Survey Research Methods (2011)
Vol.5, No.2, pp. 53-61
ISSN 1864-3361
http://www.surveymethods.org

Household survey panels: how much do following rules affect sample size?

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In household panels, typically all household members are surveyed. Because household composition changes over time, so-called following rules are implemented to decide whether to continue surveying household members who leave the household (e.g. former spouses/partners, grown children) in subsequent waves. Following rules have been largely ignored in the literature leaving panel designers unaware of the breadth of their options and forcing them to make ad hoc decisions. In particular, to what extent various following rules affect sample size over time is unknown. From an operational point of view such knowledge is important because sample size greatly affects costs. Moreover, the decision of whom to follow has irreversible consequences as finding household members who moved out years earlier is very difficult.

We find that household survey panels implement a wide variety of following rules but their effect on sample size is relatively limited for a couple of decades. Even after 25 years, the rule "follow only wave 1 respondents" still captures 85% of the respondents of the rule "follow everyone who can be traced back to a wave 1 household through living arrangements" in the SOEP. Once children of permanent sample members start moving out, following such children greatly affects sample size. This effect is noticeable after 40 years in the PSID. Unless attrition is low, there is no danger of an ever expanding panel because even wide following rules do not typically exceed attrition.

Grown children of permanent sample members with their own households have a significantly lower attrition rate than first wave respondents in the PSID. Presence of a spouse or a child in a household does not affect attrition; however, presence of other household members significantly increases attrition.

Keywords: survey panels, survey methodology

1 Introduction

Household panel surveys, such as the Panel Study of Income Dynamics (PSID), the German Socio-Economic Panel Study (SOEP), and the British Household Panel Survey (BHPS), are increasingly used by scholars to study public opinion, political behavior and attitudes (Finkel and Muller 1998; Kotler-Berkowitz 2001; Scott and Zac 1993). Because household panel surveys contain information about entire families and often span decades, they lend themselves in particular for studying attitudinal or behavioral change (Johnston et al. 2005; Prior 2010; Schmitt-Beck, Weick and Christoph 2006) and family influences (Kroh 2009; Zuckerman, Dasovi and Fitzgerald 2007). Panel data are also useful for causal analysis because a cause precedes an effect in time and the direction of causality becomes more obvious with measurements at multiple points in time.

In any longitudinal survey, the population definition is a key aspect of survey implementation. However, in longitudinal surveys defining the population requires understanding of how operationalizing the population definition affects sample size over time. In longitudinal household panels sampling units are still individuals; however, if one member is sampled usually all household members are also interviewed. Therefore, in household panels two fundamental challenges arise which do not occur in cross sectional surveys:

(1) the composition of households changes over time,
(2) the target population changes over time through immigration/emigration and births/deaths.

While household panels typically also survey people who move into a sample household (e.g. spouses, partners, births), they do not necessarily continue to survey those that leave (e.g. separation/divorce, grown children moving out) in subsequent waves of the survey panel. The rules that govern which respondents are still surveyed when households split up are called following rules or tracking rules. If a respondent who is followed forms a new household, all new household members are interviewed while living with the individual. (However, respondents who move into institutions such as old people's homes or prisons are typically not interviewed irrespective of following rules. The HILDA panel, an exception, does follow respondents should they move into

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old people's homes and other-non private dwellings but not into prisons.)

Following rules must be decided upon at the design stage and this initial decision has irrevocable consequences. Once the contact to sample members moving out is lost, it typically cannot be regained. In the past some panels had to reverse their initial decision about following rules. For example, the German SOEP changed their following rules in wave 7 (1990) because interviewers had difficulties distinguishing between who should be followed and who not. The Swiss Household Panel (SHP) changed their following rules in wave 9 in an attempt to counterbalance the effect of attrition. A household panel evolves from consisting only of wave 1 members (initial wave) to having a smaller number of wave 1 members (due to attrition) and a range of new household members who over time were born into or moved into the households.

From a field perspective, it is very important to know how following rules affect sample size because of the cost implications. Considerable work has been done on panel attrition (Fitzgerald, Gottschalk and Moffitt 1998; Lipps 2010; Uhrig 2008; Watson and Wooden 2004), but to what extent following rules offset attrition is unclear. Some have speculated that following everybody who was ever part of a sample household might result in a snowball effect leading to an ever expanding sample (Kalton and Brick 1995). The sparse relevant literature on following rules addresses following rules mainly in the context of their effect on cross sectional weights (Kalton and Brick 1995; Lynn 2009; Rendtel and Harms 2009) though the rationale for following non-original sample members for life course and other analyses has been argued also (Kroh, Pischner, Spiess and Wagner 2008). At present, the literature offers little guidance how different following rules affect sample size and sample composition. Following rules also have implications for analysis because measurements of individuals living in the same household may be correlated. Depending on the specific measurement of interest, correlation may persist after the household splits up. Therefore, analysis methods need to address such correlation (e.g., using hierarchical models).

