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PANEL ATTRITION IN SURVEY DATA: A LITERATURE REVIEW

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Social Surveys Unit

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Panel Attrition in Survey Data: A Literature Review

Panel studies, where the same individuals or households[1] are interviewed at multiple points in time, have a number of advantages over cross-sectional studies for the study of certain social phenomenon. For example, cross-sectional data may document a constant unemployment rate over two periods of time, but will render no information content regarding whether bouts of unemployment are cyclical, with the same proportion of individuals transitioning in and out of the job market within the time period, or whether unemployed status is a chronic condition for a select group of individuals. In a similar vein, panel data allows researchers to examine the nature of poverty: is poverty a temporary occurrence, or is there perhaps a perpetual "underclass" for which poverty is a permanent, even inter-generational, phenomenon? By collecting information on the same individuals and households across periods, panel data give social science researchers the opportunity to explore what social, economic, individual, and household-level characteristics operate to sustain or perpetuate poverty.

Additionally, panel data gives social science researchers the opportunity to study life cycle transitions, including school-to-work, family formation, adolescence to adulthood, and retirement. Interviewing the same individuals and households multiple times allows researchers to examine the factors that condition the choices people make during such transitions, and how these choices impact their futures. In developing countries, the informational value of panel data is particularly great. Many of these countries are undergoing rapid demographic, social, political, and economic transformation. The use of panel analysis in developing countries can enhance our somewhat limited understanding of how these diverse environmental factors influence the shape and trajectory of transition in the lives of individuals.

However, panel surveys often suffer from a high degree of sample attrition between survey waves, a phenomenon that may have negative consequences for the informational content of a study. Attrition can be conceptualized as the combination of three cumulative factors: mortality, migration between waves, and survey non-response. In developed countries, the issue of non-response is often of greater concern for researchers, and is often a problem for cross-sectional as well as panel data collection. Many studies have documented the

[1] This paper does not consider panel studies of firms, but many of the points made about panels of individuals or households apply also to panels of firms.

inverse relationship between the likelihood of survey response and income. In developed countries, the high opportunity cost of time amongst relatively affluent people may make many potential respondents reluctant to participate in a study. Contrastingly, migration-related attrition is less likely to be a serious issue, as communications and information networks in developed countries enables fieldworkers to locate most respondents who have changed residence between waves.

Researchers in developing countries generally have the reverse problem. Experience has indicated that non-response is generally very low in developing countries, both in cross-sectional and panel surveys. However, the issue of migration-related attrition is much more problematic. Due to the relatively poor communications infrastructure, the costs of tracking respondents who have moved residence can seem prohibitively high. While in developed countries, survey respondents are often a phone call away, tracking movers in developing countries may require considerable ingenuity, time, and resources on the part of both researchers and fieldworkers.

In addition, tracking respondents in developing countries is further complicated by many of the underlying processes of development: growth and industrialisation are often associated with higher levels of socio-economic mobility and the increased prevalence of long-distance migration, often from rural to urban settings. Thus, as a result, some panel studies in developing countries have opted not to follow respondents who have moved. These "rooftop" surveys drop from the sample respondents who have moved between survey waves, making no effort to track movers to their new residences.

However, the failure to track movers will result in the systematic exclusion of a sub-group of the population. Movers are likely to possess a specific set of characteristics, and their exclusion from the survey will result in a loss of information. For example, residential mobility may be linked to upward socio-economic mobility, particularly in the context of rapid economic growth and the creation of new economic opportunities. Contrastingly, it may be that adverse shocks such as an AIDS-related sickness or death, the loss of employment of a primary breadwinner, or the dissolution of a marriage, induce migration. Failing to track movers will circumscribe the ability of researchers to analyze these dynamics. Indeed, in South Africa, research has suggested that the death of the primary breadwinner as a result of the AIDS virus may result in the dissolution of the household. Without the ability to track movers, these dynamics are difficult to ascertain. Thus, particularly in developing countries, the ability to examine the dynamic behaviour of movers may be of significant value to social science research. Whether large-scale attrition matters for researchers using the data depends on the particular objectives of the study, the social, economic and

demographic context, and the particular patterns of migration of the population of interest.

Another issue associated with attrition is the problem of sample selectivity. Failure to track respondents to new residences has resulted in an attrition rate as high as 50% in some studies, which may have significant consequences for the representativeness of the panel. If the attrition is random, then a high rate of attrition may not have any significant consequences. However, attrition is often non-random and selective on certain characteristics, which may result in attrition bias in subsequent regression analyses. Differences between the attriting and non-attriting sample can result in biased parameter estimates if the differences are systematically related to a variable of research interest. For example, if residential mobility of female-headed households is positively associated with a lower number of children, then the failure to track respondents through residential moves will result in the under-representation of women with lower fertility rates. Subsequently, regression models based solely on the non-attriting sample, in which fertility is a variable of interest, may lead to incorrect coefficient estimates, particularly if the attrition rate is high. Thus, to prevent large-scale attrition, some studies in developing countries have undertaken the task of tracking respondents who have moved to new residences, despite the additional cost associated with the tracking process. The tracking of respondents to new residences can significantly decrease the rate of attrition, and thus may reduce the potential for selection bias.

This paper will examines the problem of attrition in panel studies, and the different sets of methodological issues facing researchers in developed and developing countries. In particular, the study explores he hypothesis that attrition is contingent on certain specific community, household, and/or individual level characteristics, and examines options for reducing the impact of attrition through tracking. The study reviews the existing literature on panel data and attrition, examines the question of selectivity and attrition bias, and documents various techniques employed by researchers to reduce attrition.

Panel Studies and Attrition in Developed Countries

Researchers conducting panel studies in developed countries are likely to experience a somewhat different set of methodological problems from those conducting panel studies in developing countries. As already mentioned, the more comprehensive communications and information infrastructure in developed countries lowers the costs associated with tracking respondents

between waves. Thus, panel attrition in developed countries is generally more a function of non-response, as it is related to the inability to find respondents who have moved between waves. However, the experience of panel studies in developed countries can nonetheless offer insights into the social, demographic, and economic factors related to attrition, as well as methodological issues associated with the tracking process, the problem of selectivity and attrition bias, and the impact of selectivity on ensuing attempts to model economic behaviour.

Panel studies in developed countries vary considerably with respect to sample size, duration, study objectives, and study design. Many national panel studies have the objective of examining broad social, demographic, and economic dynamics in the particular country. Surveys can have the individual, the household, or a parent-child or spousal pair as the primary unit of study. Cohort studies, such as the Health and Retirement Survey and the National Longitudinal Study of Youth, focus on the experience of a particular sub-group of society by selecting respondents who fall within a certain cohort, or age group, at the beginning of the study. Some panel studies, such as the Panel Study of Income Dynamics and the British Household Panel Study, are indefinite life panels, in which children of the original sample households are automatically added to the sample and followed in all subsequent waves. This allows researchers to study long-term dynamics such as inter-generational poverty.

Some rotating labour force surveys, such as the Spanish Labour Force Survey and the Current Population Survey, give researchers the opportunity to study short-term dynamics such as entry and exit into the labour market. Though many researchers use these surveys to conduct cross-sectional analyses, some also exploit the rotating nature of the surveys to match individuals across waves and thus conduct panel analysis. Table 1 below gives a summary of some of the major longitudinal studies undertaken in developed countries, many of which will be discussed in more detail later in the analysis.

Table 1: Panel studies in developed countries

Survey	***Sample***	***Survey Design***	***Survey Objectives***	***Reference***
United States: Panel Study of Income Dynamics (**PSID**)	4800 households in 1968, growing to more than 7000 households in 2001 through the inclusion of "split-offs"	Indefinite life panel-children of the household are automatically added to the sample Annually from 1968-1996, biennially thereafter	Focuses on dynamic aspects of economic and demographic behaviour, but has over the years been expanded to include broad social and psychological measures	Institute for Social Research at the University of Michigan http://www.isr.umich.edu/ src/psid/
United States: Survey of Income and Program Participation (**SIPP**)	Sample size varies from 14,000 to over 40,000 households, depending on the panel (panels in 1984-1993, 1996, 2001)	Series of national household panels, length ranging from 2.5 to 4 years in duration, beginning in 1984 Each panel interviewed every four months	To provide detailed information on income, taxes, assets, liabilities, and participation in government transfer programs	US Bureau of Labour Statistics http://www.bls.census.gov/sipp/
United States: Health and Retirement Survey (**HRS**)	Initial sample of 12,600 individuals in 1992, growing to 22,000 individuals by 1998 through inclusion of additional birth cohorts	Cohort panel Biennially from 1992 onwards	To provide information on aspects of ageing, including physical and mental health, insurance, financial status, labour market status, retirement, and family support systems	Institute for Social Research at the University of Michigan http://hrsonline.isr.umich.edu
United States: National Longitudinal Survey of Youth (**NLSY**)	Two panels: 12,686 young adults who were between the ages of 14-22 in 1979; 9000 young adults between the ages of 14-22 in 1997	Cohort panel of 20 years duration Annually, 1979-2000	Focus is on labour force behaviour; also information on education, health, sexual activity, marital and fertility behaviour, and substance abuse	US Bureau of Labour Statistics http://www.bls.gov/nls
United States: Current Population Survey (**CPS**)	50,000 households	Short-term rotating panel; households interviewed monthly for 4 months, rotated out for 8 months, then interviewed again for 4 months	Provide information on labour force behaviour and short-term labour market dynamics	US Bureau of Labour Statistics http://www.bls.gov/cps

