

Measuring Self-Control Problems

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While models of self-control problems have proliferated in recent years, there have been few corresponding advances in measurement. We develop a survey instrument to measure self-control problems and apply it to a sample of highly educated adults. Measured self-control relates in the anticipated manner to wealth accumulation and standard personality measures. Yet while self-control problems are typically seen as resulting in overconsumption and low wealth, we identify a significant group who underconsume and thereby accumulate high levels of wealth. In addition, self-control problems are found to be smaller in scale for older than for younger respondents. Those who put money aside in retirement accounts may be delaying access to a point at which self-control problems are no longer important. Continued advances in measurement are essential to guide development of self-control models in empirically relevant directions.

I. The Self-Control Measure and Its Properties

Most theories of self-control share a common structure. There is an ideal action that the agent

would like to take and there is something that tempts the agent to deviate from this ideal. The actual action represents a balance between these forces. Models that fit this general framework include the model of temptation and self-control of Faruk Gul and Wolfgang Pesendorfer (2001); the time-inconsistent framework of Robert Strotz (1956) and David Laibson (1997); the model of cue-triggered mistakes of B. Douglas Bernheim and Antonio Rangel (2004); and the dual-self models of Richard Thaler and Hersch Shefrin (1981), Jess Benhabib and Alberto Bisin (2005), and Drew Fudenberg and David Levine (2004).

A. The Question

Our measure of self-control problems makes use of this structure. It is based on a simple hypothetical choice scenario. We assume that people understand whether they face a control problem and know how it affects their choices. We ask people how they would ideally allocate a prize over time, whether they would be tempted to deviate from this ideal, and whether their actual choice would deviate from the ideal. To ensure the allocational integrity of our hypothetical problem, we bound the period of availability of the prize. To remove simple substitution into the general lifetime pattern of consumption, we want the prize to be attractive, yet too much of a luxury for most agents to pay for out of their own resources. We also do not want the prize to be a completely indivisible, once-in-a-lifetime experience, since this would reduce the information content of our allocation question. Extraordinary restaurant meals struck us as a good candidate of close-to-universal appeal. We asked the following question:

Suppose you win ten certificates, each of which can be used (once) to receive a “dream restaurant night.” On each such night, you and a companion will get the best table and an unlimited budget for food and drink at a restaurant of your choosing. There will be no cost to you: all payments, including gratuities, come as part of the prize. The certificates are available for im-

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mediate use, starting tonight, and there is an absolute guarantee that they will be honored by any restaurant you select if they are used within a two-year window. If they are not used up within this two-year period, however, any that remain are valueless.

The questions below concern how many of the certificates you would ideally like to use in each year, how tempted you would be to depart from this ideal, and what you expect you would do in practice:

- (a) From your current perspective, how many of the ten certificates would you ideally like to use in year 1 as opposed to year 2?
- (b) Some people might be tempted to depart from their ideal allocation in (a). Which of the following best describes you (please mark only one):
 - I would be strongly/somewhat tempted to keep more certificates for use in the second year than would be ideal;
 - I would have no temptation in either direction (skip to d);
 - I would be somewhat/strongly tempted to use more certificates in the first year than would be ideal.
- (c) If you were to give in to your temptation, how many certificates do you think you would use in year 1 as opposed to year 2?
- (d) Based on your most accurate forecast of how you think you would actually behave, how many of the nights would you end up using in year 1 as opposed to year 2?

Our measure of self-control problems is the numerical difference between expected consumption in the first period and ideal consumption, (d) less (a). We label this difference the expected-ideal (EI) gap. A positive EI gap represents a standard problem of overconsumption, while a negative gap corresponds to underconsumption. We can also construct a measure of temptation, results on which are reported in Section III below.

B. *The Sample*

Our questions were included in a survey sent in February 2003 to a sample of TIAA-CREF participants. All of the approximately 2,500 who received the survey had responded to two previous surveys: the Survey of Participant Fi-

nances (henceforth SPF), fielded in January 2000; and the Survey of Financial Attitudes and Behavior (henceforth FAB), fielded in January 2001. The response rate to our third survey was on the order of 65 percent, with 1,632 providing responses. We removed 87 respondents who failed to answer both the questions on expected and ideal consumption. We also asked respondents to value the free dinner prize and removed 25 respondents for whom the prize had no value. We end up with 1,520 in the “entire sample,” which defines the sample in analyses that do not require complete data on wealth.