In this paper we survey what types of following rules are implemented in household survey panels in Australia, Canada, Germany, Great Britain, The Netherlands, The United States, and Switzerland. We have chosen these panels because they represent some of the most prominent panels worldwide. Further, using the panel with the widest possible following rules, SOEP, we simulate the effect of narrower following rules.

The remainder of this paper is organized as follows. In section 2 we describe different following rules and how they are implemented in various panel surveys. In section 3 we simulate the effect of following rules on sample size in the SOEP, HILDA and PSID. In section 4 we explore whether the presence of other household members affects household attrition in the PSID. Section 5 concludes with a discussion.

2 A Survey of following rules implemented in household panels

Members of the sample in the first wave are called original sample members (OSMs). Most household panels expand the definition of OSMs to include other respondents who are followed. The expanded definition of OSMs can be a little confusing because respondents joining the panel at a later time are clearly not *original* respondents. However, using two different names (e.g. OSMs and "other permanent sample members") may lead the reader to question whether other permanent sample members are treated differently from OSMs. They are not. We therefore choose to adopt a single name in this paper: permanent sample members (PSMs).

Table 1 shows which category of household members are followed in the following household survey panels: British Household Panel Survey (BHPS, Great Britain) (Taylor, Brice, Buck and Prentice-Lane 2009), Household, Income and Labour Dynamics in Australia (HILDA, Australia) (Watson and Wooden 2009), Longitudinal Internet Studies for the Social sciences (LISS, The Netherlands)[1], Panel Study of Income Dynamics (PSID, USA), (Gouskova, Heeringa, McGonagle and Schoeni 2008), Survey of Labor and Income Dynamics (SLID, Canada)[2], Socio-Economic Panel (SOEP, Germany)[3], The Survey of Health, Ageing and Retirement in Europe (SHARE, Europe)[4], Swiss Household Panel (SHP, Switzerland)[5]. Among these surveys, only Canada's SLID uses a rotational design in which panel members are rotated off the panel after 6 years. None of the other panels rotates members off the panel. Household surveys that use a very short rotational design in which households are retired after only a year or two like the Current Population Survey or those that draw a fresh sample each year (repeated cross-sections) like the American Community Survey are not considered here because they do not have following rules.

Household members fall into one of the following categories: wave 1 respondents, births or adoptions to at least one PSM parent, spouses/partners with a PSM child, spouses/partners without a PSM child, recent immigrants, and other household entrants. Wave 1 respondents include children present during wave 1 even if they were too young to fill out a survey. PSM Births refer to a PSM birth *after* wave 1, and a grown adult born after wave 1 would still be part of the following group "PSM birth". Recent immigrants refer to immigrants into the sample frame since wave 1. (A national living abroad during wave 1 who returns afterwards would also be considered a recent immigrant. However, in practice it is very hard to identify such people. Conversely, an immigrant who already lived in the target population at the time the wave 1 sample is drawn is not considered a recent immigrant.) Recent immigrants and births reflect changes in the target population over time. Of course, following rules affect only those recent immigrants that move into sample

[1] http://www.centerdata.nl/

[2] www.statcan.gc.ca/imdb-bmdi/3889-eng.htm

[3] http://www.diw.de/en/soep

[4] http://www.share-project.org/

[5] http://www.swisspanel.ch

Table 1: Following rules in household survey panels

	SLID	PSID	LISS	BHPS	HILDA	SHARE	SHP	SOEP
Wave 1 respondents	PSM	PSM	PSM	PSM	PSM	PSM	PSM	PSM
Births / adoptions to PSM	NA [2]	PSM	PSM	PSM	PSM	[5]	PSM	PSM
Recent Immigrants[1]					PSM[4]	PSM	PSM[6]	PSM[7]
Partner with child from PSM				PSM[3]	PSM	PSM	PSM[6]	PSM
Partner w/o child from PSM						PSM	PSM[6]	PSM[7]
Other household entrants							PSM[6]	PSM[7]

[1] Recent Immigrants are immigrants who entered the target population after wave 1.

[2] Does not apply – respondents stay only for 6 years in panel and respondents younger than 16 are not interviewed.

[3] While these sample members are followed, they receive zero weight when they leave the household of other PSMs.

[4] Since wave 9 (2009).

[5] Respondents aged 50+; Rare births from younger partners are not followed.

[6] Since wave 9 (2007).

