cross-sectional data was available. However, those households that had moved in the year prior to the interview were coded as willing to move (regardless of their stated preference at the time of the interview), "... because then the effect of household changes in the past year on the willingness-to-move is measured more precisely". As independent variables they use: age of the head of household, household size at time t, change of household size between time t and time t+1, dwelling size (number of rooms), tenure status of the dwelling (owner/renter) and dwelling type (apartment/single family unit). They describe their results as fitting the data well and capturing most of the variance in the dependent variable. All of their coefficients were "significantly different from zero" and have the expected sign, except for their indicator of changes in household structure (an increase in household size). Due to the similarity in the dependent variables and the inclusion of household size among the independent variables, this model appears as a reasonable base model for considering residential mobility among one-person households using the SOP data (10).

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(9) Even under the most heroic of assumptions the retrospective data available in the SOP data provides insufficient information to adequately date the formation of a sizeable portion (13%) of the one-person households existing at the start of the panel.

(10) We have eliminated two of the variables used by Rima and van Wissen from our model because in the case of one-person households they are so closely correlated with other independent variables: owners are almost exclusively found in the oldest age group, while all single family units fall into the largest category of dwellings occupied by one-person households. Adding these variables does nothing to enhance the model and simply multiplies the number of cells containing few observations.

(11) The number of rooms occupied at the start of the observation period is the only variable common to all models and in each case this variable is

	(1)	(2)	(3)	(4)
Constant	-.758	-.928	-.629	-.704
	(.082)	(.072)	(.068)	(.078)
Change from one-person household to multi-person household	.307	-	.245	.493
	(.072)	-	(.068)	(.066)
Number of rooms in dwelling				
1-2	.306	.231	-	.394
	(.082)	(.077)	-	(.079)
3	-.039	-.081	-	-.084
	(.096)	(.093)	-	(.093)
Age				
older than 53	-.362	-.441	-.412	-
	(.072)	(.068)	(.070)	-
34 - 53	-.074	-.073	-.071	-
	(.080)	(.079)	(.079)	-
Likelihood ratio chi-square	5.319	23.297	20.929	54.574
df	12	13	14	14
Difference relative to model 1	-	17.978*	15.610*	49.255*
Chi-square				
df	-	1	2	2

Based on Waves 1 - 3 of the SOP. N = 997. * indicates a difference from model 1 significant at the .001 level. (standard errors)

Table 10
Logit Models with Dependent Variable: Moved/Remained at Same Address One-Person Households of All Ages in the FRG

Results for a model including the main effects for three independent variables are presented in column 1 of Table 10. The relatively large size and negative sign of the coefficient for the constant reflects the general lack of residential mobility found among one-person households. The positive coefficients for a change in household composition and a small number of rooms in a dwelling indicate that these factors are associated with a change of address, while the negative coefficients attached to persons in large dwellings and in the two oldest age categories indicate a greater likelihood that these persons will remain at the same address. The overall fit of the model is very good. In fact the fit is so good that at the .05 level of significance one can not reject the hypothesis that the expected logits produced by the model are different than those associated with a fully saturated model, a model including all possible interactions between the independent variables.

coded somewhat differently: for the oldest age group we distinguish between 1 room, 2 room, 3 room and 4 room or larger (omitted category) dwellings; for the middle age group between 1 room and 2 room or larger (omitted category) dwellings; and for the youngest age group between 2 room or smaller and 3 room or larger (omitted category) dwellings.

The normal strategy pursued in the case of a logit model that fits so well is to consider if any of the parameters in the model can be eliminated without a significant decrease in the overall fit of the model. The difference between two models can be tested by subtracting the L^2 values for the two models. The resulting sum is distributed approximately as a chi-square value with df equal to the difference in df's between the two models (Knoke and Burke, 1980). Columns 2 through 4 in Table 10 present the results obtained when each of the independent variables is eliminated from the model. In no case is the resulting increase in the number of degrees of freedom sufficient compensation for the increase in the L^2 ratio to justify excluding a parameter from the original model.

Based on our descriptive analysis of one-person households and the variety of types of persons living alone, it appears somewhat implausible that such a model, despite its good statistical properties, is an adequate representation of the process of residential mobility for one-person households. It seems quite likely that this model fits well for the entire population of one-person households but is inadequate for particular subgroups of this population. To consider this possibility the age group categories used above present a rough but simple categorization of one-person households. Considerable heterogeneity remains within each age group. A more precise analysis would call for theoretically more interesting categories and a more sophisticated and efficient organization of the data regarding the timing of changes. The intent here is not to produce a single, "best" model for each of these age groups. Rather, we hope to demonstrate that by treating subpopulations separately the underlying social processes may be more realistically portrayed.

The results presented in Table 11 use different combinations of variables for each age group to estimate the logits for residential mobility.(11) These models do not fit the observed data as well as the previous model. On the other hand, the overall fit of these models (the probability that deviations as large as those observed would occur if the model were the true model) is within the range normally regarded as a good fit. Moreover taking away any of the variables in the models leads to a significantly worse fit, while the fit may be improved only by adding interaction terms that do not lend themselves to meaningful interpretation.

As presented in Table 11, however, the models suggest a number of interpretable results concerning the patterns of residential mobility among one-person households in each age group. To begin with, the decreasing absolute value of the constant term as one goes from the oldest to the youngest age group represents the successively increasing proportion of mobile persons. The transition from a one-person households to a multi-person household, though common in the population at hand, is relatively rare in the oldest age group and among members of our sample was never associated with residential mobility. Thus there is nothing to be gained by including this type of change in household composition in the model for the oldest age group. In the two younger age groups, on the other hand, the transition to a multi-person household is clearly positively related to residential mobility. To consider the possibility that mobility among the older group of persons could represent the lagged response to a change in household composition prior to the start of the observation period, a dummy variable was constructed indicating persons known to have been widowed or divorced in the previous three years. However, there was no clear cut relationship between this variable and residential mobility and it was not included in the model.

The coefficients for the number of rooms in the dwelling at T1 are a good example of the contrast between the age groups. In the two youngest age groups a small dwelling is positively associated with residential mobility. As discussed above, in the younger age groups residential mobility is in the direction of larger dwellings and in the oldest age group toward smaller dwellings. Accordingly, in the oldest age group we find a negative coefficient for persons in the smallest dwellings (these persons have already attained the desired dwelling size) and a positive coefficient for persons in the next largest size dwelling. This is the group of persons moving into

smaller quarters. The coefficient for three-room dwellings is negative, as is the coefficient for the variable indicating older one person households living in one or two family houses as opposed to multi-unit buildings. Presumably persons in the largest of dwellings are relatively immobile because they have the financial resources to continue to occupy such a dwelling. The inclusion of monthly household income in the model failed to capture this relationship, but this is a poor measure of financial resources for persons in this age group. A variable for whether the dwelling was owned or rented also failed to improve the model, primarily because in this age group nearly all property owners are owners of large dwellings and thus this variable is redundant. Substituting property ownership for either or both indicators of dwelling size only decreases the overall fit of the model.

	(1)	(2)	(3)
Age in Years	**≥ 54**	**53 - 34**	**33 - 16**
Constant	-1.516	-.642	-.206
	(.132)	(.149)	(.100)
Change from one-person household to multi-person household	-	.435	.293
	-	(.142)	(.087)
Number of rooms in dwelling			
1	-.149	.207	-
	(.254)	(.129)	-
2	.437	-	.207
	(.142)	-	(.102)
3	-.067	-	-
	(.170)	-	-
1 or 2 family house	-.133	-.010	-
	(.102)	(.132)	-
In school or vocational training at T1	-	-	.077
	-	-	(.098)
In school or vocational training <u>and</u> in dwelling with ≤ 2 rooms at T1	-	-	.179
	-	-	(.099)
Likelihood ratio chi-square	1.788	2.483	1.394
df	3	4	3
Probability	.618	.648	.707

Based on waves 1-3 of the SOP. n = 997 (standard errors)

Table 11
Logit Models with Dependent Variable: Moved/Remained at Same Address
Separate Model for Each Age Group

For persons in the youngest age group we added a variable to consider our hypothesis that mobility among the youngest one-person households is concentrated among those persons who have not yet settled into occupational life. As expected we found a positive relationship between residential mobility and a dummy variable indicating that a person was still in school or occupational training at the start of the observation period. Moreover the overall fit for our model for persons in the youngest age group only became tolerable when we added an interaction term representing persons still in school or occupa-

tional training at T1 and living in 2 room or smaller dwellings. Here one can conclude that the relationship with residential mobility decreases when a person has already acquired a more desirable dwelling (in this age group more desirable means larger and not smaller as is the case with older persons) before completing his or her education.

4 Conclusions

The findings presented above demonstrate how the growth in the number of one-person households can be interpreted by examining the social processes that are the constituent elements of this growth. In this context the comparison between the FRG and the US is particularly instructive. In the time period considered relatively more new one-person households were formed in the US than in the FRG. However the increase in the number of one-person households was relatively greater in the FRG than in the US, because relatively more one-person households were being dissolved in the US. Previous research using panel data has emphasized an important point in conjunction with the study of unemployment and poverty: the proportion of persons in a given state depends both on the rate at which people enter and leave the state. This principle also applies to types of households and stages of family life.

Typically one thinks of a young one-person household as a temporary living arrangement between the parental household and the formation of a household with a partner or spouse. However, our finding show that a great number of one-person households are formed, particulary in the United States, through the dissolution of a marriage or partnership. Sociologists of the family have described changing patterns of living-together, marriage, divorce and remarriage as "serial monogamy". The research presented above indicates that one-person households often serve as a stepping stone in the transition from one partnership to the next. On the other hand, the transition from a one-person household to a multi-person household often does not lead to the formation of a partnership but to a reintegration in the parental household. Our results indicate that this trend, noted by others in the US (Heer, Hodge and Felson 1985), is of far less importance in the FRG. The majority of transitions to multi-person households in the FRG lead to the formation of a household with a partner -- more often without than with a marriage certificate.

The description of residential mobility among one-person households illustrates an important aspect of the process of residential mobility in general. In the course of their lives persons in the US change dwellings on the average far more frequently than those in the FRG, where the average person thirty years of age or younger has moved three times and those between thirty and sixty-five only four times. Greater residential mobility and more frequent changes in household composition and family status are not independent of one another, for these events in fact often accompany one another. The low rate of residential mobility among young one-person households without changes in household composition in the US provides strong support for this argument. In the absence of changes in household composition housing concerns and, for the youngest of persons, occupational placement are the most important determinants of residential mobility.

As the final section of the paper emphasizes, different types of one-person households exhibit different patterns of residential mobility. While we found no relationship between the transition to a multi-person household and residential mobility in the oldest age group, in the two younger age groups a change in household composition was positively associated with a change in address. Attention to the different responses to changes in household composition exhibited by different types of households is necessary to improve the accuracy of models of residential mobility. To the extent that housing and labor market policies are aimed at the allocation of persons to specific areas the housing needs of young one-person households, the most mobile type of household, are worthy of special attention. Obviously this implies a sufficient number of adequate and affordable dwellings in the appropriate locations. Less obviously, however, attention must also be paid

to the future housing needs of such persons; for many of these persons living alone is only a temporary situation, followed by marriage or the formation of a household with an unrelated person. Nothing is gained if persons are succesfully attracted to an area, but they are then forced to move elsewhere because they are unable to find appropriate housing for a multi-person household.

The findings presented above, in part, rest on a relatively small number of observations. However they provide the foundation for more exact models of changes of household composition involving one-person households and the related processes of residential mobility. Fortunately the SIPP and SOP panel projects are such that these preliminary results may be built upon and research in this direction may be continued. The topical modules in the 1984 SIPP panel concerning migration and marital history promise a wealth of additional data. The ongoing nature of the SOP panel -- data from the fourth wave will soon be available and the fifth wave is currently being collected -- will alleviate some of the sample size problems associated with the study of changes in household composition in the FRG. Over the course of the panel, cases of the formation of one-person households and the transition from one-person households to multi-person households accumulate. Assuming that the processes involved have themselves not changed, observations from different points in time may be combined allowing for more detailed analysis. Finally, we hope our work will encourage others to undertake comparative panel research. Individual-oriented longitudinal data, such as that offered by SIPP and SOP, and the software and hardware necessary to work with such data, have only recently become available. By drawing attention to the similarities and differences between processes in more than one society, a comparative approach can be a great aid in making sense of the wealth of information offered by data of this type.

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Methodische Konzepte für die Hochrechnung von Panel-Daten

von

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1 Einleitung

In diesem Aufsatz wird ein methodisches Konzept für die Hochrechnung von Panel-Daten vorgestellt. Dieses Konzept beruht darauf, die Hochrechnungsfaktoren durch den Kehrwert der Auswahlwahrscheinlichkeit einer Stichprobeneinheit zu bestimmen.

Für einfache Querschnittsdaten ist diese Methode schon von Horvitz und Thomson 1952 vorgestellt worde. Panel-Daten unterscheiden sich von gewöhnlichen Querschnittsbefragungen dadurch, daß die einzelnen Stichprobeneinheiten nach der ersten Befragung in festen zeitlichen Abständen wieder aufgesucht werden und im Fall einer erfolgreichen Kontaktaufnahme erneut befragt werden.

Der Auswahlprozeß stellt bei Panel-Studien damit eine Erweiterung des bei gewöhnlichen Querschnittsbefragungen erforderlichen zweistufigen Auswahlprozesses dar. Diese zwei ersten Stufen sind gekennzeichnet durch:

1) die Auswahl im Rahmen des Stichprobendesigns und

2) die Antwortgewährung im Falle der Auswahl.

