

THE EFFECTS OF BRACKETING IN WEALTH ESTIMATION

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The use of bracketing in wealth surveys is sometimes criticized on the grounds that it will encourage respondents to substitute rough guesses for careful thought. In such a manner, the use of bracketing will “crowd out” more specific answers, creating the illusion of a reduction in nonresponse. This paper examines the patterns of wealth response in the first two waves of the Health and Retirement Study. On average, people do not appear to transition to bracketing. New tests of the breakeven level of crowding-out are suggested. Based on the explanatory power of the brackets, the degree of crowding-out which would be necessary to make the use of bracketing counterproductive appears to be much higher than plausible.

1. INTRODUCTION

Analysis of wealth dynamics is often complicated by problems of survey nonresponse. A method that has been used in various surveys to reduce item nonresponse rates is to use bracketing. Kennickell (1997) discusses a brief history of using brackets in the Survey of Consumer Finances (SCF) since 1967. Built on the SCF experience, the two longitudinal surveys—the Health and Retirement Study (HRS) and the Asset and Health Dynamics of the Oldest Old (AHEAD)—use brackets in their wealth and income questions. Results from these surveys suggest that bracketing may dramatically reduce the amount of wealth item nonresponse. For example, as reported in various studies (see, for example, Chand and Gan, 2002; Juster and Smith, 1997; Smith, 1997; and Hoynes, Hurd, and Chand, 1998), the nonresponse rates are reduced from around 30 percent to about 10 percent for most of the assets.

Relatively little work, however, has examined the potential drawbacks of bracketing.¹ Such work is warranted since analysts need to gauge whether observed relationships in cross-section and in panel are partially an artifact of the measurement and imputation methodology.

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¹Kennickell (1997) discusses the effect of bracketing on continuous responses in the Survey of Consumer Finances. Juster and Smith (1997) list several possible drawbacks of using bracketing. Hurd *et al.* (1998) investigate the bias that bracketing may bring due to anchoring effect, and provide a method in undoing this effect.

This paper will investigate two phenomena which may be associated with bracketing. First, does the availability of the bracketing option lower the propensity to provide a specific amount? Do specific amounts appear to be “crowded out” by brackets? Longitudinal data will allow greater insights as to whether bracketing elicits new information or merely repackages the information. Second, does there appear to be systematic self-selection into the different forms of response? To answer these questions, a simple test is proposed to value whether the bracketing method should be adopted in surveys.

This paper will proceed as follows. Section 2 will provide a brief description of two waves of HRS. The third section will examine whether bracketing appears to crowd out more precise reports of wealth. The following section will incorporate the results of the previous section into a model of the level of crowding-out necessary to make bracketing undesirable. Some evidence will also be presented as to where along this range the HRS appears to lie. Section 5 will examine the degree to which people appear to self-sort into the different available forms of response. While the previous sections examine the level of possible crowding-out, this section examines whether there is a differential effect of crowding-out on various subgroups. The final section provides a brief conclusion.

2. THE DATA

The Health and Retirement Study (HRS) is a national longitudinal survey focusing on the birth cohort of 1931–41. Interviews conducted every two years will examine the health and wealth dynamics of individuals as they approach and enter retirement. The first wave of the HRS was conducted between March 1992 and March 1993, yielding a sample of 12,652 respondents and 7,702 households. The response rate was 82 percent. The second wave of the HRS was conducted by telephone from May 1994 to January 1995, producing 11,602 interviews for a 92.1 percent response rate. Our sample consists of households that do not have any major changes in composition. For example, households that had new spouses or suffered divorces were excluded. Households in which a spouse died were included unless the surviving spouse had since remarried. These selection criteria resulted in 16 percent of wave 1 households being omitted from the wave 2 sample. In the sample we work with, 96.65 percent of the responses were answered by the same respondents in two waves.

The wave 2 interview contained several modifications to wealth measurement. Since the second wave was a telephone survey, a range card was not used for the wealth module. Brackets could still be provided through the unfolding bracket sequence. The use of bracketing was also expanded to include housing and household debt, the two components in wave 1 which did not use the unfolding sequence. Bracketing was also used for the income module in an attempt to reduce the level of missing data in the module. A separate section on capital gains was also added in an attempt to separate changes in wealth due to savings from those due to capital gains. This section included questions on the purchase and sale of assets such as housing, real estate, stocks and bonds. Information about capital improvements to housing and real estate and additions to employer-sponsored pensions was also solicited.

Typically, a respondent may provide a number (continuous response), “Don’t Know” (DK) or “Refuse” (RF) after being asked a question about the value of an asset or an income. If the respondent’s answer was DK or RF, further efforts were made to elicit bracketed responses. Over the years, the questions that are used to elicit bracketed responses have been improved. Initially, bracketing questions consisted of respondents being asked, “Is it [the amount held] more than x ?” The value x is the breakpoint. Currently, the question is refined to be: “Is it [the amount held] less than x , more than x , or what?” About 10 percent of the respondents give an amount “just about x ” that is more like a continuous response.²

The breakpoints for the wave 2 sequence of unfolding questions were refined using an algorithm developed by Heeringa, Hill, and Howell (1995). This method sought to maximize the expected explanatory power of the brackets over a weighted combination of the limiting cases of a Box-Cox transformation, level and log-level. As a result, the breakpoints were changed substantially for many assets. A common result of the breakpoint optimization was to dramatically increase the amount of the highest breakpoint. For example, the top bracket of both real estate wealth and stock wealth increases from “\$150,000 and above” to “\$1,000,000 and above,” while the top bracket of checking and savings wealth increases from “\$50,000 and above” to “\$300,000 and above.” As we shall see later, while this refinement increased the explanatory power of the brackets, the refinement may necessitate the use of strong distributional assumptions for the imputation of the amount within these top brackets.

