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how much do following rules affect sample size?**

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

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Household Survey Panels: How Much Do Following Rules Affect Sample Size?

Abstract

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. 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”. Almost all of the remaining 15% live in households of children of wave 1 respondents who have grown up (5%) and in households of former spouses/partners (10%). Unless attrition is low, there is no danger of an ever expanding panel because even wide following rules do not typically exceed attrition.

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 & Muller, 1998; Kotler-Berkowitz, 2001; Scott & 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, & Christoph, 2006) and family influences (Kroh, 2009; Zuckerman, Dasovi, & 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, usually all household members are also interviewed. Therefore, in household survey 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. Household survey panels typically also survey people who move into a sample household (e.g. spouses, partners, births), but 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 who is surveyed are called following rules or tracking rules. 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. Figure 1 illustrates how the composition of 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, & Moffitt, 1998; Lipps, 2010; Uhlig, 2008; Watson & 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 & Brick, 1995). The sparse relevant literature on following rules addresses following rules mainly in the context of their effect on cross sectional weights (Kalton & Brick, 1995; Lynn, 2009; Rendtel & Harms, 2009) though the rationale for following non-original sample members for life course and other analyses has been argued also (Kroh, Pischner, Spiess, & 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. 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. Section 4 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, & Prentice-Lane, 2009), Household, Income and Labour Dynamics in Australia (HILDA, Australia) (Watson & Wooden, 2009), Longitudinal Internet Studies for the Social sciences (LISS, The Netherlands) (<http://www.centerdata.nl/>), Panel Study of Income Dynamics (PSID, USA), (Gouskova, Heeringa, McGonagle, & Schoeni, 2008), Survey of Labor and Income Dynamics (SLID, Canada) (www.statcan.gc.ca/imdb-bmdi/3889-eng.htm), Socio-Economic Panel (SOEP, Germany) (<http://www.diw.de/en/soep>), The Survey of Health, Ageing and Retirement in Europe (SHARE, Europe) (<http://www.share-project.org/>), Swiss Household Panel (SHP, Switzerland) (<http://www.swisspanel.ch>). 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 a 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 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 spouse/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”¹ 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 SWISS panel 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

¹ <http://www.understandingsociety.org.uk/>

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. 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 2 shows the counts and percentage of individuals for each following status in different years. The number of wave 1 respondents is decreasing rapidly through attrition. 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 2b, 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). However, a household is followed when one or more persons in the household are followed and all individuals in a followed household are surveyed. Therefore the sample size for a following rule is the number of all individuals in households that are followed (Figure 3). 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 2b) virtually disappears in Figure 3b because they live in households which would be already be followed under a narrower rule. Many of the “HH member, other” (Figure 2b) 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 4). While the number of households in each following group (Figure 4) is of course smaller than the total number of individuals in those households (Figure 3), 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. To find out whether the results were generalizable, we replicated the simulation with the HILDA panel and compared the effect of different nested following rules on SOEP and HILDA after 9 waves each. Because absolute sample sizes are different in the two panels, we only show percentages (Figure 5). The two distributions of individuals across following groups are remarkably similar in both panels after nine waves (Figure 5a). In both panels, most sample members still live in a wave 1 household after 9 waves (Figure 5b).

4. 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.

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% (own calculations² for BHPS, HILDA and SOEP).

For wave-on-wave attritions, the rates are 2-3% in the PSID³ (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, & 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 & 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 was 1.4% with Australia (1.2%) and Great Britain (1.1%) falling in between⁴. 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.

² 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.

³ 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.

⁴ <http://www.infoplease.com/ipa/A0004395.html>

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 highest 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 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). 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.

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, p.28). Panels generally either use a model to estimate unknown quantities or use the “weight share method” (Kalton & 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) Assuming that all panels will want to include births, the key decision with respect to following rules is whether or not to follow partners without PSM children. After 25 years, this decision affects about 10% of the maximal possible sample size. All other decisions about following rules have almost no effect on sample size.