Um nun beispielsweise in die zweite Welle eines Panels zu gelangen, müssen noch zwei weitere Auswahlstufen passiert werden, nämlich:

3) die Kontaktaufnahme mit den antwortenden Stichprobeneinheiten aus der ersten Welle und

4) die Antwortgewährung in der zweiten Welle bei den erreichten Stichprobeneinheiten aus der ersten Welle.

Unter diesem Ansatz ist zur Hochrechnung von Panel-Daten lediglich die Bestimmung der Auswahlwahrscheinlichkeiten des Stichprobendesigns und die Analyse des Ausfallverhaltens zwischen den Panelwellen erforderlich.

Diese Ausfallanalyse ist für die erste Welle schwerer zu realisieren als für die folgenden Befragungswellen, da in der ersten Welle über die

ausgefallenen Stichprobeneinheiten nur sehr wenige Informationen vorliegen. Nach der ersten Panelwelle stehen dann bei ausfallenden Befragungseinheiten alle bisher erhobenen Merkmale zur Modellierung der Antwortwahrscheinlichkeiten zur Verfügung. Daher müssen zumindest für die erste Welle Techniken herangezogen werden, die externe Informationen bei der Schätzung der Antwortwahrscheinlichkeiten berücksichtigen.

Der in dieser Arbeit benutzte Ansatz, externe Informationen zu berücksichtigen, korrigiert die bisher geschätzten Antwortwahrscheinlichkeiten in der Weise, daß für ausgewählte, bestimmte Merkmalsausprägungen die Hochrechnungsergebnisse, die ja über die Auswahlwahrscheinlichkeiten bestimmt sind, mit der Anzahl der Merkmalsausprägungen in der Grundgesamtheit übereinstimmen (vgl. Merz 1983). Dieses "Redressment" der Auswahlwahrscheinlichkeiten liefert daher nicht nur eine Anpassung der Hochrechnungsergebnisse der ersten Welle an einen Gewichtungsrahmen, es liefert auch genauere Schätzungen der Antwortwahrscheinlichkeiten in der ersten Welle und beeinflußt über diese auch die Hochrechnungsergebnisse in weiteren Panelwellen.

Zusätzlich kann die Technik, die Schätzung von Antwortwahrscheinlichkeiten durch die Berücksichtigung von externer Information zu korrigieren, für jede weitere Panelwelle angewandt werden.

Diese Vorgehensweise ist verschieden von einer ungekoppelten Hochrechnung einzelner Panelwellen, bei der jede Panelwelle wie ein von den anderen Panelwellen unabhängiger Querschnitt hochgerechnet wird. Die ungekoppelte Hochrechnung von einzelnen Panelwellen liefert außerdem keine Hinweise, wie Längsschnitte über mehrere Panelwellen hochgerechnet werden können. Ein Ausweg wird in diesen Fällen über ad-hoc-Strategien gesucht (vgl. Judkins et al. 1985). Z.B. wird der Hochrechnungsfaktor für Längsschnitte als Mittelwert aller (Querschnitts-)Hochrechnungsfaktoren bestimmt.

Abgesehen davon, daß die theoretischen Eigenschaften (- z.B. die Erwartungstreue der Hochrechnungsergebnisse -) von solchen Verfahren kaum zu ermitteln sind, können bei dem über die Auswahlwahrscheinlichkeiten gekoppelten Verfahren relativ leicht die exakten Relationen zwischen den Hochrechnungsfaktoren für Längs- und Querschnitte hergeleitet werden. Diese Relationen sehen allerdings anders aus als die über die ad-hoc-Strategien postulierter Beziehungen. Beispielsweise hängt die Übereinstimmung der Faktoren für Längs- und Querschnitte wesentlich davon ab, ob zu einem Haushalt im Laufe des Längsschnitts noch weitere Personen hinzugezogen sind oder nicht.

Insgesamt eröffnet der hier benutzte Ansatz die Möglichkeit, mit nur wenigen Bausteinen - dies sind die Wahrscheinlichkeiten, auf den einzelnen Auswahlstufen des Panels in der Stichprobe zu verbleiben alle möglichen

Hochrechnungsfaktoren zu ermitteln. Die Hochrechnungsfaktoren können dabei rekursiv von der ersten Welle aufbauend bestimmt werden.

Das hier vorgestellte Konzept wurde auf die ersten beiden Befragungswellen des Sozio-ökonomischen Panels angewandt. Das Sozio-ökonomische Panel wurde 1984 als repräsentative Befragung von Personen und Haushalten in der Bundesrepublik Deutschland gestartet, im jährlichen Rhythmus werden in ca. 6000 Haushalten alle Personen, die älter als 16 Jahre sind, befragt. Eine ausführliche Beschreibung der Befragungsschwerpunkte, des Erhebungsdesigns und des Weiterverfolgungskonzeptes findet man bei Hanefeld (1984). Die Umsetzung dieses Hochrechnungskonzeptes und die Ergebnisse der Ausfallanalyse zwischen der ersten und zweiten Welle findet man bei Rendtel (1988).

Im zweiten Abschnitt dieses Aufsatzes werden die verschiedenen Grundgesamtheiten vorgestellt und abgegrenzt, auf die Paneldaten hochgerechnet werden können. Die grundlegenden Annahmen des Hochrechnungskonzeptes werden in den Abschnitten drei und vier diskutiert.

Der fünfte Absatz stellt die Methode der Anpassung an externe Informationen dar, die für die Schätzung der Antwortwahrscheinlichkeiten in der ersten Welle benötigt wird.

Im sechsten und siebten Abschnitt wird die Modellierung der Ausfallprozesse zwischen zwei Panelwellen behandelt. Diskutiert wird insbesondere, welche Variablen hierfür berücksichtigt werden sollten. Ferner werden Methoden zur Variablenreduktion und zur Aggregation von Kontigenztabellen vorgestellt, die die Schätzungen der Antwortwahrscheinlichkeiten stabilisieren.

Abschnitt acht und neun stellen dar, wie im Rahmen des auf Auswahlwahrscheinlichkeiten basierenden Ansatzes die Hochrechnungsfaktoren für Querschnittsauswertungen der zweiten Welle eines Panels berechnet und an externe Informationen angepaßt werden können.

Schließlich wird im zehnten Abschnitt gezeigt, wie die Hochrechnungsfaktoren von einer Panelwelle auf die folgende rekursiv fortgeschrieben werden können.

2 Zum Begriff der Grundgesamtheit bei Panel-Befragungen

Allgemein läßt sich das Ziel einer Hochrechnung darin beschreiben, auf Basis der Stichprobenerhebung auf das Vorkommen interessierender Merkmalskombinationen in der Grundgesamtheit zu schließen. Im Sinne der Schätztheorie ist also der unbekannte Populationsparameter

$$Y = \sum_{i=1}^{N} Y_i$$

zu schätzen, wobei die Indikatorvariable Y_i anzeigt, ob die i-te Stichprobeneinheit die interessierende Merkmalskombination besitzt (Y_i=1) oder nicht (Y_i=0) (vgl. Cochran 1977, S. 21).

Bei Paneluntersuchungen ist die Grundgesamtheit G_t meist für jede einzelne Panelwelle t=1,...,T festgelegt. Besteht die Grundgesamtheit beispielsweise aus der Bevölkerung in Privathaushalten innerhalb des Erhebungsgebietes, so variiert G_t im Laufe der Zeit. Die Differenz besteht aus:

- den Geburten und den verstorbenen Personen,
- den Zuzügen aus dem Ausland und den Wegzügen ins Ausland und
- Wechselnden vom Anstalts- in den Privatbereich und umgekehrt.

Die Querschnitts-Population G_t eines Panels besteht also zu unterschiedlichen Zeitpunkten aus nicht immer denselben Erhebungseinheiten.

Ganz anders sieht die Situation bei Längsschnitten aus. Längsschnitte erhält man von allen Personen, die von der ersten Befragungswelle an ununterbrochen am Panel teilgenommen heben. Diese Stichprobenergebnisse können dann hochgerechnet werden auf die Längsschnitt-Grundgesamtheit G (1, T), die aus denjenigen Personen besteht, die zum Zeitpunkt der ersten Panelwelle der (Querschnitts-)Grundgesamtheit G_1 angehörten und die im Zeitraum der Weiterverfolgung weder das Erhebungsgebiet verlassen haben noch verstorben sind.

Da der Längsschnittpopulation immer dieselben Personen angehören, altert diese Population von Erhebungswelle zu Erhebungswelle. Für einige Variablen kann dieser Alterungseffekt erheblich sein. Beim Sozio-ökonomischen Panel reduziert sich beispielsweise innerhalb der Längsschnitt-Grundgesamtheit G (1, 2) die Anzahl derjenigen Personen, die an einer betrieblichen Ausbildung teilnehmen, von 1,89 Mill. Personen (1984) auf 1,15 Mill. Personen (1985). Diese Abnahme jedoch spiegelt lediglich die Tatsache wider, daß bei durchschnittlich dreijähriger Lehrzeit nach einem Jahr ca. ein Drittel der Lehrlinge die Lehre beendet hat und neue Lehrlinge altersbedingt in der Regel nicht der Längsschnittpopulation G (1, 2) angehören, da die meisten neuen Lehrlinge 1984 noch nicht im Befragungsalter waren.

Die Querschnitts- und Längsschnitts-Grundgesamtheiten stellen lediglich Extremfälle einer Vielzahl von möglichen Grundgesamtheiten dar (vgl. Judkins et al. 1985). Diese Grundgesamtheit wird immer durch das Auswer-

tungsinteresse bestimmt. Allgemein führen Längsschnitte zwischen den Panelwellen T_a und T_e ($1 \leq T_a \leq T_e \leq T$) zu Grundgesamtheiten $G(T_a, T_e)$:

$G(T_a, T_e)$ = Menge aller Personen, die bei Panelwelle T_a in G_{T_a} wohnen und bis Welle T_e weder das Erhebungsgebiet verlassen haben, noch verstorben sind.

3 Das Hochrechnungsverfahren nach der Methode der inversen Auswahlwahrscheinlichkeiten

Die Verwendung der Auswahlwahrscheinlichkeiten für die Hochrechnung des Sozio-ökonomischen Panels wurde von Galler (1986) vorgeschlagen. Dieser Ansatz wurde auch für die Gewichtung des Survey of Income and Program Participation (SIPP) benutzt (vgl. Judkins et al. 1985, Huang 1985).

Der Hochrechnung über die Auswahlwahrscheinlichkeiten liegt der Randomisierungsansatz (vgl. Rubin 1983) zugrunde, bei dem die Merkmalsausprägungen Y_i ($i=1,...,N$) der einzelnen Einheiten der Population als feste Größen betrachtet werden, und lediglich die Auswahl der Stichprobenelemente als zufälliges Ereignis angesehen wird. Der Vorteil dieser Vorgehensweise liegt darin, daß keine Modellannahmen für das Auftreten der Y_i ($i=1,...,N$) gemacht werden müssen. Allerdings gelten die Vorteile des Randomisierungsansatzes streng nur bei Datensätzen ohne fehlende Werte. Das Nonresponse-Problem nötigt auch den Randomisierungsansatz zu Modellannahmen[1)] (vgl. Abschnitte 4, 5 und 6).

Modell-basierte Hochrechnungsansätze findet man bei Särndal (1978) und Royall (1970). Gemischte Ansätze, die sowohl die unterschiedlichen Auswahlwahrscheinlichkeiten der Stichprobenelemente als auch die Modellannahmen für die Y_i berücksichtigen, werden bei Cassel/Särndal/Wretman (1976) und Särndal (1980) diskutiert. Little (1982, 1983) behandelt modellbasierte Hochrechnungen unter verschiedenen Annahmen für die Stichprobenausfälle durch Nonresponse.

Für die Erstellung von Hochrechnungsfaktoren, die universell eingesetzt werden sollen, erscheinen jedoch die modell-basierten Ansätze zu spezifisch. Allerdings können modell-basierte Hochrechnungsfaktoren bei Einzelanalysen zu genaueren Schätzungen führen.

Die Hochrechnung über die inversen Auswahlwahrscheinlichkeiten (vgl. Horvitz/Thompson 1952) basiert auf der Zufallsgröße C_i, die angibt, ob die Einheit i der Stichprobe angehört ($C_i=1$) oder nicht ($C_i=0$).

Beschränkt man sich auf lineare Schätzer der Form

$$Y = \sum_{i=1}^{N} \alpha_i C_i Y_i \quad ,$$

so liefert die Forderung nach Erwartungstreue von Y:

$$E(Y) = \sum_{i=1}^{N} \alpha_i E(C_i) Y_i \quad .$$

Hieraus folgt:

$$\alpha_i = \frac{1}{E(C_i)} = \frac{1}{P(C_i=1)} \quad , \; i = 1,\ldots,N$$

Man erhält damit:

$$\hat{Y} = \sum_{i=1}^{N} \frac{1}{P(C_i=1)} C_i Y_i = \sum_{i=1}^{n} \frac{1}{P(C_i=1)} Y_i$$

Ist die Auswahlwahrscheinlichkeit für alle Stichprobenmitglieder gleich dem Auswahlsatz n/N, so liefert $\hat{Y}$ als Spezialfall die freie Hochrechnung, d.h. die Multiplikation der Besetzungszahlen von Kontingenztabellen mit dem inversen Auswahlsatz N/n.

Die aus diesem Ansatz resultierende Aufgabe besteht nun darin, für alle Stichprobenelemente ihre Auswahlwahrscheinlichkeit zu bestimmen. Für Panel-Daten soll dies über eine Erweiterung des Poststratifizierungsansatzes geschehen.