3. “CROWDING OUT”

Critics of the use of bracketing raise the possibility that the option of providing a bracket rather than a specific amount might lead people to substitute rough guesses for careful thought. In such a scenario, bracketed responses will “crowd out” more precise responses, making the reduction in nonresponse little more than an optical illusion. Previous studies using the AHEAD and SCF suggest that the bracket option is particularly employed by those whose initial response was DK. In Chand and Gan (2002), DK response was used by those older in age and those with the indicators of cognitive impairment. For financial assets such as stocks, bonds, checking/savings, IRAs/Keogh, and CDs, financial respondents identified as cognitively impaired were generally five to ten times more likely to give the DK response. In contrast to the results for DKs, RFs are not characterized by cognitive impairment. These results suggest that DK responses, particularly those by individuals identified as cognitively impaired, are more likely due to general uncertainty. The more troubling respondents are RFs since they may potentially fall disproportionately in the upper tail of the asset distribution. Nevertheless, analysis in Chand and Gan (2002) suggests bracketing elicits new information. However, since the use of bracketing is fairly new and the possible effects are poorly documented, the longitudinal structure of HRS provides a worthwhile opportunity to systematically address this phenomenon.

²We thank one referee for pointing out this improvement.

TABLE 1
ASSET RESPONSES BY WAVE (IN PERCENTAGE)

| Assets | Wave 1 | | | | Wave 2 | | |
|------------------|--------|---------|------|------|--------|---------|------|
| | Amount | Bracket | Card | NR | Amount | Bracket | NR |
| Real estate | 75.4 | 15.7 | 5.8 | 3.1 | 79.6 | 18.0 | 2.4 |
| Business | 69.6 | 19.9 | 4.6 | 5.9 | 65.1 | 29.9 | 5.0 |
| IRA/Keogh | 74.4 | 16.0 | 5.3 | 4.4 | 77.8 | 18.5 | 3.7 |
| Stocks | 68.3 | 20.5 | 5.5 | 5.7 | 68.9 | 25.9 | 5.3 |
| Checking/savings | 73.9 | 16.0 | 5.2 | 4.9 | 80.3 | 15.2 | 4.5 |
| CD/saving bonds | 71.2 | 15.5 | 6.8 | 6.5 | 75.5 | 16.8 | 7.7 |
| Bonds | 69.2 | 13.0 | 6.8 | 11.0 | 69.6 | 19.6 | 10.8 |
| Vehicles | 85.9 | 9.5 | 2.8 | 1.8 | 90.0 | 9.1 | 0.9 |
| Other assets | 72.8 | 15.8 | 5.2 | 6.1 | 79.0 | 16.2 | 4.8 |
| Debt | 96.4 | — | — | 3.6 | 88.6 | 9.7 | 1.7 |
| Housing | 97.8 | — | 1.3 | 0.9 | 92.1 | 7.4 | 0.5 |

The phenomenon of crowding-out is difficult to examine with only cross-sectional data. Heeringa *et al.* (1995) examine whether individuals become more likely to provide brackets as their exposure to bracketing within the wave increases; they find minimal effects. The drawback of this approach is that different asset holdings are likely to be characterized by different degrees of knowledge, possibly confounding the effects of bracketing exposure. This paper will utilize the longitudinal structure of the survey to examine whether across waves of surveys, individuals become increasingly likely to provide brackets rather than amounts. To the extent that individuals learn within a wave, the same effect should be exhibited across waves, with the added advantage that the panel structure will allow one to control for asset heterogeneity. After the magnitude of these effects is gauged, this paper will model the tradeoff between precision and nonresponse to determine when it would be counterproductive to employ a bracketing sequence.

Table 1 displays the frequency of asset response type of owners of the different assets in the first two waves of the HRS. On first glance, it appears that the percentage of asset owners who respond using brackets increases in the second wave. The increase is more noteworthy for assets which might be expected to present privacy concerns. For example, the proportion of business owners who use brackets increases from 20 percent to 30 percent in wave 2. Similar increases are seen for stocks and bonds. However, this first glance is misleading. While the proportion of bracketed responses increases, the percentage of continuous responses also remains steady or increases. While businesses, stocks, and bond holdings become more likely to be ascertained through the unfolding sequence, the proportion of owners who provide amounts remains steady. For other assets such as IRAs/Keogh, checking/savings accounts, and vehicle wealth, the proportion providing amounts increases by roughly 4 percent. The source of this discrepancy is a change in survey format between waves 1 and 2. In wave 1, either a range card or a series of unfolding bracketing questions was utilized.³ This option was discontinued in wave 2 since the interviews were by telephone rather than in person.

³Although the range card is supposed to be used only in the housing section while unfolding questions are supposed to be used in other assets, some interviewers used the range card for all questions.

