Behavioral Household Finance*

In Preparation for the *Handbook of Behavioral Economics*

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Introduction

Household finance encompasses the analysis of several fundamental questions in economics. How do households allocate resources across time and across states of the world? Which financial products and strategies do households use to pursue their objectives? How can firms and governments design products, interventions, and regulations to influence household financial outcomes? How do all of these factors affect household welfare?

This chapter is divided into two parts, each of which is further divided into several sections. The first part summarizes key facts regarding household financial behavior, emphasizing empirical regularities that are inconsistent with the standard classical economic model and discussing both extensions of the classical model and explanations grounded in behavioral economics that can account for the observed patterns. This part covers five topics: (I) consumption and savings, (II) borrowing, (III) payments, (IV) asset allocation, and (V) insurance. The second part addresses interventions that firms, governments, and other parties deploy to shape household financial outcomes: (VI) education and information, (VII) peer effects and social influence, (VIII) product design, (IX) advice and disclosure, (X) choice architecture, and (XI) interventions that directly target prices or quantities. The final section of the paper (XII) concludes.

We offer broad coverage of the household finance literature, but we limit the scope of our discussion along some dimensions. We focus on the U.S. institutional context and on empirical work based on U.S. data, although we do bring evidence from other wealthy countries to bear when germane and occasionally reference evidence from developing countries. We address household asset allocation but do not draw out its implications for asset pricing, which are covered by the asset pricing chapter in this handbook. Although household decisions regarding health care are relevant to household finance, we largely omit this literature from our chapter because it is covered in depth in the chapter on behavioral health economics. Finally, there is some overlap between our section on financial product design and the chapter on behavioral industrial organization; we refer readers to that chapter for related material on that topic.

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Part 1: Facts

I. Consumption and Savings

Beginning with the seminal work of Modigliani and Brumberg (1954) and Friedman (1957), economists have embraced the view that households choose to save and borrow to smooth consumption over the lifecycle. Intuitively, if agents have concave utility functions over consumption, then they should spread consumption across time to optimally exploit that curvature.

The theory of optimal consumption is summarized by the Euler Equation, which is a first-order condition for optimal consumption dynamics:

$$u'(c_t) = E_t[R_{t+1}\delta u'(c_{t+1})].$$

Here, u is the utility function, c_t is consumption at date t, R_{t+1} is the gross after-tax real rate of return between dates t and $t + 1$, and δ is the time discount factor from an exponential discount function.

In the special case where $R_{t+1}\delta = 1$, marginal utility is a random walk:

$$u'(c_t) = E_t[u'(c_{t+1})].$$

If the utility function is quadratic, then consumption itself is a random walk:

$$c_t = E_t[c_{t+1}].$$

Since Hall (1978), economists have empirically tested whether consumption dynamics follow the Euler Equation and, by implication, whether households smooth consumption. Many papers, including Hall's original work, have found support for the Euler Equation, estimating that consumption does not respond to large predictable payments (Browning and Collado, 2001; Hsieh, 2003) or predictable changes in wages (Adamopoulou and Zizza, 2015). Households implement some consumption-smoothing behavior by cutting consumption before job losses (Stephens Jr., 2001), anticipating the job loss and thereby avoiding an even greater reduction in consumption when they separate from their employer.

However, a large body of evidence challenges the notion that households smooth consumption. Myriad papers have found that consumption responds strongly to both unexpected changes in income (Johnson et al., 2006; Parker et al., 2013 and predictable changes in income Campbell and Mankiw, 1989; Shea, 1995; Stephens Jr. and Unayama, 2011; Kueng, 2018. Moreover, the size of these responses is anomalously large relative to the classical benchmarks. For example, Broda and Parker (2014) use Nielsen data to study the Economic Stimulus Payments of 2008 and find a within-year marginal propensity to consume (MPC) of 50-75%. Ganong and Noel (2017) find that household consumption falls by 13% when households receiving unemployment benefits reach the predictable end of their eligibility for these benefits. Food stamp and Social Security beneficiaries' consumption exhibits monthly cycles, rising upon receipt of their monthly payment and then declining until the receipt of their next payment (Stephens Jr., 2003; Shapiro, 2005; Mastrobuoni and Weinberg, 2009; Hastings and Washington, 2010).

Consumption behavior around retirement is actively examined.[1] Many studies have shown that consumption expenditure falls at retirement (e.g., Bernheim et al., 2001b; Angeletos et al., 2001; Haider and Stephens Jr., 2007; Olafsson and Pagel, 2018). Bernheim et al. (2001b) show that the drop is larger for households with a lower income replacement rate from Social Security and defined benefit pensions. They also show that there is no relationship between accumulated wealth and the household's consumption growth rate, which is striking given the strong implication of the lifecycle hypothesis that such a correlation should exist—greater patience should lead to steeper consumption growth and more wealth. Moreover, those with less wealth or lower income replacement rates at retirement do not have larger declines in work-related expenses or leisure-substitute consumption. Consequently, there is no indication that the decline in consumption at retirement is greater for those with greater predictable reductions in needs.

The extent and meaning of the decline in consumption at retirement is debated. Using a structural model of optimal lifecycle savings, Scholz et al. (2006) conclude that 80% of households over age 50 in the 1992 Health and Retirement Study have accumulated at least as much wealth as a lifecycle model prescribes for their life stage, and the wealth deficit of the remaining 20% is generally small. Aguiar and Hurst (2005) argue that despite a fall in *expenditure* on food, caloric and nutritional consumption is smoothed across the retirement threshold due to more intensive home production. Retirees shop more intensely for bargains and spend more time preparing meals themselves (see related analysis in Aguiar and Hurst, 2007; Hurd and Rohwedder, 2013; Agarwal et al., 2015c). However, the finding that calories/nutrition are smoothed across the transition into retirement has recently been challenged by Stephens Jr. and Toohey (2017), who find an approximately 20% drop in average caloric intake at retirement in data not used by Aguiar and Hurst (2005).

Before turning to explanations of consumption-income co-movement, we introduce one additional set of stylized facts. Table 1 reports the 25th, 50th, and 75th percentiles of three different measures of net worth calculated from the 2016 Survey of Consumer Finances (SCF).[2] The three definitions of net worth—NW1, NW2, and NW3—are constructed by using liquidity

[1] This literature begins with work by Hamermesh (1984) and Mariger (1987).

[2] Appendix A provides analogous tables for the asset and the liability sides of the household balance sheet. See Appendix B for a detailed description of how these tables were constructed, including the standard errors. The Stata program used to compute estimates and confidence intervals, titled `scfses`, is available on GitHub.

as the organizing principle. NW1 incorporates only the most liquid assets and the most liquid liabilities. NW3 incorporates all assets and all liabilities. NW2 is an intermediate construct. Specifically, NW1 is all financial assets excluding retirement accounts and whole life insurance minus all debt excluding collateralized debts and student loans. NW2 is all financial assets excluding whole life insurance minus all debt excluding collateralized debts. NW3 is all assets (including whole life insurance and durables) minus all debt. Note that all three measures of net worth exclude future labor earnings, defined benefit pension claims, and Social Security (none of which are reported in the SCF). The percentiles are reported separately by the age of the household head.

Table 1 illustrates two intriguing regularities: households do not accumulate *liquid* assets over the life-cycle, but they do accumulate *illiquid* assets. The median value of net liquid assets (NW1) starts at $1,000 for households in the 21-30 age bucket and then barely rises to $6,719 for households in the 61-70 age bucket. NW2 also shows only moderate progress over the life course, starting at $40 at ages 21-30 and monotonically rising to $36,942 at ages 61-70. On the other hand, NW3 does show robust growth over the life course. The median value of NW3 starts at $7,611 for households in the 21-30 age bucket and rises to $209,227 in the 61-70 age bucket. This shows that the typical U.S. household is doing almost all of its voluntary wealth accumulation in illiquid assets.

Successful theories of consumption and savings behavior need to explain three sets of stylized facts: a high degree of consumption-income co-movement, low levels of liquid wealth (including a high incidence of credit card borrowing[3]), and high levels of illiquid wealth. Moreover, these behaviors often co-exist within the same household, so theories of household heterogeneity cannot explain these phenomena on their own. It is the joint nature of these phenomena that has motivated the work of Kaplan & Violante (2014); Laibson, Maxted, Repetto, Tobacman (2017); Laibson, Repetto, & Tobacman (2003).

There are numerous proposed rational explanations for deviations from the benchmark of consumption smoothing over the lifecycle.

<u>Liquidity constraints.</u> Households are limited in their ability to sell claims to their future labor income. Young households in particular have access to far less liquidity than the net present value of their lifetime earnings. When households cannot borrow and are at least modestly impatient, they will adopt an optimal consumption rule (sometimes referred to as a buffer stock savings rule) that features consumption growth that is positively correlated with income growth (e.g., Deaton, 1991; Carroll, 1992; Hubbard et al., 1994; Gourinchas and Parker, 2001, 2002; Aydin, 2016). However, the degree of consumption-income co-movement that such buffer-stock

[3] As measured in the 2016 SCF, 57.6% of households with a credit, charge, or store card report that they had a positive balance after their last payment.

models predict is relatively small compared to the actual magnitude of co-movement observed in empirical data. A calibrated model of buffer stock consumers generates an annual average marginal propensity to consume (MPC) out of *predictable* changes in income of 5%, whereas the observed empirical MPC is approximately 30% (see Angeletos et al., 2001). To generate an empirically realistic MPC, households with exponential discount functions would need to be highly impatient (an annual discount rate of 15%; see Laibson et al., 2017). But such impatience generates counterfactually low predicted total asset accumulation.

<u>Support for dependents.</u> Childcare expenses tend to be high when parents are in midlife, which is when their real earnings tend to peak as well (Attanasio and Weber, 1995). It may only be a coincidence that income is highest when consumption expenditures are highest because of support of dependents. If low frequency lifecycle income dynamics coincide with low frequency dependent-driven variation in consumption needs, then marginal utility smoothing predicts relatively low levels of voluntary household savings (e.g., Scholz et al., 2006). However, Rottke and Klos (2016) and Dushi et al. (2016) have argued that household consumption changes little when children leave the house, implying an increase in per capita consumption after these departures. It is not yet well understood how the number of dependents *should* optimally affect consumption dynamics.

<u>Purchases of durables.</u> Durable purchases may be timed to coincide with income payments, even though actual consumption flows co-move only weakly with income. However, studies that show excess consumption co-movement with income generally do so using non-durable consumption. Gelman et al. (2014) show that a related channel—payments of recurring expenses such as rent that coincide with income receipt—explains part of the high frequency co-movement between income and expenditure.

<u>High levels of impatience.</u> Consider a population divided between highly impatient (myopic) households living hand-to-mouth and patient households with large stocks of retirement wealth that smooth consumption over the lifecycle. An economy with both subpopulations would generate high levels of aggregate consumption-income co-movement and high levels of wealth formation (Campbell and Mankiw, 1989; Parker, 2017).

<u>Illiquid assets.</u> Kaplan and Violante (2014) argue that illiquid assets such as homes have extremely high rates of return (a 7.8 percentage point unlevered after-tax, risk-adjusted premium above the return on risk-free liquid assets once illiquid assets' use/rental value is included). If illiquid assets do offer such high rates of return, then a large portion of the household balance sheet should optimally be invested in illiquid assets. If it is costly to extract cash from illiquid assets, households will tend to be highly liquidity constrained. Consequently consumption will track income shocks and consumers will frequently borrow on credit cards to smooth consumption (see also Kaplan et al., 2014). However, such models rely on very high rates of

return on illiquid assets and explain credit card borrowing by assuming counterfactually low interest rates on credit cards and no mortgage market.

Near-rationality. The concept of near-rationality can be used to explain modest deviations from the rational model in any context, including consumption smoothing. In this case, the welfare costs of modest consumption-income tracking are second-order, and the mental costs of rigidly smoothing consumption are first-order, making it rational to only crudely smooth consumption over the lifecycle (e.g., Cochrane, 1989; Hsieh, 2003; Gabaix, 2015; Kueng, 2018). A modest degree of consumption-income co-movement is probably constrained-optimal.

The following psychological mechanisms have also been used to explain these empirical regularities.