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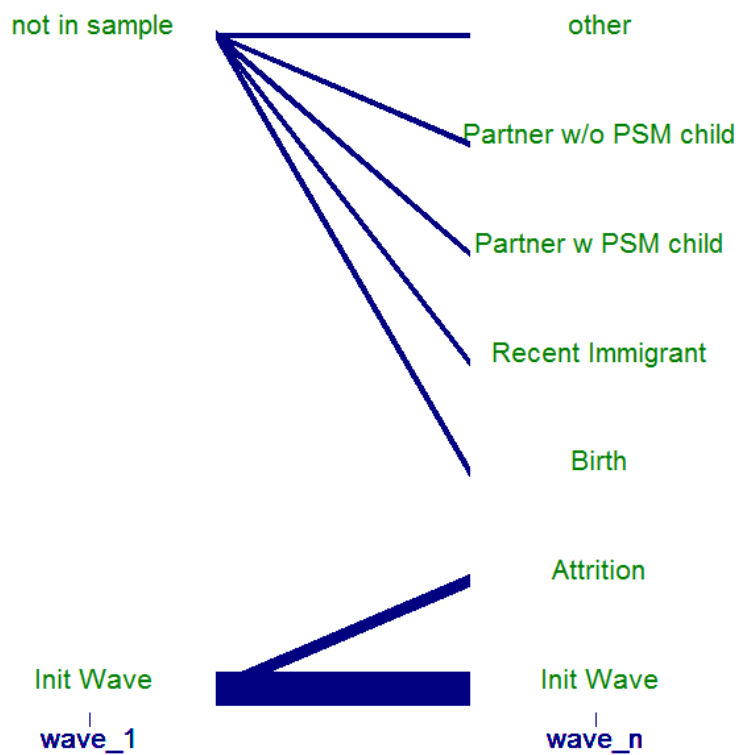


Figure 1: The sample evolves from consisting only of wave 1 members to fewer wave 1 members and a range of other new household members.

	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	NA (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) Does not apply, Respondents aged 50+

(6) Since wave 9 (2007).

(7) Since wave 7 (1990).

Table 1: Following rules in household survey panels

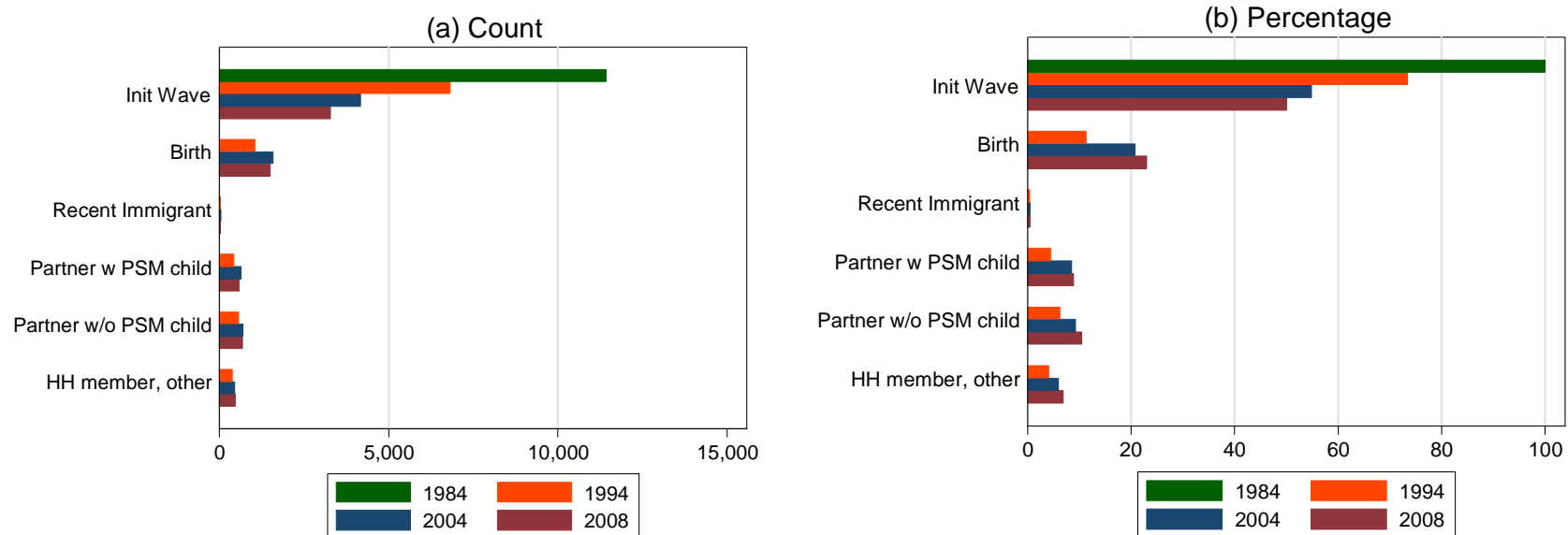


Figure 2: The effect of different nested following rules in the SOEP panel (sample A) on the number of *individuals* in different years. (a) Number of individuals (counts) by following groups. (b) Percentage of individuals by following group. For a given year, percentages sum to 100%.

