Are Defined Contribution Plans a Commitment Device?

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Many who want to save more for retirement are tripped up by short-run temptations. Yet, some can still achieve their goals by using commitment devices to limit suboptimal behavior. Defined contribution plans in the United States resemble a commitment device because they are framed as savings for the future and penalize early withdrawals. This study investigates whether defined contribution plans are particularly useful for households that value the future and exhibit self-control problems. We find that participation in defined contribution plans has a greater impact on wealth accumulation among households with hyperbolic preferences. Our results suggest that those who find it difficult to resist short-run temptation can achieve long-run goals through the use of less liquid accounts and automated savings.

Keywords: defined contribution, time preference, commitment device, retirement saving

Many who value long-run outcomes, such as adequate saving for retirement, have a difficult time setting money aside for this purpose in the present. There is a growing body of literature that provides evidence that individuals often appear impulsive when making short-run choices while simultaneously exhibiting prudence when making decisions that involve long-run outcomes. This phenomenon is known as hyperbolic discounting (Laibson, 1997). Hyperbolic savers say they want to save more for retirement but have a difficult time making the spending sacrifices in the present needed to achieve their long-run goals.

Hyperbolic savers are those who have the most difficulty avoiding short-run temptations that interfere with their long-term goals. Unlike those who simply do not place much importance on saving for retirement, hyperbolics want to save more but do not do it. The competing short-term and long-term behaviors create what is referred to as a preference inconsistency. Individuals want to save more but can't overcome short-run temptations. A proposed solution that can allow a hyperbolic to achieve the long-term goals they desire (but have difficulty realizing) is through the use of an instrument that restricts short-run choice, also known as a commitment device.

An example of a commitment device that could help hyperbolic savers is an automatic retirement contribution plan that withdraws assets from current income. It avoids the conflict between short-run and long-run preferences that exists when an individual has to choose whether to save or spend from their paycheck. The temptation to raid a savings plan can also be reduced by the penalties assessed on funds withdrawn. It is possible that those who exhibit hyperbolic preferences will benefit most from the use of a restrictive savings vehicle.

The purpose of this study is to investigate whether defined contribution plans and other tax-advantaged accounts can help hyperbolic households save more. Previous studies have used multiple self-control proxies, such as saving goals, saving rules (Rha, Montalto, & Hanna, 2006), and spending exceeding annual income (Gutter, Hayhoe, & Wang, 2007). We employ a unique method to identify households with low self-control through the use of a structural modeling approach in which we estimate both a myopic and a long-term time discounting factor score for each respondent based on health behavior questions available in the NLSY 1979. We then identify hyperbolic respondents by comparing their myopic and long-term time discounting, and selecting those who exhibit high myopia and strong future orientation.

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Literature Review

Many who appear present oriented in short-run choices simultaneously apply more prudent discounting to decisions involving outcomes in the long run. Individuals persistently engage in behaviors that involve a suboptimal intertemporal trade-off, such as smoking (Bickel, Odum, & Madden, 1999), gambling (Dixon, Marley, & Jacobs, 2003), drug use (Kirby, Petry, & Bickel, 1999), and alcoholism (Petry, 2001), while wishing they could quit in order to improve long-run welfare. Most U.S. households report that they wish they could save more for retirement, but more than half of them never actually increase their retirement saving amount (Angeletos, Laibson, Repetto, Tobacman, & Weinberg, 2001).

Inconsistency in time preference leads to a reduction in welfare when long-run utility preferences are sabotaged by an inability to resist short-run temptation (Laibson, 1997). It is not optimal to prefer a consumption path that reflects a low long-run discount rate while making short-run choices that involve a large transfer of utility from the future to the present. Although literature in multiple fields studies this issue, this study focuses on financial decisions.

Hyperbolic time discounting theory is proposed to capture this present bias and to explain multiple suboptimal financial decisions. Time-inconsistent choices may contribute to high levels of expensive credit card debt, even among those who are simultaneously saving for long-run goals (Angeletos et al., 2001; Laibson, 1997). Ikeda and Kang (2015) also find a positive association between lack of self-control and household indebtedness in their Japanese sample. A lack of self-control and procrastination also contribute to insufficient participation in retirement saving plans (Madrian & Shea, 2001; Thaler & Benartzi, 2004). Poterba, Rauh, Venti, and Wise (2007) find less variation in retirement wealth among employees who participated in defined benefit plans in which savings is automatic, while a significant number of employees in defined contribution plans are likely to undersave.