TABLE 2
ASSET TRANSITIONS (IN PERCENTAGE)

| Assets | Wave 1 Amt | | | Wave 1 Bkt | | | Wave 1 Card | | | Wave 1 NR | | |
|--------------|------------|-----|----|------------|-----|----|-------------|-----|----|-----------|-----|----|
| | Wave 2 | | | Wave 2 | | | Wave 2 | | | Wave 2 | | |
| | Amt | Bkt | NR | Amt | Bkt | NR | Amt | Bkt | NR | Amt | Bkt | NR |
| Stocks | 82 | 16 | 2 | 49 | 45 | 6 | 64 | 28 | 8 | 26 | 47 | 26 |
| Checking | 88 | 10 | 2 | 63 | 28 | 8 | 70 | 22 | 8 | 34 | 39 | 27 |
| IRA/Keogh | 87 | 11 | 2 | 58 | 36 | 6 | 65 | 31 | 4 | 30 | 45 | 25 |
| CDs | 86 | 10 | 3 | 56 | 33 | 11 | 76 | 15 | 9 | 32 | 29 | 39 |
| Bonds | 88 | 8 | 4 | 50 | 40 | 10 | 64 | 18 | 18 | 24 | 29 | 48 |
| Real estate | 87 | 12 | 1 | 52 | 40 | 8 | 72 | 25 | 3 | 57 | 30 | 13 |
| Business | 75 | 22 | 3 | 46 | 43 | 11 | 64 | 33 | 3 | 38 | 49 | 13 |
| Vehicles | 92 | 7 | 1 | 76 | 21 | 3 | 83 | 16 | 1 | 71 | 23 | 6 |
| Other assets | 89 | 9 | 2 | 63 | 33 | 4 | 74 | 14 | 11 | 38 | 45 | 17 |
| Debt | 89 | 10 | – | – | – | 1 | 84 | 14 | 2 | – | – | – |

Several reasons suggest that those who give range card answers should be treated as bracketers rather than nonrespondents for the analysis of crowding-out. First, the information ascertained is very similar to that from the unfolding brackets. Range cards assign households into brackets, which are often of narrower width because they include a greater number of categories. Second, an examination of how households who used the range card in wave 1 responded in wave 2 suggests that they behave more like the bracketers than the nonrespondents. Table 2 combines a household's responses in waves 1 and 2. Roughly 85 percent who provided an amount in the first wave also provided an amount in the second wave. Those who provided a bracket in the first wave were less likely to provide an amount in the second wave, while nonrespondents in the first wave (those who own the asset but provided no information about amount) were least likely to provide an amount in wave 2. From this table one can see that those who used the range card in wave 1 behave more closely in wave 2 (when the range card option is no longer available) to those who provided brackets in wave 1, than to those who were nonrespondents in wave 1. Furthermore, the rate of complete nonresponse (owners who provide neither amounts nor brackets) suggests that those who used the range card were not those converted from nonresponse since we do not observe an increase in nonresponse once the range card is discarded in wave 2. These considerations suggest that these households would be better categorized as bracketers than nonrespondents. Therefore, when one combines range card respondents with bracketed respondents, the percentage of households employing some kind of bracket no longer increases sharply between waves 1 and 2. Fears of a strong "crowding-out" effect across waves did not seem to materialize.

Additional evidence against the possibility of "crowding-out" comes from the changes in the nonresponse rates and the rates of people who gave exact amounts. The nonresponse rates on asset amounts decline in ten of the eleven asset categories while the proportion of respondents willing to provide exact amounts rises in eight of the eleven categories shown in Table 1. In Section 5, we offer a detailed account on how different response modes change across waves.

4. OPTIMAL BRACKETING

Using the information on the amount of bracketing in the first two waves of the HRS, the effects of bracketing on the estimation of wealth can now be assessed in better detail. It is possible to determine under which conditions it is desirable to allow the bracketing option to respondents, and whether these conditions are likely to have been met.

Consider the following simple model of the decision to offer a choice of a bracketing option. The wealth module is constructed to elicit wealth information such that the post-imputation sum of squared errors is minimized. Respondents may fall into three possible groups—continuous respondents (those who provide a specific amount), bracketed respondents who provide a range, and nonrespondents. Continuous respondents do not require imputation, while the other two groups each require an amount to be imputed and have an associated error. The imputation error for nonrespondents will be highest, followed by bracketers, and then continuous observations (typically assumed to have zero error). The bracketing option should be included in the survey design if the expected imputation error is lower in the bracketing regime.

These considerations may be represented by the objective function with which the survey design attempts to minimize the total sum of squared errors (*TSS*), which is the sum of squared errors of continuous responses, bracket responses and nonresponses.

$$(1) \quad TSS_{observed} = \sum_{i=1}^{n_c} SSE_c + \sum_{i=1}^{n_b} SSE_b + \sum_{i=1}^{n_n} SSE_n,$$

where n_c , n_b , and n_n represent the number of continuous, bracketed, and nonrespondent observations respectively. Direct comparison of *TSS* under the two regimes is impossible since we do not observe the counter-factual case, particularly the proportion of bracketers who would have provided amounts had the other regime been operative. Nonetheless, we can form an estimate of what this proportion would have had to have been to make it counterproductive to allow bracketing. Assuming for the time being that this proportion is unrelated to the bracket, call this proportion x . This requires solving for the level of x that equalizes the observed *TSS* with the *TSS* in the counter-factual case.