Present bias. Present bias (Strotz, 1955; Phelps and Pollak, 1968; Akerlof, 1991; Laibson, 1997; O'Donoghue and Rabin, 1999) is the most widely analyzed psychological mechanism that generates income-consumption co-movement. See the chapter on Intertemporal Choice for a more extensive discussion of present bias and the broader category of models that feature present-focused preferences. Present bias replaces the standard exponential discount function (δ^t) with a two-part discount function: current utils get weight 1 and future utils get weight $\beta\delta^t$, where $0 \leq \beta \ll 1$ and δ is close to one. With such preferences, agents will be willing to hold illiquid assets with modest rates of return because δ is close to one and it is costly or impossible to tap these assets for immediate consumption. On the other hand, present-biased agents are also unable to persistently hold large stocks of liquid wealth because $\beta \ll 1$. The inability to hold much liquid wealth implies that these agents are perpetually close to their liquidity constraints despite their large holdings of *illiquid* assets, leading them to have a quantitatively realistic marginal propensity to consume. Angeletos et al. (2001) study a calibrated life-cycle model with present bias which matches the balance sheet properties of U.S. households and generates a high MPC. Present bias can also help explain paternalistic policies like Social Security, retirement savings systems, and the Earned Income Tax Credit (Feldstein, 1985; Laibson et al., 1998; Beshears et al., 2017a; Lockwood, 2017). When agents naïvely fail to anticipate that their future selves will be present-biased, they will not be willing to constrain their own future choice sets (Strotz, 1955; O'Donoghue and Rabin, 1999). In such cases, the social planner can have an important role to play. When agents are naïve and have heterogeneous levels of present bias[4] that are not observed by the government, the socially optimal savings regime includes a forced savings mechanism like Social Security (Beshears et al., 2017a).[5]

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[4] For evidence on heterogeneity in present bias, see Brown and Previtero (2014).

[5] See related work by Amador et al. (2006), who study the case of sophisticated agents in autarky. Here too, forced savings is optimal, though this time it is self-imposed by the agents.

Mental accounting. The study of mental accounts goes back to Keynes (1936), who described a consumption function that is closely tied to disposable income. Since then, Thaler and Shefrin (1981), Thaler (1985), and Shefrin and Thaler (1988) have argued that households use mental accounts to make consumption decisions. For example, a household might think of its retirement wealth as "out of bounds" and thereby protect it from premature spending.[6] By contrast, a household might view its checking account as fair game for all household expenditures. Accordingly, the medium-term (e.g., six month) MPC out of retirement accounts is close to zero (among working age households), but the medium-term MPC out of a checking account is close to one. Such mental accounting can also occur at the level of individual expenditure categories. For example, Milkman and Beshears (2009) document a flypaper effect—money sticks where it hits—with shopping coupons.[7] When customers receive a coupon for $10 off any purchase from an online grocery, they increase their spending at the online grocery by 16% of the value of the coupon rather than exploiting fungibility and holding their grocery spending constant. Hastings and Shapiro (2013) document a related mechanism at the gas pump. When gas prices fall (rise), consumers disproportionately allocate the marginal savings (costs) towards purchasing a higher (lower) grade of gasoline. Hastings and Shapiro (2018) find that the marginal propensity to consume SNAP-eligible food out of SNAP benefits is 0.5 to 0.6, even though total spending on SNAP-eligible food exceeds total SNAP benefits for the vast majority of SNAP recipients.

Reference point models. Reference point models with news utility may also explain consumption dynamics (Kőszegi and Rabin, 2006, 2009; Pagel, 2017). In these models, total utility (i.e., the agent's objective) comes not only from current consumption, but also from "news utility" reflecting *changes* in expectations about current and future consumption utility. For example, I feel good today because I am consuming 5 ounces of chocolate, and I feel even better because I had previously expected to consume only 4 ounces today. However, today's utility is decreased by the fact that yesterday, I had expected to consume 7 ounces of chocolate tomorrow, and now I only expect to consume 6 ounces tomorrow. Using models with these features, it is possible to find calibrations that generate over-consumption, under-saving, and consumption-income co-movement. However, these properties do not arise generically in these models; in determining today's utility, today's news about future consumption must be down-weighted sufficiently compared to today's news about today's consumption.

Economists have also studied models of reference points where the reference point is the consumption of other agents, rather than one's own consumption or expectations thereof (e.g., Abel, 1990; Gali, 1994; Campbell and Cochrane, 1999). Such "keeping up with the Joneses" models do not in general predict private over-consumption[8] or excessive consumption-income

[6] However, see Argento et al. (2015) for evidence that households who are decades away from retirement frequently withdraw from retirement accounts.
[7] See Hines Jr. and Thaler (1995) for a general discussion of the flypaper effect.
[8] See Bertrand and Morse (2016) for an empirical example of relative status considerations increasing consumption.

co-movement,[9] but they do imply the existence of social deadweight losses because of the negative externality of one's own consumption on other agents (e.g., Luttmer, 2005).[10] See the chapter on Social Preferences for an extended discussion of such preferences.

II. Borrowing

Zinman's (2015) review paper points out that "research on household debt has lagged behind its sister literatures on the asset side of the household balance sheet."[11] This is surprising because household debt plays a large role in the economy: In the U.S., there is $14.6 trillion of household debt (including collateralized debt like mortgages) outstanding as of 2017 Q1, or about 80% of GDP.[12]

It is possible to rationalize borrowing at essentially any interest rate, provided there is no competing, otherwise-identical credit product that offers a lower interest rate. To illustrate this point, consider an environment with no uncertainty. If a perfectly patient agent with constant relative risk aversion utility and no liquid savings expects her consumption to grow at a rate g between this period and next period (e.g., due to a transitory current slump in income), she should be willing to borrow a marginal dollar at a real interest rate of γg, where γ is the coefficient of relative risk aversion. For example, if $\gamma = 3$ and $g = 20\%$, then the agent should be willing to borrow at a 60% per period real interest rate. If a period is just a week, then the agent should be willing to pay 60% interest *per week*, which is higher than a typical payday loan interest rate.

Willingness to borrow is further increased by the fact that debt is often an obligation that is implicitly (or sometimes explicitly) state-contingent. When a household's economic fortunes are bleak, the household may be able to partially or even fully default on its debts, which increases the household's ex-ante willingness to borrow at high contractual rates of interest. Even collateralized debts offer state-contingent opportunities to default (e.g., when a mortgage balance is greater than the value of the house that serves as collateral). Countercyclical defaults can take place at the level of an isolated unpaid debt/bill or through personal bankruptcy filings. In 2010, during the aftermath of the 2007-2009 financial crisis, 1.6 million Americans filed for bankruptcy, whereas in 2017, 0.8 million Americans filed for bankruptcy.[13] Nearly one in ten U.S. households has filed for bankruptcy at some point (Stavins, 2000).

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[9] However, one will observe excessive co-movement between one's own consumption and the income of other households (Kuhn et al., 2011).
[10] See Bernheim (2016) for a critique of the type of happiness measures used by Luttmer (2005) and others.
[11] See also Tufano (2009).
[12] Federal Reserve Board of Governors, Financial Accounts of the United States (B.101 Balance Sheet of Households and Nonprofit Organizations).
[13] Bankruptcy statistics from the American Bankruptcy Institute. Filings have grown rapidly since World War II (e.g., Buckley and Brinig, 1998). Classical explanations include the decline in social stigma (Buckley and Brinig, 1998; Gross and Souleles, 2002b; Efrat, 2006; Livshits et al., 2010), reduced frictions (Livshits et al., 2010, but see

Despite the seemingly large number of personal bankruptcies, classical economic analysis implies that even more households could profitably file for bankruptcy immediately (e.g., White, 1998) and more aggressively exploit opportunities to take on debt that is dischargeable in bankruptcy before filing (Zhang et al., 2015). Ethical qualms, stigma, the value of the option to file for bankruptcy in the future, the probability that creditors will not take action to collect delinquent debt, and lack of knowledge of bankruptcy procedures may explain why households do not utilize the bankruptcy system more heavily (Buckley and Brinig, 1998; White, 1998; Guiso et al., 2013).

Borrowing may also be motivated by the desire to invest in illiquid assets with high rates of return and/or lumpiness that requires a small amount of borrowing to reach a certain threshold for investment (Angeletos et al., 2001; Laibson et al., 2003, 2017; Kaplan and Violante, 2014). For instance, households might borrow on their credit card to build up a down-payment that will enable them to buy a house. Contributions to 401(k) plans represent another example. If a 401(k) contribution is matched by an employer (e.g., 50 cents per dollar contributed), then it may make sense to borrow at a high interest rate to fund such contributions as long as the debt is repaid before too much interest compounds.

Income variation, expenditure shocks (e.g., medical bills), the option value of default, and the benefits of borrowing to fund high-return investments all create powerful incentives for household borrowing. Nevertheless, there are countervailing forces that should drastically reduce household borrowing. If households rationally anticipate the shocks that create motives to borrow, then households should save in anticipation (so-called buffer stock savings; see Deaton, 1991, and Carroll, 1992). Buffer stock savings enable households to dissave assets to smooth consumption during temporary income declines or transitory periods of unusually high expenditure instead of using high-cost debt. But many households don't appear to be engaging in active buffer stock saving. Forty-four percent of U.S. adults say that they could not come up with $400 to cover an emergency expense or would have to borrow or sell something to do so (Federal Reserve Board of Governors, 2017). Gross and Souleles (2002a) report that well over half of households with bankcards carry debt from month to month (overwhelmingly at high interest rates). They also report that almost 15 percent of bankcard accounts have utilization rates exceeding 90 percent of the cardholder's credit limit. When these high-utilization cardholders receive additional liquidity (an increase in their bankcard credit limit), their marginal propensity to consume is almost 50 percent. On average across all households in their analysis, the propensity to consume out of marginal liquidity is about 12 percent.

Gross et al., 2014), and strategic behavior, including preserving option value (White, 1998; Fay et al., 2002; Lefgren and McIntyre, 2009).

Credit Cards

Simulations of populations of rational (exponentially discounting) households generate low levels of equilibrium borrowing on credit cards compared to the amount of borrowing actually observed (Angeletos et al., 2001). Accordingly, there exists a debt puzzle (Laibson et al., 2003): It is difficult to reconcile the *impatience* that generates high frequencies/quantities of credit card borrowing with the *patience* that delivers the observed life-cycle savings in partially illiquid assets like retirement accounts and home equity. This tension has been explained with buffer stock models augmented with an additional assumption: either discounting with present bias (Laibson et al., 2003, 2017) or illiquid assets with very high rates of return and credit cards with counterfactually low interest rates (Kaplan and Violante, 2014).

Present bias has also been used to explain willingness to hold high-interest debt (Ausubel, 1991), suboptimal debt-repayment trajectories (Kuchler and Pagel, 2017), and heterogeneity in debt levels. Individuals who exhibit present bias in laboratory tasks are 15 percentage points more likely to have credit card debt, and conditional on borrowing, have about 25 percent more debt (Meier and Sprenger, 2010).[14]

Credit cards offer two other puzzles that have been documented in the literature. First, consumers often fail to choose the credit card contract that offers them the lowest borrowing costs. Ausubel (1999) finds that customers are too sensitive to teaser interest rates relative to post-teaser interest rates, suggesting that they underestimate how much they will borrow in the future. (Agarwal et al., 2015a) report that 40% of consumers make the wrong choice between a credit card with an annual fee but a lower interest rate and a card with no annual fee but a higher interest rate, although the costliness of the error tends to be small. Stango and Zinman (2016) find that the *within*-consumer difference between the highest and lowest credit card interest rate offers received during a given month is typically several hundred basis points, and the result is that the variation in realized credit card borrowing costs is large even after controlling for borrower risk and card characteristics.

Second, consumers simultaneously hold high-cost credit card debt and *liquid* assets that earn low rates of return (Gross and Souleles, 2002a). This may be explained by the fact that certain expenses must be paid by cash or check, so households must hold some level of liquid asset balances (Zinman, 2007a; Telyukova and Wright, 2008; Telyukova, 2013). Strategic motives to increase non-collateralized debt in anticipation of bankruptcy may also explain why some households roll over credit card debt while holding substantial cash equivalents (Lehnert and Maki, 2007). Not paying down credit card debt despite holding liquid assets may additionally serve to constrain the spending behavior of other members within the household or one's future present-biased self by reducing the amount of unused credit capacity (Bertaut et al., 2008).

[14] See Brown and Previtero (2014) for evidence on heterogeneity in present bias as it relates to savings.

These theories of why households borrow at high interest rates while lending/investing at low interest rates have difficulty explaining another violation of the no-arbitrage condition that lies solely *within* the credit card domain: People do not minimize interest costs when allocating their purchases among the credit cards they already have. In surveys, they report paying little attention to their credit card interest rates and preferring to spread purchases across their cards and to use specific cards for specific kinds of purchases (Ponceet al., 2017). There is a similar failure to minimize interest costs when paying down credit card debt. Gathergood et al. (2017) find that rather than repaying the credit card with the highest interest rate first, borrowers use a "balance-matching heuristic"—they allocate repayments to their credit cards in proportion to the balances on each card.

In addition to present bias, other psychological factors may partially explain the popularity of borrowing on credit cards and other related types of costly credit. Stango and Zinman (2009) document the pervasiveness of exponential growth bias, which is the propensity to underestimate how quickly interest compounds. Misunderstanding compounding may increase the willingness to hold debt because it is perceived to be less costly than it actually is, and may reduce the willingness to accumulate assets because they are perceived to yield lower long-run returns than they actually do.

