Assessing Panel Bias in the Knowledge Networks Panel: Updated Results from 2005 Research

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Abstract

Sample panels are susceptible to bias resulting from a respondent's tenure on the panel. Research conducted in 2001 when the Knowledge Networks panel was two years old concluded that no serious undercurrent of panel tenure bias existed for the multiple case study data examined. Recent research results with the panel now aged to 6 years supports the earlier finding when taking into account sample design changes over time.

1. Overview

A number of factors associated with respondents' time on a panel may produce changes in survey measures and thereby complicate analyses. The impact of these factors has been described as a ***history effect, secular effect, maturation effect, panel bias, or time-in-sample bias***. These factors include the reactivity of respondents to survey measures, changes in the expectation or performance of the respondent role, the "conditioning" effect of multiple administrations of a survey or similar surveys, and the aging of the panel. Changes in survey measures due to such effects present a danger to the extent that panel biases actually exist and the sample size contribution of the bias in the measured outcomes.

In past case study evaluations into panel effects in Knowledge Networks (KN) panel data, evidence of serious panel tenure bias was not found.[1] Estimates compared across panel tenure were not statistically (or substantively) different and estimates compared to outside reliable benchmarks matched very closely. We have conducted analyses of panel tenure effects using more recent survey data from the KN panel that supports the earlier findings.

We analyzed approximately 30 different survey outcomes from KN data, extracting sample design effects and found that less than 10% resulted in statistically different results at the 90% confidence level when comparing panel tenure subgroups (*Membership on the panel: less than 6 months, 13-18 months, 19-24 months, 25-36 months, and 37+ months*). Outcomes included health, technology, and consumer behavior topics.

After a brief summary of the sample design of the Knowledge Networks panel in section III, we present our analysis plan and findings below in sections IV and V respectively.

2. Knowledge Networks Panel Sample Design

The Knowledge Networks sample design begins with a Random Digit Dialing (RDD) sample of households, followed by a reverse address match, and mailing of an introductory letter to every household for which we are able to obtain an address match. Households (both addressed matched and non-addressed matched) are then recruited by telephone. Once a household agrees to participate, Knowledge Networks either delivers a MSN®TV unit that essentially transforms the television in the household into a monitor for survey administration or recruits the household to take surveys via their computer if they have a computer and Home Internet Access in the house. All household members are recruited and all adults (18 and over) are given a welcome survey to familiarize them with use of the MSN®TV. Then a profile questionnaire is assigned to each household to collect basic demographic information about the household and its members. Once we have received the profile data, the household is considered ready to receive regular surveys.

The sample design for the Knowledge Networks Panel Sample begins as an equal probability design that is self-weighting with several known deviations from this guiding principle to make

[1]Dennis, J. Michael. 2001. Are Internet Panels Creating Professional Respondents? The Benefits of Online Panels Far Outweigh the Potential for Panel Effects. *Marketing Research,* Summer: 34-38.
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the sample more flexible and efficient. Adjustments are calculated and applied to base sampling weights to account for these known deviations.

The six sources of deviation from an equal probability sample design in the KN panel are:

1. Subsampling of telephone numbers for which we could not find an address,
2. Random Digit Dial sampling rates proportional to the number of phone lines in the household,
3. Minor oversampling of Chicago and Los Angeles due to early pilot surveys in those two cities,
4. Short-term double-sampling the four largest states (CA, NY, FL, and TX) and central region states,
5. Under-sampling of households not covered by MSN® TV, and
6. Oversampling of minority households (Black and Hispanic)

There are several sources of survey error that are an inherent part of any survey process such as nonresponse, non-coverage and response error. We address these sources survey error using standard post-stratification adjustments to the weights using data from the most recent Current Population Survey.