[7] Since wave 7 (1990).

households. None of the panel surveys makes a distinction between partners and spouses, or between PSM births and PSM adoptions.

Because new permanent members are not only followed but are treated just like wave 1 sample members, following status is inheritable and can have far reaching effects. Suppose wave 1 respondent A moves in with partner B. Next, suppose partner B moves out and moves in with a new partner, C, who also has a child, D, from a previous marriage. If spouses/ partners are considered PSMs, then A, B, and C would be part of the sample, but child D would be categorized as "other household entrant" and might not be followed unless "other household entrants" were also followed. However, household panels typically survey all household members of a household that is being followed. Therefore, as long as child D lives with a parent who is followed, child D is still part of the sample.

Overall, we find that household panels use a large variety of following rules (Table 1), ranging from following wave 1 members and later PSM births in the PSID through following everybody in SOEP and SHP panels. All household panels in Table 1 follow births, though we are aware of one exception not listed in Table 1. The recent British panel survey "Understanding Society"[6] follows only births of female PSMs to avoid overrepresentation of children of one PSM parent (P. Lynn, personal communication). More specifically, two PSMs who have children with one another contribute fewer children to the sample on average than if they each had children with a non-sample member. Following only the children of one of the two PSMs (e.g. the female) avoids this problem, but also limits the analysis of generational effects amongst the other (e.g. male) sample members.

3 Simulation of following rules

Because SOEP is the only panel that has followed everyone (the SHP just recently adopted this rule), it is ideally suited to simulate the effect of narrower following rules on sample size. We simulate the following nested following rules:

1. First Wave respondents only
2. Add PSM Births/adoptions
3. Add recent immigrants
4. Add Partner/Spouse with PSM child
5. Add Partner/Spouse without PSM child
6. Everybody

Following rule 1 is the narrowest following rule and 6 the widest. A respondent is always categorized into the lowest numbered group he/she qualifies for. For example, a recent immigrant (listed third above) who is also a partner/spouse (listed fourth and fifth), is followed as a recent immigrant in this setup. Given the same sampling protocol, we assume following rules do not affect non-response, i.e. we would have obtained the same respondents that responded in the SOEP under narrower following rules.[7] For the purpose of the simulations we count all household members in the sample (regardless of whether or not members responded in any one wave) as well as all children regardless of age. For example, if a household member responded in waves 1 and 3 (but not in wave 2) and died after wave 3, this household member would be counted in waves 1 through 3. Partners/ Spouses are identified through variables supplied with SOEP data which were derived from questions about marital status, relationship of respondent to head of household, and, in case of unclear assignments, marital history. The SOEP definition of parents' children includes natural children and adoptions, but not step or foster children. Because of its long history, SOEP has added a number of refreshment samples over the year. The simulations are based on the original sample "A" as it has been in operation the longest.

Figure 1 shows the counts and percentage of individuals for each following status in different years. The number of wave 1 respondents is decreasing markedly through attrition.

[6] http://www.understandingsociety.org.uk/

[7] There is no differential household response burden under different following rules. Even under narrower following rules everybody in the household is typically still interviewed and would not reduce total household response burden. The exception is the PSID where only one person per household is interviewed.

The number of individuals in other groups is relatively stable; attrition balances out new entrants. Among respondents, there is about an equal number of partners with and without a PSM child.

In Figure 1b, the percentages sum to 100% for a given year. By definition, in wave 1 (1984) all respondents had the same following status "first wave". This percentage decreases to about 50% in wave 25 (2008). Figure 1 refers to the following status of individuals. However, if one person in a household is followed then all individuals in that household are interviewed. Therefore, the sample size for a following rule is the number of all individuals in households in which at least one individual is followed (Figure 2). Even in wave 25 (2008), following rule 1 still captures 85% the sample size of following rule 6 (following everybody). Most of the remaining respondents live in households with partners without PSM child or in households with following status "PSM birth". The sizable percentage of individuals with following status "HH member, other" (Figure 1b) virtually disappears in Figure 2b because they live in households which would already be followed under a narrower rule. Many of the "HH member, other" (Figure 1b) are children of partners from a previous marriage. Very few immigrants are entering the panel even though immigrants who are also partners/spouses are counted as immigrants in the simulation.

For face-to-face surveys cost is largely a function of the number of households (rather than sample size) as interviewers have to drive to individual households. Therefore, we also considered the effect of following rules on the number of households (Figure 3). While the number of households in each following group (Figure 3) is of course smaller than the total number of individuals in those households (Figure 2), the distribution is essentially the same. The findings do not change when considering number of households instead of individual sample size.