Table 1: Panel studies in developed countries continued…

Survey	***Sample***	***Survey Design***	***Survey Objectives***	***Reference***
United States: National Education Longitudinal Studies (**NELS**) The National Longitudinal Study of the High School Class of 1972 (**NLS-72**) High School and Beyond (**HS&B**) National Education Longitudinal Study of 1988(**NELS: 88**).	Approximately 20,000 high school seniors 12,000 individuals in two cohorts, 1980 sophomore and 1980 senior classes 15,000 eight-graders	Cohort panels 1973, 1974, 1976, 1979, and 1986 Biennially, 1980-1986, 1992 Biennially, 1988-2000	To study the educational, vocational, and personal development of young people beginning with their elementary or high school years, and following them over time as they begin to take on adult roles and responsibilities	National Centre for Educational Statistics http://www.nces.ed.gov/surveys
United Kingdom: British Household Panel Survey (**BHPS**)	5,000 households and 10,000 individuals	Indefinite life panel: children of the household are automatically added to the sample Annually, 1990-present	To provide information social and economic change at the individual and household level	Institute for Social and Economic Research http://iserwww.essex.ac.uk/bhps
Netherlands: Dutch Socio-Economic Panel (**ISEP**)	5,000 households, or approximately 10,000 individuals	Indefinite life panel- children of the household are automatically added to the sample Twice annually, 1984-1989 Annually 1990-present	Basic information on social and economic conditions, and self-reported measures of well-being, possession of durable goods	Statistics Netherlands http://center.kub.nl/research/facilities/sep.html
Spanish Labour Force Survey (**EPA**)	64,000 households and approximately 150,000 adults	Rotating quarterly panel of 1.5 years duration Quarterly	Provides information on short-term employment and labour market trends in Spain	Jiminez-Martin and Peracchi, 2002

Table 1: Panel studies in developed countries continued…

Survey	***Sample***	***Survey Design***	***Survey Objectives***	***Reference***
French Household Panel (**ESEML**-Enquête Socio-Economique auprès des Ménages Lorrains)	Approximately 2,000 households and 7,000 individuals living in the Lorraine region	Annually, 1985-1990	Household composition and demographic characteristics of each individuals, housing, income, education, employment, life events	CEPS / INSTEAD http://www.ceps.lu/paco/pacofrpa.htm
Luxembourg Household Panel (**PSELL** -Panel Socio-économique "Liewen zu Lëtzebuerg")	Approximately 2,000 households and 6,000 individuals	Annually, 1985-1992	Demographic characteristics, income, consumption, savings, debt, education, employment, public transfers, medical consumption	CEPS / INSTEAD http://www.ceps.lu/paco/pacofrpa.htm
Italy: Survey of Household Income and Wealth (**SHIW**)	8,000 households total, approximately 4,000 households in panel	Biennial cross-sections with panel component; since 1995, new household units formed by persons leaving original households also included Biennially, 1989-present	Provides information on basic demographic and economic variables, with a focus on consumption, savings, and wealth	Bank of Italy http://fmwww.bc.edu/ecp/data/bkital/bankitalia.html

Tracking to Reduce Attrition

In developed countries, most panel studies employ mechanisms in order to ensure that individuals and/or households that attrit between waves are not lost to the sample. As the communications infrastructure in developed countries is comprehensive and information networks are well defined, the problem of tracking respondents from wave to wave is vastly simplified. Using telephone directories, administrative records obtained from various public and private institutions, and the internet, fieldworkers can track down most respondents who have moved between waves, at a relatively low cost. Nonetheless, panel studies vary significantly with respect to attrition rates. This variation is attributable to a number of survey-specific reasons such as characteristics of the target population, survey design, and the quality of field teams, but also as a result of the level of commitment to tracking respondents, and the particular procedures employed to locate respondents lost between waves.

The National Longitudinal Survey of Youth (NLSY) is a panel survey that has been particularly successful at minimizing attrition despite its long duration. The NLSY79 panel, with a base-year sample of 12,686, was re-interviewed annually for twenty years. Despite the potential for large-scale attrition over such a long period, attrition rates for the NLSY79 are impressively low. For the first five waves, the attrition rate hovered at around 5%. (US Department of Labour, 1999:29). After ten waves of the study, the re-interview rate was 90.2% of base-year respondents that remained eligible[2]. By the 18th wave of the panel, the retention rate had dropped to 84.3%. The relatively low rate of attrition in the NLSY79 can be attributed to survey design, and to the extensive tracking procedures implemented by fieldworkers and staff of the chartered institution, the National Organisation for Research at the University of Chicago (NORC).

The design of the NLSY is such that interviewers in each wave attempt to re-interview all baseline respondents, thus resulting in reduced attrition. If a respondent was not interviewed in any given wave, due to unavailability or refusal, the respondent is nonetheless contacted in all subsequent waves. Over 95% of all eligible base-year respondents participated in nine waves or more, and less than 1% of respondents participated in less than four waves (*ibid*: 34). Thus, despite the fact that the attrition rate in 1998 was 15.7%, many of those respondents had been interviewed in a number of other waves. This policy of re-contacting all base-year respondents has a significant effect on reducing the

[2] Retention rate is defined as the percentage of base-year respondents within each sample type remaining eligible, who were interviewed in a given survey year. It excludes those individuals who were dropped for sampling reasons. Included in the eligible sample are deceased and difficult-to-field respondents whom NORC did not attempt to contact.

loss of informational content arising from attrition. Furthermore, the NLSY interviews are conducted face-to-face instead of over the phone, which may have the effect of creating a greater sense of respondent ownership of and attachment to the survey, thus lowering non-response.

Additionally, NLSY respondents are paid for their participation, $10 per completed interview from 1979 to 1994, and $20 in waves thereafter (*ibid*: 25). This tactic may also have the effect of reducing attrition, although it is difficult to determine the scale of the impact of monetary incentives on survey response. Finally, fieldworkers at NORC employ an active "conversion strategy" to persuade those respondents who refused to participate to change their minds. Supervisors or "conversion specialists" at the NORC office write letters tailored for each respondent who refused, addressing the specific concerns of the respondent and reinforcing the importance of his/her participation in the study. This conversion strategy reduces refusals by anywhere from 33 to 50% in the different waves of the study (*ibid*: 25).

Furthermore, the extensive tracking procedures implemented by NORC helps to minimize attrition. Two weeks prior to the date of interview, respondents receive an update letter reminding them of the upcoming interview, and offering a toll-free number, website, and project e-mail address in order to give them the opportunity to ask questions or send updated contact information. At the end of each wave of data collection, respondents are supplied with a thank-you letter and an address update postcard, which includes return postage pre-paid, so that respondents can notify NORC of any residential moves and changes in contact information (including email addresses).[3] Between panel waves, respondents are mailed a newsletter or a press release notifying them of the significant uses of the data from the NLSY and reminding them of the importance of the contribution they make by participating.[4] Changes of address noted from the postal returns of these letters are also used to update contact information.

During the field period, interviewers are given locator sheets containing current contact information, information for two or three other individuals who might be able to reach the respondent if he/she has moved (relatives, friends, employers, teachers), work details and contact information, and information on any plans or intentions to move. Fieldworkers are responsible for interviewing all respondents in their caseloads, tapping into additional resources where necessary in order to locate respondents (post offices, department of motor vehicles, directory assistance, contact information of relatives and friends) (US Department of Labour, 1999: 24).

[3] Correspondence with NLSY79 survey director, 7/3/03, Kymn Kochanek
[4] ibid

In the event that efforts at the local level fail, cases are forwarded to NORC's locating office, where locating specialists can use hard copies of the interviews to access additional locating information. In addition to the techniques employed by the fieldworkers, the locating specialists may also conduct web searches, check voter registration records, jails and prison records, death certificates, and college/university enrolment records.[5] The vigorous application of these procedures reduces attrition considerably. The average number of respondents that cannot be located is 174 over the 18 waves, or around 1-2% of the entire eligible sample, depending on the year. Refusals account for a much greater proportion of attritors than those who cannot be located. The average number of respondents who refuse to participate is 447 over the 18 waves.

Similarly, the National Educational Longitudinal Study (NELS) implemented a number of effective measures designed to minimize migration-related attrition. The first wave of the NELS survey was in 1988, interviewing a school-based sample of 20,000 8th graders. By 1994, most of the cohort had graduated and been out of school for two years, and had either entered the workforce or were pursuing post-secondary education. The next follow-up occurred in 2000, after the cohort members had been out of school for eight years. For both of these follow-up waves, intensive locating efforts helped to minimize attrition. Locating activities involved three different stages: advance locating conducted before the start of the interviewing, intensive location during field operations, and field locating conducted on site by specially trained field personnel (US Department of Education, 2002: 127).

In the first phase, locating information for sample members obtained from prior survey rounds was entered into a database; this included sample members' home and school addresses and telephone numbers, contact information for several relatives and friends, driver's licence and Social Security numbers, and information regarding the high school and post-secondary schools the students had attended. Telephone numbers and addresses were submitted to Telematch, a commercial database that maintains address and telephone number changes, in order to update any changed information. Advance letters were then mailed to the sample members and their parents, explaining the purpose of the study and informing them of the upcoming interview (*ibid*: 128).

Most individuals were found during this first stage of tracking; however, a large proportion of certain subgroups, such as American Indians and high school dropouts, required additional tracking efforts. The first step involved contacting next of kin and other contacts obtained from prior rounds of data collection. The second tier involved using commercially available person-locating

[5] Correspondence with NLSY79 survey director, 7/3/03, Kymn Kochanek

databases, as well as credit-history databases, which contain telephone listings and current addresses for consumers who had any credit history. Tracking specialists also consulted the department of motor vehicles in selected states, as well as military records and death certificates; the US Department of Education's National Student Loan Data System, a directory of student financial aid recipients, was also searched. For those individuals who still had not been located, specially trained personnel were sent into the field. Tracking information employed at this phase included information from post-secondary and high schools, past or present employers, social service agency records, government offices, public libraries, the US Postal Service, and departments of motor vehicles (*ibid*: 129).

The concerted efforts of researchers to track movers undoubtedly helped to keep the attrition rate of the NELS follow-up rounds low by comparison to other panel surveys. Like the NLSY, NELS is a cohort study, in which tracking is more difficult than in a household panel study, because of the need to locate and re-interview a particular individual instead of the somewhat easier task of locating any member of the sample household. Furthermore, like the NLSY, the target population of the NELS is youth and young adults, a group likely to have a higher incidence of migration than the population at large. Especially in the two post-school waves, one would expect tracking to be particularly difficult. In this period, many young adults embark on important life course transitions, such as finding employment, enrolling in tertiary education, or starting a family. These decisions are likely to result in increased mobility, a factor complicating the tracking process.

Thus, the third and fourth follow-up of the NELS occurred two and eight years after the cohort graduated from high school, when mobility related to life course changes is undoubtedly high. Indeed, almost 30% of the sample in the first post-school follow-up required tracking and locating efforts (*ibid*: 3-7). Despite these difficulties, NELS researchers were able to keep attrition remarkably low. In the first post-school follow-up (the third follow-up overall), six years after the base-year survey and two years after graduation from high school, the attrition rate was 9.1%. In the second post-school follow-up (the fourth follow-up overall and eight years after graduation), the attrition rate was 17.3%, an impressively low rate considering the time lapse of twelve years.