Hyperbolics are not doomed to financial failure. It is possible that many seek commitment devices to help them restrict the short-run temptation in their future selves. Laibson (1997) suggests that households intentionally hold more illiquid assets but fewer assets (such as liquid accounts and unused credit balances) that provide easy access to immediate consumption. Similarly, Thaler and Benartzi (2004) find that workers prefer a saving plan that allows them to commit to contributing a greater amount to an illiquid retirement account when their salary increases in the future. This study adds to the literature by investigating whether defined contribution plans and other tax-advantaged accounts serve as commitment devices to these hyperbolic households.

Theoretical Framework

We implement Laibson's (1997) quasi-hyperbolic time discounting model as our theoretical framework. Similar to the exponential time discounting model, δ represents the long-term discount factor in the utility function, $\beta\delta$ represents the discount factor in the near-term measure of myopia, β alone represents the self-control or present bias, and a lower β indicates a greater tendency to make time-inconsistent decisions. We refer agents with lower β as hyperbolics in the later text.

$$U_t = E_t \left[u\left(C_t\right) + \beta \sum_{\tau=1}^{T-t} \delta^{\tau} u\left(C_{t+\tau}\right) \right]$$

We assume agents have full knowledge of their self-control ability and predict that their future selves will make time-inconsistent choices. They, therefore, choose to use a commitment device to constrain their future selves from short-term temptation. A commitment device either limits future choices or makes it very costly to make myopic decisions. The less self-control they have, the more commitment devices they should choose to use. In doing so, they maximize expected lifetime utility.

Similar to Griesdorn, Lown, DeVaney, Cho, and Evans (2014), defined contribution plans and other tax-advantaged accounts fit the definition of commitment devices. The automatic saving feature withdraws resources from current income without forcing the individual to make a choice. The 10% penalty and restrictions on early withdrawals make it harder and more costly for households to consume these resources before the long-term goal is achieved. These accounts also frame the savings as money set aside a future goal, creating a behavioral barrier that discourages workers from using the funds for another purpose.

Studies also suggest that self-control can be depleted by resisting the temptation to avoid compromising long-run

goals (Muraven, Tice, & Baumeister, 1998). Setting up automatic defined contribution savings from a monthly paycheck removes the need to actively reject spending more in the present in order to achieve a long-run retirement saving goal. Avoiding the need to actively choose to defer gratification is particularly important for consumers who have a difficult time controlling the temptation to spend today (Joireman, Kees, & Sprott, 2010). The Pension Protection Act (PPA) of 2006 increased the number of employees who were automatically enrolled in defined contribution retirement savings plans by their employer (Beshears, Choi, Laibson, & Madrian, 2010). Many hyperbolic employees who otherwise would have a difficult time avoiding the temptation to spend in the present were placed in automatic retirement savings plans. The high rate of participation among those who were automatically enrolled suggests that many of these hyperbolic employees are now saving more for retirement because self-control is no longer needed to initiate or make regular deposits to a savings account.

Based on this theoretical model, we hypothesize that: *Those who exhibit strong short-run discounting while placing a greater value on future saving will benefit most from the use of defined contribution plans.*

Measurement of Time Preference

Studies that measure time preference have used money choice experiments to estimate the rate at which future utility is discounted. Most of these studies use a hypothetical money choice task (HMCT) in which subjects make choices based on hypothetical money rewards, while some studies (Madden, Begotka, Raiff, & Kastern, 2003) use real money rewards to measure delayed discounting. Simpson and Vuchinich (2000) study the reliability of these methods and discover differences in results produced by HMCT and real money rewards. One possible cause is the existence of a magnitude effect where agents tend to exhibit a higher discount rate toward a smaller reward than a larger reward (Green & Myerson, 2004). The validity of HMCT measurement is also undermined by individual variation in mathematical skills and financial literacy, which can result in responses that are a better indication of financial education and experience than true intertemporal preferences (Finke & Huston, 2013).

Empirical studies on health and wealth provide evidence of a strong correlation between health/health behavior and financial outcomes (Grafova, 2007; O'Neill, 2009; Zagorsky, 2005). Some studies suggest that both health and financial behaviors are the result of a common factor such as time preference and self-control. Grossman (1972) is among one of the earliest to model health as an investment in human capital, similar to behavior associated with investing in financial assets. Fuchs (1982) suggests that both financial and health behaviors involve an intertemporal trade-off and finds strong empirical evidence of the relationship between time preference and smoking.