4 Die Erweiterung des Poststratifizierungsansatzes auf Panel-Daten

Bei Oh/Scheuren (1983) wird die Stichprobenermittlung als zweistufiger Prozeß gesehen:

1. Stufe: Auswahl eines Stichprobenelementes gemäß der Stichprobenanlage. Diese Design-Auswahl wird über die Indikatorvariable D_i (i=1,...,N) angezeigt.

2. Stufe: Auskunftsgewährung durch das Stichprobenelement, das über die Indikatorvariable R_i (i=1,...,N) angezeigt wird.

Für C_i gilt daher $C_i = D_i R_i$ und man erhält:

$$P(C_i=1) = P(D_i=1, R_i=1) = P(D_i=1)\ P(R_i=1/D_i)$$

Weiter wird angenommen, daß sich die Grundgesamtheit in H Subpopulationen (Schichten) aufteilen läßt, innerhalb derer die Antwortgewährung als unabhängige Wiederholung eines Bernoulli-Experiments mit der Erfolgswahrscheinlichkeit Φ_h (h=1,...,H) beschrieben werden kann. Die Schichtzugehörigkeit ist dabei sowohl für die Antwortenden als auch für die Antwortverweigerer bekannt. Die Schätzung für die Wahrscheinlichkeit der Antwortgewährung innerhalb der Schicht h (h=1,...,H) erfolgt dann durch:

$$P(R_i=1/D_i) = \Phi_h$$

$$= \frac{m_h}{n_h} = \frac{\text{Anzahl der Respondenten in Schicht h}}{\text{Anzahl der Befragten in Schicht h}}$$

Zusammen mit den aus der Anlage der Stichprobe meist bekannten Wahrscheinlichkeiten $P(D_i=1)$ erhält man für den Hochrechnungsfaktor HRF_i innerhalb der h-ten Schicht:

$$HRF_i = \frac{1}{P(C_i=1)} = \frac{1}{P(D_i=1) \cdot \frac{m_h}{n_h}} \qquad h = 1,...,H$$

Die Auswahl eines Längsschnitts über T Panelwellen wird nun als Auswahl-Prozeß mit 2T Stufen betrachtet, die folgendermaßen charakterisiert sind (um die Notation zu vereinfachen wurde auf den Index i für die Stichprobenelemente verzichtet):

1. Stufe: Design-Auswahl (Anlage der Stichprobe)
$P(D=1)$

2. Stufe: Antwort in der ersten Welle
$P(R_1=1/D)$

3. Stufe: Erfolgreiche Kontaktaufnahme in der zweiten Welle
$P(K_2=1/D, R_1)$

4. Stufe: Antwortgewährung in der zweiten Welle
$P(R_2=1/D, R_1, K_2)$

.
.
.

2T. Stufe: Antwortgewährung in der T-ten Welle
$P(R_T=1/D, R_1, K_2, ..., K_T)$

Die Auswahlwahrscheinlichkeit P(C=1) für ein Element der Längsschnitt-Grundgesamtheit G(1,T) erhält man dann über:

$$
\begin{aligned}
P(C=1) &= P(D=1, R_1=1, K_2=1, \ldots, R_T=1) \\
&= P(D=1) \cdot P(R_1=1/D) \\
&\quad \cdot P(K_2=1/D, R_1) \\
&\quad \cdot P(R_2=1/D, R_1, K_2) \\
&\quad \vdots \\
&\quad \cdot P(R_T=1/D, R_1, K_2, \ldots, K_T)
\end{aligned}
$$

Die Erweiterung des Poststratifizierungsansatzes liegt in der Annahme, daß auf jeder Stufe S=1, ..., 2T des Auswahlprozesses eine Unterteilung in H_S Subpopulationen (Schichten) gefunden werden kann, innerhalb derer die Wahrscheinlichkeiten, im Panel zu verbleiben, konstant sind.

Da die Schichtzugehörigkeit sowohl für die im Panel verbliebenen Stichprobeneinheiten als auch für die aus dem Panel ausscheidenden Stichprobeneinheiten bekannt sein muß, bestimmt sich die Schichtung im wesentlichen über Merkmale, die aus früheren Panelwellen bekannt sind. Dies hat zur Konsequenz, daß die Wahrscheinlichkeit für ein Verbleiben im Panel über die Merkmale aus früheren Panelwellen erklärt wird.

Neben diesem Modell für das Ausfallverhalten in Abhängigkeit von den Angaben aus der vorherigen Panelwelle werden in der Literatur auch Modelle diskutiert, bei der Variablen aus der aktuellen Panelwelle das Ausfallverhalten beeinflussen. Modelle, die ein derartiges Ausfallverhalten beschreiben, sind u.a. bei Griliches/Hall/Hausman (1978) Hausman/Wise (1979) Kitamura/Bovy (1987) und Hsiao (1986, S. 198ff.) dargestellt. Diese Modelle werden jedoch vorwiegend für die Analyse einzelner Variablen eingesetzt, wo meist sehr spezifische Vorstellungen über die Gründe des Ausfallverhaltens bestehen - z.B., daß der Nonresponse bei Einkommensangaben von der Höhe des aktuellen Einkommens abhängt. Die Nichtbeachtung solcher "nicht ignorierbarer" Ausfallprozesse (vgl. Rubin 1983, Little 1983) kann zu erheblichen Verfälschungen sowohl von Regressionsanalysen als auch von Hochrechnungen führen.

Bei der Herleitung von Hochrechnungsfaktoren, die für eine thematisch breite Analyse von Kontingenztabellen bestimmt sind, erscheint es jedoch kaum sinnvoll, sehr spezifische Annahmen über die Natur des Ausfallprozesses im Panel zu machen. Eine solche Vorgehensweise erscheint insbesondere dann angebracht, wenn die Paneluntersuchung - wie z.B. das Sozio-

ökonomische Panel - keiner spezifischen Fragestellung unterliegt. Weiterhin darf man annehmen, daß die Werte aus der vorhergehenden Welle (z.B. Einkommen) eine gute Näherung für den Wert in der aktuellen Panelwelle darstellen und der Poststratifizierungsansatz damit auch die Modelle des genannten Typs annähernd berücksichtigt.

Insofern mag es gerechtfertigt erscheinen, wenn mit dem Poststratifizierungsansatz ein verhältnismäßig einfach zu handhabendes, wenig spezifisches Instrument zur Bestimmung der Hochrechnungsfaktoren gewählt wurde.

Für spezielle Untersuchungen sollten jedoch auch alternative Modelle für den Ausfallprozeß untersucht werden (vgl. Oh/Scheuren 1983). Die Robustheit der Analyseergebnisse sollte anhand dieser Modelle geprüft werden.

5 Die Schätzung der Antwortwahrscheinlichkeiten in der ersten Welle mit Hilfe des Prinzips des minimalen Informationsverlustes

Für die Schätzung der Antwortwahrscheinlichkeiten $P(R_1=1/D)$ stehen bei den nicht antwortenden Haushalten lediglich Informationen über Regionalmerkmale und das Wohnumfeld zur Verfügung.

Im ersten Schritt kann damit die Antwortbereitschaft von Haushalten mit den gleichen Regionalmerkmalen und dem gleichen Wohnumfeld geschätzt werden durch:

$$P(R_1=1/D) = \frac{\text{Anzahl antwortender Haushalte der Merkmalskombination}}{\text{Anzahl der befragten Haushalte der Merkmalskombination}}$$

Dieser erste Schritt der Berechnung der Antwortwahrscheinlichkeiten liefert zusammen mit $P(D_i=1)$ eine erste Näherung für die (Querschnitts-) Hochrechnungsfaktoren der ersten Welle:

$$HRF_i = \frac{1}{P(D_i=1)\ P(R_{1,i}=1/D_i)}$$

In der zweiten Stufe sollen zunächst die Hochrechnungsfaktoren HRF_i durch Zusatzinformationen modifiziert werden. Da diese Modifikationen von der Form

$$HRF_i^* = HRF_i \cdot \frac{1}{FAKTOR_i}$$

$$= \frac{1}{P(D_i=1)\ P(R_{1,i}=1/D_i)\ FAKTOR_i} \quad , \quad i=1, \ldots, n$$

sind, läßt sich

$$P(R_{1,i}=1/D_i) = P(R_{1,i}=1/D_i) \cdot FAKTOR_i \quad , \quad i=1,\ldots,n$$

als die durch Zusatzinformationen korrigierte Schätzung der Antwortwahrscheinlichkeiten auffassen.

Diese Zusatzinformation besteht aus der Kenntnis über das Gesamtaufkommen von ausgewählten Merkmalskombinationen in der Grundgesamtheit. Von den modifizierten Hochrechnungsfaktoren HRF_i^* wird verlangt, daß die hochgerechneten Merkmalsausprägungen mit den tatsächlichen, bekannten Werten $r_j (j=1, \ldots, J)$ übereinstimmen:

$$\sum_{i=1}^{n} HRF_i^* \, m_{ij} = r_j \quad , \quad (j=1, \ldots, J)$$

Das obige Gleichungssystem lautet in Matrixnotation

$$M \cdot HRF^* = R \quad ,$$

wobei $M = (m_{ij})_{J \times n}$, $HRF^* = (HRF_1^*, \ldots, HRF_n^*)'$

und $R = (r_1, \ldots, r_J)'$.

Zum anderen fordert man, daß sich HRF^* möglichst wenig von der bisherigen Näherung $HRF = (HRF_1, \ldots, HRF_n)$ unterscheidet.

Benutzt man das Kriterium des minimalen Informationsverlustes (vgl. Gokhale/Kullbach 1978) gegenüber HRF, so ist HRF^* die Lösung des folgenden Minimierungsproblems[2)]

$$I(HRF^*, HRF) = \sum_{i=1}^{n} HRF_i^* \ln \frac{HRF_i^*}{HRF_i} = \min$$

unter der Nebenbedingung

$$M \cdot HRF^* = R \quad .$$

Eine Anwendung dieses Ansatzes auf Rahmendaten, die sowohl aus Haushalts- als auch aus Personeninformationen bestehen, findet man bei Merz (1983). Dort wird auch eine Lösung des Minimierungsproblems mit Hilfe des Newton-Raphson-Algorithmus vorgestellt.

Es sollte an dieser Stelle erwähnt werden, daß eine Berechnung des Hochrechnungsfaktoren mit Hilfte des "Raking"-Verfahrens, das die Hochrechnungsfaktoren nacheinander an vorgegebene Randverteilungen anpaßt (vgl. Oh/Scheuren 1983) und auf der Anwendung des Iterative-Proportional-Fitting-Algorithmus basiert, methodisch der gleichen Fragestellung unterliegt, nämlich den Informationsverlust I (HRF^*, HRF) unter linearen Nebenbedingungen an HRF^* zu minimieren, vgl. Ireland/Kullbach 1968. Stimmen daher die Nebenbedingungen und die Startverteilung HRF überein, so liefern beide Verfahren - wenn auch unter Benutzung unterschiedlicher Algorithmen - die gleiche Lösung HRF^*.

Die Struktur der Lösung HRF^* erhält man über einen Lagrange-Ansatz. Es sei hierzu $\lambda = (\lambda_1, ..., \lambda_J)'$ der Vektor der zu den J Nebenbedingungen gehörenden Lagrange-Multiplikatoren und

$$L = I\,(HRF^*, HRF) + \lambda'\,(M \cdot HRF^* - R)$$

die Lagrangefunktion des Minimierungsproblems. Für die Lösung HRF^* muß gelten:

$$\frac{\partial L}{\partial HRF_i^*} = 0 \quad , \; i = 1, ..., n$$

Diese Gleichungen liefern nach einigen Umformungen:

$$HRF_i^* = HRF_i \, e^{\lambda' m(i) - 1} \quad , \; (i=1,...,n)$$

Hierbei ist m(i) die i-te Spalte der Merkmalsmatrix M, die aus den Merkmalsausprägungen der i-ten Stichprobeneinheit besteht.

Ingesamt erhält man damit für die modifizierten Antwortwahrscheinlichkeiten[3]:

$$P(R_{i,1}=1/D_i) = P(R_{1,i}=1/D_i) \cdot e^{-\lambda' m(i)+1}$$

Die Antwortwahrscheinlichkeiten sind damit konstant für alle Stichprobeneinheiten i mit gleichen Regionalmerkmalen und gleichem Merkmalsvektor m = m(i). Dies bedeutet, daß der Ansatz über den minimalen Informationsverlust implizit eine Poststratifizierung der Antwortwahrscheinlichkeiten in der ersten Welle bedeutet und damit in den allgemeinen Ansatz (Poststratifizierung auf jeder Stufe des Panel, vgl. Abschnitt 4) eingepaßt werden kann.

6 Die Schätzung der Wahrscheinlichkeiten, im Panel zu verbleiben

Neben der Schätzung der Antwortwahrscheinlichkeiten in der ersten Panelwelle müssen die Wahrscheinlichkeiten geschätzt werden, zwischen je zwei Befragungswellen nicht aus dem Panel ausscheiden.

Die Ausfallprozesse zwischen zwei Panelwellen lassen sich untergliedern in Ausfälle, die entstehen, weil mit den Stichprobeneinheiten kein Kontakt aufgenommen werden konnte, und Ausfälle, bei denen nach der Kontaktaufnahme kein Interview zustande kam. Diese Unterteilung findet man ebenfalls bei Hoag (1981).