In analyzing wealth accumulation, we limit attention to the subsample that supplied complete data on all financial and demographic variables of interest. The asset and debt information is drawn from the SPF, in which a highly detailed breakdown of wealth by category is available. (The results in Ameriks, Caplin, and Leahy (forthcoming) comparing self reports with accounting data, indicate the wealth data to be of unusually high quality.) Data on earnings are from the FAB, in which we asked households to provide estimates of their overall taxable income from employment in 1999, as well as past and projected future income from employment. We eliminate a total of 1,015 respondents due to incompleteness of data, primarily in the wealth and income categories. We also drop 128 annuitants for whom data on retirement assets are hard to interpret, and 3 outliers with unusually large gross financial assets in excess of \$5 million (inclusion of these additional 131 subjects leaves the results essentially unchanged). We refer to the 374 remaining households as the “regression sample.”

Our working paper (Ameriks et al. 2004) tabulates the basic demographic, educational, occupational, and economic characteristics of households, in both the entire sample and the regression sample. As detailed therein, our sample is far from representative. Respondents stand out in terms of their educational achievements and their financial status. Just over one-third of respondents have PhD degrees. Median net worth (gross financial assets and real estate assets less total debt) is about \$500,000, far higher than among working households in the 1998 Survey of Consumer Finances. The vast majority of households have significant nonretirement financial assets, and very few have high levels of personal debt. The median level of personal debt is zero.

TABLE 1—DISTRIBUTION OF THE EI GAP

| EI gap | Entire sample | | Regression sample | |
|--------|---------------|---------|-------------------|---------|
| | Number | Percent | Number | Percent |
| 5 | 9 | 0.6 | 2 | 0.5 |
| 4 | 2 | 0.1 | 0 | 0.0 |
| 3 | 8 | 0.5 | 1 | 0.3 |
| 2 | 39 | 2.6 | 9 | 2.4 |
| 1 | 113 | 7.4 | 35 | 9.4 |
| 0 | 1,059 | 69.7 | 246 | 65.8 |
| -1 | 141 | 9.3 | 41 | 11.0 |
| -2 | 94 | 6.2 | 28 | 7.5 |
| -3 | 25 | 1.6 | 7 | 1.9 |
| -4 | 9 | 0.6 | 1 | 0.3 |
| -5 | 14 | 0.9 | 2 | 0.5 |
| -6 | 2 | 0.1 | 1 | 0.3 |
| -7 | 1 | 0.1 | 1 | 0.3 |
| -8 | 1 | 0.1 | 0 | 0.0 |
| -9 | 3 | 0.2 | 0 | 0.0 |
| All | 1,520 | 100.0 | 374 | 100.0 |

Source: Authors' tabulation of 2003 survey data.

C. Ideals, Expectations, and Corners

Nearly 60 percent of respondents indicated that their ideal allocation involved an equal split between the two periods. Among those who gave other answers, the overwhelming tendency was to wish to consume more in the first year, with almost eight times as many selecting answers of six and above than answers of four and below. The contrast at the extremes is especially striking. More than 15 percent of respondents stated a wish to consume all of their meals in the first year, with only a tiny fraction preferring to consume all in the second year. The distribution of expected consumption is more dispersed, with less than 50 percent expecting an equal split.

Table 1 reports the distribution of the EI gap for both the entire sample and the regression sample. The EI gap is typically small: 95 percent of responses are less than two in absolute value. Roughly two in every three respondents have EI gaps of zero, corresponding to their having no self-control problem according to our measure. Note, also, that of those with a non-zero EI gap and therefore a measured problem of self-control, roughly two in every three expect to use fewer than their ideal number of certificates in the first year, with only one in three expecting to use more than their ideal number. This suggests that there is a significant group who appear to have problems of under-

consumption, at least for consumption activities that also involve time.

Either the expected or the ideal consumption lies at a corner for about 17 percent of the observations. It is possible that two individuals may have identical self-control problems yet different measured EI gaps, if differences in their ideal levels of consumption lead one or both to hit a corner. Our measure of self-control problems is therefore censored. We address this issue in our statistical analysis.

II. Self-Control Problems and Wealth

We investigate the relationship between self-control problems and wealth in a regression of the form

$$(1) \quad w = \alpha_0 + \alpha_1 sc + \alpha_2' \mathbf{x} + \varepsilon,$$

where w is some relevant wealth measure, sc is the self-control problem, \mathbf{x} is a vector containing other economic and demographic variables often included in classical life-cycle regressions, and ε is an error term. We use 1999 income from the FAB as our right-hand-side income variable, since this corresponds most closely to the wealth data from the SPF.