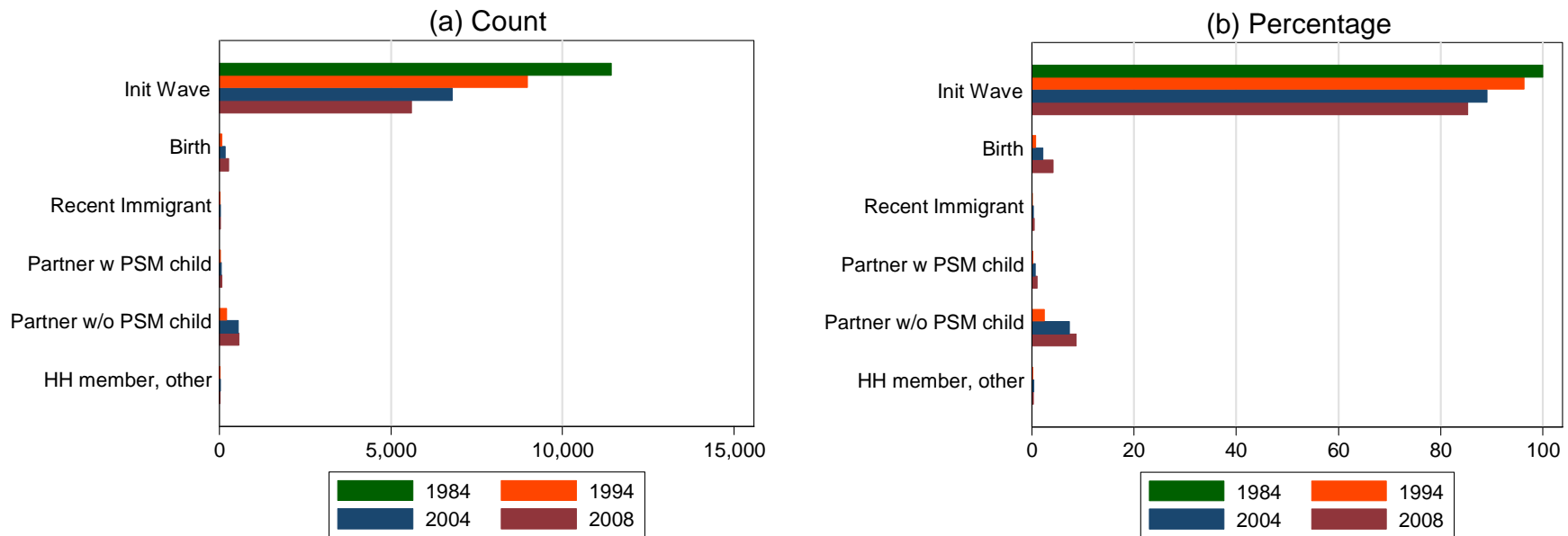


Figure 3: The effect of different nested following rules in the SOEP panel (sample A) on *sample size* in different years. Sample size includes all individual household members if one individual is followed. (a) Sample size (counts) by following groups. (b) Percentage sample size attributable to different following groups. For a given year, percentages sum to 100%.