Im Gegensatz zur ersten Befragungswelle steht in weiteren Panelwellen bei den ausgefallenen Stichprobeneinheiten eine Fülle von Variablen aus den vorhergehenden Panelwellen zur Schätzung der Auswahlwahrscheinlichkeiten zur Verfügung. Das Problem besteht eher darin, herauszufinden, welche Variablen für die Erklärung der Ausfälle am aussagekräftigsten sind. Zunächst sollten Variablen herangezogen werden, die in einem unmittelbaren Kontext zu den Ausfällen stehen.

Bei der Kontaktaufnahme erscheint es sinnvoll, die Haushalte (bzw. die in den Haushalten lebenden Personen) in vier Untergruppen einzuteilen:

- Haushalte ohne Adressenänderung: Mit diesen Haushalten ist die Kontaktaufnahme relativ leicht.

- Verzogene Mehrpersonen-Haushalte: Die Adresse sollte aufgrund der vielen Kontakte dieser Haushalte noch relativ leicht zu ermitteln sein. Ebenso ist hier die Erreichbarkeit des Haushalts groß.

- Verzogene Einpersonen-Haushalte: Diese Haushaltsgruppe dürfte am schwierigsten zu erreichen sein.

- Haushaltsabspaltungen: Hier verfügen die im Haushalt verbliebenen Personen meist über die Adresse des abgespaltenen Haushaltsteils.

Weiterhin kann man annehmen, daß in einer Wohnumgebung, die durch ein hohes Maß an Anonymität gekennzeichnet ist, wenig Hinweise auf eventuelle Adressenänderungen bzw. die An- oder Abwesenheit der Befragungspersonen zu finden sind. Diese Anonymität kann über den Ortstyp bzw. das unmittelbare Wohnumfeld operationalisiert werden. Da diese Größen auch für die ausgefallenen Haushalte bekannt sein müssen, ist es notwendig, die Modellierung der Kontaktwahrscheinlichkeiten anhand der Merkmale der Startadresse bei der letzten Panelbefragung vorzunehmen.

Bei der Antwortbereitschaft muß zunächst zwischen der Antwortbereitschaft auf Haushalts- und auf Personenebene unterschieden werden. Werden nämlich in einem Panel alle Personen eines Haushalts, die das Befra-

gungsalter erreicht haben, interviewt, so ergibt sich die Möglichkeit, daß zwar ein Interview auf Haushaltsebene gewährt wird, aber nicht alle Befragungspersonen ein Interview geben. Dies hat zur Folge, daß die Antwortwahrscheinlichkeiten von Haushalten und die der Personen, die hierin leben, nicht notwendig identisch sind. In der Praxis zeigt es sich aber, daß zwischen den Haushaltsmitgliedern eine sehr große Geschlossenheit hinsichtlich ihrer Antwortbereitschaft besteht. So reagierten beim Sozio-ökonomischen Panel in der zweiten Welle von 5937 Haushalten 5814 Haushalte (= 98 vH) geschlossen.

Dieser hohe Grad der Geschlossenheit im Antwortverhalten erklärt sich einmal aus

- der Auswahl der Haushalte in der ersten Welle (es werden nur Haushalte ausgewählt, die geschlossen auskunftsbereit waren),
- der intensiven Feldarbeit, die die Ausfälle wegen Abwesenheit reduziert, und
- der geringen Anzahl der Befragten pro Haushalt (in zwei Drittel aller Fälle ein bis zwei Personen).

Allerdings erklären diese Faktoren nicht das geschlossene Auftreten von Verweigerungen auf Haushaltsebene, wo in 615 von 738 Fällen (= 84 vH) alle Befragungspersonen eines Haushalts die Antwort verweigern. Dieser Sachverhalt läßt darauf schließen, daß innerhalb eines Haushaltes Entscheidungsprozesse ablaufen, die darauf hinwirken, nach außen geschlossen aufzutreten. Verstärkt wird dieser Eindruck noch, wenn man sieht, daß von den 123 Haushalten mit partiellen Ausfällen in 101 Haushalten lediglich die Antwort einer Person fehlte und in 91 Haushalten der Ausfall durch Krankheit oder Abwesenheit bedingt ist. D.h. lediglich in 32 von 5937 Haushalten (= 0,5 vH) sind die Ausfälle durch eine unterschiedliche Antwortbereitschaft innerhalb eines Haushaltes begründet.

Wegen dieser Gleichförmigkeit der Antwortbereitschaft auf Haushalts- und Personenebene kann die Antwortwahrscheinlichkeit von Personen durch die Antwortwahrscheinlichkeit ihrer Haushalte geschätzt werden.

Ein möglicher Grund für eine geringe Antwortbereitschaft eines Haushalts kann eine hohe zeitliche Belastung durch die Interviews in der vorhergehenden Panelwelle gewesen sein. Diese Belastung kann gemessen werden über die Gesamtdauer der Interviews im Haushalt oder - als einfache Näherung hierfür - über die Anzahl der befragten Personen.

Umgekehrt können trotz geringer Interviewbelastung für den Haushalt Streßfaktoren bestehen, die eine Antwortverweigerung ("Keine Zeit") begründen. Als Streßfaktoren können z.B. gewertet werden:

- Pflege- und Sterbefälle im Haushalt (ja/nein) oder
- Umzug des Haushalts (ja/nein) .

Hierbei sind im Kontaktbericht des Interviewers (Adressenprotokoll) Informationen über mögliche Sterbefälle seit der letzten Befragung enthalten.

Die Variable Umzug operationalisiert nicht nur einen möglichen Streßfaktor für den Haushalt, sie zeigt auch einen Wechsel des Interviewers an. Es ist bei einer Wiederholungsbefragung zu erwarten, daß sich ein allmählich entwickelndes Vertrauensverhältnis zwischen Interviewer und Interviewtem positiv auf die Antwortbereitschaft auswirkt.

Schließlich kann eine insgesamt kritische Haltung gegenüber Befragungen zu einer Antwortverweigerung im Laufe des Panels führen. Diese kritische Haltung kann darüber operationalisiert werden, ob bei Haushalten, die ansonsten auskunftsbereit sind, keine Angaben bei sensiblen Fragestellungen gemacht werden. Werden beispielsweise in der vorangehenden Panelwelle keine Angaben zum Haushaltsnettoeinkommen gemacht, so drückt dies bei ansonsten auskunftsbereiten Haushalten eine gewisse Reserviertheit gegenüber der "Neugier" der Erhebung aus, die eventuell in der folgenden Befragungswelle zum Abbruch der Befragung führt.

Ganz wesentlich wird die Stabilität des Haushaltsverbandes die Auskunftsbereitschaft von Haushalten in den folgenden Panelwellen beeinflussen. Da das Antwortverhalten auf Haushaltsebene nahezu geschlossen ist, darf man annehmen, daß auf zugezogene Personen ein gewisser Druck in Richtung Antwortbereitschaft ausgeübt wird. Umgekehrt wird man erwarten dürfen, daß innerhalb einer völlig neuen Haushaltszusammensetzung die Antwortbereitschaft eines Haushaltsmitgliedes in der vorherigen Panelwelle nur noch geringe Auswirkungen auf die Antwortbereitschaft der übrigen Haushaltsmitglieder hat. Eher ist zu erwarten, daß die Responsequote auf den üblichen Wert bei einfachen Querschnittsbefragungen (also ca. 65 vH) sinkt. Eine grobe Operationalisierung kann beispielsweise über eine Einteilung der Haushalte in Haushaltsabspaltungen und übrige Haushalte vorgenommen werden[4)].

Schließlich sollten noch einige demographische Merkmale des Haushaltsvorstandes bei der Modellierung der Antwortbereitschaft berücksichtigt werden. Zumindest bei der Variable Alter besteht ein direkter Zusammenhang zur Antwortbereitschaft, da älteren Menschen die Beantwortung von relativ komplexen Sachverhalten (wie sie beim Sozio-ökonomischen Panel erhoben werden) häufig schwer fällt. Auch sind in dieser Altersgruppe die Ausfälle durch Krankheit wahrscheinlicher.

Weitere wichtige Größen, die die Antwortbereitschaft beeinflussen, sind die Motivation, das Interesse und eventuelle Frustrationsgefühle, die die Befragung bei den einzelnen Personen auslöst. So stellte sich bei der Panelstudie

"Politik in der Bundesrepublik" (vgl. Hoag 1981, S. 14) heraus: "Je mehr Lebensprobleme ein Befragter hat, je ungerechter er seine Position findet, je unerfreulicher sein Arbeitsplatz ist und je weniger Befriedigung jemand aus seiner Arbeit gewinnt, desto größer ist die Wahrscheinlichkeit, daß er bei der nächsten Welle zu den Ausfällen gehört."

Die Nichtbeachtung von Ausfällen infolge von Frustrationseffekten kann zu Fehlschätzungen - z.B. höherer Zufriedenheit als der tatsächlich vorhandenen - führen. Nicht nur bei der Bestimmung der Ausfallwahrscheinlichkeiten, sondern auch bei der Schätzung von Verhaltensgleichungen müssen diese nicht ignorierbaren Ausfälle in Erwägung gezogen werden, wie dies beispielsweise bei der Analyse von Zufriedenheitsskalen durch latente-Variablen-Modelle bei Hujer/Löwenbein (1987) geschieht.

Ein anschauliches Beispiel für den Einfluß von Motivation und Interesse gegenüber der Befragung findet man bei einer Paneluntersuchung des Reise- und Verkehrsverhaltens von Haushalten (vgl. Kitamura/Bovy 1987). Bei dieser Untersuchung zeigte sich in der zweiten Panelwelle eine deutliche Zunahme der Antwortbereitschaft in Abhängigkeit von der Anzahl der Autofahrer im Haushalt.

Allerdings kann bei einer thematisch sehr breit angelegten Paneluntersuchung aus einer Antwortverweigerung (Unit-Nonresponse) nicht auf eine spezifische Frustration geschlossen werden. Jedoch sollten mögliche Frustrationseffekte bei der Behandlung des Item-Nonresponse in Erwägung gezogen werden[5].

7 Methoden zur Aggregation von Kontingenztabellen

Schon eine mäßige Anzahl von Variablen zur Modellierung der Kontakt- und Antwortwahrscheinlichkeiten führt zu Kontingenztabellen mit geringen Zellenbesetzungen. Allein sechs Variablen mit jeweils drei Ausprägungen liefern zusammen mit den zwei Antwortkategorien eine Kontingenztabelle mit $3^6 \cdot 2 = 1458$ Feldern.

Eine Schätzung der Antwortwahrscheinlichkeiten durch die empirischen Häufigkeiten, d.h. durch den Quotienten von antwortenden und zu befragenden Haushalten innerhalb jeder Merkmalskombination, dürfte bei den schwach besetzten Zellen häufig zu wenig plausiblen Ergebnissen führen - nämlich zu Werten nahe bei 0 oder 1.

Auch birgt die Aufnahme zu vieler Variablen in den Modellansatz zwei weitere Gefahren in sich: Erstens eine Vergrößerung der Varianz der Hochrechnungsergebnisse aufgrund der geringen Zellenbesetzung in den einzelnen Schichten (vgl. Oh/Scheuren 1983) und zweitens eine mögliche Verzerrung der Hochrechnungsergebnisse. Beispiele hierfür werden bei

Herberger (1985) angegeben. Es bedarf also zunächst explorativer Techniken zur Reduzierung der Variablen und der Anzahl der Ausprägungen innerhalb der Variablen.

Hier bietet das automatische Selektionsverfahren CHAID (= Chisquare Automatic Interaction Detection) eine gewisse Hilfestellung. Bei diesem Verfahren werden aus dem vorhandenen Variablenset nacheinander die jeweils erklärungskräftigsten für die abhängige Variable ausgewählt (vgl. Langeheine 1984 und du Toit/Steyn/Stumpf 1986). Hierbei wird außerdem geprüft, welche Variablenausprägungen zusammengelegt werden können.

In der Praxis begegnet man dem Problem der schwach besetzten Kontingenztabellen dadurch, daß man einzelne Zellen aufgrund von Plausibilitäts-Erwägungen zusammenfaßt, bis die Besetzung der zusammengefaßten Zellen groß genug ist (vgl. Oh/Scheuren 1983). Hoag (1981) benutzt eine Zusammenfassung derjenigen Zellen, die zu einem gleichen Indexwert führen. Dieser Index zählt alle diejenigen Ausprägungen innerhalb einer Merkmalszelle, die eine geringe Antwortbereitschaft anzeigen. Dieses Verfahren liefert eine sehr hohe Aggregation auf wenige Zellen.

Im folgenden soll skizziert werden, daß die Schätzung der Antwortwahrscheinlichkeiten im Rahmen eines Logitmodells in die Problematik der Aggregation einer Kontingenztabelle eingebettet werden kann. Die Schätzung von Antwortwahrscheinlichkeiten durch Logitmodelle stellt daher eine Alternative zu den bei Hochrechnungen üblichen Aggregationsmethoden dar.

Diese Darstellung beruht auf dem Sachverhalt, daß jedes Logitmodell als spezielles log-lineares Modell aufgefaßt werden kann (vgl. Fahrmeir/Hamerle 1984, S. 550ff.). So entspricht beispielsweise einem Logit-Haupteffektmodell mit den Variablen V_1, V_2, V_3 und der abhängigen Variablen R (= Response ja/nein) das hierarchische log-lineare Modell, das durch das Erzeugende System

$$V_1V_2V_3/V_1R/V_2R/V_3R$$

charakterisiert ist - dies sind gerade die höchsten Interaktionsterme des log-linearen Modells. Wesentlich ist für diese Modellklasse, daß zur Schätzung der Modellparameter lediglich Werte aus den Kontigenztabellen des erzeugenden Systems benötigt werden, und die erwarteten Häufigkeiten mit den beobachteten Häufigkeiten auf diesen Kontigenztabellen übereinstimmen (vgl Fahrmeir/Hamerle 1984, S. 516ff.).