The SOEP panel is ideally suited for the simulation because it has wide following rules and many waves. We replicated the simulation with the HILDA and the PSID panels[8] and compared the effect of different nested following rules on SOEP, HILDA and the PSID after 9 waves each. Because absolute sample sizes are different in the two panels, we only show percentages (Figure 4). The distributions of individuals across following groups for HILDA and SOEP are remarkably similar after nine waves (Figure 4a). In both panels, most sample members still live in a wave 1 household after 9 waves (Figure 4b). The distribution for the PSID contains noticeably more PSM births and more "other household members". The birth rate in the US at that time was higher than that of Australia and in particularly that of Germany.

Respondents born into a panel do not form their own households until they are in their late teens or early twenties. Even though the SOEP has a 25 year history, this may not be long enough to observe the transition between the growth of first-wave households and the growth of PSM birth households. The PSID has the narrowest following rules but also the longest history. Figure 5 shows the number of households with at least one initial wave member and the number of households without initial wave members but with at least one PSM birth.[9] The number of initial wave households increases for almost 20 years as children born before the initial wave (children who are PSMs) move out, initial-wave couples separate and form separate households, and other initial wave household members move out. The number of initial wave households decreases thereafter as death and attrition dominate household splits involving first-wave members. The number of households with PSM births not containing an initial wave member begins to increase rapidly after 25 years. Between years 20 and 25, the number of households is relatively stable as the number of first wave households is no longer growing and the number of PSM birth households has not yet reached the phase of steep increase after year 25. After 40 years, the number of households in the two categories is nearly equal.

4 Household composition and attrition

Following rules classify household members into different groups. To date, little is known about differential attrition in different groups. For example, PSM birth respondents may be more likely to attrite because they may have less attachment to the panel than first-wave members. Panel households change over time as new spouses/partners and others move-in. New household members are not familiar with the panel survey and their presence may affect attrition of existing households.

PSM birth respondents are not themselves interviewed until they are old enough to qualify as a respondent. Because this takes almost two decades, their attrition rate is best studied in the longest running panel, the PSID. The PSID started in 1968 and therefore has data on PSM births until they are about 40 years old. Unlike in most other panels, in the PSID only the head of household is interviewed. Therefore, we restrict our analyses to head of households. Because the PSID does not follow other groups, the analysis is further restricted to those head of households who are first-wave members or PSM-births. As before, Latino and immigrant samples are excluded from analysis. Census households deliberately dropped at the beginning of 1997 are included but are considered censored as of 1997.

We study attrition using a survival analysis; specifically the Cox Proportional Hazard model. The covariates are: respondent age, respondent is a PSM birth respondent (vs. a first wave respondent), household includes a wife, and house-

[8] HILDA does not follow groups (5) and (6). We report results for all groups, but numbers for groups 5 and 6 will be underestimated. Similarly, PSID does not follow groups (3) through (6).

[9] This calculation excludes refresher samples (immigrant and Latino samples) and households that were deliberately dropped from the census sample at the beginning of 1997 due to budgetary constraints (ER33437=80). To be counted in any one year, individuals had to be living in the family (sequence indicator for the corresponding year between 1 and 20). The PSID distinguishes between PSM children born into a responding household ("born-ins") and PSM children born into a non-responding household ("movers-in"). Both these categories are included in PSM births.

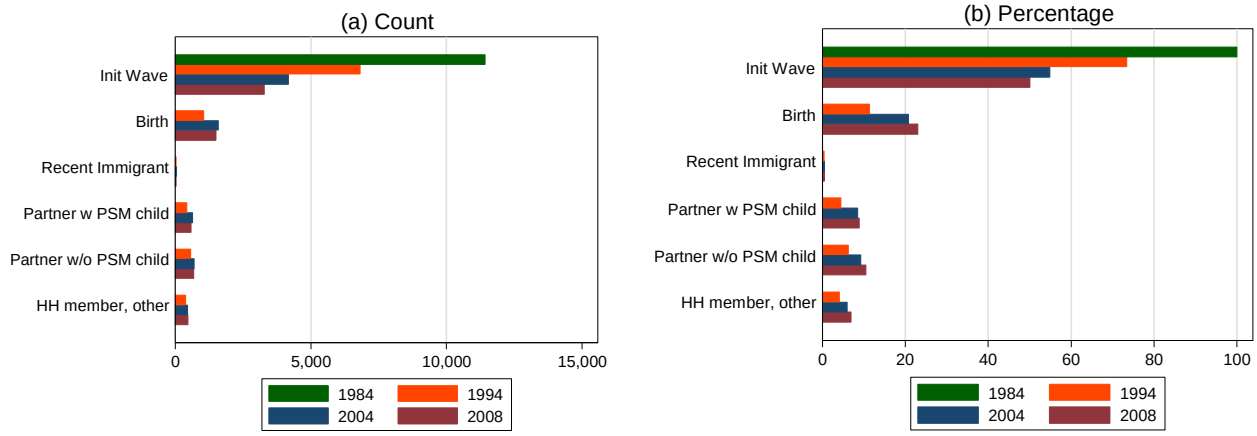

Figure 1. The effect of different nested following rules in the SOEP panel (sample A) on the number of *individuals* in different years. (a) Number of individuals (counts) by following groups. (b) Percentage of individuals by following group. For a given year, percentages sum to 100%.