3. Analysis Plan

The ideal situation would be to simply present a table of estimates cross-tabulated by their tenure group to show the existence or nonexistence of panel tenure. However, this will not tell the whole story. There are two issues that complicate such a simple crosstabulation analysis. The first is that the sample design and recruitment of KN panel members changed over the past 3 ½ years – different tenure groups will have differing sample compositions. We account for the sample design changes in the calculation of sample design weights for the full panel, but it is impossible to do it at the tenure group level since we actually stopped recruiting the NonInternet segment of the population for a year. The other complicating factor is attrition. We know that we have higher rates of attrition for certain groups: young adults, Blacks, Hispanics, people with high school or less than high school educations. Again, we account for this and attempt to reduce bias due to attrition in the overall panel weights, but we do not currently implement these adjustments at the tenure group level.

Therefore, the individual effects of panel tenure are challenging to tease out. We attacked the problem using four approaches:

1. We summarized whether significant differences exist in survey outcomes when crossed by panel tenure. We analyzed outcomes from major health, behavior and attitude data collected from KN panelists and analyze outcomes for two very specific consumer oriented surveys.
2. When statistically significant differences were found, we eliminated the major sample design changes (such as the temporary suspension of Non-Internet household recruitment) that may have contributed to the observed differences. We examined outcomes by panel tenure for NonInternet panelists only.
3. We applied logistic regression to the data to parse out the multiple sample design factors from any real panel biasing effects. The sample design factors include oversampling of Black and Hispanic households, oversampling of address listed households, oversampling on Internet households and oversampling the Midwest region. We also investigated whether re-weighting individual panel tenure groups eliminates possible effects.
4. We also present results from an independent study conducted by Stanford University on the quality of KN data. Stanford compared KN panel estimates to known, reliable benchmarks and to an RDD phone survey using the same questionnaire and fielding time to assess the magnitude of overall bias in KN panel estimates. The benchmarks come from the U.S. Current Population Survey, the Consumer Expenditure Survey, MRI's Readership Survey, and the Annual Housing Survey. These results give further evidence to the minimal impact of panel tenure bias in KN survey data.

3.1 Knowledge Networks Profile Data

In construction of the Knowledge Networks Panel, a great deal of data is periodically collected to profile the demographic, economic and behavioral characteristics of all panel

members that are contacted for surveys. Some elements of profile data are available for up to 94% of panel members. The type of profile data available includes the following:

- Person and Household Demographics
- Computer and Internet Use
- TV and Cable
- Health and Ailments:
- Political Profile
- Magazine and Newspaper Readership,
- Financial Profile
- Lifestyle Profile

The availability of the profile data collected on panel members allows us to examine the potential bias associated with panel tenure, i.e., the length of time panel members have been active on the panel, and assess whether final analyses and study conclusions are affected by panel tenure.

3.2 Consumer Data

We also conducted several surveys using KN panel members on very pertinent consumer research questions. We analyze this data by panel tenure to make sure that outcomes that influence important business decisions in consumer companies are included in the evaluation. The two areas are consumption in the United States of different beverages and ownership of high technology items in the household.

4. Findings

Chart 1 presents the behavior of ten different estimates from KN profile data crossed by panel tenure group (< 6 months, 6 – 12 months, 13-18 months, 19-24 months, 25-36 months, and 37+ months) without regard to sample design changes that disproportionately effect each of the panel tenure groups. Specifically comparing results from the <6 months group to the 37+ group, 7 estimates are statistically different. Chart 2 presents results for the same estimates only for the NonInternet subsample, where just 1 estimate remains statistically significant after eliminating the oversample feature of Internet households.

Charts 3 and 4 present similar results when we analyzed data from a beverage consumption study. Without taking the oversampling of Internet households into effect, 2 estimates out of 10 were statistically different when comparing <6 months tenure to 37+ months tenure. This drops to one statistically significant difference when we analyze the Noninternet subsample.