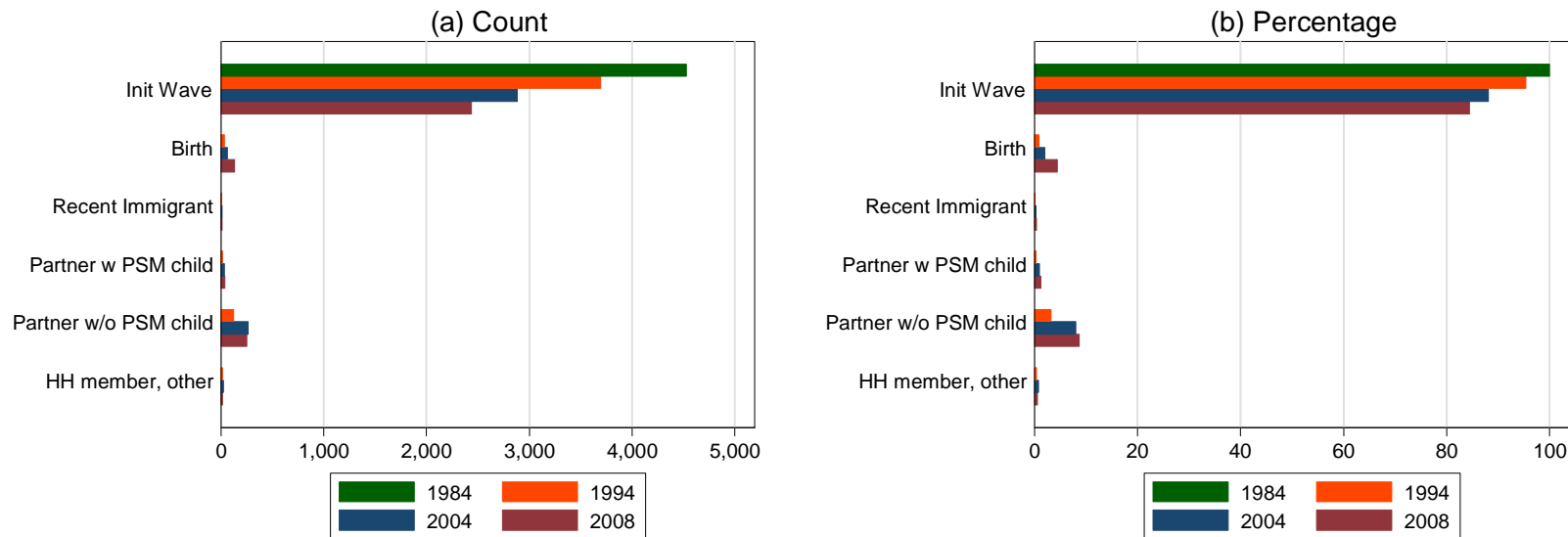


Figure 4: The effect of different nested following rules in the SOEP panel (sample A) on the *number of households* sampled in different years. (a) Number of households by following groups. (b) Percentage of households by following group. For a given year, percentages sum to 100%.

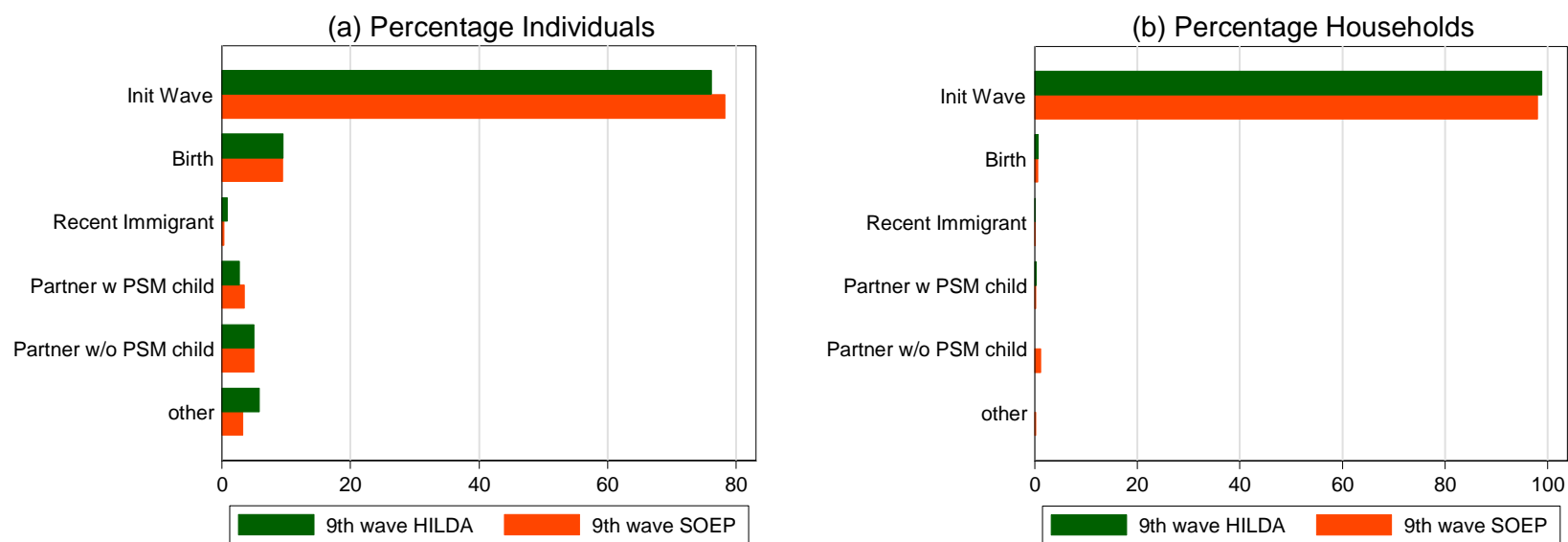


Figure 5: Comparison of the effect of different nested following rules between the SOEP and HILDA after 9 waves each. (a) Percentage of individuals by following group. (b) percentage of total sample size attributable to various following groups.