Table 2 documents the attrition rates of various developed country panels. The attrition rates of the NELS and the NLSY are indeed quite low in comparison with a number of other panel studies in developed countries. Both the NLSY and the NELS are cohort studies; one would expect the attrition rates for such studies to be higher than that of household panel studies. Thus, the low attrition rates are particularly striking in comparison to some of the other panel surveys.

Attrition rates vary from a low of 0.87% average attrition per annum for the NLSY, to a high of 13.6% average attrition per annum for Current Population Survey (CPS) in the US and 19.8% average attrition per annum for the Spanish Labour Force Survey (EPA), both of which are rotating surveys that do not track movers to new residences.

The CPS and the EPA are not expressly designed for panel analysis, and so the high attrition rates in the surveys may not be of significant consequence for researchers. Even for those researchers who seek to match samples across rotations to conduct panel analysis, attrition may not be a significant concern. Both the CPS and the EPA have extremely large sample sizes (50,000 and 64,000 households respectively), and are of short duration (both surveys last under two years in total). However, for most panels, which are of longer duration and smaller sample size, large-scale attrition may indeed have significant consequences for the representativeness of the sample, as well as the confidence with which one can establish statistical relationships among variables due to diminished sample size.

Table 2: Attrition rates in developed countries panel studies

Survey	***Survey Interval***	***Attrition Rates***		***Reference***
		Immediate	***Long-term***	
United States: Panel Study of Income Dynamics (**PSID**)	Annually from 1968-1996, biennially thereafter.	11.9% household attrition after 1st follow-up;	51% household attrition after 21st wave	Fitzgerald, Gottschalk, and Moffit, 1997 Zabel 1998
United States: Survey of Income and Program Participation (**SIPP**)	Series of national household panels, length ranging from 2.5 to 4 years in duration, beginning in 1984. Each panel interviewed every four months.	SIPP84: 5.9% household attrition after 1st follow-up SIPP90: 7.6% household attrition after 1st follow-up	SIPP84: 28.6% household attrition after all eight waves SIPP90: 26.6% household attrition after all eight waves	Zabel, 1998
United States: Health and Retirement Survey (**HRS**)	Cohort Panel Biennially from 1992 onwards	10.9% after first follow-up	18.2% after 5th wave	Institute for Social Research http://hrsonline.isr.umich.edu/
United States: National Longitudinal Survey of Youth (**NLSY**)	Cohort panel of 20 years duration Annually, 1979-2000	4.3% after first follow-up	15.7% after 18th wave	US Bureau of Labour Statistics www.bls.gov/nls NLSY79 User's Guide
United States: Current Population Survey (**CPS**)	Series of short-term rotating panels; households interviewed monthly for 4 months, rotated out for 8 months, then interviewed again for 4 months.	1990 panel: 12% household attrition after 1st rotation (4th wave). 1980 panel: 11% household attrition after 1st rotation (4th wave)	1990 panel: 14.8% household attrition after 2nd rotation (8th wave) 1980 panel: 18.1% household attrition after 2nd rotation (8th wave)	US Bureau of Labour Statistics www.bls.gov/cps Peracchi and Welch, 1995

Table 2: Attrition rates in developed countries panel studies continued…

Survey	***Survey Interval***	***Attrition Rates***		***Reference***
		Immediate	***Long-term***	
National Education Longitudinal Study of 1988 (**NELS: 88**)	Cohort Panel Biennially, 1988-2000	1st follow-up (1994) after cohort graduated from school (previously a school-based sample): 9.1%	2nd post-school follow-up (2000), 8 years after cohort graduated from high school: 17.3%	National Centre for Educational Statistics www.nces.ed.gov/surveys Methodology Report: NELS 1988-1994, March 1996
High School and Beyond (**HS&B**)	Cohort Panel Biennially, 1988-2000	11.1% of respondents "monotone" participants, who left the sample and did not return 7.4% were "nonmonotone" participants	22% of respondents missed one or more of the 4 waves of the study	National Centre for Educational Statistics www.nces.ed.gov/surveys
United Kingdom: British Household Panel Survey (**BHPS**)	Annually, 1990-present	13.6% individual attrition after 1st follow-up	37.2% individual attrition after 10th wave	Institute for Social and Economic Research http://iserwww.essex.ac.uk/ bhps
Spanish Labour Force Survey (**EPA**)	Rotating quarterly panel of 1.5 years duration Quarterly	14.3% average individual attrition after 1st follow-up (average of attrition rates of all panels between sample period 1987 to 1997)	29.7% average individual attrition after 6th wave	Jiminez-Martin and Peracchi, 2002
Luxembourg Household Panel (**PSELL** -Panel Socio-économique "Liewen zu Lëtzebuerg")	Annually, 1985-1993	15.3% household attrition after 1st follow-up	47.6% household attrition after 8th wave	CEPS / INSTEAD http://www.ceps.lu/paco/pacofrpa.htm
French Household Panel (ESEML-Enquête Socio-Economique auprès des Ménages Lorrains)	Annually, 1985-1990	12.8% household attrition after 1st follow-up	23.1% household attrition after 6th wave	CEPS / INSTEAD http://www.ceps.lu/paco/pacofrpa.htm

Panel Selectivity

Perhaps the most well-known and longest-running panel study is the Panel Study of Income Dynamics (PSID), which was begun in 1968 at the University of Michigan in an attempt to understand transitions into and out of poverty in the United States. Though the data has been used widely to model economic behaviour, only a few studies have analyzed the issue of attrition in the PSID (Fitzgerald, Gottschalk, and Moffit, 1997; Zabel, 1998). The inclusion of "split-off" families has helped PSID maintain representativeness over its lifespan (Fitzgerald *et al*, 1997). Nonetheless the issue of attrition merits closer examination: the attrition rate for the sample in the first follow-up wave was 11.9 percent and by the 21st wave, only 48.8 percent of the original sample had been present for all waves of the survey (Zabel, 1998: 2). After accounting for deaths, the attrition rate over the 21 waves falls to 45% of the baseline sample (Fitzgerald *et al*, 1997: 6).

As mentioned above, attrition in panel studies is often attributable to two main factors: the inability to follow respondents who have moved between waves, and survey non-response. In most panel studies in developed countries, the latter problem poses a greater obstacle to maintaining panel representativeness, while following movers is facilitated by the availability of well-articulated communications and information networks. This has indeed been the case for the PSID, as the effect of nonresponse outweighs the significance of the effect of attrition due to the inability to track movers successfully. For the first follow-up wave, 9.9% of the sample attrited as a result of non-response, while only 1.6% of the sample had moved and were unsuccessfully tracked to new residences (*ibid*: 58). Though non-response levels off significantly after the second wave, the average effect of non-response over 21 waves of the survey is still 2.1% of the base-year sample, while attrition as a result of migration averages around 0.6% of the sample (*ibid*: 58).

Fitzgerald, Gottschalk, and Moffit find that attritors are more likely to receive government assistance, less likely to be married or older, and more likely to be non-white (*ibid*: 26). Additionally, they have lower levels of education, work fewer hours, earn less labour income, and are more likely to rent rather than own their own homes (*ibid*: 26). The implications of this pattern seem to be that attritors are concentrated largely at the lower end of the socio-economic continuum. However, the variance of labour income is greater for attritors, and the income distribution is actually more dispersed at the higher end of the income spectrum for attritors, suggesting that some high labour income households possess a greater propensity to attrit as well. Probits for attrition using base-year values confirm this non-linear relationship; even when

controlling for a number of different socio-economic factors, attrition probabilities are greater at high and low income levels for male-headed households, and lowest at the middle of the income distribution *(ibid*: 29). Additionally, the authors explore dynamic attrition by using lagged values over all 21 waves of the survey to estimate attrition hazards during 1989. They find that men who have more unstable histories (greater variability with respect to labour income, marital state, and migration behaviour) are more likely to attrit from the sample. They also find that shocks, such as a drop in earnings, marriage dissolution, or geographic move, increases the probability of attrition in the subsequent wave (*ibid*: 52).

Despite this evidence for selective attrition, the authors find that the PSID sample remains largely representative of the US population. For regressions on earnings, marital status, and welfare participation, the authors find that differences in regression coefficients using the PSID and the Current Population Survey (CPS) data are usually small, and by the 1989 wave are not statistically different. The authors conjecture that the absence of attrition bias is probably a result of the tendency of differences in the values of time-variant characteristics (such as age, marital status, income, education) between attritors and non-attritors to converge over time (*ibid*: 38). For example, the authors note, the initial bias towards highly educated men in the PSID is offset by a slower rate of growth of education over the life cycle among non-attriting individuals in the PSID than in the CPS; similarly, an initial selection on married men in the first wave of the PSID is partly offset by a more rapid decline in marriage rates in the PSID than in the CPS (*ibid*: 38). Furthermore, for all the probit equations, the predictive value of explanatory variables is consistently small (low R-squared values), which may be why selective attrition does not result in measurable attrition bias (*ibid*: 41). However, the authors caution that the presence or absence of attrition bias is likely to be model-specific.

Zabel compared the labour-market behaviour of attritors and non-attritors in both the PSID and the Survey of Income and Program Participation (SIPP). Zabel's study uses the 1984 and 1990 panels of the SIPP, with the corresponding completion rates of 71.4 and 73.4 percent, respectively, and the first 21 waves of the PSID (Zabel, 1998: 6). In examining the determinants of attrition, Zabel first examines the means for a variety of geographic, economic and social variables by attrition status for the first wave values. For both the PSID and the SIPP, he found that individuals who left the survey were more likely to reside in urban locations, live in the South or West, be non-white, be unmarried, not own homes, and have fewer children than the individuals who remained in the survey (Zabel, 1998: 6). However, in estimating a model for attrition, Zabel finds that most of these demographic factors have a limited impact on attrition, with the

exception that home ownership and labour force participation are negatively correlated with attrition, and blacks are more likely to attrit than whites.