If all individuals within the same response mode have the same SSE, then the *TSS* in equation (1) is simply changed to⁴:

$$(2) \quad TSS = n_c \times SSE_c + n_b \times SSE_b + n_n \times SSE_n$$

The *TSS* in the counter-factual case, without the bracketing option, depends on the percent of bracketers that would have become continuous respondents rather than nonrespondents. Representing the percentage that would have become continuous respondents is x , without the bracketing option, the *TSS* in equation (2) would become:

$$(3) \quad TSS_{counter\ factual} = (n_c + xn_b)SSE_c + [n_n + (1-x)n_b]SSE_n$$

⁴For bracketers, this could be interpreted as the average SSE over all bracketers.

TABLE 3
EXPLANATORY POWER OF BRACKETING

| Assets | Wave 1 | | Wave 2 | |
|-------------------|--------------|------------|--------------|------------|
| | R^2 Levels | R^2 Logs | R^2 Levels | R^2 Logs |
| Real estates | 0.38 | 0.73 | 0.86 | 0.69 |
| Checking/savings | 0.29 | 0.87 | 0.86 | 0.67 |
| IRA/Keogh | 0.55 | 0.87 | 0.84 | 0.85 |
| CDs, saving bonds | 0.38 | 0.90 | 0.85 | 0.82 |
| Bonds | 0.81 | 0.79 | 0.84 | 0.75 |
| Business | 0.52 | 0.81 | 0.50 | 0.79 |
| Stocks | 0.74 | 0.75 | 0.87 | 0.83 |
| Vehicles | 0.10 | 0.85 | 0.77 | 0.76 |
| Housing | – | – | 0.80 | 0.82 |
| Debt | – | – | 0.51 | 0.83 |
| Other assets | 0.14 | 0.78 | 0.83 | 0.73 |

This assumes the simple case where bracketers would have had the same distribution of amounts as the observed distribution. Assuming that continuous respondents do not require any imputation, then $SSE_c = 0$, and the breakeven point where the TSS with and without the bracketing option is the same is given simply by:

$$(4) \quad x^b = \frac{SSE_n - SSE_b}{SSE_n}.$$

Under these assumptions, the fraction x^b necessary for the bracketing option to be undesirable depends on the difference in squared-errors of nonrespondents and bracketers. Thus, the breakeven level of crowding-out depends on the degree to which the brackets reduce the variation in imputed wealth. If a simple hotdeck imputation is done, the breakeven fraction is simply the R^2 in a regression of wealth on dummies for the brackets. For assets, where a substantial proportion of the variation in asset holdings can be explained by knowledge of the bracket alone, the proportion of households which were “crowded out” from amounts to brackets needs to be quite high to make it undesirable to provide a bracketing option.

Table 3 displays the results of this regression of amounts on brackets. Two features are particularly striking. First, using a linear metric, the explanatory power of the brackets increased greatly from wave 1 to wave 2. The regressions for most assets have an R^2 of around 0.85. This is due to the refinement of the break-points used in wave 2 through the Box-Cox type of algorithm used by Heeringa *et al.* (1995). As the original breakpoints were better suited to fitting log-amount, the refined breakpoints performed more poorly in the second wave under this standard; however, they still explain a large proportion of the variation of wealth holdings.⁵ The second striking feature is the following. The high explanatory power of the brackets suggests that the proportion of households which would have had to have been crowded out to make the bracketing option counterproductive is very

⁵Since the brackets were chosen to make the proportion of variance explained by the two different metrics roughly equal, the poorer performance of the log metric in wave 2 suggests that the distribution of continuous responses moved downwards between wave 1 and wave 2.

TABLE 4
IMPLIED VS. EXPECTED NONRESPONSE FOR SUBOPTIMAL BRACKETING

| Assets | Observed | Implied | SIPP rate |
|-------------------|----------|---------|-----------|
| Stocks | 31.1 | 15.6 | 41.5 |
| Checking/savings | 19.7 | 6.6 | 13.3 |
| IRA/Keogh | 22.2 | 6.5 | – |
| CDs, saving bonds | 24.5 | 10.2 | – |
| Bonds | 30.4 | 13.9 | 25.9 |
| Real estate | 20.4 | 4.9 | 33.5 |
| Business | 34.9 | 9.5 | 6.2 |
| Vehicles | 10.0 | 3.0 | – |
| Other assets | 21.0 | 7.6 | 33.5 |
| Debt | 11.4 | 6.5 | – |
| Housing | 7.8 | 1.9 | – |

high. The counter-factual level of nonresponse (NR) implied by the breakeven level of crowding-out is given simply by:

$$(5) \quad NR_{implied} = NR_{initial} - n_b \times x^b,$$

where n_b represents the proportion of owners who are bracketers and x^b represents the breakeven level of crowding-out. The implied crowding-out and nonresponse rates are listed in Table 4. An examination of nonresponse rates suggests that the actual proportion of households which is crowded out is nowhere near the 0.85 R^2 level of most of the assets (using the untransformed metric). Were the proportion to be that high, then the initial nonresponse rates for amount without the bracketing option would have had to be extremely low, typically between 5 and 10 percent. Nonresponse in the Survey of Income and Program Participation (SIPP), a major survey which does not provide a bracketing option, suggests that nonresponse is much closer to the observed levels rather than the levels necessary to make it counterproductive to provide a bracketing option. Thus, the evidence suggests that under all but the most extreme assumptions, the use of bracketing is desirable.