Bertrand et al. (2010) document using a field experiment the influence of advertising in the consumer debt market. For instance, including a photograph of a woman in marketing materials or presenting only one example loan (rather than four example loans) causes the same increase in loan take-up as reducing the loan interest rate by 200 basis points.

Payday Loans

In recent years, payday loans have become an active topic of research for at least three reasons. First, the market is large: In a single year, approximately 12 million U.S. households take out at least one payday loan, representing at least 5% of the adult population (Pew Charitable Trusts, 2012). Second, payday loans charge extremely high rates of interest. For a two-week loan, a typical finance charge is 15% or 30% of the principal, implying astronomical annualized gross interest rates of $1.15^{26} - 1 = 3{,}686\%$ to $1.30^{26} - 1 = 91{,}633\%$. Third, as a consequence of the first two facts, payday loans have become a target of regulatory review.[15]

A body of research finds that payday loans harm consumers. Some people use payday loans when less expensive options are available (Carter et al., 2011). Access to payday loans may reduce job performance (Carrell and Zinman, 2014) and create a debt service burden that increases the difficulty of paying mortgage, rent, medical, and utility bills (Melzer, 2011; Skiba

[15] http://files.consumerfinance.gov/f/documents/CFPB_Proposes_Rule_End_Payday_Debt_Traps.pdf

and Tobacman, 2011). Providing improved disclosure about the costs of payday loans reduces take-up (Bertrand and Morse, 2011; Burke et al., 2015), though these effects are estimated to be modest in magnitude (an 11-13% reduction in volume), suggesting that only a minority of borrowers do not understand the nature of the contract.

However, other researchers have found that payday loans are not harmful or may even be helpful in certain circumstances. There is some evidence that payday borrowing helps households smooth consumption (Zinman, 2010; Morse, 2011) and that it does not have adverse impacts on credit scores or job performance (Bhutta, 2014; Bhutta et al., 2015; Carter and Skimmyhorn, 2017).

Researchers have concluded that self-control problems (Gathergood, 2012) and a lack of financial literacy (Lusardi and Scheresberg, 2013) contribute to payday borrowing, in part by engendering the low asset accumulation and resulting financial distress that serve as pre-conditions for payday borrowing.

Mortgages

Mortgages started to play a much more central role in the household finance literature after the 2007-2009 financial crisis, which brought a 32% decline in the S&P/Case-Shiller 20-City Composite Home Price Index, falling mortgage values, collapsing prices of mortgage-backed securities, and insolvency for many financial institutions that held mortgages or mortgage-backed securities. Mortgages also play a dominant role in the consumer credit market. Of the $14.6 trillion of household debt in the U.S. in 2017 Q1, $9.8 trillion is comprised of mortgages.[16]

Many behavioral economists interpret the financial crisis through the lens of a housing bubble. According to this view, unsustainable housing prices—based in part on borrowers' and lenders' overly optimistic beliefs about future home price appreciation—and high loan-to-value mortgages set the stage for the financial crisis (Foote et al., 2008, 2012; Gerardi et al., 2008; Mayer et al., 2009; Kuchler and Zafar, 2016). When housing prices fell, homeowners, mortgage holders, and MBS investors were left holding the bag.

A complementary perspective places special weight on the subprime market, arguing that expansion in credit supply to borrowers with low credit scores and weak income growth played a key role in the mortgage crisis of 2007-2009. Credit enabled these subprime borrowers to spend more on non-durable consumption and buy homes that they otherwise wouldn't have bought. This credit boom may also have caused housing prices to rise and then fall when the bubble burst, with these dynamics being especially forceful in low-income neighborhoods. Mian and

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[16] Federal Reserve Board of Governors, Financial Accounts of the United States (B.101 Balance Sheet of Households and Nonprofit Organizations).

Sufi (2009) study the period leading up to the bursting of the housing bubble and argue that zip codes with a higher fraction of subprime borrowers had more growth in mortgage credit, lower growth in income, and a larger eventual increase in mortgage delinquencies. However, Adelino et al. (2016) and Foote et al. (2016) dispute the notion that mortgage credit was extended disproportionately to low-income subprime borrowers and that such borrowers were the primary drivers of rising defaults during the housing bust.

The period leading up to the financial crisis exhibited other behavioral anomalies. Gurun et al., (2016) find large residual variation in mortgage interest rates; even after controlling for borrower and loan characteristics, the mean difference between the 5th and 95th percentile adjustable rate mortgage (ARM) reset interest rates within geographic region and quarter was 3.1 percentage points. Within a region, lenders that advertised more charged higher interest rates, and a given lender charged more in regions where it advertised more. The positive relationship between advertising and prices is particularly strong in areas with a high percentage of racial minorities, less educated consumers, and low-income consumers.

Relatedly, Agarwal et al., (2016) find that lenders steered borrowers towards mortgages with above-market costs that increased lender profits. These mortgages were disproportionately likely to be complex mortgages—interest-only mortgages or option ARMs. Such complex mortgages became more prevalent during the early 2000s before the financial crisis, raising concerns that they were sold largely to take advantage of naïve borrowers. However, Amromin et al. (2018) document that even though complex mortgages were much more likely to default, they were primarily used by more sophisticated borrowers.

Even outside the run-up to the financial crisis, mortgage originations and refinancings are characterized by numerous behavioral anomalies. Households overpay their mortgage brokers because they solicit prices from too few brokers, and those who pay their brokers using both cash and a commission from the lender (funded by a higher loan interest rate) pay twice as much as observationally similar borrowers who pay their brokers using only a commission from the lender (Woodward and Hall, 2012). Borrowers are too eager to pay mortgage points (an upfront fee) in exchange for a lower interest rate, consistent with their overestimating how long they will keep the mortgage (Agarwal et al., 2017).

The normative model of Campbell and Cocco (2003) finds that ARMs are generally more attractive than fixed-rate mortgages (FRMs) because of the high exposure of FRM real value to inflation risk, but most borrowers choose FRMs. The share of FRMs is strongly negatively correlated with the level of long-term interest rates, suggesting that households believe that long-term rates are mean-reverting, even though long-term rate movements are in fact extremely hard to forecast. Koijen et al. (2009) find that variation in the FRM share is highly correlated with the difference between the five-year Treasury yield and the three-year moving average of past one-year Treasury yields, indicating that households have adaptive expectations about future short rates, although the authors argue that such a decision rule is close to optimal. Malmendier and Nagel (2016) find that at a given point in time, individuals who have lived through higher inflation are more likely to take out FRMs because they expect higher future inflation. These results are identified by studying cross-sectional variation in inflation experiences across birth cohorts, controlling for calendar time fixed effects.

After obtaining their mortgages, FRM borrowers are too slow to refinance (Keys et al., 2016; Andersen et al., 2018), even though the mass-market personal finance literature nearly universally advises borrowers to refinance too quickly. Most books and websites recommend a refinancing threshold linked to when the present value of doing so equals zero, rather than incorporating the option value of waiting (Agarwal et al., 2013).

III. Payments

Households must decide which services and contractual arrangements to use when conducting transactions. On a day-to-day level, households must frequently choose a mode of payment (e.g., cash versus credit card), and they must sometimes choose which payment plans to use when entering long-term service contracts. On a broader level, households must decide which financial institutions to interact with (e.g., banks versus check-cashing stores). In all of these decisions, it is interesting to explore whether households are minimizing the costs that they incur.

Some households do not interact at all with traditional financial institutions. The 2015 FDIC National Survey of Unbanked and Underbanked Households finds that 7% of U.S. households are "unbanked," meaning that they do not hold a checking or savings account. Non-Asian minorities, low-income households, less educated households, young households, and households with disabled members are particularly likely to be unbanked. Unbanked households rely on alternative financial service providers such as payday lenders and check-cashing stores for transactional services. These providers' fees are often high. For example, their fee for cashing a check is typically between 1% and 3% of the check's face value (and can be significantly larger), whereas the holder of a traditional checking account can typically deposit a check without paying a fee.

Why do some households rely on alternative financial service providers instead of traditional financial institutions? In the FDIC survey, 57% of unbanked households say that a lack of sufficient funds is one of the reasons they do not have a traditional bank account.[17] Twenty-nine percent cite a desire for privacy, and 28% cite mistrust of banks. Twenty-eight percent say that

[17] Of course, as discussed in Section I, this explanation raises the question of why households have such low levels of liquidity in the first place.

high account fees are a reason, and 24% mention the unpredictability of account fees.[18] Personal experiences with the banking sector seem to play a role. Immigrants in the U.S. who lived through a systemic banking crisis in their native country are 11 percentage points less likely to have a checking account than immigrants from the same country who did not live through a banking crisis (Osili and Paulson, 2014).

Even among households that use traditional financial services, the fees paid for certain transactions can be high. When a household executes a transaction that takes its bank account balance below zero, the median overdraft fee charged by a large bank is $34 (Consumer Financial Protection Bureau, 2017). If the bank refuses the transaction, it charges a non-sufficient funds (NSF) fee that is typically the same amount as an overdraft fee (except for declined debit card transactions, which generally incur no fee). As much as $17 billion of overdraft and NSF fees are paid in the U.S. each year, and the 8% of account holders who overdraft more than 10 times per year pay 74% of all overdraft fees (Consumer Financial Protection Bureau, 2017)

Although incurring an overdraft fee may be the best option available to a household at a given point in time, Stango and Zinman (2014) argue that inattention is an important driver of overdrafts. They study a panel data set of individual checking accounts and find that a positive shock to the amount of attention paid to overdrafts created by a survey asking overdraft-related questions reduces the probability of incurring an overdraft fee in the month of the survey by 3.7 percentage points from a base probability of 30%.

Experience is also an important factor in determining the level of transaction fees paid by a household. Agarwal et al. (2009) find that the level of credit card late payment fees, over limit fees, and cash advance fees paid each follows a U-shaped pattern over the lifecycle, with the bottom of the trough occurring between 50 and 60 years of age.[19] They suggest that the U-shaped pattern is the result of the confluence of two factors. First, households learn to reduce costs more effectively as they gain experience, although at a diminishing rate as experience increases. Second, households experience cognitive decline as they age, which tends to lead to higher costs.

A growing literature studies households' choices among payment methods. Transaction characteristics such as dollar value and payment-method characteristics such as prices, rewards programs, credit limits, speed, convenience, security, and ease of record-keeping influence the decision to use credit cards versus debit cards versus checks versus cash (White, 1975; Bounie and François, 2006; Borzekowski et al., 2008; Klee, 2008; Zinman, 2009a; Bolt et al., 2010; Simon et al., 2010; Ching and Hayashi, 2010; Schuh and Stavins, 2010, 2011, 2015; Arango et al., 2011; Bursztyn et al., 2017). In a field experiment, Bursztyn et al. (2017) show that certain payment methods serve

[18] The percentages sum to more than 100% because respondents could indicate multiple reasons.
[19] Agarwal et al. (2009) also document that the costs associated with seven other financial decisions follow a similar U-shaped pattern over the lifecycle.

as signals of social status. Willingness to pay to upgrade to a platinum credit card—which has status signaling benefits when it is presented for payment because it has a distinctive appearance and is only available to high-income individuals—is higher than willingness to pay to upgrade to a credit card that is the same in all respects except that it is not labeled a platinum card and does not have a distinctive appearance. Interestingly, there is also evidence that paying with a credit card instead of cash may increase the willingness to pay for certain items (Prelec and Simester, 2001), perhaps because credit cards create psychological distance between the act of making a purchase and the loss of money that induces a "pain of paying" (Prelec and Loewenstein, 1998).

In addition to making decisions regarding their use of transactional services, households must decide which payment plans to use when they enter long-term service contracts. DellaVigna and Malmendier (2006) study the payment plan choices of members at three gyms. Among members who chose a monthly membership and paid full price, the monthly fee was on average $75 for the first six months of the membership. Since average attendance was 4.36 visits per month, the fee per visit was more than $17. These members could have lowered their costs by instead paying for each visit individually at a per-visit price of $12, or purchasing a ten-visit pass for $100. Members who signed up for the monthly plan were either overly optimistic about their future gym attendance or wished to use their monthly membership as a way of encouraging themselves to visit the gym by lowering the marginal cost of a gym visit.[20]

IV. Asset Allocation

In this section, we discuss four puzzles in individuals' asset allocation: low rates of stock market participation, under-diversification, poor trading performance, and investment in actively managed and costly mutual funds.