Zabel also found that a number of interviewer characteristics and aspects of the interview process have significant impacts on attrition. Interview length has a positive impact on attrition, likely due to the fatigue and loss of interest resulting from repeated long interviews. Using the same interviewer across all waves of a panel survey is negatively associated with attrition, due to the rapport built between the respondent and interviewer over repeated waves. Furthermore, they find that the duration of interviews is negatively associated with completion rates if the interview is longer than 90 minutes, though the overall effect is small in magnitude. Finally, Zabel finds that a higher frequency of interviews is likely to lead to higher attrition rates, probably a result of the issue of time constraints: a higher frequency allows less time for repeat attempts to get an interview if and when the first attempt is unsuccessful.

Zabel subsequently models labour supply behaviour using both the PSID and the SIPP, in order to investigate whether the behaviour of attritors is substantively different from that of the non-attritors. He finds that the estimated parameters for the models using the sub-sample of attritors and non-attritors separately are significantly different; the estimate of wage elasticity for the attriting sub-sample is greater, indicating that the attritors are more responsive to changes in wages (*ibid*: 9). Thus, there is evidence that the labour market behaviour of attritors and non-attritors does differ qualitatively. However, parameters for a model of attrition and labour supply behaviour using the combined sample of attritors and non-attritors differs only slightly from the parameters using the non-attriting sample alone. This contrary result probably arises because there are relatively few observations where attrition occurs, and thus attrition bias may be hard to detect (*ibid*: 11).

Similarly, authors of a study of the National Longitudinal Study of Youth (Gritz, MaCurdy, Mroz, 1994) provide some evidence that the labour market behaviour of attritors and non-attritors is substantively different. The attrition rate in the National Longitudinal Study of Youth (NLSY) is extremely low, considering that the length of the panel is over twenty years; attrition rates for the first ten waves hovered at around five per cent of the eligible sample, and even after eighteen waves the attrition rate was only 15.7%. As in the PSID, a larger proportion of attrition is attributable to non-response, while difficulty in locating respondents accounts for a smaller proportion. In the 1998 wave, non-response accounted for 46% of those individuals who were not interviewed, while around 17% of attrition resulted from the inability to locate a respondent. In examining the selectivity of attrition, the authors found that attritors come disproportionately from the lower end of the income and wealth distribution and

thus exhibit less labour force attachment. However, they did not conclude that this selectivity will necessarily result in biases of consequence for subsequent behavioural models using the NLSY data. Because the overall rate of attrition in the NLSY is relatively low, the selectivity of attrition is unlikely to result in large changes in estimated coefficients.

Like the National Longitudinal Study of Youth, the High School and Beyond Longitudinal Study (HS&B) seeks to examine education and employment outcomes of American youth. A large majority of the original sample, 78 percent, were present for all waves of the study, while 11.1% were "monotone" participants who left the sample permanently, and 7.4% were "non-monotone" participants who left the sample at one point but returned in a later wave. In a study of attrition in the HS&B, Burkam and Lee (1998) model the determinants of attrition and find that students of non-English speaking households are more vulnerable to attrition, both monotone and non-monotone, while academic-track students (i.e. those who are college-bound) are less likely to attrit. Furthermore, they find that being black is positively associated with attrition, while female students are less likely to attrit than males. Students from the Northeast and West are more likely to attrit than students of other regions, and rural school location is negatively associated with attrition. Finally, students who exhibited more item non-response in the original base-year survey, both in the survey and the aptitude tests, are more likely to attrit, suggesting that students who are less attentive and conscientious in completing the original survey are more vulnerable to attrition in subsequent waves of the study.

Burkam and Lee go on to investigate the potential bias resulting from panel attrition. They find that coefficients for models of demographic effects on achievement, and demographic effects on educational aspirations, differ significantly for the separate full-time, monotone, and non-monotone sub-samples. Students in both the monotone and non-monotone attrition groups score lower on achievement relative to full-time participants, and also harbour lower educational aspirations. In modelling the effect of demographic factors on academic achievement, the authors find evidence of attrition bias, as "the restriction of the sample to full-time participants systematically inflates the estimated Black/White achievement gap" (*ibid*: 8). However, in the regression model of educational aspirations, the authors find that bias results from the attrition of monotone participants only, suggesting that re-contacting the entire base-year sample in all waves (regardless of attrition in any particular wave) may serve to reduce somewhat the extent of attrition bias. Furthermore, though there is evidence of bias, the authors find that excluding the attriting sub-sample only results in small changes in parameter estimates, because the full-time participation rate for the HS&B is so high.

Another longitudinal study in a developed country is the Spanish Labour Force Survey (EPA), a rotating quarterly panel survey used to analyze short-term employment and labour market trends in Spain. Each panel consists of six quarterly interviews, amounting to a total of one-and-a-half years' duration for each panel. Since all participants from the original panel are re-contacted regardless of attrition in any particular wave, there is a variety of patterns of nonmonotone attrition. Full-time respondents of all six waves of the survey constitute 65% of all participants, while over 23 percent participated in any three of the six total waves. Thus, along with attrition, re-entry into the survey is also an object of interest, and is likely related to the dynamic of attrition.

In a study of sample attrition in the EPA, Jimenez-Martin and Peracchi find that attrition rates are highest at ages during which important life transitions often occur (such as marriage, job-related moves in young adulthood, and retirement), while re-entry rates tend to be lower during these transitions (Jimenez-Martin and Peracchi, 2002: 87). Thus, those individuals experiencing these life-cycle transitions, which are often the exact object of interest in panel studies, are the most likely to leave the survey and not return in subsequent waves. Attrition rates increase with age up to about thirty, then decline until the age of fifty, increasing thereafter. Attrition is higher for the more educated, lower for the head of the household, and decreases with the size of the household (*ibid*: 87).

In order to determine whether attrition results in bias, the authors model labour market transition probabilities between four mutually exclusive states, namely full-time employment, part-time employment, unemployment, and out of the labour force. The authors conclude that attrition and re-entry in the survey do not pose significant consequences for model estimation. Nor do they detect any significant evidence of attrition bias. Nonetheless, the authors add the important caveat that this conclusion does not apply to young people transitioning from inactivity to employment. The null hypothesis that attrition does not cause biases in estimates of labour market transitions is rejected for this particular category of people.

By contrast, in a study of attrition in the Current Population Survey, Peracchi and Welch (1995) find more significant support for the possibility of attrition bias. The Current Population Survey is one of the most commonly-used sources for information on income and employment in the United States. The CPS is a rotating monthly panel survey with a rotation scheme such that each panel is interviewed for four consecutive months, temporarily excluded for the eight subsequent months, then re-interviewed for another four consecutive months. The sampling frame allows for three-quarters of the entire sample to be matched in any two consecutive months, assuming zero attrition. Matching person records across CPS waves allows economists to study short-term labour market

dynamics. The CPS, unlike the other surveys previously mentioned, does not attempt to follow movers. Thus, those occupants who move between survey waves are simply dropped. Failure to produce a match across CPS waves is a product of four cumulative factors: death, migration, non-response, or construction or demolition that removes the dwelling of a previous respondent.

Peracchi and Welch find that attrition is indeed linked to specific household and individual level characteristics. Interestingly, a third of all attrition in the CPS results from the failure to track individuals of college age in households that are successfully re-contacted, and the failure to track young households who have moved (Peracchi and Welch, 1995: 160). In order to test for the potential for attrition bias, the authors model labour-force transition rates, wages, and transition probabilities for each of the attriting and non-attriting sub-samples (ibid: 166). For transition rates, they find that coefficients of key variables such as age, race, educational level, and relationship to the household head differ significantly for the matched and unmatched households.

For the model of wages, the authors also find that coefficients differ markedly between the attriting and non-attriting sample. The non-attriting, or matched, sample exhibits larger wage dispersion, and a wider black/white differential. The wage model for the attriting sample shows a wider differential between high-school graduates and high-school dropouts. For labour force transition probabilities, the authors find no evidence of systematic bias resulting from attrition (ibid: 173). Thus, as the authors conclude, attrition from the CPS is concentrated among younger respondents, and often seems to be the result of household and person mobility arising from schooling decisions, family formation, and employment search. As illustrated in the wage and transition rate models, attrition may indeed bias the estimation of behavioural relationships.

Thus, the experience of panel studies in developed countries, while qualitatively different from the problems associated with such studies in developing countries, can nevertheless offer important considerations for researchers administering panel surveys in developing countries. As the above studies have shown, panel attrition in developed countries is often a function of non-response, although geographic mobility also results in significant attrition, particularly when the study is not designed to follow movers, such as in the case of the Spanish Labour Force Survey (EPA) and the Current Population Survey (CPS). Panel attrition in the Panel Study of Income Dynamics (PSID), the Survey of Income and Program Participation (SIPP), the National Longitudinal Study of Youth (NLSY), the High School and Beyond (HS&B), the Spanish Labour Force Survey (EPA), and the Current Population Survey (CPS) is found to be selective on a range of different demographic, economic, geographic, and

social characteristics; this is to be expected considering that the target population varies considerably from survey to survey.

However, across the different studies, the general trend seems to be that panel attrition is concentrated amongst minorities, younger individuals and households. Additionally, attrition is higher at the lower end of the socio-economic distribution, suggesting that migration may be linked to economic stress. Furthermore, the literature on the PSID suggests that the causal factors behind survey attrition may be linked to economic and social shocks, such as the loss of a job or the dissolution of a marriage. The authors of the study on the PSID also found that men who have more unstable histories (greater variability with respect to labour income, marital status, and migration behaviour) are more likely to attrit from the sample.
Finally, analysis of the EPA, PSID, and the CPS suggests that the potential for attrition is higher amongst young adults, most likely a result of the increased mobility required of important transitions associated with young adulthood, such as schooling decisions, family formation, and employment search.

Panel attrition is also affected by factors in the design of the survey itself; interview length, consistency of interviewer across panel waves, and the frequency of waves can all affect the completion and retention rates. In developed countries, shorter interview length, interviewer consistency, and less frequent waves are all associated with higher completion rates. Additionally, the decision to re-interview all baseline respondents in each wave regardless of attrition in previous waves, such as in HS&B and the NLSY, is likely to have the effect of lowering cumulative attrition and reducing the potential for attrition bias.