If both health and financial choices are affected by time preference, it is possible to proxy time preference through health behaviors and use this proxy to study financial outcomes. Joireman, Shaffer, Balliet, and Strathman (2012) use a factor analysis to identify those with a future time orientation and find that they consistently engage in healthier behaviors. Finke and Huston (2013) investigate eight health behaviors that involve a trade-off between present and future utility and find two constructs arise from a factor analysis that mirror myopia in short-term events and long-term time preference in distant events. They document that health behaviors created as a proxy of long-term discounting are more consistent predictors of retirement savings intention than hypothetical money questions.

In this study, we move one step forward and develop an empirical method to identify the hyperbolic households based on health-related behaviors similar to those in Finke and Huston (2013). We use data from the National Longitudinal Survey of Youth (NLSY) conducted by U.S. Bureau of Labor Statistics. This survey follows two cohorts of young Americans and asks about their health-related behaviors, financial matters, household composition, and so forth. We use data from the 1979 cohort, who were between 14 and 22 years old when initially interviewed. The NLSY Cohort 79 is particularly useful in measuring retirement savings because the respondents have reached age 47–55 by 2012, which are peak life cycle savings years.

In our study, myopia is measured through short-run behaviors that reflect a reduced ability to resist short-run temptation in various decision-making domains. We measure myopia based on the following variables: cigarettes smoked in a lifetime and whether the respondent is currently smoking, cocaine use, age of first sex, and time discounting in 1 month. These variables have a relatively large correlation

TABLE 1. Short-Term Time Preference Measurement and Actual Behaviors

	Myopic/Short-Term Discounting		
	High (n = 1,379)	**Mid (n = 1,385)**	**Low (n = 1,425)**
Smoke less than 100 cigarettes in life	9.43%	51.3%	94.4%
Smoke more than 100 cigarettes in life but quit	19.5%	30.5%	5.0%
Smoke more than 100 cigarettes and currently smoker	71.1%	18.3%	0.6%
Drug use more than 10 times in life	30.8%	3.5%	0%
Age of first sex	14.82	16.30	18.69
Time discount rate in 1 month[a]	1.0576	1.0515	1.0426

Note. NLSY = National Longitudinal Survey of Youth. [a]NLSY79 includes a hypothetical money question "Suppose you have won a prize of $1,000, which you can claim immediately. What is the smallest amount of money in addition to the $1,000 you would have to receive 1 month from now to convince you to wait rather than claim the prize now?" We calculate the time discount rate in 1 month assuming a natural logarithm utility function. Time discount rate of 1.0576 means that one needs to receive 1.0576 unit of future utility to be indifferent to 1 unit of current utility.

with each other, supporting the idea that they are all motivated by the same latent myopic preference.

We proxy long-term time discounting using the following variables: use of nutrition labels when shopping for food, regular exercise in the past month, educational attainment, body mass index, and time discounting in 1 year. These variables also have relatively large correlations with each other, supporting the idea that they reflect the same latent construct of long-run time discounting.

We then conduct a principle component analysis to capture each latent variable. Table 1 shows the summary statistics of the myopic measures sorted in three groups. The measure clearly separates highly myopic people from their counterparts. For individuals with a high value in the myopic measure, 71.1% of them reported that they smoked more than 100 cigarettes in their life and were currently smoking at the time of survey. 30.8% reported to have used cocaine more than 10 times in their life. The age of first sex is about 14.82. For individuals with a low value in the myopic measure, 94.4% of them reported that they have smoked less than 100 cigarettes in their life and were not currently smoking. None reported the use of cocaine, and the average age they first had sex is 18.69.

Table 2 shows summary statistics of the long-term discounting measures sorted into three groups. Similarly, this measure clearly separates future-oriented individuals from present-oriented individuals. For those with a high long-term discount rate, 64.9% reported exercising daily, 69% only have a high school degree, and they are relatively overweight compared to other groups. For those who place a low discount rate on long-run utility, 99.1% exercise daily, 59% have a college or professional degree, and they are more likely to report reading nutrition labels.