Stock Market Non-Participation

Many households do not hold any stocks, either directly or indirectly through mutual funds or pension funds. Only half of U.S. households are stock market participants, and participation rates are below 10% in Austria, Italy, Spain, and Greece (Guiso and Sodini, 2013). Haliassos and Bertaut (1995) were the first to point out that non-participation is a puzzle because if agents have expected utility preferences and their non-stock income is uncorrelated with stock returns, then they should hold some stock as long as the equity premium is positive. Intuitively, if an agent

[20] Nunes (2000) reaches the same qualitative conclusion studying a smaller sample of gym members. Train et al. (1987) and Kridel et al. (1993) find similar results for telephone service plans, and Lambrecht and Skiera (2006) find similar results for Internet service plans. Grubb (2009) shows that many customers do not choose the cost-minimizing cellular phone plan and offers the interpretation that customers are overconfident in their projections, underappreciating the variability of their own future usage. Grubb and Osborne (2015) provide formal estimates of customers' degree of overconfidence in the same data set. For evidence against the claim that households fail to choose the cost-minimizing telephone service plan, see Miravete (2003).

holds no stock, stock returns have zero covariance with her marginal utility, so she should be risk-neutral with respect to a small additional stock position. Therefore, holding zero stock cannot be optimal. Although background risks that are correlated with stock returns can in principle drive an agent out of the stock market, given the correlations observed in the data, it is difficult to generate this result in practice without implausibly high risk aversion (Heaton and Lucas, 2000; Barberis et al., 2006).

Vissing-Jørgensen (2004) argues that small fixed costs of participation, such as information acquisition costs and time spent opening accounts, can explain most non-participation. In her highly stylized setting, the benefits of stock market participation are proportional to the stock position size. Since most households have very little financial wealth, a fixed participation cost of about $300 per year (in 2016 dollars) can rationalize 75% of non-participation. The fact that participation rises with wealth is consistent with the importance of fixed costs. Briggs et al. (2015) find that winning $150,000 in a Swedish lottery increases stock market participation by 12 percentage points among those not previously participating.

However, participation is not universal even among very wealthy households. Within the top 5% of the wealth distribution, 6% of U.S. households and more than 65% of Austrian, Spanish, and Greek households hold no stocks (Guiso and Sodini, 2013). Therefore, fixed costs are unlikely to be the only explanation for non-participation.

A variety of preference-based explanations have been advanced for non-participation. Expected utility preferences have a hard time generating non-participation because they are characterized by second-order risk aversion (Segal and Spivak, 1990): Agents with such preferences are risk-neutral with respect to infinitesimal risks. On the other hand, if agents have *first*-order risk aversion, they are risk-averse even with respect to small gambles. Examples of utility functions with first-order risk aversion that have been used to explain non-participation are prospect theory (Barberis et al., 2006), disappointment aversion (Ang et al., 2005), ambiguity aversion (Epstein and Schneider, 2010; Dimmock et al., 2016), and rank-dependent expected utility (Chapman and Polkovnichenko, 2009). Barberis et al. (2006) find that first-order risk-averse preferences alone cannot explain non-participation if the agent also bears risks outside the stock market. Because a stock investment diversifies against these other risks, the agent will find stocks attractive. This problem can be avoided if the agent is also assumed to engage in narrow framing (Kahneman and Lovallo, 1993), whereby she evaluates each risk in isolation from the other risks in her life. Choi et al. (2009a) provide evidence that investors do not consider their holdings in non-salient accounts when making 401(k) asset allocation decisions.

An alternative set of explanations appeals to beliefs. Hurd et al. (2011) and Kézdi and Willis (2011) find that survey respondents who report higher expectations for stock market returns are more likely to participate. On the other hand, Guiso et al. (2008) argue that those who believe that other market participants are likely to cheat them out of their investment will perceive stocks to have low expected returns, and thus be more reluctant to participate. Indeed, they find that trust is positively correlated with participation. Malmendier and Nagel (2011) explore the role of personal experience. They find that individuals who have experienced higher average stock market returns over their lifetime expect future stock market returns to be higher and are more likely to participate. Motivated by neuroscience research on how adversity affects the brain's response to subsequent outcomes, Kuhnen and Miu (2017) and Das et al. (2017) suggest one reason why people with low socioeconomic status are less likely to invest in stocks: they update their return beliefs less positively in response to good economic news than people with high socioeconomic status.

A potentially important barrier to participation is lack of knowledge. Using changes in compulsory schooling laws, Cole et al. (2014) estimate that an additional year of education increases the probability of stock market participation by 4 percentage points, and they argue that this is not simply an income effect. Grinblatt et al. (2011) find that IQ is positively correlated with stock market participation even after controlling for income, wealth, age, occupation, and family effects. Van Rooij et al. (2011) report a positive correlation between financial literacy and stock market participation. This positive correlation remains after instrumenting for financial literacy using the relative financial condition of the respondent's siblings and the respondent's parents' level of financial understanding. Calvet et al. (2007) find that many non-participating households would likely invest suboptimally by under-diversifying if they did enter the stock market, so they gain less from participation than they could in principle.

One mechanism through which financial knowledge might be gained is social interactions. Hong et al. (2004) show that more social households—those that report interacting with their neighbors or attending church—are more likely to invest in stocks. Brown et al. (2008a) instrument for the stock ownership level in a Metropolitan Statistical Area using the lagged average ownership level in the U.S. states in which its non-native residents were born, and conclude that a 10 percentage point increase in ownership prevalence in an individual's community raises the likelihood that the individual owns stock by 4 percentage points. Kaustia and Knüpfer (2012) report that people are more likely to begin participating in the stock market if their neighbors have recently experienced good stock returns. Using evidence from a field experiment, Bursztyn et al. (2014) show that such peer effects are driven not only by learning but also because one's utility of owning an asset is directly affected by whether a peer owns the asset, perhaps because of relative wealth concerns or the pleasure of being able to talk about a commonly held investment.

Under-diversification

Harry Markowitz reportedly quipped that diversification is the only free lunch in investing. Nevertheless, many individual investors do not fully diversify their portfolios. Blume and Friend (1975) found that the median U.S. household that holds stocks directly held only two stocks, and data from subsequent decades do not show significantly greater diversification in directly held stock positions (Kelly, 1995; Barber and Odean, 2000).[21] Investors exhibit home bias, disproportionately holding the stock of their own employer (Benartzi, 2001; Mitchell and Utkus, 2003; Poterba, 2003), stocks of companies headquartered in their own country (French and Poterba, 1991; Cooper and Kaplanis, 1994; Tesar and Werner, 1995), and stocks of domestic companies headquartered closer to their home (Grinblatt and Keloharju, 2001a; Huberman, 2001; Ivković and Weisbenner, 2005).

When investors do diversify, they may do so sub-optimally. Benartzi and Thaler (2001) argue that many 401(k) participants follow a naïve $1/n$ rule that spreads money evenly across the n investment options offered in their 401(k). This means that they will tend to hold more equities if their plan happens to offer more equity funds in the investment menu. In a cross-section of retirement savings plans, they estimate that a 10 percentage point increase in the fraction of equity funds in the investment menu is associated with a 4 to 6 percentage point increase in equity allocations. They find corroborating evidence using longitudinal data at a single plan that twice changed its investment menu. However, Benartzi and Thaler (2007) individual-level data to show that almost no plan participants have positive balances in every fund offered. The median number of funds held is three to four, regardless of the number of funds in the menu. Participants do tend to follow a conditional $1/n$ rule, dividing contributions evenly across the funds in which they have positive balances. Huberman and Jiang (2006) find that a positive relationship between equity funds offered and equity investment is present only in plans that offer ten or fewer investment options, and that the fraction of equity funds offered explains only a small amount of the variation in individual equity allocations.

Undiversified portfolios could be justified by an information advantage in the assets held (Gehrig, 1993; Van Nieuwerburgh and Veldkamp, 2009, 2010). Ivković and Weisbenner (2005) and Massa and Simonov (2006) find that individuals' investments in stocks that are geographically or professionally proximate to them realize higher average returns. Ivković et al. (2008) find that individuals with discount brokerage portfolios that hold two or fewer stocks and have more than \$100,000 of balances enjoy positive abnormal returns. Countering these results are Seasholes and Zhu (2010), who argue that there is no superior performance in geographically proximate stocks after correcting methodological flaws of previous studies, Døskeland and Hvide (2011), who find Norwegian investors earn negative abnormal returns in professionally

[21] However, overall portfolio diversification may be rising because of the spread of employer-sponsored retirement savings plans, which are usually well-diversified, at least among investments within the U.S.

proximate stocks, and Benartzi (2001), who finds that 401(k) allocations to the stock of one's employer do not predict its future returns.

Even if under-diversifying leads to higher average returns, these higher average returns may not adequately compensate for the additional idiosyncratic risk that undiversified investors bear. Ivković et al. (2008) find that more concentrated discount brokerage portfolios have lower Sharpe ratios, although they stress that one cannot draw welfare conclusions without more information about the rest of the household's assets. Using the same data as Ivković et al. (2008), Goetzmann and Kumar (2008) conclude that under-diversification hurts all but a small fraction of individuals. In contrast, Calvet et al. (2007) use nearly comprehensive wealth data on Swedish households to find that, because mutual fund and cash holdings are much more common than direct stock holdings, most Swedish households experience minimal losses from under-diversification. Nevertheless, a sizable minority does suffer considerable losses from under-diversification.

DeMarzo et al. (2004) present a model where agents rationally concentrate their investment in local securities because competition for a scarce local good (e.g., real estate) creates endogenous concerns about one's wealth relative to others in one's community, which in turn creates an incentive to hold a portfolio similar to those held by others in one's community. If some agents overweight local assets in their portfolio for corporate control purposes, to alleviate moral hazard, because they are endowed with the assets and they are not tradable (e.g., local human capital), or due to behavioral biases, other agents not subject to these constraints will also overweight local assets. Roussanov (2010) puts concern about relative wealth directly into the utility function and shows that it can generate concentrated holdings in assets uncorrelated with peers' portfolios.

The most direct evidence that under-diversification is not fully rational may come from financial literacy surveys (Lusardi and Mitchell, 2014). Hastings et al. (2013) report that only about half of adults in the U.S., Netherlands, Japan, Germany, Chile, and Mexico can correctly answer a question asking whether the statement, "Buying a single company stock usually provides a safer return than a stock mutual fund," is true or false—around what would be expected from random guessing. In India and Indonesia, the proportion who give the correct answer is only about 30%. Defined contribution plan participants on average rate the stock of their own employer to be less risky than an equity mutual fund (Munnell and Sundén, 2002; Mitchell and Utkus, 2003). Greater financial illiteracy is associated with more portfolio under-diversification (Guiso and Jappelli, 2008; Abreu and Mendes, 2010; Von Gaudecker, 2015).

Researchers have proposed a number of additional explanations for home bias. Huberman (2001) and Grinblatt and Keloharju (2001a) argue that a preference for the familiar drives home bias. Their evidence could be consistent with the models of Uppal and Wang (2003) and Boyle et al.

(2012), where ambiguity averse investors shift their portfolio towards assets whose return distributions are less ambiguous at the cost of diversification. Cohen (2009) and Morse and Shive (2011) argue that loyalty to one's employer and patriotism, respectively, contribute to home bias. On the other hand, Branikas et al. (2018) find that a significant fraction of home bias is driven by reverse causality: People tend to move to places that contain companies they are inclined to invest in anyway.

Regarding under-diversification more generally, Goetzmann and Kumar (2008) emphasize overconfidence, since high trading activity coupled with low return performance is associated with under-diversification. Alternatively, preference for right-skewed payoffs may cause investors to hold concentrated portfolios (Polkovnichenko, 2005; Mitton and Vorkink, 2007; Barberis and Huang, 2008). Brunnermeier et al. (2007) synthesize these last two ideas. In their model, agents experience anticipatory utility, so it is optimal for them to distort their beliefs to make their future seem brighter. This distortion must be traded off against the costs of making decisions based on incorrect beliefs. Agents solve this problem by overweighting assets whose returns are most positively skewed.

Trading Behavior

A long series of papers has found that individuals on average underperform in stock trading (Odean, 1999; Barber and Odean, 2000; Grinblatt and Keloharju, 2000, 2009; Andrade et al., 2008; Hvidkjaer, 2008; Barber et al., 2009a, 2009b; Choi et al., 2013). Why do individuals trade if doing so is unprofitable? A leading explanation is overconfidence, either about the absolute precision of one's information (Alpert and Raiffa, 1982), one's ability relative to others' (the "better-than-average" effect; Svenson, 1981), or one's ability to control external events (the illusion of control; Langer, 1975). Models where excessive trading is driven by overconfidence include Kyle and Wang (1997), Benos (1998), Odean (1998a), Gervais and Odean (2001), Scheinkman and Xiong (2003), Caballé and Sákovics (2003), and Hong et al. (2006).

Consistent with overconfidence driving trading, Barber and Odean (2000) find that those who trade more perform worse, and Barber and Odean (2001) find that men, who are on average more overconfident than women, trade more and have lower returns. Studies that estimate the correlation between trading volume and direct measures of overconfidence have found consistently positive associations with feelings that one is better than average, mixed support for overestimation of precision, and little evidence for the importance of the illusion of control or the tendency to attribute investment gains primarily to skill instead of luck (Biais et al., 2005; Dorn and Huberman, 2005; Glaser and Weber, 2007; Deaves et al., 2009; Grinblatt and Keloharju, 2009). Graham et al. (2009) argue that the feeling of competence in understanding investments is a more important driver of trading than the better-than-average effect.