Data from the Technology study appeared to be affected by more design changes than just the Internet oversample as seen in Chart 5. When we looked at the data in total, 6 out of the 11 estimates we examined were statistically different when comparing <6 months tenure to 37+ months tenure. To eliminate the effect of all the sample design features, we used logistic regression including independent variables for oversampling Internet households, Blacks, Hispanics, certain geographies and address listed households in the prediction model for each estimate. Table 1 presents the results from the separate logistic regressions run against each of the 6 significant outcomes. Only one estimate – DVD Player Connected to the TV – showed that panel tenure was still a significant effect after controlling for all the other sample design features.

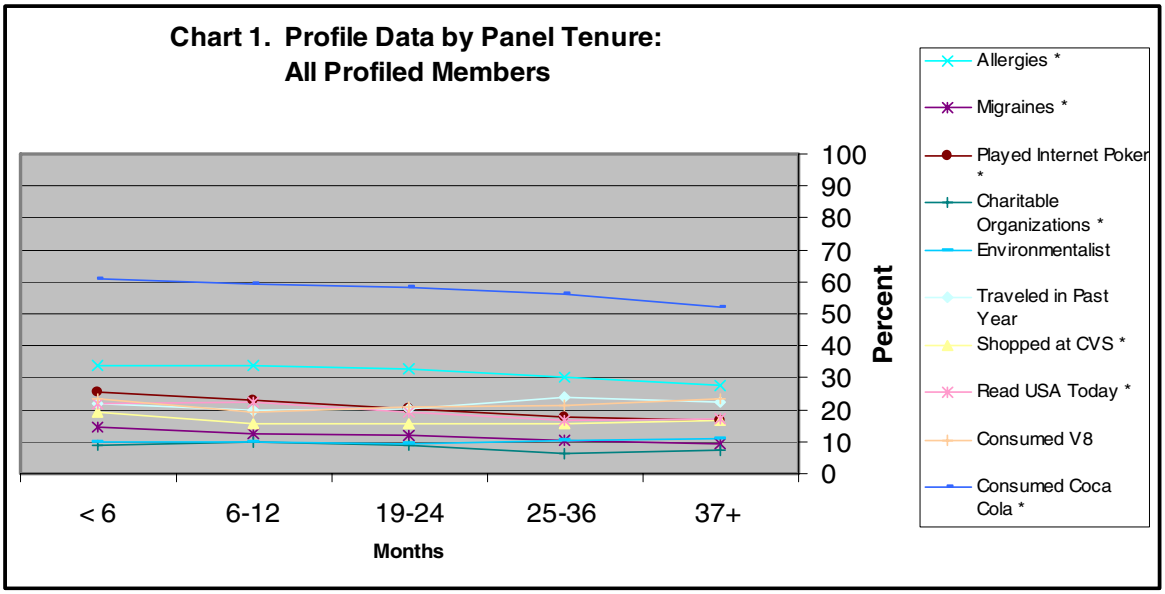
Based on these results, we decided to investigate see what would happen if we independently weighted each panel tenure group to account for sample design changes and other nonsampling error. The revised estimates are shown in chart 6. We were able to reduce the number of items with significant panel tenure differences from 6 to 2, a substantial improvement.

Accounting for sample design features, either through subgroup analysis, logistic regression and independent weighting by panel tenure group, we conclude there is no systemic evidence of panel tenure bias in the Knowledge Networks panel. We selected a fairly wide range of characteristics, behavior and attitude data and did not find more than a few statistically significant differences in estimates by their tenure in the Knowledge Networks panel.