Before running the regression, we outline an imputation procedure designed to resolve the censoring problem. We know that the right-censored observations are greater than or equal to the EI gap and the left-censored observations are less than or equal to the EI gap. We therefore first estimate $f(sc|\mathbf{x})$ from the regression,

$$\text{EI gap} = \beta_0 + \beta_1' \mathbf{x} + \nu.$$

Next, we replace the censored observations with draws from $f(sc|\mathbf{x}, sc \geq \text{EI gap})$ or $f(sc|\mathbf{x}, sc \leq \text{EI gap})$, depending on the direction of the censoring. We repeat this imputation procedure ten times and take as our estimate of α_1 the average of the estimated $\hat{\alpha}_1$'s.

Table 2 summarizes overall regression results when the wealth variable is total net worth (nonretirement financial assets plus retirement financial assets, plus real estate assets, less total debt). The regression identifies a clear relationship between self-control problems and wealth accumulation. Note that we also include the answer to

TABLE 2—NET WORTH REGRESSION RESULTS

| Variable | Coeff. | Std. err. |
|--------------------------|-----------|-----------|
| Expected-ideal gap | -0.146*** | 0.048 |
| Ideal level | -0.019 | 0.033 |
| Log 1999 income | 0.198 | 0.179 |
| Zero 1999 income | 1.555** | 0.776 |
| Past income | 0.469*** | 0.161 |
| Zero past income | 1.304* | 0.707 |
| Future income | -0.047 | 0.109 |
| Zero future income | -0.190 | 0.467 |
| Age | 0.216*** | 0.046 |
| Age ² | -0.001*** | 0.000 |
| Empl. status | | |
| Working | Omitted | |
| Partially retired | 0.068 | 0.224 |
| Retired | 0.267 | 0.264 |
| Occupation | | |
| Faculty | Omitted | |
| Mgmt./sen. admin. | -0.185 | 0.155 |
| Tech./professional | 0.003 | 0.147 |
| Other | -0.134 | 0.174 |
| Education | | |
| College or below | -0.236 | 0.172 |
| M.A./professional | Omitted | |
| Ph.D. | 0.051 | 0.128 |
| R. has defined ben. plan | -0.222* | 0.127 |
| S. has defined ben. plan | -0.087 | 0.157 |
| Marital status | | |
| Curr. married | Omitted | |
| Prev. married | -0.601*** | 0.169 |
| Never married | -0.345** | 0.158 |
| Male respondent | -0.061 | 0.113 |
| Num. kids | 0.013 | 0.063 |
| Constant | -3.356*** | 1.127 |
| N | 374 | |

Notes: The dependent variable is log of net worth. We used a censored regression (Tobit) technique to include (3) people with net worth of zero or less. Log income was set to zero for those with zero income. Asterisks indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is (independently) equal to zero: *** indicates rejection at better than a 1 percent level of confidence, ** indicates rejection at better than a 5 percent level, and * indicates rejection at better than a 10 percent level. The Pseudo- R^2 was 0.2417.

Source: Authors' tabulation of 2003 survey data.

question (a) on the ideal level of consumption and find it to have no explanatory power whatsoever. In quantitative terms, the equation suggests that the average overconsumer accumulates some 20 percent less than one with no self-control problem, while the average underconsumer accumulates some 25 percent more.

The finding of a significant impact of self-control problems on net worth is robust to alternative treatments of the corner constraints. Since we get almost identical results when we

ignore the corner constraints, we will ignore this issue in the remainder of the paper. The finding is also robust to the removal of regressors from the right-hand side, and to the introduction of additional regressors, such as measured preference parameters, information on parental gifts and bequests, and wealth shocks. Restricting the sample to those under 65 shrinks the sample to 326, yet increases the absolute value of the coefficient on self-control problems, as well as its statistical significance. Adding annuitants lowers the parameter somewhat, but significance remains.

Most theories of self control suggest that there is a significant difference between liquid and illiquid assets: it is harder to resist the temptation to consume out of liquid assets. Table 3 shows that our measure of self-control problems does indeed appear to have a greater impact on liquid assets than on illiquid assets. The liquid assets we analyze are nonretirement financial assets. The less liquid assets are retirement financial assets (note that real estate assets and debt are not included in either regression). The sample for these regressions is restricted to the group age 64 and under, since the asymmetry in liquidity between retirement and nonretirement assets is reduced when individuals reach the age of retirement. The relationship between measured self-control problems and nonretirement financial assets is robust to all variations in the treatment of the corner constraints and to the addition and removal of regressors.

III. The EI Gap as a Measure of Self-Control

A. Psychological and Demographic Correlates

Personality psychologists associate self-control with conscientiousness, one of the "big five" personality factors. If the EI gap is a measure of self-control, we would expect it to be correlated with measures of conscientiousness. We asked respondents to evaluate themselves on a six-point scale of agreement and disagreement using two standard conscientiousness questions from Paul T. Costa and Thomas A. Widiger (1994): "Sometimes I am not as dependable or reliable as I should be"; and "I never seem able to get organized."