With these measures of myopia and long-term time discounting, we are able to identify 313 hyperbolic respondents who exhibit a high rate of time discounting in short-term decisions while simultaneously applying a low rate of time discounting in long-term decisions. The other 1,107 individuals in the low long-term discounting group are the reference group in our empirical analysis. We purposely focus on individuals with low long-term time discounting because they are the group who should value saving for retirement.

Table 3 shows the summary statistics of demographic and asset holdings by hyperbolic households and the reference group. The hyperbolics and nonhyperbolics are not significantly different in age, gender, and race/ethnicity. The hyperbolic group has lower home and stock ownership, significantly lower holdings in almost all type of assets, and greater values of almost all categories of debt.

Empirical Results

We estimate ordinary least square regressions that model financial outcomes as a function of control variables (Ashraf, Karlan, & Yin, 2006; DeVaney & Zhang, 2001; Fang & Wang, 2015) and whether the respondent is a hyperbolic (Table 4). To control for financial resource availability, we include the logarithm of household average income earned

TABLE 2. Long-Term Time Preference Measurement and Actual Behaviors

	Long-Term Discounting		
	High (*n* = 1,375)	**Mid (*n* = 1,394)**	**Low (*n* = 1,420)**
Daily body exercise	64.9%	94.6%	99.1%
Highest education			
Less than high school	26.9%	8.4%	0.2%
High school	69.0%	72.7%	25.1%
Some college	3.1%	12.5%	15.9%
College	1.8%	5.8%	38.5%
Graduate and professional	0.2%	0.7%	20.4%
Frequently read nutrition label	1.69	3.26	4.19
Body mass index	29.61	28.57	26.27
Time discount rate in 1 year[a]	1.1252	1.1016	1.0771

Note. NLSY = National Longitudinal Survey of Youth. [a]NLSY79 includes a hypothetical money question "Suppose you have won a prize of $1,000, which you can claim immediately. What is the smallest amount of money in addition to the $1,000 you would have to receive 1 year from now to convince you to wait rather than claim the prize now?" We calculate the time discount rate in 1 year assuming a natural logarithm utility function. Time discount rate of 1.1252 means that one needs to receive 1.1252 unit of future utility to be indifferent to 1 unit of current utility.

between 1996 and 2012 (adjusted to 2012 dollars) and the logarithm of inheritance received by the households until 2012. Theoretically, hyperbolic households should have lower accumulated financial wealth and greater debt because they have a difficult time resisting financial temptation.

Consistent with hyperbolic consumption theory, hyperbolic households have a lower net worth, less financial assets (including retirement savings), and greater credit card and mortgage debt even after controlling for income earned over time. We find that hyperbolics earn less money after controlling for education. However, when we control for income earned over time and limit our sample to those who place a greater value on the future, our results suggest that present bias affects financial outcomes in the theoretically predicted direction.

We then study saving in defined contribution plans and other tax-advantaged accounts. Similar to Brown and Previtero (2014), we estimate a logistic regression model to examine how hyperbolic households participate in these plans as shown in Table 5. The dependent variables are whether respondents participated in either defined contribution plans or other tax-advantaged accounts. Other tax-advantaged accounts include retirement accounts such as Individual Retirement Accounts (IRAs), education saving accounts, and variable annuity products. The literature suggests that procrastination could explain lower participation in retirement plans (Madrian & Shea, 2001; Thaler & Benartzi, 2004). We expect that hyperbolic households in general will be less likely to participate in defined contribution plans and other tax-advantaged accounts. However, the PPA of 2006 provides employers with statutory authority to automatically enroll employees into defined contribution plans. Automatic enrollment could result in no difference in defined contribution plan participation by hyperbolic households. We add the additional control variable of net worth, excluding the balance in defined contribution plans or other tax-advantaged accounts.

Results show that hyperbolic households are less likely to initiate a tax-advantaged account than other households in our sample. We do not observe a significant difference in defined contribution participation. This result is consistent with the fact that default enrollment is a common feature of defined contribution plans, and participation in other tax-advantaged accounts is initiated by the individual. Minority groups are less likely to participate in defined contribution plans. Marriage, income, net worth, and inheritance received all increase the likelihood of participating in both defined contribution plans and other tax-advantaged accounts.