The evidence on attrition bias resulting from selectivity is somewhat mixed; in a few studies of attrition, the authors findings suggested the presence of some attrition bias as a result of selective attrition. Overall, however, it does not seem that selective attrition has severe consequences in developed country panels. Studies of the HS&B and CPS found that selective attrition results in detectable attrition bias, while authors of the study of attrition in the NLSY, Fitzgerald *et al's* study of the PSID, and Zabel's study of the PSID and the SIPP did not find evidence of bias despite the selectivity of the sample as a result of attrition. In the former, the authors found that estimated coefficients for regression models using the non-attriting and attriting sub-sample differed significantly.

However, qualitative differences between attritors and non-attritors may or may not result in substantial bias in analyses using only the non-attriting sample, depending on the magnitude of attrition and the variable of interest of the model in question. As Burkam and Lee suggest in their study of attrition in the HS&B,

the magnitude of attrition bias is likely to be proportional to the rate of attrition; thus, selective attrition may not be a significant problem if the overall attrition rate is relatively low. This is the precise reason that Gritz, MaCurdy, and Mroz offer as explanation for the lack of attrition bias in models of labour market behaviour using the NSLY, despite the presence of selective attrition: the attriting sample is too small to significantly affect coefficient estimates.

Finally, it is interesting to note that evidence of attrition bias was significant in two of three economic models employing data from the CPS. Peracchi and Welch found that for the transition rates model, the coefficients of key variables such as age, race, educational level, and relationship to the household head differed significantly for the attriting and non-attriting households. For the model of wages, the authors also found that coefficients differed markedly between the attriting and non-attriting sample. The CPS is a rooftop survey, which makes no attempt to follow movers; this suggests that following movers has significant payoffs with respect to reducing selective attrition and the potential for attrition bias.

Thus, overall it does not seem that selective attrition has severe consequences for panel studies in developed countries. Though a few studies suggest the presence of attrition bias, this is generally concentrated amongst the "rooftop" panels, which do not follow movers. Most panel studies in developed countries follow movers fairly effectively, and thus the extent of attrition, especially migration-related attrition, is usually low. However, this does not suggest that panel attrition in every case is unlikely to be a problem; almost all of the studies cited above focus on labour market behaviour, and as Zabel (1998) points out, attrition bias is likely to be model-specific. Furthermore, the neutrality of attrition is less likely to apply in developing country panel studies, where the range of social, demographic, and economic variables being studied is generally wider, attrition linked to migration behaviour more pronounced, and overall attrition likely to be much higher.

Panel Studies and Attrition in Developing Countries

Researchers conducting panel research in developing countries encounter greater logistical difficulties than researchers in the developed world. As mentioned earlier, communications infrastructure is somewhat limited in many parts of the developing world, making it much more difficult to track movers successfully. Furthermore, it is likely to be the case that geographic mobility in developing countries is driven by a somewhat different set of dynamics than in the developed world. Development processes are often accompanied by greater

residential mobility due to the increased frequency of rural-to-urban migration, heightened occupational mobility related to the emergence of new economic opportunities, and heightened socio-economic mobility. Thus, these factors render panel data collection more difficult and costly, which is perhaps one explanation for the relative dearth of longitudinal survey data in developing countries, particularly those of longer duration.

However, there have been a number of instances of very successful panel data collection in the developing world, with researchers achieving low attrition rates. These panel surveys are explicitly designed to follow movers to new residences, thus resulting in a reduction in potential attrition relative to "rooftop" surveys. Despite the infrastructure limitations associated with tracking in the developing world, some researchers have allocated the necessary time and resources required to track migrants, thus reducing migration-related survey attrition considerably. Table 3 below describes some of the longitudinal surveys that have been conducted in developing countries, with a focus on surveys conducted in South Africa. The table indicates whether or not movers were followed in the description of each survey.

Table 3: Panel studies in developing countries

Survey	***Sample***	***Survey Design***	***Survey Objectives***	***Reference***
Indonesia: Indonesian Family Life Survey (**IFLS**)	7,000 households	1993, 1997, 1998, 2000 *Movers followed	Collects information on a variety of economic and social indicators, such as consumption, income, labour market outcomes, health, marriage, fertility, contraceptive use, participation in community activities, intra-household decision-making	RAND http://www.rand.org/labor/FLS/IFLS Frankenburg, Thomas, Smith 2000
Russia: Russian Longitudinal Monitoring Survey (**RLMS**)	5,000 households	Annually, 1992-present Repeated cross-sections with panel component (longitudinal analysis possible with households remaining in original dwelling units over time)	Designed to measure the effects of Russian reforms on the economic well-being of households and individuals, with a particular emphasis on effects of reforms on household consumption and health	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/rlms/project/study.html
Hungarian Household Panel Study (**HHP**)	2,600 households	Annually, 1992-1997	Demographic and employment histories, economic indicators such as wealth, assets, and income	Social Research Informatics Centre (TARKI) http://www.tarki.hu/index-e.html http://www.ceps.lu/paco/pacohupa.htm
India Additional Rural Incomes Survey (**ARIS**)	4,118 households	1970/1971, 1981/1982	Intended to analyze the impact of high yield seed varieties on agricultural production, farm profits, and capital intensity	National Council of Applied Economic Research www.ncaer.org Foster and Rosenzweig 1995

Table 3: Panel studies in developing countries continued…

Survey	***Sample***	***Survey Design***	***Survey Objectives***	***Reference***
World Bank Living Standards Measurement Surveys (**LSMS**) Cote D'Ivoire Vietnam Peru	 1600 households 8,000 individuals 4,000 individuals in 1985/86, about 2,000 individuals in 1991, 1994	 Rotating panel, "rooftop" survey; 1985, 1986, 1987, 1988 *Movers followed; 1992/1993, 1997/1998 "Rooftop" survey; two panels, 1985/1986, 1990, and 1991, 1994	Designed to measure and understand poverty in developing countries. The objectives of the LSMS were to develop new methods for monitoring progress in raising levels of living, to identify the consequences for households of current and proposed government policies, and to improve communications between survey statisticians, analysts, and policymakers.	World Bank http://www.worldbank.org/html/prdph/lsms/ Falaris 2002
China Health and Nutrition Survey	3,795 households in baseline survey, living in 8 provinces in China	Indefinite life panel, with split-offs included in the sample 1989, 1991, 1993, 1997 *Movers followed	To examine the effects of the health, nutrition, and family planning policies implemented by national and local governments, and see how the social/economic transformation of Chinese society is affecting the health and nutritional status of its people.	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/china
Cebu Longitudinal Health and Nutrition Survey	3000 women in the Cebu province of Philippines	Bi-monthly in 1983/1994, then follow-ups in 1991/2, 1994, and 1999	To study infant feeding patterns and how feeding decisions interact with social and economic factors to affect health, nutritional, demographic, and economic outcomes.	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/cebu
Malaysian Family Life Survey	1,200 households of ever-married women in Malaysia	1976, 1988 *Movers followed	Collects current and retrospective information on family structure, fertility, economic status, education/training, transfers, migration, etc. Each survey also collected community-level data.	RAND http://www.rand.org/labor/FLS/MFLS Frankenburg, Thomas, Smith 2000

Table 3: Panel studies in developing countries continued…

Survey	***Sample***	***Survey Design***	***Survey Objectives***	***Reference***
Thailand: Nang Rong Projects	Over 7,000 households and 40,000 individuals in the Nan Rong district of Northeast Thailand	1984, 1994, 1995 (migrant follow-up) *Movers followed	Began as an evaluation of a government-sponsored community development program; expanded to include information on contraceptive use, and how social networks affect such behaviour as fertility and migration.	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/nangrong/ Rindfuss, 2003
Bolivia Integrated Child Development Program (**PIDI**)	2000 households	1995/1996, 1997/1998	To analyze the impacts of the early childhood development and nutrition program (PIDI) on child development outcomes related to nutrition, health, cognitive development and psychosocial skills.	World Bank http://www.worldbank.org/children/csbolivia1.html Alderman, Behrman, Kohler, Maluccio, and Watkins 2001
Kenya: Kenyan Ideational Change Survey (**KDICP**)	900 women of childbearing age and their spouses in the Nyanza Province	1994/1995, 1996/1997, 2000	To collect information on the roles of informal networks in understanding change in behaviour related to contraceptive use and prevention of AIDS.	Collected by Susan Cott Watkins www.pop.upenn.edu/networks Behrman, Kohler, Watkins 2002
Cameroon: Institut de Formation et de Recherche Demographiques (**IFORD**) *Studies also conducted in Benin, Brazzaville, Burkina Faso, and Togo	10,000 children and their mothers born in Yaoundé in 1978	Triannually, 1978-1981	Designed to measure patterns of mortality during the first 2 years of life, and the demographic, medical, cultural, and socio-economic determinants of infant and maternal mortality and morbidity.	United Nations Institut de Formation et de Recherche Demographiques Defo, 1992

Table 3: Panel studies in developing countries continued…

Survey	***Sample***	***Survey Design***	***Survey Objectives***	***Reference***
South Africa: KwaZulu-Natal Income Dynamics Study (**KIDS**)	About 1,400 Indian and African households residing in the KwaZulu-Natal Province	1993, 1998 *Movers followed	Broad array of socio-economic information, including demographics, education, expenditure, remittances, employment, agricultural activities, health, and anthropometry.	199 South African Labour and Development Research Unit at the University of Cape Town www.uct.ac.za/depts/dpru 1998: University of Natal, Durban Alderman, Behrman, Kohler, Maluccio, and Watkins 2001
South Africa: Birth-to-Twenty	3275 children born in the year 1990	Cohort panel Intermittently since 1990	Examines the social, physical, and psychological development of the cohort.	Medical Research Council. University of Witwatersrand http://www.wits.ac.za/birthto20 Richter and De Wet,2000
South Africa: Transitions to Adulthood	3,000 young adults between the ages of 14-22 and 2,000 households residing in KwaZulu-Natal province	Cohort Panel 1999, 2001/2002 *Movers followed	Investigates factors that may influence the lives and sexual behaviour of young people.	Population Council, Tulane University, the University of Natal-Durban, and Development Research Africa www.popcouncil.org Dallimore, 2002
South Africa: Cape Area Panel Study (**CAPS**)	5,000 youth aged 14-22 in the Cape Town Metropolitan Area	2002; next full wave of data collection expected 2005, partial re-interviewing in 2003 and 2004	Household module: general demographic and economic information such as employment, income, education, assets. Young adult module: information on educational expectations and outcomes, sexual behaviour, fertility, contraceptive use, employment, residential arrangements, HIV/AIDS.	Centre for Social Science Research at the University of Cape Town www.uct.ac.za/depts/cssr

Tracking to Reduce Attrition

One of the best-known examples is the Indonesian Family Life Survey (IFLS). The baseline wave of the IFLS was conducted in 1993, with the second wave (IFLS2) occurring four years later in 1997, a sub-sample being interviewed in 1998 during the Asian financial crisis (IFLS2+), and the most recent wave completed in 2000 (IFLS3). Until the recent financial crisis, Indonesia had been developing at a rapid pace, averaging almost 5% per annum. Growth has been accompanied by large-scale socio-economic changes: massive increases in life expectancy, per capita income, school enrolment rates, urban residence, and a sharp decrease in the fertility rate are a few of the indicators of the nature and scale of societal transformation.