Table 4 reports the results of a regression of the EI gap on age, sex, and our two measures of

TABLE 3—REGRESSIONS FOR WEALTH CATEGORIES

| Variable | Non-ret. fin. assets | | Retirement assets | |
|-----------------------|----------------------|---------|-------------------|---------|
| | Coeff. | S.E. | Coeff. | S.E. |
| Actual-ideal gap | -0.285*** | 0.079 | -0.081 | 0.055 |
| Ideal level | -0.006 | 0.057 | 0.018 | 0.040 |
| Log 1999 income | 0.059 | 0.306 | 0.091 | 0.216 |
| Zero 1999 income | 1.336 | 1.601 | 1.492 | 1.130 |
| Past income | 0.856*** | 0.300 | 0.540** | 0.211 |
| Zero past income | 3.297* | 1.743 | 1.272 | 1.230 |
| Future income | -0.033 | 0.181 | -0.054 | 0.128 |
| Zero future income | 0.366 | 0.797 | -0.119 | 0.562 |
| Age | -0.112 | 0.100 | 0.281*** | 0.071 |
| Age ² | 0.001 | 0.001 | -0.002*** | 0.001 |
| Empl. status | | | | |
| Working | | Omitted | | Omitted |
| Partially retired | -0.219 | 0.383 | 0.430 | 0.270 |
| Retired | -0.299 | 0.510 | -0.038 | 0.359 |
| Occupation | | | | |
| Faculty | | Omitted | | Omitted |
| Mgmt./sen. admin. | 0.152 | 0.259 | -0.077 | 0.182 |
| Tech./professional | -0.003 | 0.250 | 0.076 | 0.176 |
| Other | -0.021 | 0.300 | -0.302 | 0.211 |
| Education | | | | |
| College or below | -0.794*** | 0.289 | -0.264 | 0.203 |
| M.A./professional | | Omitted | | Omitted |
| Ph.D. | -0.353 | 0.219 | 0.091 | 0.154 |
| R. has DB plan | -0.022 | 0.222 | -0.270* | 0.156 |
| S. has DB plan | 0.134 | 0.269 | -0.024 | 0.190 |
| Marital status | | | | |
| Curr. married | | Omitted | | Omitted |
| Prev. married | -0.207 | 0.291 | -0.544*** | 0.205 |
| Never married | -0.500* | 0.275 | -0.347* | 0.194 |
| Male respondent | -0.144 | 0.190 | 0.200 | 0.134 |
| Num. kids | -0.079 | 0.106 | 0.000 | 0.074 |
| Constant | 2.296 | 2.255 | -5.595*** | 1.591 |
| <i>N</i> | 362 | | 362 | |
| <i>R</i> ² | 0.078 | | 0.179 | |

Notes: Dependent variables are natural logarithms of the quantities listed at head of each set of columns. Asterisks indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is (independently) equal to zero: *** indicates rejection at better than a 1 percent level of confidence, ** indicates rejection at better than a 5 percent level, and * indicates rejection at better than a 10 percent level.

Source: Authors' calculations based on 2000, 2001, and 2003 survey data.

conscientiousness. The data reveal a strong relationship between the conscientiousness questions and the absolute value of the EI gap, and no relationship with the level of the EI gap. For those who are conscientious, there is a lower divergence between expected and ideal consumption, regardless of sign.

A particularly interesting finding in Table 4 is the profound reduction in the scale of self-control problems as individuals age, which shows up only when one uses the absolute value of the self-control measure. Older individuals experience fewer self-control problems, either

of overconsumption or underconsumption, than do their younger counterparts. This finding is certainly consistent with the common view that temptation falls with age, and has important connections with actual consumption behavior over the life cycle. Models that allow for such a time-changing self-control parameter retirement may be necessary to explain the absence of a spike in consumption spending at the point when retirement assets become fully liquid.

These results hold if we condition separately on a nonpositive or a nonnegative EI gap. Each is separately related to conscientiousness and age.

TABLE 4—CONSCIENTIOUSNESS AND SELF-CONTROL

| Variable | EI gap | Absolute EI gap |
|-----------------------|-------------------|----------------------|
| Age | 0.003 (0.002) | -0.008*** (0.002) |
| Male | 0.048 (0.063) | -0.129** (0.056) |
| Not dependable | 0.016 (0.029) | 0.070*** (0.026) |
| Not organized | 0.057 (0.029) | 1.101*** (0.026) |
| Constant | -0.306 (0.169) | 0.682*** (0.150) |
| <i>N</i> | 1489 | 1489 |
| <i>R</i> ² | 0.005 | 0.039 |

Notes: Asterisks indicate the level of statistical confidence for rejection of the hypothesis that the relevant coefficient is (independently) equal to zero: *** at the 1 percent level and ** at the 5 percent level.