Konkret bedeutet dies, daß aus der ursprünglichen Kontigenztabelle $V_1*V_2*V_3*R$ vier Tabellen durch Aggregation gebildet werden, nämlich $V_1*V_2*V_3$, V_1*R, V_2*R und V_3*R. Das Antwortverhalten geht also nur über die drei hochaggregierten Tabellen V_1*R, V_2*R und V_3*R in die Schätzung der Antwortwahrscheinlichkeiten ein. Entsprechend basiert ein

Logitmodell mit einem zusätzlichen Interaktionsterm V_1V_2 auf einem log-linearen Modell

$$V_1V_2V_3/V_1V_2R/V_3R \quad .$$

In diesem Fall geht das Antwortverhalten über die Tabellen $V_1{*}V_2{*}R$ und $V_3{*}R$ in die Schätzung der Antwortwahrscheinlichkeiten ein.

Die Schätzung der Antwortwahrscheinlichkeiten ist über zwei Wege möglich: im Rahmen des log-linearen Modells über den Iterative-Proportional-Fitting-Algorithmus, bei dem die erwarteten Zellenhäufigkeiten unter Beachtung der vorgegebenen Randtabellen geschätzt werden (vgl. Fahrmeier/Hamerle 1984, S. 532ff.). Zum anderen im Logitansatz über die direkte Maximierung der Likelihoodfunktion in den Modellparametern unter der iterativen Verwendung des verallgemeinerten kleinste Quadrate Schätzers (vgl. McCullagh/Nelder 1983, S. 81).

8 Die Bestimmung der Antwortwahrscheinlichkeiten für Querschnitte

In den Abschnitten vier bis sieben wurde dargestellt, wie die Bausteine für die Bestimmung der Antwortwahrscheinlichkeit von Längsschnitten geschätzt werden können. In diesem Abschnitt sollen nun die Auswahlwahrscheinlichkeiten von Querschnitten bestimmt werden. Wie gezeigt werden wird, lassen sich diese Antwortwahrscheinlichkeiten aus genau den gleichen Bausteinen bestimmen wie bei Längsschnitten, was das Problem der Hochrechnung erheblich vereinfacht.

Zunächst wird dargestellt, wie sich die Antwortwahrscheinlichkeiten bestimmen, Mitglied der zweiten Panelwelle zu sein. Aus dieser Darstellung kann dann leicht die Fortschreibung der Querschnittshochrechnungsfaktoren von einer Panelwelle auf die folgende hergeleitet werden (vgl. Abschnitt 10).

Um nun die Antwortwahrscheinlichkeit für die zweite Welle zu bestimmen, stelle man sich die Haushalte der '84er und '85er Grundgesamtheit nebeneinander aufgereiht vor (vgl. Schaubild 1). Zwischen einigen Haushalten von 1984 und 1985 bestehen dadurch Beziehungen, daß in beiden Haushalten mindestens eine gemeinsame Person wohnte, die 1984 schon im Befragungsalter war. Trägt man nun diese Verbindungen zwischen den Haushalten als Pfeile, die von den Haushalten '84 ausgehen, ein, so erhält man alle mögliche Pfade, die im Rahmen des Weiterverfolgungskonzepts des Panels hätten realisiert werden können.

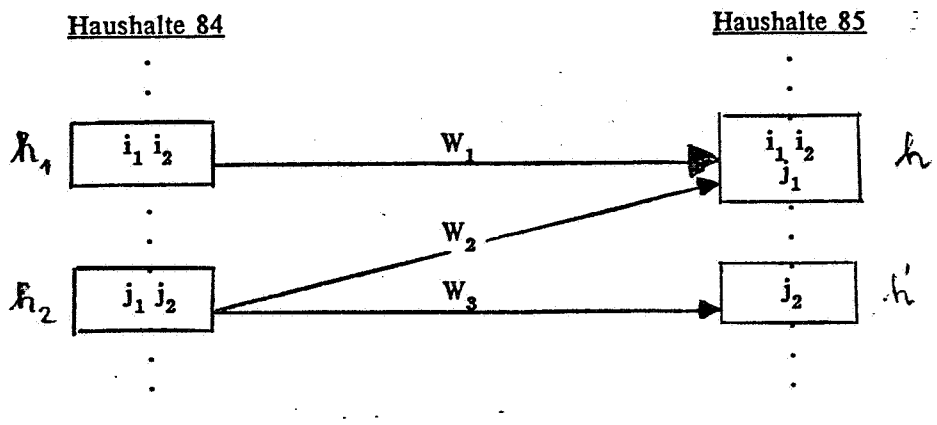

Schaubild 1: Das Weiterverfolgungskonzept zwischen den Haushalten 84 u.85.

Das im Schaubild dargestellte Beispiel soll den Sachverhalt deutlich machen: Im '84er Haushalt h_1 leben die Personen i_1 und i_2 und im Haushalt h_2 die Personen j_1 und j_2. Zwischen den Befragungen 1984 und 1985 zieht die Person j_1 mit den Personen i_1 und i_2 in den Haushalt h zusammen, während die Person j_2 1985 den Einpersonenhaushalt h' bildet. Alle Personen mögen die Eigenschaften besitzen, im Falle ihrer Auswahl in die zweite Welle weiterverfolgt zu werden[6].

Auf diese Weise bestehen für die Haushalte h_1 und h_2 drei mögliche Wege der Weiterverfolgung: Einmal über die Personen i_1 und i_2 (Weg W_1), einmal über die Person j_1 (Weg W_2) und schließlich über die Person j_2 (Weg W_3).

Wenn nun der Haushalt h_1 in der ersten Welle tatsächlich ausgewählt wurde, wird von den drei möglichen Weiterverfolgungspfaden nur W_1 realisiert. Die Antwortwahrscheinlichkeit des 85er Haushalts h - und damit die Antwortwahrscheinlichkeit aller Personen, die in diesem Haushalt leben - bestimmt sich jedoch durch das Ereignis, den Haushalt h über W_1 <u>oder</u> W_2 zu erreichen. Dieses ist die durch das Panel-Design festgelegte Auswahl in der zweiten Welle, die über die Variable $D_{2,h} = 1$ angezeigt wird. Diese Design-Komponente muß noch mit der Antwortbereitschaft des Haushalts h in der zweiten Welle multipliziert werden:

$$P(C_{2,h} = 1) = P(D_{2,h} = 1)\, P(R_{2,h} = 1/D_{2,h})$$

Aus der Unabhängigkeit der Auswahl der Haushalte in der ersten Welle folgt die Unabhängigkeit der Realisierung der Weiterverfolgungspfade:

$$P(D_{2,h} = 1) = P(W_1) + P(W_2) - P(W_1)P(W_2)$$
$$\approx P(W_1) + P(W_2)$$

Hierbei gilt die letzte Approximation aufgrund der gewöhnlich geringen Auswahlwahrscheinlichkeiten von Haushalten in der ersten Welle.Die Wahrscheinlichkeit $P(W_i)$, die Realisierung des Weiterverfolgungspfades W_i zu beobachten, ist dadurch bestimmt, daß der Haushalt h_i in der ersten Welle ausgewählt wurde und auskunftsbereit ist und daß in der zweiten Welle vom Haushalt h_i der Kontakt zum Haushalt h hergestellt werde konnte:

$$P(W_i) = P(D_{1,h_i} = 1, R_{1,h_i} = 1) \cdot P(K_{2,h} = 1/D_{1,h_i}, R_{1,h_i}) \quad , i = 1,2$$

Diese Wahrscheinlichkeiten hängen im allgemeinen von den Merkmalen der Haushalte $h_i(i=1,2)$ ab. Diese Haushaltsmerkmale sind zwar für den Haushalt h_1, der in der erste Welle in der Stichprobe war, bekannt. In vielen Fällen werden aber bei den zugezogenen Personen (im Beispiel ist dies die Person j_1) nicht die entsprechenden Merkmale des Ursprungshaushalts h_2 erhoben, aus dem die Person zugezogen ist.

Zunächst kann aufgrund der gleichen Zieladresse angenommen werden, daß die Wahrscheinlichkeit für eine erfolgreiche Kontaktaufnahme von den Haushalten h_1 und h_2 aus annähernd gleich ist:

$$P(K_{2,h} = 1/D_{1,h_1}, R_{1,h_1}) \approx P(K_{2,h} = 1/D_{1,h_2}, R_{1,h_2})$$

Hinsichtlich der Auswahlwahrscheinlichkeiten in der erste Welle wird angenommen, daß sich diese durch ein Logit-Modell beschreiben lassen, in das sowohl die bekannten personenbezogenen Merkmale PX_j der zugezogenen Person j als auch unbekannte haushaltsbezogene Variablen HX_j des Haushalts, aus dem die Person j zuzieht, eingehen:

$$\ln \frac{P_j}{1-P_j} = PX_j'\beta_1 + HX_j'\beta_2$$

Der unbekannte haushaltsbezogene Anteil $\varepsilon_j = HX_j'\beta_2$ hat damit die Funktion eines Störterms in der Beziehung:

$$y_j = \ln \frac{p_j}{1-p_j} = PX_j'\beta_1 + \varepsilon_j$$

Wird angenommen, daß diese Beziehung sowohl für die Befragungspersonen der ersten Welle als auch für die in der zweiten Welle hinzugekommenen Befragungspersonen gilt und benutzt man die in Abschnitt 4 ermittelten

Schätzungen für p_j, so läßt sich β_1 über eine gewöhnliche Kleinste-Quadrate-Schätzung bestimmen[7].

Schließlich besteht noch die Möglichkeit, daß von der zugezogenen Person die Variablen PX_j nicht ermittelt werden konnten, weil die Person die Antwortgewährung in der zweite Welle verweigerte. In diesen Fällen kann davon ausgegangen werden, daß diese Person erst recht in der ersten Welle die Beantwortung des Fragebogens verweigert hätte. Denn im Gegensatz zur zweiten Welle, wo mindestens eine Person im Haushalt lebt, die schon vor einem Jahr an der Befragung teilgenommen hat, existierte in der ersten Welle ein solcher Ansprechpartner nicht im Ursprungshaushalt h_2.

Für Haushalte mit zwei Zugangswegen erhält man damit schließlich:

$$\begin{aligned} P(C_{2,h} = 1) &= P(D_{2,h} = 1)\, P(R_{2,h} = 1/D_{2,h}) \\ &= \{P(D_{1,h_1} = 1,\, R_{1,h_1} = 1) + P(D_{1,h_2} = 1,\, R_{1,h_2} = 1)\} \cdot \\ &\qquad P(K_{2,h} = 1/D_{1,h_1},\, R_{1,h_1})\, P(R_{2,h} = 1/D_{2,h}) \end{aligned}$$

Hieraus ergibt sich die folgende Rekursionsformel für die Hochrechnungsfaktoren $HRF_h(2)$ der zweiten Welle:

$$HRF_h(2) = \frac{1}{\dfrac{1}{HRF_{h_1}(1)} + \dfrac{1}{HRF_{h_2}(1)}} \cdot f_h(2) \quad ,$$

wobei

$$f_h(2) = 1/\{P(K_{2,h} = 1/D_{1,h_1},\, R_{1,h_1}) \cdot P(R_{2,h} = 1/D_{2,h})\}$$

und $HRF_{h_1}(1)$ der Hochrechnungsfaktor in der ersten Welle für den Haushaltsteil h_1 ist und $HRF_{h_2}(1)$ der geschätzte Hochrechnungsfaktor für den zugezogenen Haushaltsteil h_2 ist. Für $HRF_{h_1}(1) \approx HRF_{h_2}(1)$ und $f_h(2) \approx 1$ reduziert sich $HRF_h(2)$ auf die Hälfte des Wertes von $HRF_{h_1}(1)$.

Für den weitaus häufigeren Fall, daß der Haushalt h nur über einen Weg gemäß dem Weiterverfolgungskonzept erreicht werden kann, läßt sich sofort die Beziehung

$$HRF_h(2) = HRF_h(1) f_h(2)$$

herleiten, wobei der '84er Haushalt h_1 mit dem '85er Haushalt h identifiziert wird.

Für diejenigen Personen der Längsschnittpopulation, die in diesen Haushalten ohne Zuzüge leben, folgt:

$$HRF_i(2) = HRF_i(1) \cdot f_h(2) = HRF_i(1,2)$$

Für diesen Personenkreis stimmen also die Längs- und Querschnittfaktoren überein.

Die beiden bisher genannten Muster von Haushaltsbeziehungen stellen sicher das Gros der auftretenden Möglichkeiten in der zweiten Welle dar. Der Fall, daß Personen aus drei unterschiedlichen Haushalten in einen Haushalt zusammenziehen, kann analog zu dem Fall zweier Ursprungshaushalte behandelt werden.