The above model makes a few simplifying assumptions which are unlikely to be true in the empirical data. First, we assume no measurement errors in deriving x^b . Previous studies have documented significant amount of measurement errors in wealth surveys. For example, Kennickell and Starr-McCluer (1997) find that only about 5 percent of the variations of the wealth changes can be explained by observed socio-demographic variables. To the extent that continuous values themselves contain some measurement errors, the level of crowding-out necessary to make bracketing suboptimal increases. This is intuitively clear since less precision on the part of continuous observations makes it less harmful to have crowding-out of continuous responses. To the extent that the measurement errors cause the responses to fall into wrong brackets, the level of crowding-out necessary to make bracketing suboptimal decreases since SSE_b in equation (4) increases. The second and more troublesome assumption is that regarding the relative distribution of bracketers, continuous, and missing respondents. The previous model as well as the breakpoint optimization algorithm of Heeringa *et al.* (1995) employs the assumption that the data are coarsened at random. Previous work, however, has

shown that bracketers tend to have a higher distribution of wealth than do the continuous observations (Smith, 1995). Since the following section examines self-sorting and differential crowding-out, the discussion on the effect of relaxing this assumption will be postponed until the following section.

5. BRACKETING AND SELF-SORTING

While the use of bracketing did not rise appreciably between the waves, it is possible that with increased exposure over time to bracketing, different types of households employ bracketing. Using data from the two waves, we can better assess the mechanism by which people self-select into the different response types. Several questions can be asked: Does the response type of individuals appear to be random or systematic over waves? To the extent that there are systematic patterns, does the response type appear to be consistent with differential uncertainty about the asset? Do the observed transitions in mode of response suggest differential crowding-out? These questions are important for several reasons. If the response mode seems systematic, then the choice of mode provides additional information that can perhaps be factored into secondary models. On the other hand, if the choice of mode seems random, then mode neither conveys significant information about reliability nor offers great benefits in nonresponse reduction. Furthermore, as seen in the previous section, if crowding-out is believed to vary by wealth level, then the range over which bracketing is desirable may not be as large as previously hoped.

These questions may be addressed by examining the transition matrix for the response type in the two waves, shown in Table 2. Several patterns emerge from these tables. First, the response type appears to be systematic. Those who provide continuous amounts in wave 1 are significantly more likely to provide continuous amounts in wave 2 as well, providing continuous response in roughly 80–90 percent.⁶ Similarly, those who provide brackets in wave 1 are significantly more likely to provide brackets in wave 2. As mentioned earlier, those who provided range card values behave similarly to bracketers. They are more likely to transition to a bracket in wave 2 than are continuous respondents and more likely to transition to continuous responses than are either bracketer or nonrespondents. Lastly, those who are nonrespondents in wave 1 account for a disproportionate amount of the nonrespondents in the second wave. Although it varies by asset, roughly 25 percent of nonrespondents transition to nonresponse in wave 2. While these respondents are more likely to remain nonrespondents than are others, they are converted to respondents in wave 2 in roughly 75 percent of the cases.

It is also interesting to examine the sample that was part of a nonresponse study in wave 1. These households originally declined to participate in the survey.

⁶Bracketers include both those who identified a particular bracket, as well as “incomplete” bracketers who began the unfolding sequence but ended the questioning before a particular bracket could be ascertained. They typically account for less than 5 percent of all bracketers. As one might expect, incomplete bracketers tend to have transitions in between those of complete bracketers and nonrespondents in terms of their propensity to provide specific amounts in wave 2. They are more likely to transition to nonresponse in wave 2 than are the other respondents and less likely to transition to a continuous response.

TABLE 5
NONRESPONSE STUDY—RATES OF OWNERSHIP AND MISSING DATA (IN PERCENTAGE)

| Assets | Initial Respondents | | | | Nonresponse Study | | | |
|--------------|---------------------|------|--------|------|-------------------|------|--------|------|
| | Wave 1 | | Wave 2 | | Wave 1 | | Wave 2 | |
| | Miss | Own | Miss | Own | Miss | Own | Miss | Own |
| Stocks | 0.6 | 27.4 | 1.0 | 30.1 | 0.7 | 33.5 | 0.7 | 33.1 |
| Checking | 0.8 | 78.5 | 1.1 | 78.9 | 0.7 | 84.0 | 0.7 | 89.3 |
| IRA/Keogh | 0.4 | 38.2 | 0.8 | 40.1 | 1.1 | 41.6 | 0.4 | 45.6 |
| CDs | 0.8 | 25.9 | 1.4 | 22.4 | 0.7 | 24.6 | 1.1 | 17.8 |
| Bonds | 0.6 | 6.2 | 1.1 | 5.6 | 0.7 | 7.8 | 0.7 | 5.7 |
| Real estate | 0.3 | 23.7 | 0.6 | 24.3 | 0.7 | 26.7 | 0.4 | 24.9 |
| Business | 0.2 | 15.9 | 0.4 | 15.8 | 0.4 | 18.5 | 0.0 | 16.7 |
| Vehicles | 0.0 | 88.1 | 0.3 | 87.6 | 0.0 | 92.5 | 0.0 | 91.8 |
| Other assets | 0.7 | 15.5 | 1.2 | 22.3 | 1.1 | 16.7 | 0.7 | 21.0 |
| Debt | 1.9 | 38.3 | 1.0 | 36.8 | 2.8 | 40.9 | 0.4 | 34.5 |