TABLE 3. Summary Statistics by Types of Households

	Whole sample (n = 1,420)	Hyperbolic households (n = 313)	Other households (n = 1,107)	p Value of difference in columns II and III
Age 43–46	48.94%	47.60%	49.32%	.592
Age 47–51	51.06%	52.40%	50.68%	.592
Education				
Less than high school	0.21%	0.96%	0.00%	.083
High school	25.07%	38.98%	21.14%	<.001
Some college	15.85%	16.93%	15.54%	.551
College	38.45%	29.07%	41.10%	<.001
Graduate	20.42%	14.06%	22.22%	<.001
Hispanic	11.83%	14.06%	11.20%	.192
Black	22.25%	21.73%	22.40%	.800
Other race	65.92%	64.21%	66.40%	.473
Male	42.32%	43.13%	42.10%	.744
Homeowner	82.18%	71.57%	85.19%	<.001
Married	65.49%	54.95%	68.47%	<.001
Tax adv. owner	56.48%	46.65%	59.26%	<.001
Stock/mutual fund owner	52.11%	44.73%	54.20%	.003
Real income[a]	$116,283	$93,998	$122,598	<.001
Net worth[a]	503,205	384,718	536,794	.002
Total assets[a]	741,868	525,515	803,041	<.001
Financial assets[a]	370,882	232,404	410,036	<.001
Residence value[a]	335,017	250,242	359,084	<.001
Defined contribution[a]	174,131	110,773	192,045	<.001
Tax adv. account[a]	98,711	59,800	109,712	<.001
Mortgage balance[a]	136,308	118,655	141,308	.109
Credit card debt[a]	11,266	14,032	10,485	.059
Student loan[a]	$30,897	$41,922	$26,706	.086

Note. Tax adv. = tax-advantaged.
[a]Variables are in dollars.

We then study the account balance among hyperbolic households by estimating an ordinary least square regression model as shown in Table 6. The dependent variables are the logarithm of account balance in either defined contribution plans or other tax-advantaged accounts, conditional on plan participation. We expect to see no difference in the account balance by hyperbolic households. We argue that once they break the entry barrier and participate in the plan, they commit themselves to a level of saving that is determined by their long-term time preference. The results show no difference in tax-advantaged account balance but a significantly lower defined contribution plan balance. Age is positively associated with defined contribution account balance, possibly because of longer duration of participation. Similar to plan participation, minority groups tend to have a lower balance, and marriage, income, net worth, and inheritance received are positively related to the account balance. Educational attainment again is positively associated with tax-advantaged account balance, as sophistication could reduce the entry cost.

Finally, with a better understanding of the participation and contribution behavior by hyperbolic households, we study the effect of plan participation on household wealth by estimating another ordinary least square regression model as shown in Table 7. The dependent variable is the logarithm

TABLE 4. Financial Outcomes by Hyperbolic Households: Estimated Through OLS Regression

DV: Log (financial outcomes)	Real Income	Net Worth	Total Assets	Tax Adv. Account	Credit Card Debt	Mortg. Balance
Hyperbolic	−0.11**	−0.35***	−0.32**	−0.59*	0.5*	1.02***
	(−2.43)	(−2.75)	(−2.44)	(−1.85)	(1.69)	(3.07)
Age	0.02**	0.04*	0.05**	0.04	0	−0.12**
	(2.32)	(1.94)	(2)	(0.6)	(−0.02)	(−2.12)
No. of children	0.07***	−0.04	−0.01	−0.23*	0.2	0.29**
	(3.88)	(−0.8)	(−0.26)	(−1.71)	(1.57)	(2.18)
Male	0.11***	−0.14	−0.13	−0.52*	−0.58**	0.4
	(2.94)	(−1.31)	(−1.2)	(−1.94)	(−2.38)	(1.53)
Some college	0.12**	0.18	0.31*	0.19	0.96**	1.05**
	(2.13)	(1.09)	(1.8)	(0.45)	(2.51)	(2.43)
College	0.42***	0.51***	0.5***	1***	0.78**	0.81**
	(8.79)	(3.71)	(3.44)	(2.8)	(2.38)	(2.25)
Graduate school	0.64***	0.49***	0.41**	0.18	0.69*	0.61
	(11.68)	(2.98)	(2.39)	(0.42)	(1.8)	(1.47)
Hispanic	−0.06	−0.19	0.01	−0.66	0.55	0.22
	(−0.97)	(−1.15)	(0.05)	(−1.59)	(1.43)	(0.51)
Black	−0.33***	−0.83***	−0.73***	−1.13***	0.82***	0.24
	(−7.07)	(−6.13)	(−5.18)	(−3.29)	(2.6)	(0.66)
Married	0.58***	0.67***	0.89***	2.41***	0.13	−0.22
	(14.35)	(5.49)	(6.89)	(7.69)	(0.47)	(−0.69)
Log (real income)		1.16***	1.39***	1.98***	−0.2	0.22
		(14.99)	(17.42)	(10.17)	(−1.1)	(0.96)
Log (inheritance received)	0.01**	0.05***	0.05***	0.12***	−0.03	−0.06**
	(2.14)	(4.28)	(4.19)	(4.03)	(−1.33)	(−2.26)
Log (residence value)						1.25***
						(7.68)
Adj. R^2	0.34	0.38	0.41	0.25	0.01	0.09
Obs	1,413	1,268	1,403	1,412	1,413	1,161