Lediglich der Fall, daß zwei Personen zusammen in einen Panelhaushalt ziehen (- dieser Fall liegt vor, wenn in Schaubild 1 die Personen j_1 und j_2 in den Haushalt h ziehen -), bedarf einer näheren Erläuterung. In diesem Fall ändert sich wegen der haushaltsbezogenen Auswahl in der ersten Befragungswelle die Wahrscheinlichkeit, den Haushalt h über den Weg W_2 zu erreichen, nicht. Ein Problem ergibt sich jedoch, diese Wahrscheinlichkeit in Abhängigkeit von den personenbezogenen Merkmalen zu schätzen. Je nach Wahl von Person j_1 oder Person j_2 kann die Schätzung dieser Wahrscheinlichkeit unterschiedliche Werte annehmen. Die Wahl der Person kann über Plausibilitätskriterien wie Alter oder - falls dies bekannt ist - die Stellung zum Haushaltsvorstand im '84er Haushalt vorgenommen werden. Alternativ können auch die Schätzwerte auf Basis der Personenmerkmale von Person j_1 und j_2 gemittelt werden.

9 Die Korrektur der Hochrechnungsfaktoren für die zweite Welle durch externe Informationen

Die Querschnitts-Hochrechnungsfaktoren für die zweite Welle bestehen damit aus dem Produkt zweier Faktoren. Der erste Faktor bestimmt sich über die Auswahlwahrscheinlichkeiten in der ersten Welle. Diese Auswahlwahrscheinlichkeiten wurden (vgl. Abschnitt 4) gemäß des Prinzips des minimalen Informationsverlustes an vorgegebene Randverteilungen der ersten Welle angepaßt. Diese Anpassung konnte als Modifikation der Response-Wahrscheinlichkeiten der ersten Welle interpretiert werden.

In der zweiten Welle besteht nun die Möglichkeit, den zweiten Faktor des Hochrechnungsgewichts, der durch die Bleibe-Wahrscheinlichkeiten der zweiten Welle festgelegt ist, wiederum nach dem Prinzip des minimalen Informationsverlustes zu modifizieren. Dies liefert die modifizierte Schätzung :

$$\hat{\hat{P}}(K_{2,i}=1, R_{2,i}=1/D_{1,i}, R_{1,i}) = \hat{P}(K_{2,i}=1, R_{2,i}=1/D_{1,i}, R_{1,i}) \cdot e^{-\lambda_2' m_2(i)+1}$$

Hierbei ist $m_2(i)$ der Merkmalsvektor des Haushalts i in der zweiten Welle und λ_2 der Lagrange-Multiplikator des Minimierungsproblems:

$$I\,(HRF^*(2), HRF(2)) = \min!$$

unter der Nebenbedingung

$$M_2 HRF^*(2) = R_2 \quad ,$$

wobei M_2 die Matrix der Stichprobenmerkmale in der zweiten Welle ist und R_2 der Vektor der Randbedingungen ist.

Diese modifizierte Schätzung für die Bleibe-Wahrscheinlichkeiten sollte auch für eine Revision der Längsschnitt-Hochrechnungsfaktoren benutzt werden. Diese Anpassung der Hochrechnungsergebnisse an den Gewichtungsrahmen '85 sollte jedoch nicht ohne eine vorherige Analyse der Abweichungen vom Hochrechnungsrahmen vorgenommen werden. Denn diese Abweichungen enthalten möglicherweise Hinweise auf eventuelle Fehlspezifikationen bei der Modellierung der Ausfallprozesse zwischen der ersten und der zweiten Panelwelle, d.h. aufgrund der Analyse der Abweichungen vom Hochrechnungsrahmen können sich Hinweise ergeben, weitere Variablen in die direkte Modellierung des Ausfallverhaltens einzubeziehen. Diese explizite Modellierung der Ausfallprozesse mit klaren Hinweisen auf mögliche Ausfallursachen ist der impliziten Korrektur der Ausfallwahrscheinlichkeiten über das Anpassungsverfahren vorzuziehen, denn sie eröffnet die Möglichkeit, im Rahmen der Panelpflege Gegenmaßnahmen zur Verringerung der Ausfälle zu ergreifen.

10 Die iterative Fortschreibung der Hochrechnungsfaktoren

In diesem Abschnitt soll gezeigt werden, wie allgemein auf Basis der Hochrechnungsfaktoren für die vorherige Panelwelle (T-1) und der Kenntnis der Ausfallwahrscheinlichkeiten zwischen der Welle T und der Welle (T-1) die Hochrechnungsfaktoren für die Welle T bestimmt werden können.

Hierbei wird wie in den vorhergehenden Abschnitten davon ausgegangen, daß die Antwortbereitschaft aller Personen i, die in der T-ten Welle zusammen in einem Haushalt h wohnen, durch die Antwortbereitschaft des

Haushalts h geschätzt werden kann. Für diese Personen i beträgt also die Wahrscheinlichkeit von der Welle (T-1) in die Welle T zu gelangen:

$$P(K_{T,h} = 1, R_{T,h} = 1/R_{T-1,h}) = 1/f_h\,(T)$$

Der Faktor $f_h(T)$ kann für jede Welle mit den in Abschnitt 6 und 7 genannten Methoden geschätzt werden.

Für die Hochrechnungsfaktoren für einen Längsschnitt über T Befragungswellen erhält man damit die rekursive Beziehung:

$$HRF_i(1,T) = HRF_i(1,T-1) \cdot f_h(T)$$

Zur Bestimmung der Hochrechnungsfaktoren HRF_i (T) für Querschnitte in der T-ten Panelwelle werden wie im Abschnitt 8 die Haushalt zur Zeit der Panelwelle T-1 und zur Zeit der Panelwelle T nebeneinander angeordnet und zwischen ihnen die durch das Weiterverfolgungskonzept implizierten Haushaltsbeziehungen eingetragen.

In der Welle T sind wieder Haushalte mit nur einem Zugang von solchen mit zwei oder mehreren Zugängen zu unterscheiden.

Für Haushalte mit nur einem Zugang erhält man analog zu Abschnitt 8:

$$HRF_i\,(T) = HRF_i\,(T-1)f_h\,(T)$$

Für Haushalte h, die aus der vorherigen Panelwelle über zwei Haushalte h_1 und h_2 erreicht werden können, ist zu entscheiden, ob die Auswahl der beiden Zugangshaushalte h_1 und h_2 unabhängig oder voneinander abhängig ist.

Im Gegensatz zur ersten Welle sind nämlich Fälle denkbar, wo die Auswahl der Haushalte h_1 und h_2 abhängig voneinander ist. Dies ist immer dann der Fall, wenn Personen vorher in einem gemeinsamen Haushalt gelebt haben, sich während der Panel-Befragung getrennt haben und in der Panelwelle T wieder zusammenziehen. Dieser Fall tritt beispielsweise auf, wenn Kinder nach dem Auszug aus dem elterlichen Haushalt im Verlaufe der Panelbefragung in den elterlichen Haushalt zurückkehren.

Um diese Fälle zu erkennen, ist es jedoch nötig, daß für jeden Panel-Haushalt eine Liste aller Personen geführt wird, die seit Beginn des Panels in diesem Haushalt gelebt haben.

Im folgenden Beispiel wird die Situation analysiert, bei der zwei Personen i und j in der Panelwelle (T-2) in einem Haushalt h_1 wohnen, während der nächsten Panelwelle zwei getrennte Haushalte h_i und h_j führen und in der T-ten Panelwelle wieder zusammen im Panelhaushalt h wohnen.

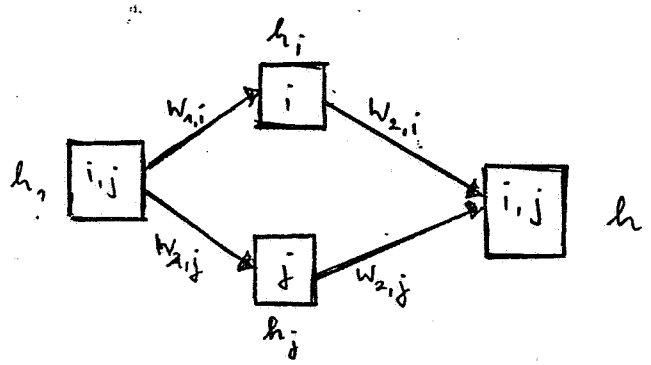

Schaubild 2: Darstellung der Weiterverfolgungspfade beim Zusammenziehen von Panel-Teilnehmern

Das Schaubild zeigt die Weiterverfolgungspfade zwischen den Haushalten h_1, h_i, h_j und h. Der Haushalt h befindet sich also genau dann in der T-ten Panelwelle, wenn der Haushalt h_1 in der (T-2)-ten Panelwelle ausgewählt wurde und der Haushalt h entweder über die Person i oder die Person j im Rahmen der Weiterverfolgung erreicht wurde.

Für die Designauswahl des Haushalts h in der Panelwelle T ergibt sich damit:

$$P(D_{T,h} = 1) = P(C_{T-2,h} = 1)\ P\ (W_{1,i}\ W_{2,i}) + P(W_{1,j}W_{2,j}) - P(W_{1,i}W_{2,i}W_{1,j}W_{2,j})$$

Hierbei ist P (W) die Wahrscheinlichkeit, daß die Weiterverfolgung über den Pfad W erfolgreich ist. Läßt sich W in die Teilpfade W_1 und W_2 zerlegen, so gilt:

$$P(W) = P(W_1W_2) = P(W_1)\ P(W_2)$$

Zur Berechnung der Wahrscheinlichkeit $P(W_{1,i}W_{2,i}W_{1,j}W_{2,j})$, daß die Weiterverfolgung über beide Personen i und j erfolgreich ist, erscheint es plausibel, anzunehmen, daß sich i und j in ihrer Antwortbereitschaft nicht beeinflussen, wenn sie in getrennten Haushalten wohnen. Allerdings ist die Kontaktaufnahme in der Welle T voneinander abhängig. Dies impliziert:

$$P(W_{1,i}W_{2,i}W_{1,j}W_{2,j}) = P(W_{1,i})\ P(W_{1,j})\ P(W_{2,i}W_{2,j})$$

$$= P(W_{1,i})\ P(W_{1,j})P(W_{2,i})$$

Das letzte Gleichheitszeichen folgt hierbei aus:

$$P(W_{2,j}/W_{2,i}) = 1$$

Wegen

$$HRF_{h_\ell}(T-1) = HRF_{h_\ell}(T-2)/P(W_{1,\ell})$$
$$= 1/\{P(C_{T-2,h_\ell} = 1)\, P(W_{1,\ell})\} \quad , \quad = i,j$$

erhält man schließlich:

$$P(D_{T,h} = 1) = \frac{P(W_{2,i})\{1-P(W_{1,j})\}}{HRF_{h_i}(T-1)} + \frac{P(W_{2,j})}{HRF_{h_j}(T-1)}$$

Hierbei ist $P(W_{2,i})$ bzw. $P(W_{2,j})$ die Wahrscheinlichkeit, über den Haushalt h_i bzw. h_j mit dem Haushalt h Kontakt aufzunehmen. $P(W_{1,j})$ ist die Wahrscheinlichkeit, daß der Haushalt h_j vom Haushalt h_1 erreicht wird und in der Welle T-1 antwortbereit ist.

Schließlich erhält man unter der Approximation $P(W_{2,i}) \approx P(W_{2,j})$:

$$HRF_h(T) = \frac{1}{P(D_{T,h} = 1)\, P(R_{T,h} = 1/D_{T,h})}$$

$$= \frac{1}{\frac{1}{HRF_{h_i}(T-1)}\left\{1 - \frac{1}{f_{h_j}(T-1)}\right\} + \frac{1}{HRF_{h_j}(T-1)}} \cdot f_h(T)$$

wobei gilt:

$$1/f_h(T) = P(R_{T,h} = 1/D_{T,h})\, P(K_{T,h} = 1/R_{T-1,h}) \quad \text{und}$$

$$1/f_{h_j}(T-1) = P(R_{T-1,h_j} = 1/K_{T-1,h_j})\, P(K_{T-1,h_j} = 1/R_{T-2,h_j})$$

Dieses Beispiel zeigt, daß es in einigen Fällen nötig sein kann, bei der Fortschreibung der Querschnitt-Hochrechnungsfaktoren auch weiter zurückliegende Informationen über das Ausfallverhalten zu berücksichtigen. Im vorliegenden Beispiel war dies die Information über das erwartete Ausfallverhalten der Person j in der Panelwelle (T-1). Jedoch stellt dies kein prinzipielles Hindernis dar, da diese Größen bei der Berechnung der Hochrechnungsfaktoren für die vorhergehenden Panelwellen bestimmt wurden.

Mit der im Beispiel angeführten Methode lassen sich mühelos ähnliche Situationen behandeln. In der Regel wird man es jedoch mit Haushalten zu

tun haben, bei denen die zwei Zugangswege von einander unabhängig sind. In diesen Fällen erhält man analog zu den Ergebnissen von Abschnitt 8:

$$HRF_h(T) = \frac{1}{\frac{1}{HRF_{h_1}(T-1)} + \frac{1}{HRF_{h_2}(T-1)}} f_h(T) \quad ,$$

wobei gilt:

$$1/f_h(T) = P(R_{T,h} = 1/D_{T,h})\, P(K_{T,h} = 1/R_{T-1},h_1)$$

Hierbei ist $HRF_{h_1}(T-1)$ der Hochrechnungsfaktor für den Haushaltsteil h_1 in der vorhergehenden Panelwelle und $HRF_{h_2}(T-1)$ der wiederum zu schätzende Hochrechnungsfaktor für den zugezogenen Haushaltsteil ist.

Die Schätzung von $HRF_{h2}(T-1)$ kann wiederum über den Logit-Ansatz von Abschnitt 8 durchgeführt werden.

Anmerkungen

1) Ein ausführlicher Vergleich des Randomisierungsansatz und der modellbasierten Methoden unter Nonresponse findet man bei Rubin (1983).