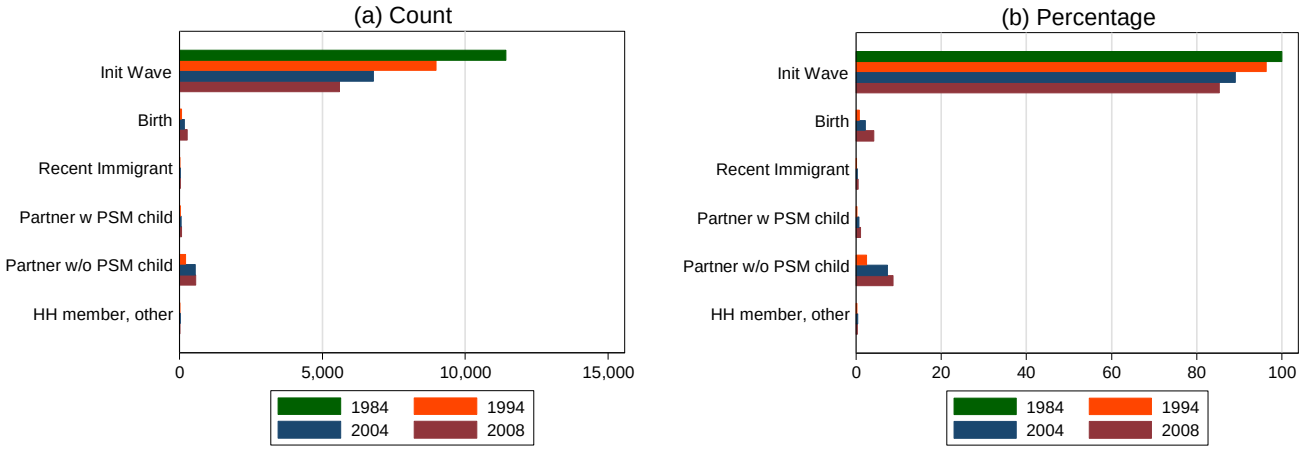

Figure 2. The effect of different nested following rules in the SOEP panel (sample A) on *sample size* in different years. Households are classified according to the individual in the household with the lowest following status. If a household is followed, all individuals in that household are classified under the household following status. (a) Sample size (counts) by following groups. (b) Percentage sample size attributable to different following groups. For a given year, percentages sum to 100%.

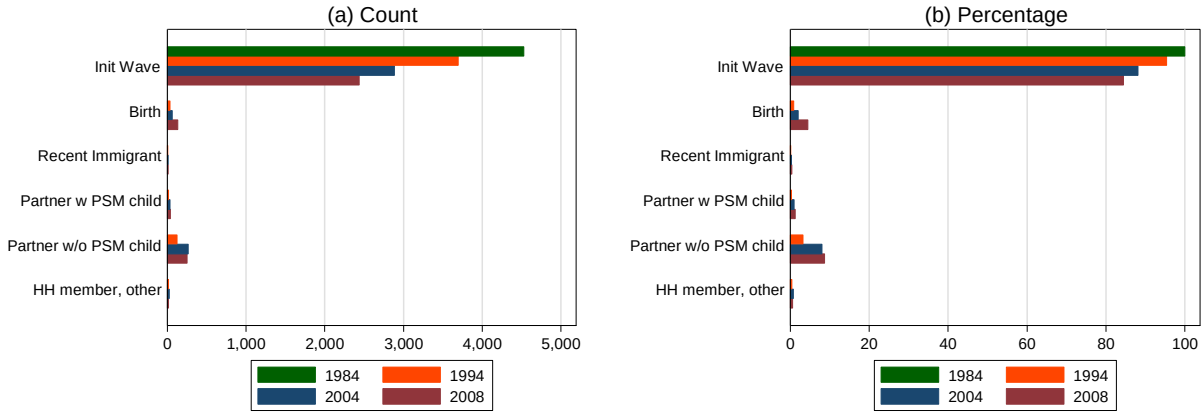

Figure 3. The effect of different nested following rules in the SOEP panel (sample A) on the *number of households* sampled in different years. (a) Number of households by following groups. (b) Percentage of households by following group. For a given year, percentages sum to 100%.