Some individuals appear to trade for the thrill of the gamble. Grinblatt and Keloharju (2009) use receipt of speeding tickets as a proxy for having a sensation-seeking personality and find that sensation-seeking is positively correlated with trading activity. Dorn and Sengmueller (2009) find that individuals who report that they enjoy investing or gambling trade more often, and numerous studies find that lotteries are a substitute for trading in the stock market (Barber et al., 2009a; Dorn et al., 2015; Gao and Lin, 2015).

Although the conclusion that individual investors underperform on average was a consensus view in the literature for a long time, several more recent papers have found that net individual buying of a stock positively predicts its future returns over horizons of a week to a month (Jackson, 2003; Kaniel et al., 2008, 2012; Barber et al., 2009b; Kelley and Tetlock, 2013) or has no predictive power (Griffin et al., 2003). However, this short-term effect is negative in Asian markets (Andrade et al., 2008; Barber et al., 2009a; Choi et al., 2013). Proposed reconciliations of these newer findings with the remainder of the literature include the scarcity of institutional investors in Asian markets and the possibility that the early literature sampled a particularly unskilled subset of individuals. Barber and Odean (2013) argue that poor performance of individual investors can coexist with short-term positive return effects because individuals hold stocks for longer than the duration of the positive returns, so they are negatively affected by the long-term return reversals documented in Barber et al. (2009b). However, Kelley and Tetlock (2013) find no long-term return reversals in their data.

When selecting investments to buy, individuals favor stocks that have experienced high past returns (Barber et al., 2009b)—consistent with survey evidence that, on average, they have extrapolative beliefs (De Bondt, 1993; Fisher and Statman, 2000; Vissing-Jørgensen, 2004; Greenwood and Shleifer, 2014; Choi and Robertson, 2017)—or recent attention-grabbing events such as abnormally high trading volume, an extreme return, news coverage, or advertising (Seasholes and Wu, 2007; Barber and Odean, 2008; Engelberg and Parsons, 2011; Engelberg et al., 2012; Lou, 2014). Individuals also tend to sell stocks with high past returns, so that they are net sellers of stocks with high returns over the past quarter and net buyers of stocks with high returns in the more distant past (Grinblatt and Keloharju, 2000, 2001b; Griffin et al., 2003; Jackson, 2003; Kaniel et al., 2008; Barber et al., 2009b).

If individuals tend to have extrapolative return beliefs, why are they net sellers of stocks with high returns over the past quarter? A large body of research, both observational and experimental, has emphasized the importance of the stock's current price relative to the price at which the investor purchased it. The disposition effect is the tendency of investors to sell stocks that have appreciated since purchase and hold stocks that have declined since purchase (Shefrin and Statman, 1985; Odean, 1998b; Weber and Camerer, 1998; Grinblatt and Keloharju, 2001b; Shapira and Venezia, 2001; Feng and Seasholes, 2005; Brown et al., 2006; Barber et al., 2007; Chen et al., 2007; Calvet et al., 2009). Although it could be rational for an investor to sell some of an appreciated stock in order to rebalance her portfolio, Odean (1998b) and Brown et al. (2006) show that investors are also more likely to completely liquidate a position when its price has fallen since purchase.

A common preference-based explanation for the disposition effect appeals to prospect theory (Kahneman and Tversky, 1979; Shefrin and Statman, 1985; Odean, 1998b; Meng and Weng, 2016). Because the prospect theory value function is convex in the loss domain and concave in the gains domain, investors will be risk-seeking in underwater positions and risk-averse in appreciated positions, causing them to be prone to hold onto losing stocks and sell winning stocks. But Barberis and Xiong (2009) show that a dynamic model where prospect theoretic utility is experienced at the end of each year based on the past year's trading profits fails to reliably produce a disposition effect. This is because the kink in the value function around the reference point is a much more significant driver of the reluctance to gamble than the value function's curvature away from the reference point. The further away the investor is from the kink, the more risk tolerant he is. Since a stock must have had a positive expected return in order for the investor to have bought it, the distance from the kink will tend to be larger after a gain than a loss, causing a *reverse* disposition effect—the investor is more prone to sell after a loss than a gain. Meng and Weng (2016) are able to restore prospect theory's ability to generate a disposition effect in the Barberis and Xiong (2009) setting by assuming that the reference point equals the lagged expectation of end-of-year wealth rather than initial wealth, which moves the reference point closer to the stock's price after a gain.

Barberis and Xiong (2009) show that a model where gain-loss utility is experienced only at the time a position is sold ("realization utility") more robustly produces a disposition effect. The reason is that the flattening of the prospect utility value function away from zero creates an incentive to realize losses infrequently all at once while realizing gains more frequently in order to enjoy each small gain separately (see also Ingersoll and Jin (2013). In fact, under realization utility, the disposition effect can be produced even with linear utility over gains and losses, since time discounting alone provides an incentive for an agent to delay selling underwater positions (Barberis and Xiong, 2012). Frydman et al. (2014) provide brain imaging evidence that investors experience gain-loss utility at the time of sale.

Alternatively, the right set of beliefs could produce the disposition effect. Odean (1998b) discusses the possibility that an irrational belief in mean reversion drives the disposition effect. Ben-David and Hirshleifer (2012) argue that the disposition effect is more likely to be due to overconfidence-driven speculation. They observe that the probability of selling as a function of returns since purchase is V-shaped, with a minimum at 0% return and the left branch of the V being shallower than the right branch. If an investor purchases a stock believing she has private information, a subsequent positive price movement will cause her to infer that the market has incorporated her private information. On the other hand, a subsequent negative movement may cause her to infer that her private information was incorrect. The combination yields a V shape in selling propensity, but overconfidence causes the left branch of the V to be shallower, since the investor is less likely to conclude from a contrary market movement that her initial beliefs were incorrect.

Intriguingly, there is a reverse disposition effect for actively managed mutual funds but not passively managed mutual funds. Chang et al. (2016) argue that this indicates that the need to maintain one's self-image as a good investor is an important driver of the disposition effect. Selling an underwater direct stock investment renders its loss permanent, making it hard to avoid the conclusion that the investor made a mistake. In contrast, a loss in a mutual fund investment can be blamed on the fund manager. They provide experimental evidence that reminding subjects of the reason they bought an asset strengthens the disposition effect for stocks and the reverse disposition effect for funds. They also find that making salient the delegated nature of mutual funds strengthens the reverse disposition effect for funds.

Mutual Fund Choices

There are three puzzles regarding individuals' mutual fund investments: why do individuals (1) hold separate stocks instead of mutual funds that offer superior diversification, (2) hold actively managed funds instead of passively managed funds, and (3) pay such high mutual fund fees? The prior sections have discussed literature relevant to the first question. We take up the second and third questions in this subsection.

The Investment Company Institute (2017) reports that in 2016, individual investors held 89% of mutual fund assets and 95% of non-money-market mutual fund assets in the U.S. Only 16% of all mutual fund assets and 25% of equity mutual fund assets are in index funds. Many studies have found that on average, actively managed mutual funds underperform their benchmarks and passive funds (e.g., French, 2008; Gruber, 1996; Jensen, 1968; Malkiel, 1995; Fama & French, 2010). In light of this underperformance, why are so many dollars invested in active funds?

One explanation in keeping with investor rationality is that active funds provide attractive hedging properties, outperforming in high marginal utility states of the world. Consistent with this explanation, Moskowitz (2000) and Kosowski (2011) find that actively managed U.S. equity funds deliver relatively high returns in recessions. Glode (2011) and Savov (2014) present rational-actor models that produce this pattern of returns. In their survey of individuals, Choi and Robertson (2017) find that 28% of active equity fund investors report that the belief that the active fund would have higher returns during recessions or market crashes despite having lower average returns was a very or extremely important factor in causing them to invest in an active fund instead of a passive fund.

However, Choi and Robertson (2017) also find that 51% of active equity fund investors say that a belief that the active fund would have a higher average return was a very or extremely important factor in their decision to invest in an active fund. Müller and Weber (2010) report that individuals who have low levels of financial literacy or who say they are better than the average investor at selecting securities are less likely to invest in index funds. Goetzmann and Peles (1997) provide evidence for a mechanism that might sustain overconfidence in fund-picking ability: in a small survey sample, individuals on average overestimate the past returns of their mutual funds, consistent with cognitive dissonance causing them to justify past investment choices by adjusting their beliefs.

External forces may also influence individuals to make poor mutual fund choices. Investor flows to funds increase with marketing and media mentions (Sirri and Tufano, 1998; Jain and Wu, 2000; Barber et al., 2005; Cronqvist, 2006; Reuter and Zitzewitz, 2006; Gallaher et al., 2015). Bergstresser et al. (2009) and Christoffersen et al. (2013) observe that funds that pay higher sales incentives to brokers attract greater inflows, and Bergstresser et al. (2009) and Del Guercio and Reuter (2014) find that broker-sold funds generally underperform compared to funds sold directly to investors.[22] These last two findings suggest that brokers often act in their own best interest rather than their customers' interest when selling funds.

The amount individuals pay for mutual fund services varies greatly across funds, despite the presence of thousands of competing funds and the fact that higher expenses are associated with lower net returns (Gruber, 1996; Carhart, 1997). Particularly puzzling is the fact that price dispersion is as large among S&P 500 index funds, which offer nearly identical pre-expense returns, as among actively managed funds (Elton et al., 2004; Hortaçsu and Syverson, 2004). One explanation is that S&P 500 index funds are not homogeneous products, since they come bundled with non-portfolio services such as customer service, financial advice, and discounted access to other investment vehicles. Another is that high investor search costs allow price dispersion to persist. Hortaçsu and Syverson (2004) present a model that uses these two factors to explain the empirical pattern of index fund expenses.

Choi et al. (2010) run a laboratory experiment to see what happens when non-portfolio services and search costs are eliminated. Their highly-educated subjects—Harvard undergraduates, Wharton MBA students, and Harvard staff—allocated a portfolio across four S&P 500 index funds and received a payment that depended on their portfolio's subsequent performance. Because the payments were given by the experimenters, the funds' non-portfolio services were irrelevant. In one condition, subjects were given a one-page summary of the funds' expenses, making search costs trivial. Nevertheless, very few subjects minimized their portfolio's fees,

[22] In contrast, Barber et al. (2005) find that net flows decrease with sales loads using a sample covering a different time period. Christoffersen et al. (2013) hypothesize that their results differ because Barber et al. (2005) use data on net flows and the fund's maximum load, whereas Christoffersen et al. (2013) use data on inflows and the amount actually paid to brokers.

suggesting that financial illiteracy is a primary source of demand for high-fee index funds. Grinblatt et al. (2016) find that high-IQ investors choose cheaper mutual funds. Gabaix et al. (2016) show that competition only weakly drives down equilibrium markups in markets where consumers make random evaluation errors.

V. Insurance

In the classical economic model, households purchase insurance policies to maximize the expectation of their utility of consumption. Concavity of the utility function causes households to use insurance products to smooth consumption across states of the world. However, market imperfections may prevent firms from supplying households with insurance contracts that make perfect consumption smoothing possible. In particular, there may exist information asymmetries between households and firms regarding households' levels of risk, both as determined by characteristics observable to the household but not to the firm at the time of contracting (adverse selection) and as determined by non-contractable household actions taken after an insurance policy is in place (moral hazard).

Even taking into account the effects of these market imperfections, an emerging body of empirical evidence documents that household decisions do not match the classical benchmark of constrained optimal insurance. In this section, we provide a selective discussion of several insurance markets in which households purchase too little or too much insurance relative to the benchmark. We also briefly discuss the literature on participation in lotteries, a form of "anti-insurance." Note that we do not review in this section the large literature on health insurance or the related literature on long-term care insurance. While these markets are certainly relevant to household finance, they are discussed in the chapter on Behavioral Health Economics. Interested readers should also see Kunreuther et al. (2013) for an extensive review of behavioral economics research on insurance markets.

Life Insurance and Life Annuities

The most valuable asset for many households is their human capital, which yields income from household members' labor supply. The standard model predicts that the household should purchase life insurance to protect against the possible death of household members—at least those with high earnings—in order to support the consumption level of surviving household members in that state of the world.[23] Do households tend to purchase life insurance in this manner? Bernheim et al. (2003) examine data from the 1992 wave of the Health and Retirement Study and compare households' observed life insurance holdings to the predictions of a rich lifecycle model of household financial decisions. The authors find that life insurance holdings

[23] Similarly, households should hold disability insurance in case disability reduces a household member's future income.

are essentially unrelated to objective measures of risk exposure and need. While the average household would experience only a minor deterioration in its standard of living if a spouse were to die, there is wide variation in vulnerability to potential losses. Forty-three percent of wives and 49% of husbands are the beneficiaries of life insurance on their spouses even though they do not need insurance to prevent a drop in their standard of living upon the spouse's death. Conversely, 20% of wives and 8% of husbands would experience a decrease in their standard of living of at least 20% upon their spouse's death. Bernheim et al. (2006) find similar results in a sample of Boston University employees.