However, despite the fairly rapid pace of growth and socio-economic transformation, the majority of Indonesians do not own a phone, and many continue to live in rural, mountainous areas not easily accessible via the existing transportation infrastructure. In addition to the poor infrastructure common to developing countries, Indonesia is also host to over 300 ethno-linguistic groups, a factor likely to compound the logistical difficulties associated with data collection. Yet despite these potential difficulties, the IFLS was able to attain high levels of retention, on a par with or even better than comparable rates in surveys of developed countries.

In a study of attrition in the IFLS baseline and follow-up survey, Thomas, Frankenberg, and Smith report that the overall re-contact rate, excluding those who had died between waves, was 94.4% between the baseline and IFLS2, and 96% in IFLS2+ (Thomas, Frankenberg, and Smith, 2000: 10). First, this is due to the fact that refusals in the IFLS were remarkably low, totalling less than 1% of the entire sample. Secondly, migration-related attrition was minimised due to the decision to track movers to their new residences, even over considerable distances, as long as the respondents remained within the 13 initially eligible provinces. Between the baseline wave and IFLS2, only 84% of baseline respondents were found at their original dwellings; an additional 10.5% were tracked and found to have moved to new locations. Thus, tracking successfully reduced the attrition rate by two-thirds. Similarly, tracking resulted in a 72% reduction in attrition in the IFLS2+ wave (*ibid*: 22).

The authors document the tracking protocols and field procedures that helped achieve such a low attrition rate. During the first phase of tracking, 23 teams of field workers were instructed to re-interview all the current members of the initial IFLS households who remained at the original residences. If no members of the household still resided at the original location, the fieldworkers were

instructed to collect information regarding their potential whereabouts from neighbours, friends, relatives, former employers, and local community figures (ibid: 8). If the household could be found within the vicinity of the original EA (within a half-hour bus ride), they were tracked and interviewed during the first phase along with those who had not moved.

Those households who had moved too far away to be tracked in the initial phase were tracked over longer distances in the second phase of the tracking process. In this phase, fieldworkers were aided in their task by "relocation sheets" containing extensive demographic and economic information and also the name of one individual who might know of their whereabouts in a few years time. Additionally, for this second phase, wages and bonuses were increased in order to give fieldworkers an incentive to track down the more difficult cases. The role of personnel in achieving high completion rates in the IFLS also merits consideration. Fieldworkers and supervisors recruited for the IFLS are highly educated relative to the average Indonesian, with most of the interviewers being recent college graduates. The authors find that interviewers with higher than average mathematics scores on an aptitude test and higher than average salaries in previous jobs were more likely to produce higher completion rates.

Like the researchers involved in the IFLS, researchers conducting the Nang Rong Survey in northeast Thailand also explicitly sought to track movers, believing that the study of migrants would be of distinct value to social science researchers. Like the IFLS, the Nang Rong Survey also yielded a remarkably low attrition rate, given the particularly difficult circumstances associated with data collection. Firstly, the study was not initially conceived as a panel study, but rather as a cross-sectional study designed to evaluate the impact of a community development project on a sample of 51 rural villages in Nang Rong. The first full follow-up wave occurred only in 1994/1995, a lapse of ten years between the base-line and follow-up.[6] Additionally, communications infrastructure, such as phone and postal services, were effectively absent in Nang Rong, in both 1984 and 1994 (Rindfuss, Kaneda, Chattopadhyay, and Sethaput, 2002: 10). The poor communications infrastructure, combined with the considerable time-lapse between waves, and the fact that the study was initially conceived as cross-sectional and thus did not have any mechanisms in place to facilitate re-interview, make the success of the Nang Rong particularly impressive.

The design of the Nang Rong Survey was such that all the households in the baseline sample of 51 rural villages were re-interviewed in 1994 if they

[6] There were a number of small quantitative and qualitative follow-up surveys which re-interviewed sub-samples of the baseline sample, but the first full follow-up wave was conducted only in 1995

continued to reside in the original 51 villages; additionally, for a sub-sample of 22 villages, migrants were followed to four major urban destinations in Thailand (ibid: 8). Most of the migrants who had left the original villages were reported to have moved to these urban locations, with only a few having migrated to other rural locations; thus, the migrant follow-up can essentially be thought of as a rural-to-urban follow-up (ibid: 8). Migrant follow-up was conducted on an individual level; that is, if any member of a 1984 household had moved independently of the household, the individual was tracked to any of the four target urban locations. If an entire household had migrated out of the original village, all members were tracked as long as they resided in one of the target urban destinations.

Multiple strategies were employed to track the migrants. Firstly, members of the original 1984 households were asked about the new residence of the migrant; if a clear address was available, an interviewer went there (ibid: 9). Secondly, whenever a migrant was located and re-interviewed, he/she was shown a list of all the reported migrants from the original village, and asked for any information on migrants that had not yet been located. Thirdly, interviewer teams went to the original 22 villages during holiday and festival times, in order to locate migrants who were visiting their families. Using these various strategies, the fieldwork teams were able to locate and re-interview 91% of the original 1984 households (ibid: 18). Additionally, for those migrants who had moved to one of the four target urban destinations, the re-contact rate was 62% (ibid: 18). The embeddedness and resilience of social networks in Thailand, as well as the consistency of rural-urban Thai migration patterns, aided fieldworkers in achieving this high re-contact rate (ibid: 18-19). However, the commitment of researchers to tracking migrants, and their extensive knowledge of local socio-economic conditions in Thailand and in Nang Rong in particular, were undoubtedly factors contributing to their success.

Tracking also had the effect of significantly lowering attrition in the KwaZulu-Natal Income Dynamics Study in South Africa. The Project for Statistics on Living Standards and Development (PSLSD), the first South African national household survey, was undertaken in 1993 by a consortium of universities study and fielded by the South African Labour and Development Research Unit (SALDRU) at the University of Cape Town. In 1998, a research consortium headed by the University of Natal re-interviewed a sub-sample of 1400 Indian and African families residing in the KwaZulu-Natal Province in 1993. Despite a long interval of five years between survey waves, relocation teams were successfully able to re-interview 84.1% of the households in the 1993 sample in the 1998 follow-up wave (Maluccio 2002: 12). If it was learned that a household had moved, the interview teams were instructed to get new location information using a household identification form. The teams sought address or

other contact information from other family members, neighbours, and local facilities, such as clinics and schools (ibid: 12). Without the tracking efforts of the interview teams, the attrition rate would have been 20.4%. Thus, tracking reduced migration-related attrition by 4.5% percentage points; alternatively stated, tracking resulted in a reduction in migration-related attrition by roughly 25% (*ibid*: 12).

Thus, the practice of tracking movers undoubtedly has significant payoffs with respect to reducing the magnitude of migration-related attrition. As Table 4 below illustrates, those surveys that have implemented some mechanism to track movers have been relatively more successful in minimizing attrition. The KwaZulu-Natal Income Dynamics Study (KIDS), the Nang Rong survey, the Indonesian Family Life Survey (IFLS), the China Health and Nutrition Survey (CHNS) and the World Bank LSMS in Vietnam all tracked movers, and all have attrition rates at or below 16%. The attrition rates of the China Health and Nutrition survey are comparable to that of the IFLS, with attrition at only 9% after two follow-up waves (four years after the baseline wave). This is despite the fact that the survey only followed movers who relocated within the vicinity of the original EA, and did not follow long-distance migrants.

The attrition in the Nang Rong survey was also extremely low, particularly considering the complicating factors discussed above. The Malaysian Family Life Survey (MFLS), which managed to re-interview 73% of all baseline households, also tracked movers to new residences. The MFLS attrition rate of 27% is higher than the other surveys mentioned, but is nonetheless quite low considering that the interval between the baseline wave and the follow-up was a lengthy twelve years.

However, the attrition rate for the South African Transitions to Adulthood Survey is relatively high, despite the fact that movers were followed to new residences. The 27.1% individual attrition rate between the 1999 and the 2001/2002 waves of the survey may be attributable to the higher mobility of the particular study group, young adults aged between 14 and 22. Older members of the cohort are in a period of their lives when they are likely to experience heightened mobility, as a result of such potential milestones as entry into the labour market, tertiary education, or family formation. Furthermore, unlike most of the other household panel studies mentioned above, the Transitions to Adulthood study is a cohort study, requiring that a particular individual be relocated and re-interviewed. Generally, locating at least one member of a household is easier than locating a particular individual, especially as many household surveys allow for proxy response in the household interview.

Additionally, it may also be the case that migration behaviour is particularly dynamic in South Africa, or that tracking of respondents is particularly difficult. In many of the informal settlements in the townships and also in rural areas, tracking was rendered particularly difficult by the lack of physical addresses and phone numbers for the respondents. Furthermore, a particularly low response rate amongst white young adults is likely to be at least partially a result of the prevalence of gated blocks of flats, electrified fences, guard dogs, and access-controlled residential compounds, which constituted a significant obstacle for interviewers.

Contrastingly, the attrition rate for surveys that did not track movers is generally higher, and the vast majority of attrition is undoubtedly linked to the migration behaviour of the target population. The attrition rate for these "rooftop" surveys averages around 30% and ranges from a low of 18% household attrition over a four- year period in the LSMS in Cote d'Ivoire, to a high of 55% household attrition between the 1985/1986 and the 1990 waves of the Peruvian LSMS. Thus, it is clear that tracking is likely to have significant returns with respect to reducing migration-related attrition. The table below compares the respective attrition rates of the different surveys mentioned above, and notes whether or not movers were followed.