TABLE 6
NONRESPONSE STUDY ASSET RESPONSES

| Assets | Wave 1 | | | | Wave 2 | | | |
|--------------|--------|---------|---------|--------|--------|---------|---------|--------|
| | N | Amt (%) | Bkt (%) | NR (%) | N | Amt (%) | Bkt (%) | NR (%) |
| Stocks | 94 | 72.3 | 23.4 | 4.3 | 93 | 67.7 | 24.7 | 7.5 |
| Checking | 236 | 72.5 | 22.9 | 4.7 | 251 | 68.9 | 22.7 | 8.4 |
| IRA/Keogh | 117 | 72.6 | 23.1 | 4.3 | 128 | 72.7 | 23.4 | 3.9 |
| CDs | 69 | 76.8 | 13.0 | 10.1 | 50 | 56.0 | 28.0 | 16.0 |
| Bonds | 22 | 81.8 | 9.1 | 9.1 | 16 | 56.3 | 31.3 | 12.5 |
| Real estate | 75 | 76.0 | 21.3 | 2.7 | 70 | 80.0 | 20.0 | 0.0 |
| Business | 52 | 75.0 | 17.3 | 7.7 | 47 | 44.7 | 51.1 | 4.3 |
| Vehicles | 260 | 84.2 | 13.1 | 2.7 | 258 | 88.0 | 10.5 | 1.6 |
| Other assets | 47 | 70.2 | 27.7 | 2.1 | 59 | 67.8 | 23.7 | 8.5 |
| Debt | 115 | 96.5 | 3.5 | 0.0 | 97 | 78.4 | 18.6 | 3.1 |

In an effort to assess how they differed from the participants, they were offered \$100 to participate. The results of this study found that they had higher wealth than the rest of the sample. Table 5 displays their rates of asset ownership in waves 1 and 2. Encouragingly, they continued to respond to questions of asset ownership in wave 2, at a rate comparable to those who were not offered the \$100 in wave 1. Table 6 displays the mode of response for the asset owners within the nonresponse study. Several features are prominent. First, the vast majority of them provide either an amount or bracket. The initial enticements to participate seem to have been effective. Second, while they do provide information about their holdings, a lower percentage provides specific amounts than the other asset owners. Fewer also provide specific amounts over the two waves, due to both a slight increase in nonresponse and in bracketing. The nonresponse study seems to have been successful in encouraging and maintaining participation. However, this subsample behaves somewhat differently from the rest of the sample, a pattern which will be seen to be characteristic of higher wealth.

TABLE 7
AMOUNTS OF TRANSITIONS (IN THOUSANDS)

| Assets | Give Amount in Wave 1 | | | | | | Give Bracket in Wave 1 | | | | | |
|-------------|-----------------------|------|-----------|------|------|------|------------------------|------|-----------|------|------|------|
| | → Amount | | → Bracket | | → NR | | → Amount | | → Bracket | | → NR | |
| | N | Mean | N | Mean | N | Mean | N | Mean | N | Mean | N | Mean |
| Stocks | 789 | 61 | 152 | 79 | 19 | 40 | 189 | 59 | 149 | 110 | 22 | 110 |
| Checking | 2992 | 15 | 338 | 26 | 68 | 17 | 632 | 17 | 262 | 23 | 81 | 22 |
| IRAs | 1430 | 44 | 182 | 52 | 25 | 38 | 268 | 46 | 157 | 71 | 23 | 74 |
| CDs | 626 | 28 | 76 | 22 | 25 | 42 | 142 | 24 | 64 | 51 | 24 | 62 |
| Bonds | 107 | 68 | 10 | 44 | 5 | 41 | 17 | 54 | 10 | 37 | 4 | 203 |
| Real estate | 725 | 120 | 103 | 314 | 10 | 452 | 139 | 235 | 85 | 269 | 15 | 251 |
| Business | 354 | 143 | 105 | 287 | 15 | 534 | 92 | 349 | 77 | 515 | 17 | 447 |
| Vehicles | 4339 | 14 | 328 | 14 | 27 | 12 | 510 | 16 | 133 | 17 | 16 | 19 |
| Other | 331 | 64 | 34 | 68 | 6 | 23 | 68 | 92 | 27 | 38 | 7 | 386 |
| Debt | 1249 | 7 | 136 | 16 | 20 | 6 | 42 | 6 | 7 | 6 | 1 | 4 |