Researchers have documented a related puzzle in the domain of life annuities—insurance contracts in which households pay a lump sum up front in exchange for a stream of future income that lasts as long as the household beneficiary or beneficiaries are alive. These products are the mirror image of life insurance; while life insurance provides protection against dying too soon, life annuities provide protection against living "too long" and running out of assets.[24] In the face of uncertainty regarding longevity, the standard economic model predicts that households should purchase life annuities (Yaari, 1965; Davidoff et al., 2005).[25] However, households invest very little in life annuities in the individual private market, a fact known as the "annuity puzzle." U.S. households over the age of 65 hold only 1% of their wealth in private-market annuities (Johnson et al., 2004), and similar results have been found in other countries (James and Song, 2001).

A large literature proposes and tests extensions within the classical framework to resolve the annuity puzzle. The typical approach is to begin by solving a lifecycle model that augment the baseline model with realistic features of annuity markets or related markets, relevant background institutions, additional components of the household utility function, or a more complete range of risks faced by households. Many researchers include multiple such modifications to the baseline model. Calibrated or estimated versions of the new model then generate quantitative predictions that are compared to data on annuity demand.

An important limitation on the attractiveness of annuities is the divergence between market prices and actuarially fair prices. Friedman and Warshawsky (1990) show that the low yields offered by annuities in the market compared to alternative investments can explain the low demand for private-market annuities. Mitchell et al. (1999) calculate the "money's worth" of life annuities available in the private market in 1995, and they find that the present discounted value of benefit payments was only \$0.75-\$0.85 per dollar of premium for a random individual in the population. The wedge between the "money's worth" and the premium covers the costs incurred

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[24] Other products that are labeled "annuities," such as fixed-term annuities and variable annuities, do not offer longevity insurance in the way that life annuities do, although some of these other products can be converted into life annuities. We focus on life annuities in this chapter.

[25] Households should not hold life insurance and life annuities simultaneously. The two products provide offsetting exposures to longevity risk, and neither can be obtained at an actuarially fair price in private markets.

by the insurance company in marketing and administering the annuity, the impact of adverse selection—which on its own can explain a large fraction of the wedge (Finkelstein and Poterba, 2002, 2004)—and the insurance company's profits.

Another possible reason for low take-up of private-market annuities is the high fraction of household wealth that is already annuitized in the form of future benefits from public retirement income programs, such as Social Security in the U.S., and from private defined benefit retirement plans (Bernheim, 1991). For example, Dushi and Webb (2004) emphasize that such existing streams of annuity income, combined with actuarial unfairness in private-market pricing, may make it optimal for households to delay private-market annuity purchases until they have reached their mid-70s or to forgo participation in the private market for annuities entirely.

Many researchers have also argued for the importance of bequest motives in explaining the annuity puzzle. The value of a life annuity drops to zero when every household member on whose life the contract is written dies, so households who wish to leave bequests should not annuitize all of their wealth. Bernheim (1991) argues for the importance of bequest motives by showing that increases in Social Security benefits increase life insurance holdings and decrease private-market annuity holdings, implying that households actively seek to leave bequests. Inkmann et al. (2011) show in an empirically motivated model that a bequest motive combined with the opportunity to invest in equities can drive annuity demand down to the observed levels.

Others have argued, however, that bequest motives are not empirically relevant. Using panel data on retired households, Hurd (1987, 1989) infers from the dynamics of consumption that bequest motives are weak and that observed bequests are in large part accidental—they are the result of uncertain lifespan and are on average larger than desired bequests. Brown (2001) finds that bequest motives are not predictive of annuity demand in defined contribution retirement savings plans, and Johnson et al. (2004) find that households with children have the same propensity to purchase annuities as childless households. Furthermore, as Brown (2007) explains, bequest motives on their own cannot account for the fact that many households annuitize *none* of their wealth. Most households do not plan to bequeath the entire stock of wealth they hold at retirement, and in such cases, households should annuitize at least some of their wealth.

Lockwood (2012) points out, however, that bequest motives interact with actuarially unfair pricing. Households with stronger bequest motives place a lower utility value on the ability to purchase actuarially fair annuities, and the observed wedges between private-market annuity prices and actuarially fair prices are enough to drive such households out of the market entirely.

A richer account of the wide array of risks that households face can also help to resolve the annuity puzzle. Many analyses of the annuity purchase decision focus on the case of a single individual, but Kotlikoff and Spivak (1981) point out that a couple faces a different decision problem than a single individual because members of a couple can partially insure each other against longevity risk. When one member dies earlier than expected, there are more resources available to help meet financial needs if the other member lives longer than expected. Brown and Poterba (2000) calculate that the utility increase experienced by a couple from the purchase of a joint-and-survivor annuity contract, which provides a stream of payments until both members of the couple die, is less (on a proportional money-metric basis) than the utility increase experienced by a single individual from the purchase of a single-life annuity, which provides a stream of payments until that one person dies. Many potential buyers of annuities are members of couples, so the lower value that couples place on annuitization can help to explain low levels of annuity purchases.

Another important set of household risks that could drive the annuity puzzle is uncertainty regarding medical payments and the cost of long-term nursing care in poor health states. The lack of perfect insurance markets for health status implies that households may refrain from purchasing annuities and instead use accumulated wealth to self-insure against the risk of health shocks (Sinclair and Smetters, 2004; Turra and Mitchell, 2008; De Nardi et al., 2009, 2010; Peijnenburg et al., 2017). Ameriks et al. (2011) place particular emphasis on the role of "public care aversion"—the distaste for long-term care in a public nursing facility—in explaining the annuity puzzle. Using a survey to disentangle the impact of public care aversion from the impact of bequest motives, they find evidence that both factors are important for explaining the low demand for life annuities. Reichling and Smetters (2015) point out that health shocks may simultaneously increase mortality risk and increase medical spending needs, implying that life annuities, which decrease in value when mortality risk increases, are an anti-hedge for certain health shocks. When they simulate their model, they find that optimal holdings of annuities are low and roughly match observed levels of annuitization, especially when they introduce additional realistic frictions.

Pashchenko (2013) develops an elaborate model that includes many of the extensions described above as well as others in order to assess the relative importance of different classical explanations for the annuity puzzle. She finds that pre-existing annuitization from government pension programs, bequest motives, minimum purchase amounts for private-market annuities, and the illiquidity of housing wealth (which makes it costly to convert housing wealth into annuities) are key contributors to the low demand for annuities. Thus, extensions of the classical economic model have had some success resolving the annuity puzzle.

Nonetheless, important challenges to classical models of annuity demand remain, many of them summarized by Brown (2007). First, many classical models explain the annuity puzzle by relying at least in part on actuarially unfair prices in the private market. Such explanations presume that household annuity demand responds strongly to prices, but the evidence for this proposition is weak. For example, choosing to delay the start of one's Social Security benefits increases the size of one's monthly Social Security payments once they begin, so delaying benefits is equivalent to purchasing an annuity, where the purchase price is the foregone early benefits. The implied annuity prices from delaying Social Security benefits are approximately actuarially fair or in some cases even better than actuarially fair (Shoven and Slavov, 2014).[26] Nevertheless, Coile et al. (2002) document that only about 10% of men retiring before age 62 delay claiming their benefits for at least one year after they become eligible. Chalmers and Reuter (2012a) study Oregon public employees choosing between partial and full annuitization of their pension benefits. Exploiting variation in pricing driven by the various formulas determining annuity rates, the researchers find that annuity take-up is not sensitive to price but is sensitive to factors such as life expectancy, risk aversion, and the level of annuitized income available. Previtero (2014) shows that annuity take-up is negatively correlated with recent stock market returns. Households appear to extrapolate when forming beliefs about future stock returns and therefore prefer lump sums that can be invested in equities when recent returns have been high.

Other researchers have stressed that the annuitization decision is complex and that households may not have the cognitive abilities or financial literacy necessary for making well-considered annuity choices. Warner and Pleeter (2001) study the decisions of military personnel as they complete their service and choose between an annuity and a lump-sum payment. The annuity in this case is a fixed-term annuity (not a life annuity), but the context is still informative regarding the factors influencing life annuity decisions. Even though choosing the lump sum implies that future income is valued using a discount rate of more than 17% per year, more than 50% of the officers and more than 90% of the enlisted personnel choose the lump sum, and choosing the lump sum is negatively associated with education and age. However, when Simon et al. (2015) study a later instance of military personnel choosing between an annuity and a lump sum, they find much more modest implied discount rates of around 3% for officers and around 7% for enlistees. The difference between the two studies is likely driven by the fact that in the first study, individuals who chose the annuity were simultaneously agreeing to enlist in the military reserves for the life of the annuity, while those who chose the lump sum were committing to only three years in the reserves and received other benefits. This confound makes the estimates of discount rates from the later study more credible. Nonetheless, the later study shows that choice of the lump sum is negatively correlated with performance on the Armed Forces Qualification Test, a measure of cognitive ability. It also replicates the finding that choice of the lump sum is negatively correlated with education.

On the other hand, annuitization may be *less* complex than alternative mechanisms for optimally spending down accumulated wealth, in which case low financial literacy cannot explain the

[26] A caveat to this analysis is that it assumes that Social Security benefits will be paid as promised, which many Americans doubt. In 2015, 51% of non-retirees (including 30% of those ages 50 to 64) said that Social Security would not be able to pay them a benefit when they retire, and 43% of retirees think that there will eventually be cuts to their Social Security benefits. (http://news.gallup.com/poll/184580/americans-doubt-social-security-benefits.aspx, accessed May 16, 2018)

annuity puzzle. Agnew and Szykman (2011) conduct a laboratory experiment in which participants choose between a simple option—a commitment to receive an annuity-like payout over all rounds of the experiment—and a complex option—a dynamic decision-making task involving a withdrawal choice and an asset allocation choice in each round. The researchers find that financial literacy is negatively associated with choice of the annuity, the opposite of the Simon et al. (2015) finding.

Benartzi et al. (2011) concur with the view that annuities can simplify the problem of how to manage the drawdown of assets during retirement. However, they note that institutional factors often make it inconvenient for households to purchase annuities. For example, few defined contribution retirement savings plans provide annuities as an option in the investment menu, and small frictions in the process of purchasing an annuity may decrease annuity take-up substantially. Thus, the relationships among cognitive ability, financial literacy, and annuity purchases may depend heavily on the details of the decision-making context.

One particularly important contextual influence on annuity purchases is the framing of the decision. Brown et al. (2008b) conduct an online survey and randomly assign participants to contemplate an annuity purchase in an investment frame or in a consumption frame. The investment frame, which emphasizes the possible future financial returns from purchasing an annuity, leads only 21% of participants to select the annuity. The consumption frame, which emphasizes the amount of consumption that the annuity would finance, leads 72% of respondents to select the annuity. Beshears et al. (2014b) also find in an online survey that the investment frame decreases annuity take-up relative to the consumption frame.

Several papers have argued that the mental accounting invoked by the investment frame may apply the "loss" label to situations in which a household member dies early and fails to "break even" on the annuity purchase. For loss-averse households, such loss scenarios loom large and make annuities unattractive (Brown, 2007; Hu and Scott, 2007). Benartzi et al. (2011) provide evidence consistent with this argument. Annuitization rates at retirement are higher in defined benefit plans, which consistently frame accrued benefits in terms of a stream of income to be consumed, than in cash balance plans, which function nearly identically but which consistently frame accrued benefits in terms of a stock of assets to be invested. Similarly, Brown et al. (2016b) find supportive data for the importance of loss aversion in a survey experiment that studies the decision to delay the claiming of Social Security benefits. Framing the decision in terms of a "break even" analysis—an investment frame—leads to earlier claiming. Additional factors that decrease annuity take-up among survey respondents include making the annuitization decision all-or-nothing instead of allowing partial annuitization, and emphasizing the loss of flexibility and control inherent in purchasing an annuity Beshears et al. (2014). Brown (2007) and Benartzi et al. (2011) provide further discussion of psychological factors that may play a role in annuitization decisions.

Finally, even if classical models of annuity demand can approximately match the cross-sectional distribution of annuity holdings, Koijen et al. (2016) show that a related puzzle remains regarding the time-series pattern of annuity holdings within a household. The classical model predicts that households will slowly shift from holding life insurance to holding annuities as their human capital is depleted, but the empirical evidence indicates that households rarely adjust these financial exposures to mortality risk, perhaps because of inertia or institutional forces.