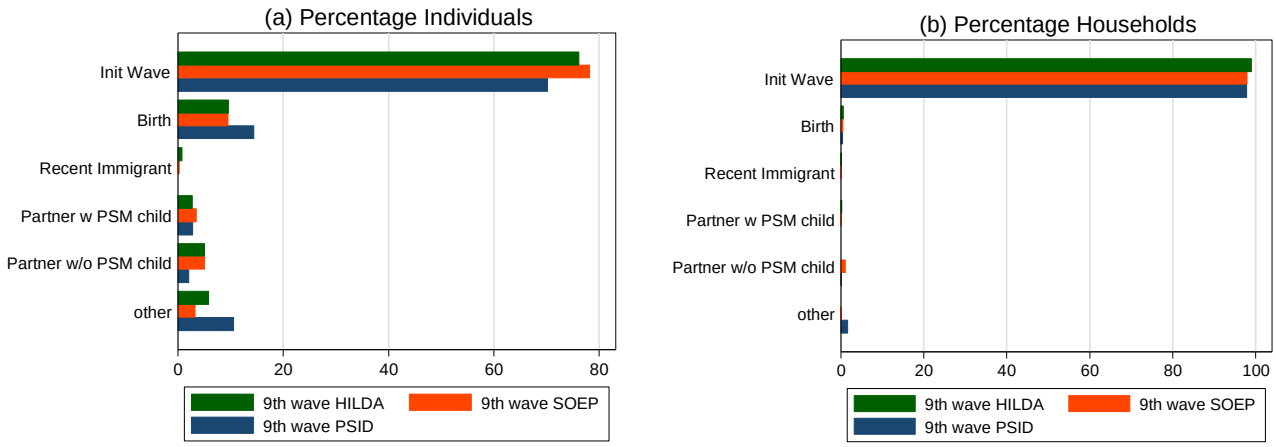

Figure 4. Comparison of the effect of different nested following rules between the SOEP, HILDA and PSID after 9 waves each. (a) Percentage of individuals by following group. (b) percentage of total sample size attributable to various following groups.

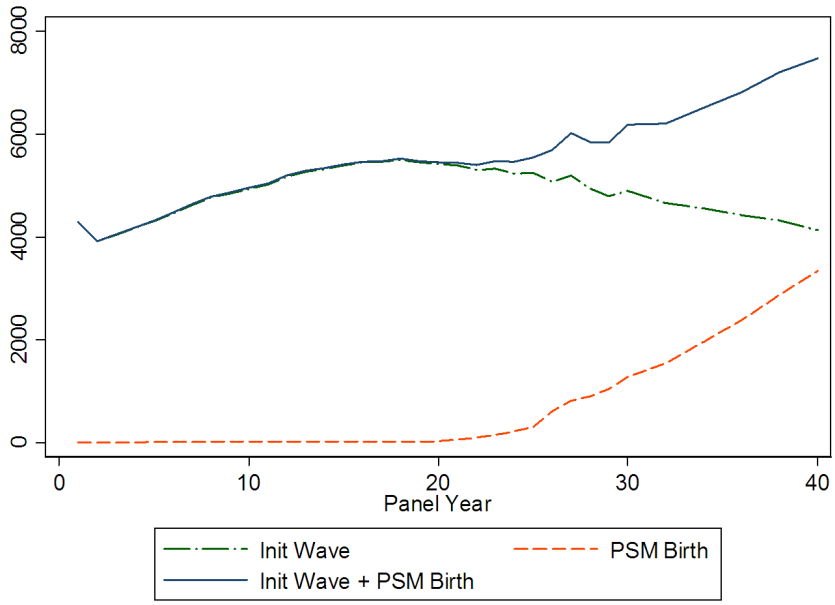

Figure 5. Number of PSID households over time for households with at least one first wave member ("Init Wave"), households with at least one PSM birth member (but without first wave members) ("PSM Birth") and their sum ("Init Wave + PSM Birth").

hold includes one or more other persons. When the head of household cannot be interviewed the PSID allows a substitute interview with another household member. Of course, this is not possible in one-person households. We therefore also adjust for single and two-person households to account for possible increased attrition in those households.

In survival analysis, time is not necessarily calendar time. Here, time starts when respondents first become head of households. For wave 1 respondents this is always 1968. For PSM births we specify the year prior to when they first become head of households to capture nonresponse in the transition. If in subsequent waves respondents were no longer head of households (e.g. moving back into the parental home), respondents were excluded for those waves only.