Table 4: Attrition rates in developing countries panel studies

Survey	***Survey Waves***	***Attrition Rates***	***Reference***
Indonesia: Indonesian Family Life Survey (**IFLS**)	1993, 1997, 1998, 2000 *Movers followed	5.6% household attrition between IFLS and IFLS2 4% between IFLS2 and IFLS2+	RAND http://www.rand.org/labor/FLS/IFLS Frankenburg, Thomas, Smith 2000
Russia: Russian Longitudinal Monitoring Survey (**RLMS**)	Annually, 1992-present Repeated cross-sections with panel component (longitudinal analysis possible with households remaining in original dwelling units over time) *Movers followed beginning with Wave 7	24.9% household attrition between Wave 1 and Wave 9 of the survey	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/rlms/project/study.html
India Additional Rural Incomes Survey (**ARIS**)	1970/1971, 1981/1982	33% household attrition rate	National Council of Applied Economic Research www.ncaer.org Foster and Rosenzweig 1995
Bolivia Integrated Child Development Program (**PIDI**)	1995/1996, 1997/1998	35% household attrition rate between the two waves	World Bank http://www.worldbank.org/children/csbolivia1.html Alderman, Behrman, Kohler, Maluccio, and Watkins 2001
Kenya: Kenyan Ideational Change Survey (**KDICP**)	1994/1995, 1996/1997, 2000	Couples: 41% Men: 33% Women: 28% *59% of attrition of women and 48% of attrition of men due to migration	Data collected by Susan Cott Watkins and colleagues www.pop.upenn.edu/networks Behrman, Kohler, Watkins 2002
Cameroon: Institut de Formation et de Recherche Demographiques (IFORD)	Cohort panel, mothers and newborn children Triannually, 1978-1981	34% attrition by 7th wave 13.3% due to long-distance migration, 8.5% known to have moved within the city, no information on 12.4%	United Nations Institut de Formation et de Recherche Demographiques Defo, 1992
China Health and Nutrition Survey	1989, 1991, 1993, 1997 *Local movers followed	5% household attrition rate between 1st wave and 1st follow-up, 9% attrition rate by 2nd follow-up	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/china

Table 4: Attrition rates in developing countries panel studies continued…

Survey	***Survey Waves***	***Attrition Rates***	***Reference***
World Bank Living Standards Measurement Surveys (**LSMS**) Cote D'Ivoire Vietnam Peru	 Rotating panel, "rooftop" survey; 1985, 1986, 1987, 1988 1992/1993, 1997/1998 *Movers followed "Rooftop" survey; two panels, 1985/1986, 1990, and 1991, 1994	 18% household attrition rate 16% individual attrition rate 1985/86-1990: 69% individual, 55% household attrition 1991-1994: 45% individual	World Bank http://www.worldbank.org/html/prdph/lsms/ Falaris 2002, and Frankenburg, Thomas, Smith 2000
Cebu Longitudinal Health and Nutrition Survey	Cohort study of pregnant women, interviewed bi-monthly for 24 months in 1983/1984, follow-ups in 1991/2, 1994, and 1999	28% attrition between baseline and 1991/1992 follow-up	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/cebu
Malaysian Family Life Survey	1976, 1988 *Movers followed	27% attrition rate between baseline and follow-up	RAND http://www.rand.org/labor/LFS/MFLS Frankenburg, Thomas, Smith 2000
Thailand: Nan Rong Projects	1984, 1994, 1995 (migrant follow-up) *Movers tracked, including households that moved and individual migrants	9% household attrition between 1984 and 1994 waves	Carolina Population Centre at the University of North Carolina at Chapel Hill http://www.cpc.unc.edu/projects/cebu
South Africa: Birth-to-Twenty	Cohort panel, mothers and newborn children. 1989, 1990, 1991, 1993, 1994, 1996. *Movers tracked	30% attrition by 7th wave 26% participated in less than 3 rounds of data collection	Medical Research Council. University of Witwatersrand http://www.wits.ac.za/birthto20 Richter and De Wet, 2000
South Africa: Transitions to Adulthood	Cohort Panel 1999, 2001/2002 *Movers followed	27.1% individual attrition	Population Council, Tulane University, the University of Natal-Durban, and Development Research Africa www.popcouncil.org Dallimore, Karim, Fensham 2002
South Africa: KwaZulu-Natal Income Dynamics Study (**KIDS**)	1993, 1998 *Movers followed	Households: 16% Children: 22%	Alderman, Behrman, Kohler, Maluccio, and Watkins 2001

Panel Selectivity

As mentioned earlier, attrition can have adverse consequences for a panel study, particularly if it is systematically linked to specific household, community, or individual characteristics. If movers are systematically different from non-attritors, failure to track them to their new residences will result in a loss of information regarding the dynamics of migration, and may also result in attrition bias. Whether large-scale attrition matters for researchers using the data depends on the particular objectives of the study, the social, economic and demographic context, and the particular patterns of migration of the population of interest. As the evidence below will illustrate, in the case of developing countries it is likely to be the case that following movers will have significant payoffs for social scientific research.

In the study of attrition in the IFLS, the authors find that attrition is indeed highly selective on individual, household, and community level characteristics. In modelling the probability of attrition, the authors find that an increase in average per capita expenditure (PCE) at the community level increases attrition, although within the bottom quartile of the income distribution, an increase in average PCE decreases attrition (Thomas, Frankenberg, Smith, 2000: 18). This first result is probably due to the higher opportunity cost of time in wealthier households; the second result suggests that within a community, the poorest households are most likely to move without retaining contacts with neighbours. Additionally, home ownership, level of educational attainment, and age of the household head are all positively associated with completion. Urban and mountainous locations are associated with lower completion rates, probably due to the anonymity associated with urban life and the difficulty of reaching respondents over mountainous terrain (ibid: 19).

The authors go on to examine the characteristics of movers, differentiating between "long-distance" movers, and movers who were found in the vicinity of their original location (less than half an hour by bus). The authors model the probability of five mutually exclusive interview outcomes: refusal, those not found, long-distance movers, local movers, and those respondents who were found in the original location. They find that the characteristics of long-distance movers and those who were not found are strikingly similar, suggesting that long-distance movers may provide evidence regarding those cases that were never found. The effects of household size, education of head, and home ownership on the probability of falling into the category of long-distance mover, are very similar to the effects of these variables on the probability of not being found at all (*ibid*: 23).

Contrastingly, those households that were found during local tracking are similar to those that were found in their original location. However, local movers tend to have smaller households, younger household heads, and are less likely to own their own homes, though to a lesser extent than the long-distance movers.

Thus, the three groups (long-distance movers, those who were not found, and those who were found in the original locale) have distinct characteristics. Furthermore, the authors of the study found that long-distance movers share similar characteristics with those not found, suggesting the importance of tracking movers in order to better understand the characteristics of those respondents who are lost to attrition from the survey. Despite the considerable resources associated with tracking movers, nevertheless the experience of the IFLS seems to suggest that the potential social and scientific yield arising from tracking is likely to far outweigh the costs.

In the case of the KwaZulu-Natal Income Dynamics Study (KIDS), Maluccio found that attrition was indeed selective on specific community and household-level characteristics. The KIDS sample is 1,400 African and Indian households residing in the KwaZulu-Natal province of South Africa. Using the presence of a community clinic in an attempt to capture the level of social embeddedness of a particular community, Maluccio found that households in communities with a clinic were less likely to have moved between survey waves. Similarly, households living in communities with higher average per capita expenditure were also less likely to have moved (Maluccio, 2002: 18-19). Controlling for the average level of wealth of a community, households with greater per capita expenditure than the average were actually more likely to move (ibid: 18-19).

Estimating household-level expenditure functions indeed revealed attrition bias related to this sample selectivity. However, Maluccio concludes that for a majority of outcome variables in the survey, such as most child anthropometric outcomes, coefficient estimates were not significantly affected by attrition, despite the presence of sample selectivity. This relative lack of attrition bias may be the result of the fairly low level of overall attrition (15.9%), and that fact that the tracking program reduced migration-related attrition by over 25%. In addition, another explanation for the lack of attrition bias in most of the models is that sample selectivity results in biased parameter estimates only if the differences are systematically related to a variable of research interest. As mentioned earlier, attrition is likely to be model-specific (Zabel, 1998), and sample selectivity may not have consequences if the dynamics of the attrition process are not related to the behaviour being modelled.

In the Transitions to Adulthood study, also in KwaZulu-Natal, attrition was a more serious problem, with an overall individual attrition rate of 27.1% between the 1999 and 2000 waves of the study, despite tracking efforts on the part of the researchers (Dallimore *et al*, 2002: 4). Attrition in the study was indeed selective on the specific characteristics of the target population. Firstly, different age groups of young adults exhibited differential attrition rates. Older members of the cohort attrited at much greater rates, with only 65.7% of 20-22 year-olds having been re-interviewed in 2000, compared to 80.2% of 14-16 year-olds, and 69.5% of 17-19 year-olds (*ibid*: 4). The relatively higher rate of attrition amongst older members of the cohort stems from the increased likelihood that older respondents will finish school, gain independence, and move out of their original households, possibly to seek employment or start a family. The higher attrition rate amongst older members of the cohort, who are also more likely to be sexually active, undoubtedly poses a problem for researchers seeking to understand sexual behaviour amongst youth in South Africa and linkages to the HIV/AIDS pandemic.

Additionally, white young adults attrited at much greater rates than other population groups. Only 39% of white young adults were found and re-interviewed, compared to 74.4% of African young adults and 79.6% of Asian young adults *(ibid*: 5). This large reduction in the size of the sub-sample of white young adults (from 187 to 73 young adults in the follow-up survey) is likely to pose problems for social scientists who attempt to research hypotheses regarding behaviour of the sub-group of the population. As previously described, the high rate of attrition amongst whites in South Africa is probably linked to the physical barriers constituted by high security, access-controlled residential compounds. However, white respondents were also more likely to move and not be tracked, suggesting that differential patterns of migration may also be part of the explanation for the high rate of attrition among white young adults. Table 5 below illustrates the various reasons for non-interview for African, Asian, Coloured, and White respondents:

Table 5: Major reasons for non-interview, KIDS

Reason	***African***	***Asian***	***Coloured***	***White***	***Total***
Moved outside EA but in South Africa	14.1%	6.2%	4.2%	7.5%	12.2%
Moved: no information on whereabouts	4.7%	6.7%	10.4%	17.6%	5.9%
Moved Outside South Africa	.2%	-	4.2%	9.1%	.8%
Not at Home	3.0%	3.8%	14.6%	23.0%	4.6%
Refused	.9%	2.9%	4.2%	3.2%	1.4%

Source: Adapted from Dallimore, Karim, and Fensham, 2002

As illustrated by Table 5, white young adults are more likely to move leaving no information on their current whereabouts. Furthermore, they are most likely to "not be at home," which is probably attributable to parents who implicitly or explicitly refuse to allow their young adults to participate in the study. Whites are also most likely to have moved outside South Africa, with 9.1% of the white cohort known to have emigrated. Overall, white young adults are most likely to have moved, with 34.2% of the cohort having moved either within South Africa, leaving no information on whereabouts, or out of the country. Whether this migration behaviour is linked to the higher socio-economic status of whites or whether the migration is more directly a result of alternative social dynamics, is difficult to ascertain and is a topic that may merit further research.