Property and Casualty Insurance

The property and casualty insurance market is another domain in which households sometimes purchase too little insurance relative to the classical economic benchmark. For example, households often neglect to purchase insurance against catastrophic risks such as floods and earthquakes, even though such insurance is available at prices that are approximately actuarially fair or even subsidized (Kunreuther et al., 2013). This fact is probably not the result of a reliance on government disaster relief, as Kunreuther et al. (1978) document that few households believe they will receive such relief. A leading explanation for the lack of catastrophic insurance demand is that households underestimate or even completely ignore the probability that a catastrophe might strike, and it does not occur to them (or it is perceived as too costly) to gather additional information about the extent of their risk (Kunreuther and Pauly, 2004).

Conditional on purchasing property and casualty insurance, households often purchase too much protection against modest losses by choosing deductibles (the amount of losses the household will absorb before insurance coverage begins) that imply implausibly high levels of risk aversion under the standard expected utility model. Sydnor (2010) studies data on 50,000 home insurance policies issued by a large insurance provider. Adopting a simplified version of Sydnor's calculations, a household's deductible choice problem from a menu of one-year policies is

$$\max_j \pi \cdot u\big(w - P_j - D_j\big) + (1 - \pi) \cdot u\big(w - P_j\big)$$

where j indexes the available policies, π is the probability of an insurance claim during the year, w is the household's initial wealth, P_j is the policy's premium, D_j is the policy's deductible, and u is a constant relative risk aversion utility function over wealth. Assume that the household experiences at most one claim per year and that the loss in the event of a claim is always between the amount of the highest available deductible and the insurance coverage limit.[27] The parameters P_j and D_j are directly observed for the policies in the menu offered to a given household. For a given level of wealth and claim probability, a choice of one deductible over other available deductibles generates bounds on the household's implied coefficient of relative risk aversion.

[27] Each home insurance policy studied by Sydnor (Sydnor, 2010) had a coverage limit equal to the house value.

Focusing on new policyholders in the data set, and assuming wealth of $1 million and a claim probability equal to the average frequency among households who chose the deductible level, Sydnor calculates that the median household that chose a $500 deductible (the most popular choice, where the other available deductibles were $100, $250, and $1,000) has an implied coefficient of relative risk aversion between 1,839 and 5,064. This level of risk aversion is extreme, given that 10 is the commonly accepted reasonable upper bound on this parameter (Mehra and Prescott, 1985). It implies that if households applied the same utility function across all their financial decisions, essentially all of the households that chose a $500 deductible would reject a gamble featuring a 50% chance of losing $1,000 and a 50% chance of gaining any positive amount of money, no matter how large (Rabin, 2000). Cutler and Zeckhauser (2004) provide similar calculations for home insurance, auto insurance, and warranties on consumer durables, and they also find high levels of implied risk aversion. Kunreuther et al. (2013) argue that cancer insurance, flight insurance, and rental car insurance are similarly overpurchased. Cohen and Einav (2007) examine deductible choices among Israeli auto policy holders and find that an important fraction of individuals in the sample exhibit high levels of implied risk aversion but that the majority of individuals exhibit much more modest levels of implied risk aversion.

Beyond the question of whether households purchase too much insurance against modest losses, researchers have used data on property and casualty insurance to examine other insurance puzzles that are difficult to explain with the classical model. Households may display inconsistent levels of risk aversion across contexts, and their decisions can be subject to probability distortions. Insurance choices may also be influenced by framing, whether the losses are salient, and a desire to avoid ambiguity.

To assess whether households display consistent levels of risk aversion across multiple insurance choices, Barseghyan et al. (2011) study a data set that links the deductible choices of households in the home, auto collision, and auto comprehensive insurance domains. Using the deductible choice methodology to place bounds on the coefficient of relative risk aversion implied by a household's choices in each domain, they show that only 23% of households have overlapping implied intervals. As a benchmark, if choices were randomly assigned, we would expect 14% to have overlapping implied intervals. Households exhibit more risk aversion in home insurance deductible choices than in auto insurance deductible choices. Einav et al. (2012) study the choices of Alcoa employees across several benefit domains, including disability insurance, health insurance, and retirement savings asset allocation, and they find that only 30% of the sample is internally consistent across the six domains.

Several explanations have been proposed for the high and internally inconsistent levels of risk aversion implied by property and casualty insurance deductible choices and warranty purchases. Household choices may imply high levels of risk aversion because households behave according to prospect theory (Kahneman and Tversky, 1979; Schoemaker and Kunreuther, 1979; Tversky and Kahneman, 1992; Kőszegi and Rabin, 2006, 2007). Such households are loss averse—the disutility from experiencing a loss relative to a reference point is greater than the utility from experiencing a gain of the same magnitude—so there is a strong motive to protect against losses. However, a difficulty with this explanation is that loss aversion should also apply to the premium paid for an insurance policy, making insurance less attractive.[28] In addition, the prospect theory value function is risk seeking in the loss domain, further decreasing the attractiveness of insurance. The feature of prospect theory that increases the attractiveness of insurance is the probability weighting function, which leads small probability events to receive more weight in the decision calculus than they would receive under the expected utility model. Sydnor (2010) notes that typical calibrations of the probability weighting function can partially explain his results.

Barseghyan et al. (2013a) simultaneously estimate households' degree of risk aversion and the extent to which choices reflect probability distortions, whereby states of the world receive decision weights that are not proportional to their objective probabilities of occurring. The prospect theory weighting function may be the source of probability distortions, but misperceptions of risk and other factors are also possible sources. Using the data set on deductible choice in home, auto collision, and auto comprehensive insurance, the researchers find that probability distortions play an important role in deductible choices. For example, a 2% objective probability translates into an 8% decision weight, and a 10% objective probability translates into a 16% decision weight. Barseghyan et al. (2013b) show that probability weighting can in fact be distinguished from risk misperceptions when choices across several domains are combined.[29]

Many other factors may cause the risk of a low-probability negative event to receive disproportionately high weight in insurance decisions. Moving beyond the question of deductible choice to consider the willingness to pay for insurance more broadly, Johnson et al. (1993) demonstrate the role of framing effects in shaping insurance demand. In their laboratory experiment, more vivid descriptions of a hazard increase insurance take-up.

Another factor that can increase the salience of risks is losses experienced in the past, either by oneself or another similar individual. Flood insurance, which covers a peril typically excluded from home insurance contracts, is an ideal setting for studying the role of past experiences with losses. Gallagher (2014) examines community-level data on flood insurance policies linked with county-level flood data. Following a flood, flood insurance take-up increases by 9%. Furthermore, flooding in a nearby county with a shared media market leads to a 3% increase in flood insurance take-up. To explain these results, Gallagher proposes a learning model in which

[28] This concern can be resolved if households do not code the purchase price as a loss (Kőszegi and Rabin, 2006, 2007).
[29] For a detailed discussion of these findings in particular and models of insurance choices more generally, see Barseghyan et al. (2016).

people react to the salient event but forget over time. Atreya et al. (2015) also find that prior flooding increases flood insurance take-up, with the effect dissipating over three years.

Changing perceptions of the probability of a loss are likely a key driver of these effects. Botzen et al. (2015) show that experiencing a flood leads to an increase in the perception of flood risk. However, the relationship between past experiences with losses and insurance take-up is not monotonic. Michel-Kerjan et al. (2012) study zip-code-level claims data from the National Flood Insurance Program and U.S. Census data on flood insurance penetration and find that experiencing a small claim (less than 10% of the limit) in the first year of holding insurance leads to higher subsequent insurance take-up relative to having no claim. But they also find that having a large claim (more than 75% of the limit) in the first year of holding insurance leads to lower subsequent take-up. After a large claim, perhaps a household is unable to afford insurance or tends to move to a new geographic location. It is also possible that households believe that large claims, unlike small claims, predict a lower frequency or size of future losses.

While misperceptions of the size of losses likely influence insurance decisions, the direction of misestimation seems to vary across contexts. In a field survey on washing machine warranty purchases, Huysentruyt and Read (2010) find that people overstate the cost of repairs and the likelihood of breakdowns. Botzen et al. (2015), on the other hand, show that twice as many people underestimate flood damages as overestimate flood damages.

Finally, there is evidence that ambiguity regarding the likelihood of experiencing a loss increases insurance demand. In a laboratory experiment, Hogarth and Kunreuther (1995) show that people are more likely to purchase warranties for consumer electronics when they are not given information about the likelihood of a loss than when the loss probability is stated. Schade et al. (2012) provide evidence that this effect is driven by "worry" as opposed to probability misperception or ex-post rationalizations.

Lotteries

In 2015, lottery sales in the U.S. exceeded $70 billion, or more than $200 per person.[30] According to the classical model, a household should not accept a gamble that offers negative expected returns and that generates fluctuations in wealth that are uncorrelated with any other risks borne by the household. Such gambles cause the household to lose money on average without providing any hedging benefits. From the perspective of the classical model, it is therefore a puzzle that participation in lotteries is so prevalent.[31]

[30] National Association of State and Provincial Lotteries, http://www.naspl.org/faq.

[31] It might also be considered a puzzle that participation in casino gambling and other games of chance is widespread, but these activities are structured in such a way that the direct entertainment value is apparent (Oster, 2002). Nonetheless, the explanations for lottery participation that we discuss can also explain participation in casino gambling.

A first category of explanations for lottery participation posits that participation enters the household utility function in a way that is distinct from its implications for household wealth (Fishburn, 1980; Thaler and Ziemba, 1988; Conlisk, 1993). Adams (1996) argues that lottery participation generates positive affect from feelings of anticipation and is also a positive social experience shared with family members, friends, and colleagues. Consistent with this hypothesis, Forrest et al. (2002) show that the excitement generated by a lottery, as captured by the size of its maximum prize, has explanatory power for U.K. lottery purchases beyond the expected value of a lottery ticket relative to its price. However, many explanations of this type are unsatisfying because it is unclear why the posited benefits of lottery participation, such as positive affect and positive social experiences, are not also available from purchasing assets with positive expected returns.

Several other explanations have been put forward as resolutions to the lottery participation puzzle. An individual may have a utility function over wealth that is concave around the current level of wealth, generating positive demand for insurance, and convex around higher levels of wealth, generating positive demand for lotteries (Friedman and Savage, 1948). Garrett and Sobel (1999) find evidence consistent with this hypothesis when they estimate a cubic utility function over wealth using data on the prizes and winning probabilities offered in U.S. lotteries.[32] One possible explanation for a utility function that is convex around levels of wealth significantly higher than the current level is that such wealth may confer social status benefits.

Chetty and Szeidl (2007) show that positive demand for lotteries can arise even when the utility function is strictly concave. They posit a utility function that takes two arguments: a good whose quantity is costless to adjust (e.g., food), and a good whose quantity is costly to adjust (e.g., housing). Such an agent will adjust his housing only if his wealth changes by a sufficiently large amount. Suppose the agent's wealth is just below the threshold at which he would find it worthwhile to pay the adjustment cost to move to a better house. At that point, he is consuming a large amount of food relative to housing, so his marginal utility of food is relatively low. The utility loss from losing a dollar, which would be entirely accommodated by lowering food consumption, is then less than the utility gain from gaining a dollar, which would cause him to move to a better house. Thus, a lottery becomes attractive.

Financial desperation may be another important driver of lottery participation. A household that is experiencing financial hardship may participate in a lottery in the hopes of winning a prize that enables it to escape the difficult situation. Clotfelter and Cook (1989) document that spending on lotteries as a fraction of income falls as income rises. Blalock et al. (2007) show that lottery sales are positively correlated with poverty rates, and they argue that this pattern is not the result of an association between poverty and increased demand for inexpensive entertainment, as poverty is

[32] Golec and Tamarkin (1998) find similar results for horse-race betting markets.

not correlated with movie ticket sales. In an experiment, Haisley et al. (2008) find that low-income participants are more likely to participate in a lottery when they are primed to think about their low economic status.

A household that participates in a lottery because of a negative financial shock may continue to participate in lotteries even after recovering from the shock if this behavior becomes a habit. Guryan and Kearney (2010) provide evidence that lottery participation is addictive. After the sale of a winning lottery ticket, lottery purchases in the zip code of the winning sale increase by 14%, and approximately half of this increase remains six months later. Farrell et al. (1999) similarly find evidence for habit formation in time-series analysis of aggregate U.K. lottery data.

Another possible explanation for lottery participation is that households perceive the probability of winning the lottery to be higher than the objective probability. Relatedly, households that correctly perceive the win probability may nonetheless make decisions as if it were higher, as modeled by the prospect theory probability weighting function.[33] Clotfelter and Cook (1989) document that lottery participation is negatively correlated with education, suggesting that a misunderstanding of probability plays a role in lottery participation. Cook and Clotfelter (1993) hypothesize that individuals judge the likelihood of winning the lottery based on the frequency with which somebody wins instead of the objective probability. This error could explain why states with larger populations tend to have higher lottery sales per capita. A larger population increases the size of jackpots, which increases per capita demand for the lottery, holding all else equal. A larger population also decreases the objective probability that a given individual wins the lottery, but this does not reduce lottery demand if individuals simply use the frequency of observing lottery winners to judge the likelihood of winning.