2) Üblicherweise wird I (P^*, P) als Informationsverlust gegenüber einer Wahrscheinlichkeitsverteilung P angegeben. Normiert man die Hochrechnungsfaktoren zu 1, d.h. setzt man

$$P_i = \frac{HRF}{N} \quad \text{bzw} \quad P_i^* = \frac{HRF^*}{N} \quad ,$$

so sieht man, daß sich I (P^*, P) von I (HRF^*, HRF) nur um den konstanten Faktor N unterscheidet.

3) Der Ansatz über den minimalen Informationsverlust garantiert allerdings nicht, daß $P(R_{1,i}=1/D_i)$ die Obergrenze 1 einhält. Alternativ hierzu könnte man ein Logit-Modell für $P(R_{1,i}=1/D_i)$ aufstellen, das bezüglich der Merkmale der Randbedingungen nur die Haupteffekte enthält. Dies führt auf das Problem der Parameterschätzung von Modellen bei nur unvollständig bekannten Kontingenztabellen (vgl. Fuchs 1982).

4) Die Definition einer Haushaltsabspaltung bereitet bei einigen Fällen von Haushaltsteilungen Schwierigkeiten, etwa wenn sich ein Ehepaar trennt. Alternativ könnte man die Haushalte untergliedern in solche ohne neue Befragungspersonen und solche mit 1, 2, 3,... neuen Befragungspersonen.

5) Dies kann z.B. dadurch geschehen ,daß man die Ergebnisse über die hier vorgestellte Hochrechnung vergleicht mit Ergebnissen einer alternativen Hochrechnung, bei der die Antwortwahrscheinlichkeiten im Hinblick auf mögliche Frustrationseffekte modelliert werden.

6) Diese Annahme bedeutet keine Einschränkung, da die Gegenwart von Personen ohne Weiterverfolgungsstatus für die Relationen zwischen den Haushalten 1984 und 1985 irrelevant sind.

7) Das Argument für die Benutzung der OLS-Schätzung ist hier das Gauss-Markov-Theorem (vgl. Fahrmeier/Hamerle 1984, S. 88), nach dem die OLS-Schätzung unter allen linearen, erwartungstreuen Schätzfunktionen diejenige mit der kleinsten Varianz ist.

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	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Number of rooms	15*	(2)	13*	(2)	22*	(2)	22*	(2)	13*
Adequacy of living space in housing unit	16*	6*	14*	17*	23*	17*	23*	8*	14*
Characteristics of housing unit	17*	(2)	11*	(2)	20*	(2)	20*	(2)	11*
Type of remodeling within the last year		8*							
Who paid for remodeling		9*							
Whether remodeling was done by the individual or a company		10*							
Housing status: owner or renter	18*	20*	15*	24*	24*	18*	24	9*	15*
<u>Neighborhood</u>									
Distance to center of nearest city				5*	5*				
Accessibility of school, shops, public transportation etc.				6*	6*				
Whether bothersome noise level in neighborhood				7*	7*				
Whether bothersome air pollution				8*	8*				
Social status of the household in comparison with neighbors				9*	9*				
Degree of segregation: How many other non-Germans live in neighborhood				10*	10*				
Nationality of other non-German neighborhood residents (4)				10B*	10B*				
Degree of contact with neighbors				11*	11*				
Whether visits with neighbors socially				12*	12*				
Frequency of social visits				13*	13*				
Degree of satisfaction with neighborhood				14*	14*				
<u>Reference group: renters</u>									
Monthly rent including all utilities except heat and hot water	19*	21*	16*	26*	26*	19*	26*	10*	17*
Monthly costs of heat and hot water				27*	27*	20*	27*	11*	18*
Whether rent is reduced by landlord (e.g., employer or relatives)				25*	25*	(2)	25*	(2)	16*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Reference group: all respondents									
Transfer payments, income and assets of the household in the prior calendar year									
Government housing subsidies: (Number of months received and monthly amount)	28/30*	28*	28*	40*	40*	40*	40*	31*	31*
Number of children for whom governmental child allowance received	31*	33*	33*	45*	45*	45*	45*	36*	36*
Monthly amount of governmental child allowance		33*	33*	45*	45*	45*	45*	36*	36*
Whether social welfare assistence received	32*	29*	29*	41*	41*	41*	41*	32*	32*
Regular subsistance assistence: (Number of months received and monthly amount)	33/35*	30*	30*	42*	42*	42*	42*	33*	33*
Special circumstances assistence: (Number of months received and monthly amount)	36/37*	31*	31*	43*	43*	43*	43*	34*	34*
Whether lump sum assistence	38*	32*	32*	44*	44*	44*	44*	35*	35*
Owner of real estate other than primary dwelling	39*								
Annual gross income from rent received	40/41*	34/35*	34/35*	46/47*	46/47*	46/47*	46/47*	37/38*	37/38*
Annual expenses (mortgage and maintenance) on property from which rents are received	42*	36*	36*	48*	48*	48*	48*	39*	39*
Whether assets other than real estate	43*	37*	37*	49*	49*	49*	49*	40*	40*
Annual gross income from interest and dividends	44/45*	38*	38*	50*	50*	50*	50*	41*	41*
Monthly net income of the household at time of interview	46*	39*	39*	51*	51*	51*	51*	42*	42*

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	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
HOUSEHOLD QUESTIONNAIRE (Respondent: head of household)									
Reference group: all respondents									
Household composition									
Each household member by first name birth year, sex, relationship to head of household, reason for temporary absence from household	1*	AP*	AP*	AP*	AP*	AP*	AP*	AP*	AP*
Total number of persons in household	AP*	AP*	AP*	AP*	AP*	AP*	AP*	AP*	AP*
Change in household composition since the last interview (Wave 1: since January 1 of prior year)	2*	AP*		AP*		AP*		AP*	
Date of formation of household (In wave 1 only for new households since January 1 of the prior year)	3*		AP-		AP-		AP*		AP*
Household members who joined since the prior interview (month and year joined)	4*	AP*	AP-	AP*	AP-	AP*	AP*	AP*	AP*
Household members who have left the household since the prior interview (month and year)	5*	AP*		AP*		AP*	AP*	AP*	AP*
Whether children under 16 years of age in household	6*	1*	1*	1*	1*	1*	1*	1/2*	1/2*
Birth month of children under 16						2*	2*		
Type of school attended, for children under 16 years of age	7A*	2+	2+	2*	2*	3*	3*	3*	3*
Sponser of school/day care facility						4*	4*		
Monthly cost of school/day care facility						5*	5*		
Persons outside the household who care for children						6*	6*		
Nationality of children under 16 years of age for households with non-German heads	7B*							3A+	3A+
Whether any household member requires care by someone else	8*	3*	3*	3*	3*	7/8*	7/8*	4*	4*
Type of care required		4A*	4A*	4A*	4B*	9+	9+	5A*	5a*
Relationship of person providing care		4B*	4B*	4B*	4B*	10+	10+	5B*	5B*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Burden on the household						11*	11*		
If extra help is needed, who should provide the care						12*	12*		
Special costs associated with care						13*	13*		
Level of monthly costs and who pays them						14*	14*		
<u>Housing</u>									
Type of building	AP*	(2)	AP*	(2)	AP*	(2)	AP*	(2)	AP*
Type of institution	AP*	(2)	AP-	(2)	AP*	(2)	AP*	(2)	AP*
Type of neighborhood	AP*	(2)	AP*	(2)	AP*	(2)	AP*	(2)	AP*
Whether plans to move within the next 12 months	12/13*	5-	5-						
Year in which house was built	9*	(2)	9*	(2)	18*	(2)	18*	(2)	9*
Whether dwelling needs repairs	10*	(2)	10*	(2)	19*	(2)	19*	(2)	10*
Year in which occupancy of dwelling began (month is also coded for 'dwellings first occupied after wave 1')	11*	(2)	6*	(2)	15*	(2)	15*	(2)	6*
Main reason for moving			7*		16*		16*		7*
Comparison of new dwelling with prior dwelling			8*		17*		17*		8*
Size of housing unit in square meters	14*	7*	12*	15/16*	21*	15/16*	21*	6/7*	12*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988
		G	B	G	B	G	B	AI
<u>Asset Inventory</u>								
Ownership of dwelling in which one lives								1
Book value of dwelling								1A
Market value of dwelling								1B
Ownership of other dwellings or land								2
Type of dwelling or land owned								2A
Type of dwelling or land owned in country of origin (4)								2A
Market value of dwelling or land								2B
Market value of dwelling or land in country of origin (4)								2B
Owner of agricultural business								3
Size of agricultural business and type of ownership								3A
Type of agricultural business								3B
Business ownership								4
Type of business								4A
Market value of business								4B
Amount of savings								5/5A
Home ownership savings plan								6/6A
Ownership of stocks and bonds								7/7A
Private life insurance for persons in the household (up to 3 policies)								8/8A
Year in which life insurance policy taken out								8B
Original amount of policy								8C
Size of monthly premium								8D
Age of payment in the event of survival								8E
Credit obligations to banks, savings and loan associations, employer or private persons (amount of outstanding debt)								9

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988
		G	B	G	B	G	B	AI
Total value of net assets								10
Total value of net assets in country of origin (4)								10
Inheritance since 1960, person in household receiving the inheritance (up to 3 inheritances)								11/11A
Year of the inheritance								11B
Type of property inherited								11C
Value of inheritance at time received								11D
Type of property ownership between spouses (3)								12A
Contractual arrangement of property ownership between unmarried persons living together (3)								12B
Type of property in country of origin (4)								12

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
INDIVIDUAL QUESTIONNAIRE (Respondents: all household members 16 years and older)									
Reference group: all respondents									
Labor force participation									
Present employment status	8*	9/16*	9/16*	5/16*	5/16*	5/12*	5/12*	5/12*	5/12*
Employment during prior calendar year	36*	55*	55*	55*	55*	55*	55*	50*	50*
Characteristics of extra jobs		3*	3*	3-	3-	3*	3*	3*	3*
Time spent on extra jobs		4*	4*	4*	4*	4*	4*	4*	4*
Type of work done around the house				6*	6*	7*	7*	6*	6*
Estimated value of work done around the house				7*	7*			7*	7*
Estimated cost of materials for work done around the house				8*	8*			8*	8*
Reference group: Those employed at time of interview									
Current job									
Month and year hired by present employer	23*	44*	44*	(1)	35*	(1)	33*	33*	33*
Occupation (ISCO code)	24*	(1)	30*	(1)	30*	(1)	28*	(1)	28*
Whether the present job is the one for which you are specially trained (European job training system)	25*	(1)	31*	(1)	31*	(1)	29*	(1)	29*
Industry (3-digit code)	26*	(1)	33*	(1)	33*	(1)	31*	(1)	31*
Number of employees of the whole firm	27*	(1)	34*	(1)	34*	(1)	32*	(1)	32*
Type of occupation (white-collar, blue collar, self-employed, etc.)	28*	38*	38*	46*	46*	38*	38*	38*	38*
Type of training required for the job	29*	(1)	32*	(1)	32*	(1)	30*	(1)	30*
Regularly scheduled weekly work hours, not including overtime	30*	40*	40*	47*	47*	40*	40*	39*	39*
Average actual weekly work hours, including overtime (overtime pay or comp-time)	31*	41*	41*	48*	48*	41*	41*	40*	40*
Reasons for part-time employment						42*	42*		

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Preferences regarding overtime								43*	43*
Actual overtime hours worked in the last month				49*	49*			41*	41*
Type of compensation for overtime	32*	42*	42*	50*	50*			42*	42*
Overtime allowance, percent				51*	51*				
Preferred weekly work hours		36*	36*	41*	41*	45*	45*	47*	47*
Gross and net wages/ salaries in the last month	33*	43*	43*	52*	52*	44*	44*	44*	44*
Personal commitment to employment		35*	35*	40*	40*			46*	46*
Expectations about future employment		37*	37*			46*	46*		
Chance of finding equivalent employment						47*	47*	45*	45*
Working conditions (13 indicators)		39*	39*			39*	39*		
Duration of employment contract		45*	45*	(1)	36*	(1)	34*	34*	34*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Whether company retirement plan available		46*	46*	(2)	37*	(2)	35*	35*	35*
Whether currently covered by company retirement plan with present employer		47*	47*	(2)	38*	(2)	36*	35*	35*
Whether covered by company retirement plan with a prior employer		48*	48*	(2)	39*	(2)	37*	35*	35*
Number of kilometers to present job (one way)		49*	49*						
Mode of transportation		50*	50*						
Length of time of commute to work (hours, minutes)		51*	51*						
Satisfaction level with commute to work		52*	52*						
<u>Reference group: Those out of labor force/ unemployed and looking for work at the time of the interview</u>									
<u>Most recent job</u>									
Whether ever employed	9*	21-	21-	21-	21-	19*	19*	19*	19*
Reason for leaving most recent job	10*	(1)		(1)		(1)		(1)	
Whether previously employed full time, part time or less	11*	(2)	22*	(2)	22*	(2)	20*	(2)	20*
Beginning/ending years of last job	12*	(2)	21-	(2)	21-	(2)	19*	(2)	19*
Past occupation (ISCO Code)	13*	(2)		(2)		(2)		(2)	
Industry (3-digit code)	14*	(2)	23-	(2)	23-	(2)	21*	(2)	21*
Number of employees of the whole firm	15*	(2)		(2)		(2)		(2)	
Type of occupation (white collar, blue collar, self-employed etc.)	16*	(2)	24*	(2)	24*	(2)	22*	(2)	22*
Type of training and qualifications required for the job	17*	(2)		(2)		(2)		(2)	
<u>Future employment plans</u>									
Whether plans to be employed	18*	17*	17*	17*	17*	14*	14*	14*	14*
When do you plan to be employed	19*	18*	18*	18*	18*	15*	15*	15*	15*
Whether desires full time, part time, etc.	20*	19*	19*	19*	19*	16*	16*	16*	16*
Whether immediately available for work	21*	20*	20*	20*	20*	18*	18*	18*	18*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Chance of finding an appropriate position						13*	13*	13*	13*
Desired net income						17*	17*	17*	17*
<u>Reference group: Continuing responents with job changes since the beginning of prior calendar year</u>									
<u>Job change</u>									
Type, month and year of job/position change		22*		22*		20*		20+	
Month and year last job ended		23*		23*		21*		21*	
Length of time spent on last job (years and months)		24*		24*		22*		22*	
Mode of termination of job		25*		25*		23*		23*	
Reason for leaving most recent job		26*		26*		24*		24*	
Past vs. present job comparisons		27*		27*		25*		25*	
Whether present job better uses skills		28*		28*		26*		26*	
Way in which present job was found		29*		29*		27*		27*	