TABLE 8
RESPONSE MODEL—TOP BRACKETS VS. OTHER BRACKETS

| Assets | Percentage Providing Amounts | | | | | | | |
|--------------|------------------------------|------|-------------|------|---------------|------|-------------|------|
| | Wave 1 | | | | Wave 2 | | | |
| | Lower Bracket | | Top Bracket | | Lower Bracket | | Top Bracket | |
| N | % | N | % | N | % | N | % | |
| Stocks | 1636 | 72.7 | 33 | 60.6 | 1768 | 73.0 | 64 | 65.6 |
| Checking | 4441 | 78.1 | 357 | 72.0 | 4837 | 84.2 | 19 | 63.2 |
| IRA/Keogh | 2133 | 77.5 | 214 | 79.9 | 2444 | 80.9 | 44 | 77.3 |
| CDs | 1343 | 75.8 | 204 | 78.9 | 1297 | 82.1 | 16 | 56.3 |
| Bonds | 349 | 77.9 | 6 | 66.7 | 312 | 78.8 | 11 | 54.5 |
| Real estate | 1176 | 79.0 | 304 | 73.4 | 1494 | 83.0 | 26 | 0.0 |
| Business | 884 | 75.8 | 80 | 53.8 | 930 | 70.5 | 32 | 0.0 |
| Vehicles | 4485 | 87.6 | 669 | 86.8 | 5553 | 90.9 | 20 | 60.0 |
| Other assets | 580 | 75.0 | 357 | 81.8 | 1330 | 83.2 | 26 | 69.2 |
| Debt | 2373 | — | 88 | — | 2248 | 90.7 | 62 | 72.6 |

Asset owners appear to self-sort into mode of response largely on the basis of the level of the asset holdings.⁷ Table 7 shows the wave 1 asset holdings by the form of response in wave 2. Those who provided brackets in wave 2 typically had higher wealth in wave 1 than those who provided amounts in wave 2. This relationship holds both for people who provided amounts in wave 1 as well as those who provided brackets. Respondents appear to be self-selecting across the waves into amounts and brackets according to the level of their wealth holdings.

This relationship is highlighted when one examines those who fall in the top asset bracket in the second wave. Those who fall in the top bracket tend to disproportionately provide brackets rather than amounts (Table 8). This relationship

⁷There does appear to be some self-sorting into the appropriate mode of response on the basis of other characteristics. Proxy respondents as well as those who performed poorly on the cognition battery were found to be less likely to provide specific amounts. However, these effects were markedly smaller in magnitude than the effect of wealth.

TABLE 9
MEAN ASSET AMOUNT IN WAVE 1 FOR HOUSEHOLDS IN TOP BRACKET IN WAVE 2

| Assets | Gave Wave 2 Amount | | Gave Wave 2 Bracket | |
|-------------------|--------------------|------|---------------------|------|
| | N | Mean | N | Mean |
| Stocks | 42 | 244 | 22 | 554 |
| Checking/savings | 12 | 134 | 7 | 426 |
| IRA/Keogh | 34 | 322 | 10 | 342 |
| CDs, saving bonds | 9 | 249 | 7 | 255 |
| Bonds | 6 | 292 | 5 | 7 |
| Real estate | 0 | – | 26 | 854 |
| Business | 0 | – | 32 | 872 |
| Vehicles | 12 | 76 | 8 | 60 |
| Other assets | 18 | 295 | 8 | 138 |
| Debt | 45 | 34 | 17 | 41 |
| Housing | 201 | 364 | 5 | 246 |

becomes even stronger in wave 2. While the change in bracket points might explain part of the apparent self-sorting across waves, it is unlikely to explain all of it. For real estate and business wealth, all of those falling in the top range responded using brackets rather than amounts. There is complete separation in the mode of response for those with very high wealth in these assets. For these extreme cases of business and real estate wealth, an amount can no longer be imputed to those in the top bracket using the observed distribution of continuous responses since there are none. Instead, an amount within this open bracket will need to be imputed based either upon their prior asset holdings or some assumed distribution. Even for the less extreme examples, the new top bracket became very thin in terms of continuous respondents. Bank accounts, CDs, vehicles, and bonds all have 12 or fewer continuous respondents who fall into the top bracket in wave 2. These small cell sizes complicate the associated imputation task and make it undesirably sensitive to outliers.

Table 9 displays the mean wave 1 asset holdings for these wave 2 top bracketers. When one examines these transitions, one once again sees that those who transit to brackets were much wealthier than those who transit to amounts. In other words, those with high asset holdings seem to be more likely to provide brackets than amounts.

These findings suggest several things. First, the distributions of bracketers and continuous respondents differ substantially and this difference appears to be widening. Second, while the overall level of crowding-out may not be terribly large, the effect differs substantially by wealth level, being most severe at the upper end of the wealth distribution. The extreme cases of business and real estate wealth suggest that this self-sorting may have undesirable consequences for subsequent imputations. These findings also raise questions about the distributional assumptions in the previous section. Let us now return to this issue.