In a study of attrition in the Nang Rong survey, the authors found that attrition was linked to specific demographic, economic, and social characteristics. The follow-up wave of the Nang Rong survey was designed with the express intent of studying the behaviour of individual migrants, and thus the attrition-migration linkages are explored in great detail in the study (Rindfuss, Kaneda, Chattopadhyay, and Sethaput 2002). The authors find that attrition is related to such demographic and economic factors such as gender, age, household size, household economic status, as well as processes such as marriage and seasonal migration related to cyclical agricultural opportunities (*ibid*: 23-25). Individuals from larger households are more likely to migrate, suggesting the necessity amongst larger households to diversify their economic risks *(ibid*: 23). Similarly, households with less land to cultivate were more likely to migrate, as they are perhaps more likely to experience economic stress in the context of an agricultural community.

Additionally, those individuals who reported that they were not agricultural workers in 1984 were more likely to have migrated, which reflects migration to urban environments where non-agricultural opportunities are undoubtedly more widespread (*ibid*: 23). Men in the marriage phase of their life course were also less likely to be re-interviewed, reflecting the cultural practice of men moving into residence in the village of their wives, but also the greater rate of occupation-related migration for men of working age.

Furthermore, the authors found that migration is linked to village level characteristics; in particular, the stability and resilience of social networks increase the likelihood of re-interview (*ibid*: 25). For example, migrants from villages that were linguistically homogenous were more likely to be found and re-interviewed, probably due to the greater interconnectedness experienced by linguistically homogenous villages.

The authors conclude that in the Nang Rong survey, the demographic processes that were the focus of the study are also linked to the processes involved with retaining and relocating households and individuals in the sample (*ibid*: 32). Such dynamics as migration, marriage, union dissolution, and economic stress are linked to attrition, thus suggesting the importance of a study design that successfully tracks migrants to their new residences. Thus, as they perceptively conclude, "To the extent that some of the processes that we want to study are also linked to the retention of panel members, then it would suggest that the more we know about these processes and the more their likely effects on attrition are built into the actual study design, the better the data for studying these processes" (*ibid*: 32).

Conclusion

The process of panel attrition varies according to the specific design of the panel study, and the socio-economic context of the study population. Nevertheless, some broad commonalities and patterns can be discerned. In developed countries, the general trend suggests that panel attrition is higher amongst minorities, younger individuals and households, and in particular those at the lower end of the income distribution, suggesting that migration may be linked to economic stress. Contrastingly, researchers in most of the developing country studies find that migration-related attrition is often linked to higher economic status and/or processes of upward economic mobility.

In studies in both the developed and developing country studies, several authors underscore the causal link between social and economic "shocks," such as the loss of a job or marriage dissolution, and the increased likelihood of attrition. Another common theme that emerges is the heightened potential for attrition amongst young adults, most likely as a result of the increased mobility required of important transitions associated with young adulthood (such as schooling decisions, family formation, and employment search). Undoubtedly, these dynamic processes that affect attrition propensities are important fields of study for social science research, suggesting the importance of building the understanding of these processes into the study design in order to minimise attrition.

Almost all the studies, regardless of where they were conducted, also found that panel attrition is highly selective on specific economic, social, and demographic characteristics. This selectivity may or may not have significant consequences for subsequent estimation based on the non-attriting sample, depending on the size of the remaining sample, the behaviour being modelled, and the magnitude of attrition. On the whole, it does not seem that selective attrition has severe consequences for panel studies in developed countries, where most panel studies follow movers fairly effectively; thus the extent of attrition, especially migration-related attrition, is usually low. However, as several authors point out, attrition bias is likely to be model-specific. The neutrality of attrition is less likely to apply in developing country panel studies, where the range of social, demographic, and economic variables being studied is generally wider, attrition linked to migration behaviour more pronounced, and overall attrition likely to be much higher.

Tracking movers between waves of a survey may require considerable time, resources, and commitment, particularly in developing countries where the communications and information infrastructure is somewhat limited in scope. However, failure to track movers will result in the systematic exclusion of a sub-group of the study population. Despite the greater difficulty associated with tracking movers between waves, particularly in developing countries, this investment is likely to yield information of significant social scientific value, as well as improve the quality of the resulting data set. Thus, panel researchers in developing countries should invest in tracking movers, using localised knowledge of attrition processes to devise appropriate follow-up strategies.

References

Alderman, Harold, Jere R. Behrman, Hans-Peter Kohler, John A. Maluccio, and Susan Cott Watkins. 2001. Attrition in Longitudinal Household Survey Data. *Demographic Research* 5(4), 79-124.

Behrman, Jere R., Hans-Peter Kohler, and Susan Cott Watkins. 2002. Social Networks and Changes in Contraceptive Use over Time: Evidence from a Longitudinal Study in Rural Kenya. *Demography* 39(4), 713-738.

Burkam, David T. and Valerie E. Lee. 1998. Effects of Monotone and Nonmonotone Attrition on Parameter Estimates in Regression Models with Educational Data: Demographic Effects on Achievement, Aspirations, and Attitudes. *Journal of Human Resources* 33(2), 555-574.

Curtin, Thomas R., Steven J. Ingels, Shiying Wu, and Ruth Heuer. 2002. National Education Longitudinal Study of 1988: Base-year to Fourth Follow-Up Data File User's Manual, Washington, DC: U.S. Department of Education, National Center for Educational Statistics.

Dallimore, Anthea, Ali Mehryar Karim, and Ruanne Fensham. 2002. Descriptive Report on the Attrition Rate of the Transitions to Adulthood Study. School of Development Studies, University of Natal. DRAFT.

Defo, Barthelemy Kuate. 1992. Mortality and Attrition Processes in Longitudinal Studies in Africa: An Appraisal of the Ilford Surveys. *Population Studies* 46, 327-348.

Falaris, Evangelos M. 2003. The Effect of Survey Attrition in Longitudinal Surveys: Evidence from Peru, Cote d'Ivoire, and Vietnam. *Journal of Development Economics* 70, 133-157.

Hill, Daniel H. and Robert J. Willis. 2001. Reducing Panel Attrition. *Journal of Human Resources* 33(3), 416-438.

Kosolapov, Mikhail S., Michael S. Swafford, and Steven G. Heeringa. 2002. Design, Methods, and Statistical Properties of the Russian Longitudinal Monitoring Survey. Draft 05/23/2002.

Jimenez-Martin, Sergi and Franco Peracchi. 2002. Sample Attrition and Labour Force Dynamics: Evidence from the Spanish Labour Force Survey. *Spanish Economic Review* 4, 79-102.

MaCurdy, Thomas, Thomas Mroz, and R. Mark Gritz. 1998. An Evaluation of the National Longitudinal Survey on Youth. *The Journal of Human Resources* 33(2), 345-436.

Maluccio, John. 2000. Attrition in the KwaZulu-Natal Income Dynamics Study, 1993-1998. Washington, DC: International Food Policy Research Institute.

Neumark, David and Daiji Kawaguchi. 2001. Attrition Bias in Economic Relationships Estimated with Matched CPS Files. Cambridge, MA: National Bureau of Economic Research.

Pannenberg, Markus. 2000. Documentation of Sample Sizes and Panel Attrition in the German Socio Economic Panel, 1984-1998.

Peracchi, Franco and Finish Welch. 1995. How Representative are Matched Cross-Sections? Evidence from the Current Population Survey. *Journal of Econometrics* 68, 153-179.

Richter, L. and T. De Wet. 2000. Methodological Issues. Medical Research Council, University of Witwatersrand.

Rindfuss, Ronald R., Toshiko Kaneda, Arpita Chattopadhyay, and Chanya Sethaput. 2002. Panel Studies and Migration. Chapel Hill, North Carolina: Carolina Population Center, The University of North Carolina.

Taylor, Marcia Freed (ed) with John Brice, Nick Buck, and Elain Prentice-Lane. 2001. British Household Panel Survey User Manual Volume A: Introduction, Technical Report, and Appendices. Institute for Social and Economic Research at the University of Essex.

Thomas, Duncan, Elizabeth Frankenberg, and James P. Smith. 2001. Lost but not Forgotten: Attrition and Follow-up in the Indonesian Family Life Survey. *Journal of Human Resources* 36(3), 556-592.

US Department of Education, National Center for Education Statistics. 1999. National Education Longitudinal Study: Base-year Through Third Follow-Up, 1988-1994. Washington, DC: US Department of Education, National Center for Education Statistics; Ann Arbor, MI: The Inter-University Consortium for Political and Social Research.

US Department of Labour, 1999. NLSY79 User's Guide: A Guide to the 1979-1998 National Longitudinal Study of Youth. Washington, DC: US Department of Labor; Columbus, Ohio: Center for Human Resource Research at Ohio State University.

Wooden, Mark. 2001. Design and Management of a Household Panel Survey: Lessons from the International Experience. Household, Income, and Labour Dynamics in Australia Survey Project Discussion Paper Series No. 2/01, Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Yang, Xiushi. 1994. A Sensitivity Analysis of Repeat Migration Attrition in the Study of Migrant Adjustment: The Case of Bangkok. *Demography* 31(4), 585-592.

Zabel, Jeffrey E. 1998. An Analysis of Attrition in the Panel Study of Income Dynamics and the Survey of Income and Program Participation with an Application to a Model of Labor Market Behaviour. *Journal of Human Resources* 33(2), 479-506.

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