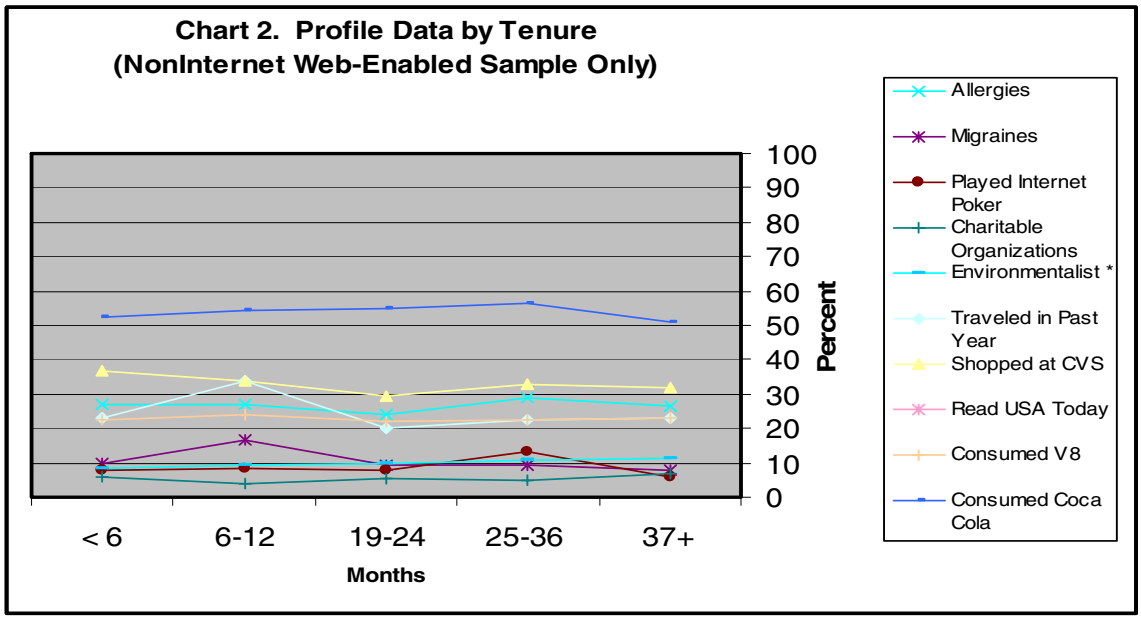
In further support of the overall quality of data from the KN panel are results from an independent study conducted by Stanford University in the spring of 2005 comparing results from the same questionnaire across an RDD selected telephone survey, a KN panel sample, and six non-probability based Internet samples. Table 2 below shows that KN estimates performed as well or better than the RDD telephone survey with respect to bias as

compared to objective (and often official) benchmarks.

Assessing the Stanford Study results in addition to the case study analyses of the existence/level of panel tenure bias, we are confident that panel tenure bias is not a serious issue for surveys conducted using the KN panel.



* Significant at the α = .10 level



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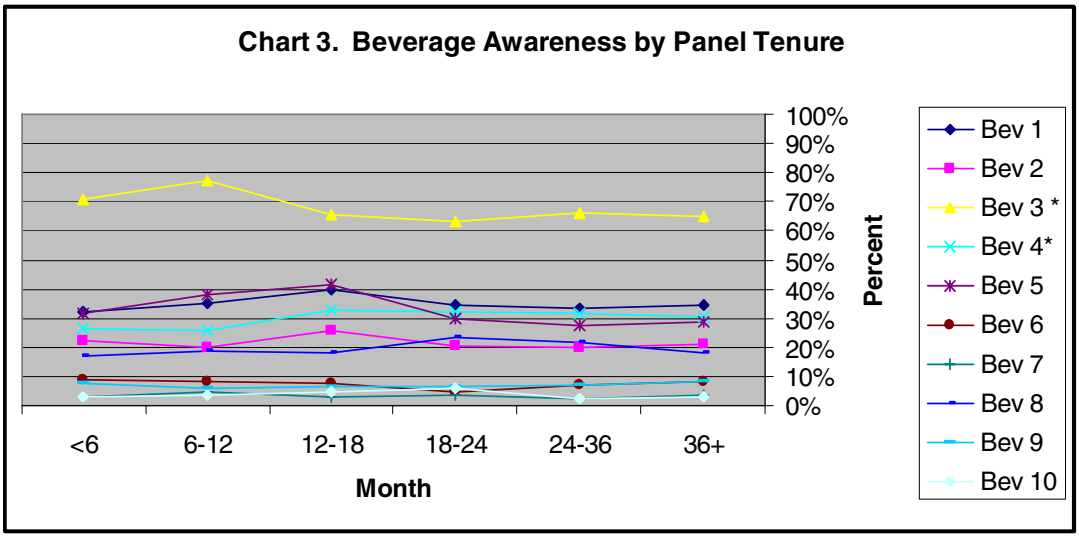