Note. DV = Dependent Variable; Tax adv. = tax-advantaged.
***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively; t- value is provided within parentheses.

of household total net worth. A dummy variable is created to represent respondents' participation in either defined contribution plans or other tax-advantaged accounts. We also include an interaction term of plan participation and hyperbolic households. With the commitment device feature of defined contribution plans and other tax-advantaged accounts, we hypothesize that plan participation will be more beneficial to these hyperbolic households because automatic saving and illiquidity are able to constrain their short-term temptation to spend and will help them achieve long-term financial goals.

Consistent with the findings in Table 4, hyperbolic households tend to have significantly lower net worth than households who do not have time-inconsistent preferences. Plan participation in general increases household net worth possibly due to employer match and tax deferral. Consistent with our hypothesis, we find that account participation results in a higher net worth among hyperbolic households than among nonhyperbolic households. Once they participate in defined contribution plans or tax-advantaged accounts, hyperbolic households are able to accumulate a higher level of wealth. We find empirical evidence that these defined contribution accounts are significantly more effective at increasing wealth among hyperbolic households than among nonhyperbolics.

Conclusion and Implications

In this study, we test whether defined contribution plans and tax-advantaged accounts could serve as a commitment device and help hyperbolic households achieve their long-term goals. Consistent with Rha et al. (2006), we find evidence that

TABLE 5. Retirement Plan Participation by Hyperbolic Households: Estimated Through Logistic Regression

DV: Retirement Participation Dummy	Defined Contribution	Other Tax Adv. Accounts
Hyperbolic	0.95	0.79*
Age	1.02	0.97
No. of children	0.82***	0.95
Male	0.69***	0.91
Some college	0.77	1.24
College	1.26	1.36*
Graduate school	0.76	1.02
Hispanic	0.4***	1.2
Black	0.46***	0.99
Married	3.23***	2.36***
Net-worth: Mid	1.94***	1.41**
Net-worth: High	3.62***	1.6***
Log (real income)	2.18***	1.67***
Log (inheritance received)	1.05***	1.02*
Obs	1,413	1,413

Note. DV = Dependent Variable; Tax adv. = tax-advantaged. ***, **, and * indicate significance at the 0.01, 0.05 and 0.10 levels respectively; odds ratio for each variable is provided.

TABLE 6. Retirement Plan Account Balanced Conditional on Participation: Estimated Through OLS Regression

DV: Log (account balance) Conditional on Participation	Defined Contribution	Other Tax Adv. Accounts
Hyperbolic	−0.22*	−0.15
	(−1.65)	(−1.24)
Age	0.06***	0.03
	(2.66)	(1.48)
No. of children	0.002	−0.02
	(0.04)	(−0.35)
Male	−0.25**	0.11
	(−2.37)	(1.14)
Some college	0.29	0.22
	(1.52)	(1.36)
College	0.22	0.32**
	(1.51)	(2.48)
Graduate school	0.2	0.3**
	(1.18)	(2)
Hispanic	−0.19	−0.25*
	(−1)	(−1.66)
Black	−0.39**	−0.37***
	(−2.35)	(−2.91)
Married	0.32**	−0.01
	(2.1)	(−0.11)
Net-worth: Mid	0.43***	0.59***
	(3.34)	(4.91)
Net-worth: High	0.57***	0.66***
	(3.93)	(4.79)
Log(real income)	0.86***	0.83***
	(7.81)	(7.69)
Log(inheritance received)	0.01	0.01
	(1.18)	(0.7)
Adj. R^2	0.25	0.27
Obs	648	800