As mentioned before, a troublesome assumption for the model of the breakeven level of crowding-out is that the distributions of continuous respondents, bracketed respondents, and nonrespondents are identical. This assumption may be relaxed in two steps. First, assume that the distribution of continuous

TABLE 10
 WAVE 1 R^2 FOR CONTINUOUS VS. BRACKET

| Assets | Wave 1 | | Wave 2 | |
|-------------------|--------------|------------|--------------|------------|
| | R^2 Levels | R^2 Logs | R^2 Levels | R^2 Logs |
| Real estates | 0.38 | 0.73 | 0.29 | 0.84 |
| Checking/savings | 0.29 | 0.87 | 0.72 | 0.74 |
| IRA/Keogh | 0.55 | 0.87 | 0.59 | 0.77 |
| CDs, saving bonds | 0.38 | 0.90 | 0.47 | 0.80 |
| Bonds | 0.81 | 0.79 | 0.92 | 0.72 |
| Business | 0.52 | 0.81 | 0.52 | 0.89 |
| Stocks | 0.74 | 0.75 | 0.88 | 0.71 |
| Vehicles | 0.10 | 0.85 | 0.38 | 0.85 |
| Housing | — | — | — | — |
| Debt | — | — | — | — |
| Other assets | 0.14 | 0.78 | 0.27 | 0.81 |

respondents and of bracketers are each different, but that bracketers and non-respondents have the same distribution. This is the assumption currently employed in the imputations in the HRS wave 1 public release. Further assume that crowding-out is unrelated to brackets, so that the distribution of nonrespondents would be the same in the observed and counter-factual cases. In this case, the breakeven level of crowding-out is still defined by the above equation. The only difference is in the implementation of the regression implied by the breakeven value. Whereas before we could use the continuous distribution to test the variation explained by the brackets for bracketed respondents, the continuous distribution would no longer be appropriate. This could be remedied by performing a hotdeck to assign amounts within the brackets and then to use the bracketed observations only for the regression of wealth on the bracket dummies. Table 10 displays the effects in wave 1 of using this new pool of observations on the explanatory power of the brackets. While the effect varies depending on the asset and the metric, the general effect is to increase the explanatory power of the brackets under the linear metric while decreasing the explanatory power under the log metric. The increase in R^2 for the linear metric is typically more than the decrease in R^2 for the log metric. Although the proportion of variation explained by the brackets is affected somewhat by the change in distribution, the effect is not dramatic; the R^2 does not decrease substantially for any asset-metric combination.

However, when one uses the bracketed distribution in the regression for wave 2, a much more dramatic effect is observed. Table 11 compares the results from using the bracketed distribution to those using the continuous distribution.⁸ The explanatory power of the brackets decreases considerably for the linear metric. Despite the optimization of the breakpoints between the two waves, when one uses the bracketed distribution (which is the theoretically correct one to use), the brackets only explain around 45 percent of the variation.

The second step in which one might relax the assumption would be to assume that crowding-out is related to the bracket. In such a case, the nonrespondents in

⁸In order to minimize the effects of sampling variation from the hotdeck, the results displayed in Table 11 are from five iterations of the hotdeck and the regression.

TABLE 11
WAVE 2 R^2 FOR CONTINUOUS VS. BRACKETED DISTRIBUTION

| Assets | Wave 1 | | Wave 2 | |
|-------------------|--------------|------------|--------------|------------|
| | R^2 Levels | R^2 Logs | R^2 Levels | R^2 Logs |
| Real estates | 0.86 | 0.69 | – | – |
| Checking/savings | 0.86 | 0.67 | 0.43 | 0.67 |
| IRA/Keogh | 0.84 | 0.85 | 0.38 | 0.66 |
| CDs, saving bonds | 0.85 | 0.82 | 0.55 | 0.83 |
| Bonds | 0.84 | 0.75 | 0.40 | 0.71 |
| Business | 0.50 | 0.79 | – | – |
| Stocks | 0.87 | 0.83 | 0.49 | 0.75 |
| Vehicles | 0.77 | 0.76 | 0.47 | 0.67 |
| Housing | 0.80 | 0.82 | 0.54 | 0.68 |
| Debt | 0.51 | 0.83 | 0.39 | 0.71 |
| Other assets | 0.83 | 0.73 | 0.46 | 0.65 |

the observed and counter-factual case would be different, providing a more complicated expression for x , the breakeven value of crowding-out. Representing the imputation error of nonrespondents in the counter-factual case by SSE'_n , the breakeven level is now defined by:

$$(6) \quad x = \frac{SSE'_n - SSE_b}{SSE'_n} \cdot \frac{n_n}{n_b} \cdot \frac{SSE_n - SSE'_n}{SSE'_n}$$

To the extent that crowding-out is positively related to the amount of the bracket, SSE'_n should be greater than SSE_n , implying that the breakeven level x is again lower than in the simple model. This also suggests that more realistic assumptions may lead to a lower breakeven level of crowding-out. Future work will incorporate differential crowding-out into the model.

6. CONCLUSIONS

The use of bracketing in wealth surveys is sometimes criticized on the grounds that it will encourage respondents to substitute rough guesses for careful thought. In such a manner, the use of bracketing will “crowd out” more specific answers, creating the illusion of a reduction in nonresponse. This paper examines the patterns of wealth response in the first two waves of the Health and Retirement Study. The use of the different methods of wealth response appears to be systematic and to vary in the expected directions. Based on the observed patterns, fears of a crowding-out effect appear to be overstated. On average, people do not appear to transition to bracketing. Based on the explanatory power of the brackets, the degree of crowding-out which would be necessary to make the use of bracketing counterproductive appears to be much higher than plausible. However, crowding-out may present a substantial concern for the wealthiest sub-population, warranting additional attention to the choice of bracket breakpoints. New tests of the breakeven level of crowding-out are suggested by this differential effect.

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