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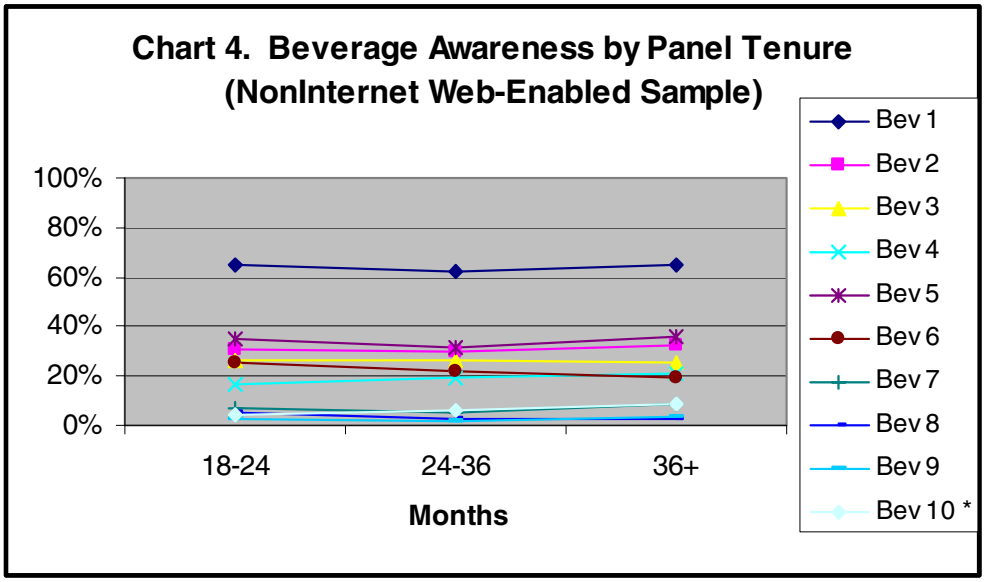

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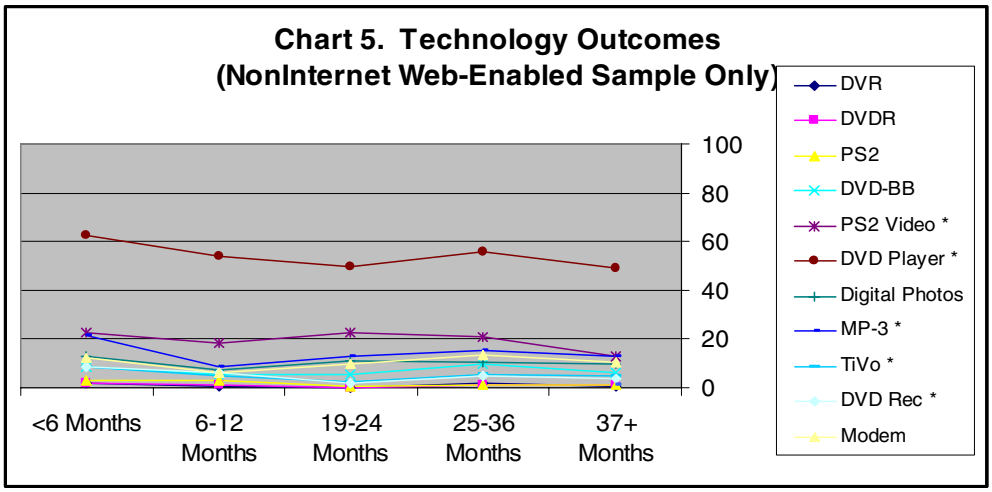