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Reference group: employed persons 50 years of age and older									
Transition to retirement									
Expected retirement age						48*	48*		
Subjective reasons for retirement						49*	49*		
Would work part-time if compensated for lower wages through early payment of retirement benefits						50*	50*		
If so at what age						51*	51*		
And at what age would you retire fully						52*	52*		
Reference group: all respondents									
Employment history									
Whether registered with unemployment bureau within the last ten years (Frequency and total months)	34*	(2)		(2)		(2)		(2)	
Number of employers within the last ten years	35*	(2)		(2)		(2)		(2)	
Employment history since age 15	62*	(2)	NB(1)	(2)	NB(1)	(2)	NB(1)	(2)	NB(1)
First job									
Age began first job				10*	10*	(2)	NB(16)	(2)	NB(16)
Occupation - first job (ISCO Code)				11*	11*	(2)	NB(18)	(2)	NB(18)
Type of occupation (white collar, blue collar, self-employed etc.)				12*	12*	(2)	NB(17)	(2)	NB(17)
Whether changed occupation (once/more than once)				13*	13*	(2)	NB(19)	(2)	NB(19)
Age at which began working in most recent occupation				13*	13*	(2)	NB(19)	(2)	NB(19)

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
<u>Labor income and transfer payments in prior calendar year</u>									
Months received and average monthly gross amount of:	37/38	57/58	57/58	57/58	57/58	57/58	57/58	52/53	52/53
- wages and salaries									
- self-employment income									
- income from extra job									
- retirement income from own work									
- retirement income through survivors' rights									
- student grant									
- maternity grant (including private insurance payments)									
- unemployment compensation									
- unemployment benefit extension									
- occupation readjustment/ retraining benefit									
- financial help from private individuals									
Bonuses for employees, monthly amount of	39*	59*	59*	59*	59*	59*	59*	54*	54*
- extra (13th) month bonus									
- extra (14th) month bonus									
- additional Christmas bonus									
- vacation bonus									
- commissions, profit-sharing									
- other such income									
Short-time work payment/ Bad weather compensation (number of weeks)	40*	60*	60*	60*	60*	60*	60*	55*	55*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
<u>Retirement and pensions</u>									
Whether receives retirement/pension		10*	10*						
Type of retirement income/pension	41*	11*	11*	61-	61-	61*	61*	56*	56*
Year first received such income		12*	12*	(2)					
Institution from which retirement income/pension is received	41*	13*	13*	61-	61-	61*	61*	56*	56*
Monthly gross amount of retirement income/pension				61*	61*	61*	61*	56*	56*
Whether has voluntarily contributed to retirement/pension fund in prior year (Number of months and monthly amount)	44*	64*	64*	64*	64*	64*	64*	59*	59*
Employer payments to retirement fund if less than 35 hours/week worked						43*	43*		
<u>Health insurance in prior year</u>									
Type of membership	42*	62*	62*	62*	62*	62*	62*	57*	57*
Type of health insurance company or organization (For private coverage: monthly premium and number of persons covered)	43*	63*	63*	63*	63*	63*	63*	58*	58*
<u>Taxes</u>									
Whether taxable income received	45*								
Amount of adjustment to tax withholding	46A*	61*	61*						
Total amount of income tax in previous year	46B*								
Whether taxable income received two years before the year of the interview		66*	66*	66*	66*	66*	66*	61*	61*
Filing status two years before the year of the interview		67*	67*	67*	67*	67*	67*	62*	62*
Total amount of income tax two years before the year of the interview		68*	68*	68*	68*	68*	68*	63*	63*
<u>Support payments</u>									
Support of other persons outside the household (3)	47*	65*	65*	65*	65*	65*	65*	60*	60*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Education									
Whether receiving schooling or training	4*	14*	14*	14*	14*	10*	10*	10*	10*
Type of schooling or training	5*	15*	15*	15*	15*	11*	11*	11*	11*
Highest grade completed (3)	6*	(2)	91*	(2)	94*	(2)	96*	(2)	85*
Type of training received (3)	7*	(2)	92*	(2)	95*	(2)	97*	(2)	86*
Whether qualifying exam or graduation in prior year		53*	53*	53*	53*	53*	53*	48*	48*
Type of qualifying exam or graduation in prior year		54*	54*	54*	54*	54*	54*	49*	49*
Time use									
In hours during weekdays/Sundays for various acitvities	1*	2*	2*	2*	2*	2*	2*	2*	2*
Frequency of recreational activities	2*	7-	7-	9-	9-			9*	9*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Vacation days used in prior year		56*	56*	56*	56*	56*	56*	51*	51*
<u>Health</u>									
Degree to which health hinders daily activities	48*	69*	69*	69*	69*	69*	69*		
Whether chronic health condition	49*	70*	70*	70*	70*	70*	70*	67*	67*
Frequency of doctor visits and type of doctor	50*	71*	71*	71*	71*	71*	71*	71-	71-
Amount of time spent in hospital in prior year	51*	72*	72*	72*	72*	72*	72*	69*	69*
Days not worked due to illness		73*	73*	73-	73-	73*	73*	70*	70*
In treatment of hospital due to occupational accident in last year						74*	74*	71*	71*
Date of visit to rehabilitative spa and who paid for the stay						75*	75*	72+	72+
Percent disability	52*	74*	74*	(2)	74*	6*	6*	66*	66*
<u>Satisfaction</u>									
... with a selection of life circumstances	3*	1*	1*	1*	1*	1+	1+	1+	1+
... with life as a whole (present, past, future)									
. German questionnaire	63*	93*	93*	96*	96*	98*	98*	89-	89-
. Non-German questionnaire	63*	104*	104*	104*	104*				
<u>Politics</u>									
Degree of interest in politics		75*	75*	75*	75*	84*	84*	73*	73*
Worries	54*	77*	77*	77*	77*	89*	89*	78*	78*
Intrusiveness of state	53*	76*	76*	76*	76*				
Degree of government expenditures (3)						85*	85*	74*	74*
Perceived degree of fairness in personal life (3)						82*	82*	79*	79*
Perceived degree of fairness in FRG in general (3)						83*	83*	80*	80*
Agreement with idea of democracy in general (3)						86*	86*	75*	75*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Satisfaction with idea of democracy in FRG (3)						87*	87*	76*	76*
Inglehart scale preference ordering of various political goals	55*	78*	78*	78*	78*				
Party preference	56*	79*	79*	79*	79*	88*	88*	77*	77*
<u>Opinions concerning social security</u>									
Judgement of personal financial security in case of illness, unemployment or old age						76*	76*		
Judgement of financial security of surviving household members in event of death of head of household						77*	77*		
Judgement of burden imposed by health insurance premiums						78*	78*		
Judgement of burden imposed by contributions to retirement funds						79*	79*		
Preferred social security system (3)						80*	80*		
Preferred arrangement for providing old age benefits for spouses (3)						81*	81*		
<u>Social origins</u>									
Whether parents living in household (3)				80*	80*		NB(8)		NB(8)
Birth and death years of parents (3)				80*	80*		NB(8)		NB(8)
Completed education of parents (3)				81*	81*		NB(9)		NB(9)
Type of occupational training of parents (3)				82*	82*		NB(10)		NB(10)

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Whether grew up with one or both parents or other guardian (3)				83*	83*		NB(11)		NB(11)
Labor force participation of parents (3)				84*	84*		NB(12)		NB(12)
Labor force participation of father when respondent was 15 (3)				85*	85*		NB(13)		NB(13)
Type of occupation (father) (white collar blue collar, self-employed etc.) (3)				86*	86*		NB(14)		NB14)
Father's occupation (ISCO Code) (3)				87*	87*		NB(15)		NB(15)
<u>Demographic characteristics</u>									
Sex	57*	85*	85*	88*	88*	90*	90*	81*	81*
Birth year	62*	81*	81*	88*	88*	90*	90*	81*	81*
Marital status	58*	(2)	(2)	89*	89*	91*	91*	82*	82*
Changes in marital status and other personal events in prior calendar year		80*	80*	91*	91*	93*	93*	84*	84*
Marital history		87/88*	87/88*	(2)	NB(4)		NB(4)		NB(4)
Whether living with partner (not married) (3)	59*	(2)		90*	90*	92*	92*	83*	83*
Year began living together with partner				90*	90*	92*	92*	83*	83*
Type of area lived in as a child		82*	82*		NB(5)		NB(5)		NB(5)
Whether still living in area lived in as a child (3)		83*	83*		NB(6)		NB(6)		NB(6)
Year left parental household		84*	84*		NB(7)		NB(7)		NB(7)
Fertility history of women		86*	86*		NB(2)		NB(2)		NB(2)
Second home in West-Germany									
. German questionnaire	60*	90*	90*	93*	93*	95*	95*		88*
. Non-German questionnaire	60*	97*	97*	97*	97*				
Citizenship									
. German questionnaire	61*	89*	89*	92*	92*	94*	94*	88+	87*
. Non-German questionnaire	61*	89*	89*	80*	80*				
<u>Other questions</u>									
Type of driver's licence		5*	5*						
Availability of car		6*	6*						

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
Membership in labor union or professional organization		8*	8*						
Savings plan								64*	64*
Security in old age based on cash or property assets								65*	65*
<u>Subgroup: Non-Germans</u>									
<u>Education</u>									
Whether attended school in Germany and grade completed	6A*	(2)	100*	(2)	100*	(2)	97*	(2)	90*
Whether attended school in another country and grade completed	6B*	(2)	101*	(2)	101*	(2)	98*	(2)	91*
Type of training or qualification received in Germany	7A*	(2)	102*	(2)	102*	(2)	99*	(2)	92*
Type of training received in another country	7B*	(2)	103*	(2)	103*	(2)	100*	(2)	93*
<u>Transfer payments in prior calendar year</u>									
Money sent to native country	47A*	65A*	65A*	65A*	65A*	65A*	65A*	60A*	60A*
Support given to relatives living in Germany but not in household	47B*	65B*	65B*	65B*	65B*	65B*	65B*	60B*	60B*
<u>Demographic characteristics</u>									
Residence of spouse	58*			90*	90*	92*	92*	85*	85*
Land of birth	62*	(2)	98*	(2)	98*	(2)	95*	(2)	88*
Year moved to Germany	63*	(2)	99*	(2)	99*	(2)	96*	(2)	89*
Number and age of children in native country	66*	95*	95*	86*	86*	88*	88*		
Intended length of stay in Germany	67*	96*	96*	87*	87*	89*	89*	77*	77*

	Wave 1 1984	Wave 2 1985		Wave 3 1986		Wave 4 1987		Wave 5 1988	
		G	B	G	B	G	B	G	B
<u>Social origins</u>									
Whether parents living in household				93*	93*		NB		NB
Residence of parents				94*	94*		NB		NB
Year of birth of parents				95*	95*		NB		NB
Completed education of parents				96*	96*		NB		NB
Planned end of employment in Germany						49*	49*		
Plans to return to native country						50*	50*		
Will you be entitled to a pension from the FRG						51*	51*		
<u>Subjective questions</u>									
National identification	64*	90-	90-	81-	81-	83*	83*	76/82-	76/82-
Own judgement of language skills	65*	91*	91*	82*	82*	84*	84*		
Whether contact with Germans		92*	92*	83*	83*	85*	85*		
Whether visited Germans in their homes within the last 12 months		93*	93*	84*	84*	86*	86*		
Whether visited at home by Germans within the last 12 months		94*	94*	85*	85*	87*	87*		
Nationality of cooking practices in the household								78*	78*
Nationality of newspapers read								79*	79*
Nationality of music listened to								80*	80*
Gender of persons in circle of friends								81*	81*
Family ties to circle of friends								81*	81*
Nationality of circle of friends								81*	81*

Legend

A Coversheet for "old" households, household questionnaire for households that didn't move since the last interview, or individual questionnaire for reinterviewed persons.

B Coversheet for "new" households, household questionnaire for households that moved or split off, or individual questionnaire for new respondents.

AP Coversheet.

VB Household questionnaire 'Asset Inventory'.

NB Biographical data obtained for persons who entered the sample after the wave in which the data was originally collected.

* Question wording is virtually identical. Slight changes were made for technical reasons.

+ Question wording is somewhat different; although variables are still comparable.

- The question was altered conceptually; comparability is restricted.

(1) These questions were asked only of those individuals with job changes in the prior year. For individuals without job changes, identical variables are available from the previous year's data.

(2) The variables are available in the previous waves.

(3) Not asked in non-German questionnaire.

(4) Not asked in German questionnaire.