Source: Authors' tabulations of 2003 survey data.

B. Temptation and Self-Control

We define the temptation-ideal (TI) gap as the difference between the answers to questions (c) and (a), the most tempting choice and the ideal choice. The correlation between the TI gap and the EI gap is about 0.4. The TI gap is also correlated with wealth, but loses all predictive power if the EI gap is included in the regression. The TI gap appears to work through the EI gap.

Most self-control theories suggest that the EI gap should lie somewhere between the TI gap and zero. This is true for 1,173 of the 1,448 respondents for whom we can construct both measures. Among the others, 235 report a TI gap of zero, yet a nonzero EI gap. Interestingly, the vast majority of the violations (211) occur when the EI gap is negative. It is possible that underconsumers do not fit into the ideal-temptation framework. It may be that temptation lacks meaning for this group (what does it mean to be tempted to consume less?) or they may have trouble consuming at all, possibly because they are busy at work or at home. It is also possible that the EI gap is capturing something other than self-control in these cases. When we restrict the sample in the wealth regressions to those that fit the TI framework, that is, those for whom the EI gap lies between the TI gap and zero, the effect of the EI gap tends to be stronger. The coefficient on the EI gap rises in absolute value to -0.19 with a *t*-statistic of 2.34 on 295 individuals, 56 of whom have nonzero EI gaps. For nonretirement financial assets, the coefficient is -0.46 and

the *t*-statistic is 3.51, whereas for retirement financial assets it is -0.12 with a *t*-statistic of 1.23. Both these regressions have 329 observations.

C. Commitment and Self-Control

An implication of most theories of self-control is that agents would like to precommit to their desired action. Following our main questions, we asked responders whether they would use an option to restrict some of the certificates for use only in the first year and/or the second year, and if so how many certificates they would like to restrict. We dropped 29 observations due to missing data, 19 observations that restricted more than the allotted 10 meals, and 103 whose restrictions made it impossible for them to consume their ideal level. This left 1,369 responses. For this group, we define the signed distance between the expected choice and the constraint set to be the revealed preference (RP) gap, a possible alternative measure of self-control.

In many ways, the RP gap reinforces our earlier findings. The correlation with the EI gap is 0.5. Like the EI gap, the absolute value of the RP gap is positively related to our measures of conscientiousness and negatively related to age, although the correlation with age is significant only at the 6 percent level. Like the EI gap, the RP gap has a large effect on wealth, although again the effect is less statistically significant. The *p*-value is 7 percent. As with the TI gap, people with overconsumption problems according to the EI gap are more likely to have a nonzero RP gap than people with underconsumption problems, indicating again that there might be something different about underconsumption.

In other ways, however, the RP gap presents a different and more complex picture. On the one hand, self-control problems appear less severe from the perspective of the RP gap. As was mentioned above, the correlation with wealth is less significant. Surprisingly, there is no correlation between the RP gap and liquid assets. Partly this is because few are willing to impose binding constraints on themselves. Fewer than 10 percent of agents impose strictly binding constraints, while 30 percent have self-control problems according to the EI gap. On the other hand, while binding constraints are rare, non-binding constraints are common. Thirty percent of the respondents with a zero RP gap choose to restrict some certificates to one period or the

other. Over 60 percent of the respondents who restrict certificates to one period also choose to restrict some to the other period.

These findings for the RP gap do not fit our simple theoretical models of self-control problems. The weak relationship with wealth, the unwillingness of some to commit, and the willingness of others to overcommit suggest considerations other than self-control are at work. Those who do not commit may value the flexibility to adjust their plans more than the cost of missing their target (Manuel Amador, Ivan Werning, and George-Marios Angeletos 2006). Those who overcommit may value the certainty of having definite plans (Ameriks, Caplin, and Leahy 2003). For these reasons, we prefer the EI gap as a measure of self-control problems. We cannot, however, rule out the possibility that the EI gap is correlated with other factors that strongly affect wealth, and that in other samples a commitment-based measure may be preferable.

IV. Concluding Remarks

We have introduced a survey-based measure of self-control problems that correlates, as theory predicts, with wealth measures, in particular with liquid wealth. While these problems are typically seen as resulting in overconsumption and low wealth, we identify a significant group who underconsume and thereby accumulate high levels of wealth. We also find that self-control problems are smaller for older respondents.

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