Results of the Cox proportional hazards model are shown in Table 2. Based on a test of Schoenfeld residuals, there is no evidence of a violation of the assumption of proportional hazards. Table 1 shows that attrition significantly increases with old age. The hazard ratio of attrition of those over 80 years old is six times that of the reference group (40-49 year old respondents). This is expected of course as old age is associated with increased risk of mental impairment and death.

One-person or two-person households are not associated with increased attrition as compared to larger households. Allowing family members to substitute for heads of household does not significantly affect attrition when adjusting for other covariates.

Table 2: Covariates related to PSID attrition of first-wave and PSM birth head of households using a Cox proportional hazard model

		Hazard ratio	p	Lower CI Limit	Upper CI Limit
HH composition	HH includes other member	1.41	0.017	1.06	1.86
	HH includes PSM Birth	0.78	0.148	0.55	1.09
	HH includes wife	1.00	0.971	0.77	1.29
Head of Household	Head of household is child of PSM	0.42	0.001	0.25	0.69
	Head of household is PSM (referent)	1.00			
Household Size	One person household	0.98	0.914	0.72	1.34
	Two person household	0.82	0.151	0.62	1.08
	Three or more person household (referent)	1.00			
Age of Head of Household	age <20	2.58	0.018	1.18	5.64
	20≤age<30	2.42	0.001	1.40	4.16
	30≤age<40	1.40	0.092	0.95	2.09
	40≤age<50 (referent)	1.00			
	50≤age<60	0.79	0.212	0.54	1.14
	60≤age<70	1.59	0.027	1.05	2.40
	70≤age<80	3.23	0.000	2.08	5.03
	80≤age	6.07	0.000	3.45	10.67

PSM-birth head of households are significantly less likely to attrite (hazard ratio 0.42) compared to first-wave head of households. This is surprising. First, to avoid a possible selection bias, we repeated the analyses but redefined "survival time" for first-wave head of households to start when their first child moved out and became head of household. The hazard ratio for PSM-birth head of households remained significant with a similar hazard ratio. Second, PSM births were born after 1968 and are at most 40 years old. When restricting the analysis to head of households aged 40 or less the hazard ratio was also significant and similar in magnitude. One explanation is that PSM births are conditioned to respond as they grew up with their parents participating in the PSID. They may perceive it more like an annual ritual like paying taxes.

Households with a member other than wife or a child are more likely to attrite (hr=1.4) even after adjusting for family size and other covariates. This suggests new members moving into a household can affect attrition. Living with a partner or starting a family does not significantly affect attrition, whereas acquiring other housemates increases attrition.

5 Discussion

Household panels use a diverse set of following rules. Overall, following rules have surprisingly little effect on sample size even after 25 yearly waves. The only decision which has a noticeable effect on sample size is to whether or not to include partners without PSM children. Even the widest following rules do not counterbalance the effect of attrition on sample size in the SOEP. Whether or not PSM births are followed eventually strongly affects sample size. In the PSID this effect becomes noticeable after 25 years.

Both attrition and the effect of following rules vary from panel to panel and SOEP has a somewhat higher attrition rate than other panels. After their respective first 8 waves, the attrition rates were as follows: PSID 25% (Fitzgerald et al. 1998, Table 1), BHPS 26% , HILDA 28%, SOEP 36%.[10]

For wave-on-wave attritions, the rates are 2-3% in the PSID[11] (Fitzgerald et al. 1998, Table 1), 4-5% in the BHPS (own calculations), 4-6% in HILDA (own calculations, also reported in Summerfield 2010), and 5-7% in the SOEP (Behr, Bellgardt and Rendtel 2005, Figure 3). The lower PSID attrition may in part be due to high incentives (currently $60; and $10 in non-interview-years) which are sent out within a few days following the interview, and greater refusal conversion efforts in the PSID (McGonagle and Schoeni 2006). In addition, the PSID gathers information about the whole household from only one person, usually the male adult head of household (Online PSID Documentation 2010). If the head of household is unwilling to respond, the head's partner may substitute. This is not typical as in most other household panels all (adult) household members are interviewed and a non-responding head of household would count as non-response.

If the effect of following rules on sample size varies from panel to panel, different birth rates in different countries is one likely cause. Household panels in countries with higher birth rates will have accrued a larger sample from births after the children are old enough to enter in the panel. Birth rates range from 0.8% in Germany, to a high in the US of 1.4% with Australia (1.2%) and Great Britain (1.1%) falling in between.[12] The variability in birth rates across countries is relatively small as compared to the variability in annual (wave-on-wave) attrition. In addition, annual attrition exceeds the birth rates in all countries. Differential attrition has a stronger affect on sample size than differential birth rates.