Note. DV = Dependent Variable; Tax adv. = tax-advantaged. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively; t- value is provided within parentheses.

hyperbolic households are less likely to use tax-advantaged accounts, possibly due to entry cost and procrastination, but their defined contribution plan participation rates are similar to nonhyperbolics. Once participating, hyperbolics accumulate significantly more wealth from owning an illiquid defined contribution plan than nonhyperbolics. This suggests that defined contribution plans fit the definition of a commitment device and provide significant benefits to households with a tendency to make time-inconsistent choices.

This study also contributes to the literature by proposing a behavioral measure of myopia and long-term time discounting to identify hyperbolic agents. We take a structural modeling approach to proxy time preference based on a series of health behaviors. This method of selecting hyperbolics based on behaviors in nonfinancial domains avoids possible biases—such as unobserved financial literacy or financial experience—that may arise if financial behaviors are used to identify hyperbolics.

By identifying hyperbolic agents using health behaviors, we also add to the literature on socioeconomic status and health. While health and economic outcomes affect each other, they could also be the result of a common latent factor. Our self-control construct comprising health behaviors is significantly related to financial outcomes, which is consistent with Grafova's (2007) proposition that time preference and self-control underlie the interrelation between health and financial behaviors. A future study on the connection between socioeconomic status and health may need

TABLE 7. Effect of Plan Participation by Hyperbolic Households on Net worth: Estimated Through OLS Regression

DV: Log(net worth)	Defined Contribution	Other Tax Adv. Accounts
Hyperbolic	−0.66***	−0.63***
	(−3.95)	(−3.51)
Plan participation	0.58***	0.70***
	(4.64)	(5.87)
Hyperbolic × participation	0.74***	0.65***
	(3.00)	(2.65)
Age	0.04*	0.05**
	(1.90)	(2.38)
No. of children	−0.02	−0.03
	(−0.34)	(−0.67)
Male	−0.09	−0.12
	(−0.86)	(−1.21)
Some college	0.2	0.12
	(1.21)	(0.76)
College	0.45***	0.42***
	(3.27)	(3.08)
Graduate school	0.47***	0.43***
	(2.90)	(2.70)
Hispanic	−0.06	−0.21
	(−0.35)	(−1.32)
Black	−0.72***	−0.84***
	(−5.37)	(−6.35)
Married	0.5***	0.49***
	(4.01)	(4.01)
Log(real income)	1.06***	1.08***
	(13.74)	(14.21)
Log(inheritance received)	0.04***	0.04***
	(3.60)	(4.06)
Adj. R^2	0.40	0.41
Obs	1,268	1,268

Note. DV = Dependent Variable; Tax adv. = tax-advantaged. ***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively; t- value is provided within parentheses.

to consider that both are a function of the same preference for consumption over time.

This finding also has implications on public policy and the financial planning profession. Policies that make illiquidity features more salient may achieve additional benefits. For example, making the early withdrawal penalty more salient or increasing the early withdrawal penalty may promote a higher saving rate rather than deterring savers. This is particularly important in light of recent efforts to increase access to defined contribution plans through loans or hardship withdrawals. For a hyperbolic consumer who values retirement savings, increasing liquidity increases the temptation to spend more in the present.

Financial planners need to understand that the creation of liquid savings funds meant to pay for potential emergencies may be less effective at building wealth among hyperbolics. Individual characteristics should be considered in their asset location recommendations. Instead of recommending a 6-month emergency fund to a client who exhibits self-control problems, it may be wiser to recommend a smaller emergency fund coupled with semiliquid accounts that require some barrier to accessing cash for immediate spending. Examples could include savings accounts from which transfers take a day to execute or a home equity line of credit.

Financial planners need to explore creative ways to automate savings so that hyperbolic clients do not have to make a conscious choice to spend less in the present. For example, setting up automatic transfers from checking to saving accounts, and automatic credit card and loan payments from these savings accounts, can help a client avoid the temptation to spend more and maintain credit balances over time. It may also be valuable to designate mental accounts for necessities, emergency funds, and fun money to help hyperbolic individuals identify which accounts can be used to fund immediate spending and which are off limits.

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