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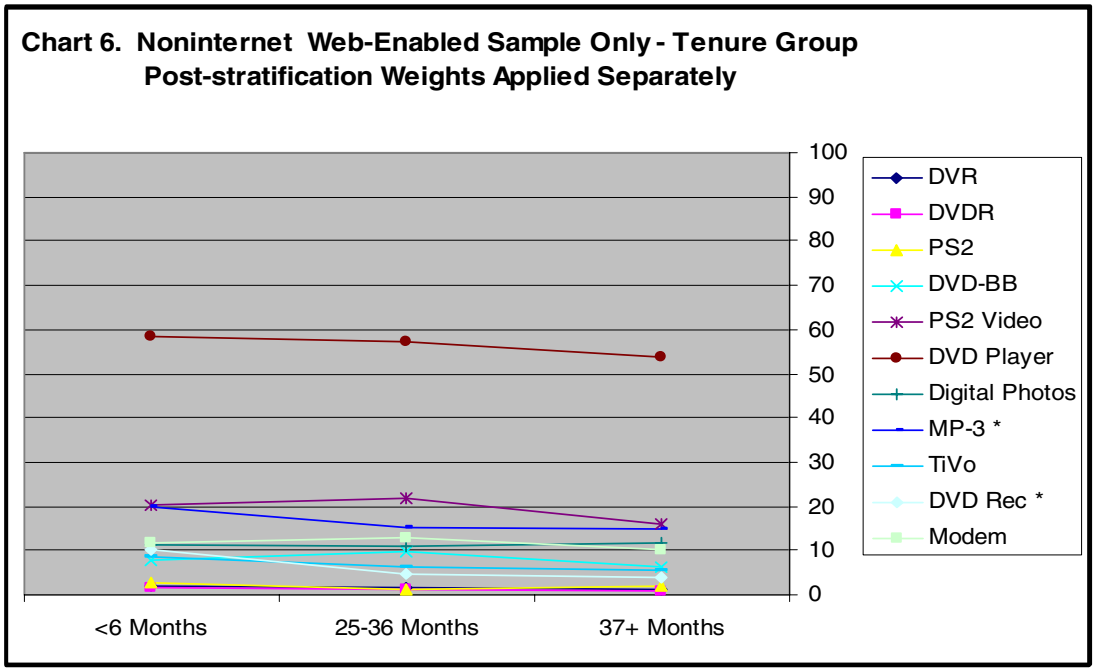

* Significant at the α = .10 level

Table 1. Significant factors in Logistic Regressions of Technology Outcomes

Sample Design Feature	Technology Outcomes				
	PS2 Video	MP-3	TIVO	DVD Recorder	DVD Player connected to the TV
Black/Hispanic Oversample Strata (=Yes)		*	*		
NonInternet Strata (=Yes)	*	*	*	*	*
Address Listed Strata (=Yes)		*		*	*
Census Region (9 Categories)			*		
Tenure Month					* (Odds ratio of 0.989)

Table 2. Comparison of KN and SRBI RDD Telephone Outcomes to Independent Benchmarks

Survey Outcome	Benchmark	Knowledge Networks	SRBI RDD Telephone
Last trip on American Airlines	17.3	16.7	31.6
Smoke every day/occasionally	21.6	24	25.7
Own valid U.S. passport	20.3	27.2	31.5
Have Current Driver's license	89.1	88.9	92.7
Traveled in past year	55.1	65.5	65.4
Member frequent flyer program	17.8	22.6	21.5
Rented a car	18.4	19.3	18.7
Exercised in past month	76	70.7	80.3
Magazine Subscriptions	4.9	6.2	9
Seen movie last month, age 60+	8	14.5	15.2