Therefore, the most likely panel to have an increasing sample size over time is the panel with the lowest attrition rate, the PSID (which is also in a country with the high-

[10] Own calculations for BHPS, HILDA and SOEP. For our attrition calculations deaths (and moves out of the sample frame) are removed from the denominator. The attrition rate for the PSID does not remove deaths from the denominator; therefore the comparable attrition rate for the PSID is even lower.

[11] However, the PSID wave-on-wave attrition rate may be too low because some of the wave-on-wave non-respondents return in later years and are counted as negative attrition then.

[12] http://www.infoplease.com/ipa/A0004395.html

est birth rate among countries considered). In fact, the only known panel in which sample size consistently increases is the PSID. The number of permanent sample members increased by 10% from 1997 to 2005 (from 15,051 to 16,620 respondents); the number of temporary sample members increased by 34% from 1997 to 2005 (from 4710 to 6298 to respondents) (Gouskova et al. 2008, Table 7). The number of families in the PSID grew by 33% from 1997 to 2005 (from 1,714 families to 2,279 families) (Gouskova et al. 2008). This is largely due to PSM births starting to move out (see Figure 5). The increase would be attenuated if the PSID followed only births to *female* PSMs like Understanding Society. In the HILDA panel sample size has been relatively stable. In two waves, waves 5 and 9, HILDA even had a 2.0% and 2.4% increase in number of responding households and a corresponding increase in the number of responding persons of 1.1% and 4.0%. The reason for the sample size increase in waves 5 and 9 was likely the change in monetary incentives HILDA introduced in both these waves.

For the PSID we observed a sustained increase in the number of families after year 25 due to PSM births establishing their own households. The SOEP has reached 25 years and the question arises how PSM births will affect the number of households. While the inflection point might be observed a little earlier or a little later, it is possible the annual decrease of the number of SOEP households will be reduced.

As mentioned earlier, Understanding Society has implemented a following rule in which only births of *female* PSMs are followed. As compared to following all PSM births, roughly half as many children are followed. If the PSID had implemented this following rule, the number of PSID households displayed in Figure 5 would have stabilized after 20 years: the midpoint between the total number of households and the PSM households remains relatively constant in Figure 5.

We found that PSM births have lower attrition than first-wave respondents in the PSID. This contributes to an increase in sample size over time as PSM births gradually replace first-wave respondents. It is difficult to make more precise statements on sample size as it is subject to so many factors.

Our study has limitations. First, our simulation was based on one survey panel because the SOEP is the only panel that has been following everyone for many years. However, we replicated the result up to wave 9 in the HILDA panel. Second, the current wide following rules in SOEP were adopted only in wave 7 (1990). However, we have looked at data through wave 25; whether the conclusions refer to a time frame of 18 years or 25 years does not qualitatively change the findings.

While sample size and associated costs are important considerations, other factors also affect the decision of whether to adopt wider or narrower following rules. Certain research questions require wide following rules such as economic and social consequences of divorce. On the other hand, wider following rules may be less desirable because additional respondents may be somewhat similar to existing respondents, giving too much weight to people already in the sample. Finally, the ability to construct sampling weights for all sample members is important. Constructing valid sampling weights for new entrants is not trivial because the selection probabilities of new entrants depend on the membership history of the entire panel (Lynn 2009:28). Panels generally either use a model to estimate unknown quantities or use the "weight share method" (Kalton and Brick 1995) though the weight share method is only appropriate for narrow following rules (rules 1 and 2).

The implications for panel designers are:

1) A large variety of following rules exist and a prospective panel designer needs to explicitly decide which rules he/she will adopt.
2) Unless attrition is low, there appears to be no danger of a snowball-like effect on sample size and sampling cost regardless of the following rule adopted.
3) The decision about whether to follow PSM births will have a major impact on the size of the sample only after about 25 years, when they start to move out into their own households, but it is an important one. The PSID has seen a 40% increase in their sample size in the last 20 years because of PSM births moving out.
4) Assuming that all panels will want to include (at least a sizeable portion of the) births, the second key decision with respect to following rules is whether or not to follow partners without PSM children and this decision needs to be made early on in the life of the panel. In the SOEP panel, after 25 years, this decision affects about 10% of the maximal possible sample size. In the SOEP panel, all other decisions about following rules have almost no effect on sample size.

Acknowledgements

Dr. Schonlau's work was primarily supported by DIW with additional support from grant 1R01AG020717 from the National Institute of Aging (USA) to RAND (Kapteyn, P.I.). Ms. Watson's research has been supported by an Australian Research Council Discovery project grant (#DP1095497). It makes use of unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, which was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research. The findings and views reported in this paper, however, are those of the authors and should not be attributed to either FaHCSIA or the Melbourne Institute.

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