The illusion of control (Langer, 1975) is another factor that may inflate perceptions of the probability of winning the lottery. Sales at a store that sells a winning lottery ticket increase afterwards by 12% to 38%, suggesting that households believe they can increase their chances of winning by purchasing tickets from a "lucky store," and this effect is more pronounced in areas with low levels of education (Guryan and Kearney, 2008). Furthermore, even though choosing numbers that are not chosen by others increases the expected value of a lottery ticket by reducing the likelihood of having to share a prize, lottery participants tend to choose similar numbers, presumably because these numbers are "lucky" (Finkelstein, 1995; Farrell et al., 2000; Roger and Broihanne, 2007).

[33] However, DellaVigna and Pope (2017) do not find evidence for probability weighting in a real-effort experiment, as a lottery offered as an incentive for effort does not have the positive impact on performance predicted by the overweighting of small probabilities.

Part 2: Interventions

If people make financial mistakes, can firms and policymakers move outcomes towards normative prescriptions? In Part 2, we summarize the research on the impact of interventions to do so. We first discuss less intrusive approaches (education and information, peer effects and social influence, product design, advice and disclosure, choice architecture) before examining more intrusive measures (directly targeting market prices or quantities). This part of the chapter also discusses "interventions" that are deployed by profit-maximizing firms, which may not be designed to improve social welfare.

VI. Education and Information

If financial mistakes result from a lack of knowledge, then financial education could presumably improve financial outcomes. A large body of research has documented low financial literacy in many different countries and virtually all demographic subgroups (Hastings et al., 2013; Lusardi and Mitchell, 2014). Although many different approaches have been used to measure financial literacy, one that has become popular in the last decade is the so-called "Big Three," a module of three multiple-choice questions (Lusardi and Mitchell, 2011):

> Suppose you had \$100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?
>
> - More than \$102
> - Exactly \$102
> - Less than \$102
> - Don't know
>
> Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than today, exactly the same as today, or less than today with the money in this account?
>
> - More than today
> - Exactly the same as today
> - Less than today
> - Don't know
>
> Do you think that the following statement is true or false: Buying a single company stock usually provides a safer return than a stock mutual fund?
>
> - True
> - False
> - Don't know

Hastings et al. (2013) report that in the 2010 Health and Retirement Study, 71% of U.S. adults correctly answered the compound interest question, 81% correctly answered the inflation question, and 64% correctly answered the risk diversification question. Only 43% provided the correct response to all three questions.

A sizeable literature has documented correlations between financial literacy (and related concepts[34]) and a wide range of financial behaviors and outcomes, including beneficial personal financial management practices (Hilgert et al., 2003), planning for retirement (Lusardi and Mitchell, 2007; Clark et al., 2015), saving and wealth accumulation (Ameriks et al., 2003; Lusardi, 2004; Lusardi and Mitchell, 2007, 2011; Stango and Zinman, 2008; Hung et al., 2009; Van Rooij et al., 2012), stock market participation (Kimball and Shumway, 2006; Christelis et al., 2010; Van Rooij et al., 2011), choosing a low-fee investment portfolio (Choi et al., 2010; Duarte and Hastings, 2012), portfolio diversification and the frequency of stock trading (Graham et al., 2009), debt accumulation (Stango and Zinman, 2008; Lusardi and Tufano, 2015), high-cost borrowing (Lusardi and Tufano, 2015), poor mortgage choice (Moore, 2003), and mortgage delinquency and home foreclosure (Gerardi et al., 2010).

The literature also shows a robust association between financial education and a variety of financial outcomes (Bernheim and Garrett, 2003; Lusardi, 2004; Danes and Haberman, 2004; Lusardi and Mitchell, 2007; Bell et al., 2008; Bell et al., 2009). Despite these strong correlations, the evidence on the causal effect of financial education on either financial literacy or actual financial behaviors and outcomes is mixed. A recent meta-analysis of dozens of papers on the impact of financial education concludes that "interventions to improve financial literacy explain only 0.1% of the variance in financial behaviors studied" (Fernandes et al., 2014). The biggest limitation of this literature is a dearth of studies that credibly estimate causal effects. Additional difficulties in characterizing the results of this literature arise from the fact that what constitutes "financial education" runs the gamut from low-touch, time-limited, and narrowly tailored informational interventions to high-touch, long-duration interventions designed to impart a broad range of knowledge. The populations studied include schoolchildren, college students, members of the military, small business owners and the self-employed, farmers, potential home buyers, older individuals nearing retirement, and broader general populations.

The early literature on financial education exploited endogenous cross-sectional variation in participation in financial education programs or courses to measure their effect. The cross-sectional variation used in these early studies has an obvious problem when it comes to causal inference: individuals who enroll in financial education are almost surely different from those who do not. For example, individuals with lower levels of financial competence might feel a greater need for financial education. This could explain why many early studies find no relationship between financial education and financial literacy (e.g., Jump$tart, 2006; Mandell,

[34] Measures related to financial literacy include more general measures of cognitive ability, numeracy, and feelings of financial competence.

2008). Meier and Sprenger (2013) find that individuals who elect to participate in the financial education program they study are more future-oriented than those who do not. If those with lower time discount rates are more likely to save for retirement, then comparisons between those who do receive education and those who don't will give a biased estimate of the impact of financial education on saving. Other factors that could similarly bias the estimates of financial education's impact include personality (Borghans et al., 2008) and family background (Cunha and Heckman, 2007; Cunha et al., 2010).

Recent studies exploit natural experiments that create quasi-exogenous variation in who receives financial education. Skimmyhorn (2016) evaluates the phased roll-out across military bases of a mandatory eight-hour financial literacy course for enlisted personnel in the U.S. Army. Compared to soldiers hired just before the financial education course was implemented, those hired just after are twice as likely to participate in the U.S. federal government's Thrift Savings Plan (a 401(k)-like retirement savings account) and contribute roughly twice as much, although much of this effect is probably due to the fact that the course instructors offered direct assistance in enrolling in the Thrift Savings Plan. More likely to be the result of the educational portion of the course are the reductions in debt balances, delinquent accounts, and probability of facing an adverse legal action (foreclosures, liens, judgments, and bankruptcies), although none of these credit effects are statistically significant by the second year after the course.

Several papers have exploited differences in high school curriculum requirements across states and/or over time as a source of variation in financial education. Cole et al. (2016) find that financial education mandates passed from 1957 to 1982 had no impact at midlife (average age around 45) on wealth accumulation, the likelihood of paying bills on time, credit scores, and the likelihood of bankruptcy. Cole et al. (2016) also examine the impact earlier in adulthood (average age around 30) of a set of 1984-1994 math curriculum reforms that increased the number of math courses taken in high school. In contrast to the null results estimated for financial education, they find that additional math education does affect several financial outcomes, increasing financial market participation, investment income, and home equity, and decreasing the likelihood of loan delinquency and home foreclosure.[35]

[35] The first study to use high school curriculum mandates for identification, Bernheim et al. (2001a), examines self-reported financial outcomes in 1995 for individuals born between 1946 and 1965. They conclude that attending high school when a state financial education mandate was in place is associated with higher levels of wealth accumulation. Because their empirical specification does not include state fixed effects, much of their identifying variation comes from differences across states rather than differences over time within the same state. Cole et al. (2016) revisit the Bernheim et al. (2001a) results using data from the Census and the Survey of Income and Program Participation. They replicate the Bernheim et al. (2001a) results in these data using the original empirical specification, but when they additionally control for state-of-birth and year-of-birth fixed effects, the effects of financial education on wealth accumulation disappear. They conclude that state adoption of these mandates was correlated with economic growth, which could have had an independent effect on savings and wealth accumulation.

Urban et al. (2018) study high school financial education mandates enacted in Georgia, Idaho, and Texas in 2007. They compare financial outcomes at ages 18-21 for students in these states to those for students in demographically similar states (defined using synthetic control methods) that did not mandate financial education before 2011. Using a difference-in-differences approach, they find that financial education decreases debt delinquency and improves credit scores, and these effects are stronger in later cohorts, perhaps due to implementation delays and growing teacher familiarity with the material.

Brown et al. (2016c) examine three types of state-level high school curriculum reforms enacted between 1998 and 2012: mandates that require students to (1) take an economics course, (2) take a financial literacy course, or (3) take more math courses. They use an event study approach that controls for state × year fixed effects, birth cohort × year fixed effects, and linear state × cohort time trends. They find that math education improves creditworthiness but also increases student debt, while financial literacy education decreases loan delinquencies and the likelihood of having any debt. On the other hand, requiring students to take an economics course increases the probability of holding debt and the probability of having repayment difficulties. The salutary effects of financial literacy and math training dissipate by the time people reach their mid-twenties, which could reconcile these estimates and those of Urban et al. (2018) with the null findings of Cole et al. (2016).

Brown et al. (2016c) also report the results of a difference-in-differences analysis of the impact of financial education on financial literacy using assessments conducted by the National Jump$tart Coalition in states that either implemented a financial literacy mandate between 2005 and 2007 (treatment states) or did not have a mandate during that time (control states). In contrast to the weak results found in studies using the same data but relying solely on cross-sectional variation (Jump$tart, 2006; Mandell, 2008), they find that financial education increases financial literacy scores by one standard deviation, a very large effect.

Choi et al. (2005) study the impact of media coverage of the Enron, WorldCom, and Global Crossing bankruptcies in the early 2000s. All three of these firms' employees held in their 401(k) plans large amounts of their employer's stock, which became worthless after the bankruptcies. The "financial education" provided by this media coverage had only a small effect on the 401(k) asset allocations of employees in a group of other large firms. The percent of balances invested in employer stock at these other firms was reduced by at most 2 percentage points from a base of 36%.

A growing body of more recent research has used random assignment to financial education programs or interventions in order to estimate their causal impact. The results from these studies are also mixed. Bruhn and Zia (2013) and Berg and Zia (2017) both find that financial education increases measures of financial literacy. The latter study randomizes whether individuals were paid to watch a South African soap opera with a storyline about gambling and debt management, or paid to watch another soap opera airing at the same time. They find that treated viewers score higher on a financial literacy assessment, and while no less likely to borrow, are 2.8 percentage points (62%) more likely borrow from a formal creditor, 7.1 percentage points (61%) more likely to borrow for productive purposes conditional on borrowing, 4.4 percentage points (23%) less likely to use retail credit, and 5.2 percentage points (17%) less likely to gamble.

Lusardi et al. (2014) compare the effects of four different approaches to providing financial education. While all four approaches increase self-efficacy (the belief that one can accomplish a specified goal), only some increase performance on a subsequent financial literacy assessment. Carpena et al. (2015) find that financial education has a positive impact on both short- and longer-run measures of financial awareness and financial attitudes, but has no impact on participants' ability to perform financial calculations correctly or on actual financial behaviors such as budgeting, saving, or reducing debt utilization. Ambuehl et al. (2016) find that financial education improves performance on a financial literacy assessment but does not improve the quality of financial decision-making in a task where individuals can make objectively better or worse decisions. Liebman and Luttmer (2015) study an intervention that provided information to 55 to 65 year old workers on the incentives embedded in the U.S. Social Security system. Those given more information are 4 percentage points (6%) more likely to be employed one year later but are equally likely to have claimed Social Security benefits (conditional on being age-eligible and not having claimed at the time of the intervention).

The largest randomized field study of financial education to date was conducted by Bruhn et al. (2013) in Brazil. Eight hundred ninety-two high schools were randomly assigned to either have one eleventh grade class participate in a new financial education program or not. The financial education was integrated throughout the curriculum over a 17-month period. The lessons were designed to take between 72 and 144 hours of classroom teaching time and included exercises for students to complete at home with their parents. The researchers find positive effects on a number of student outcomes immediately after the curriculum ended: scores on a financial literacy exam (a 0.2 standard deviation increase), grade-level passing rates, employment, saving (a 1.4 percentage point—or 11%—increase in the percent of disposable income saved), budgeting, and negotiating over prices. But the program also caused students to become 2.9 percentage points (10%) more likely to borrow money, and there is some evidence that they were more likely to fall behind in their loan repayments. Interestingly, the program also had an impact on students' parents, who scored higher on a financial literacy assessment and were more likely to report saving and using a budget. This result suggests that well-designed financial education programs could have meaningful spillover effects.

The mixed findings on the impact of financial education have led to a shift away from studies designed to assess "does it work" to studies designed to assess "what makes it more or less effective." Much of this latter work draws on behavioral concepts to inform the strategies that might make financial education more effective.

Drexler et al. (2014) evaluate two approaches to providing financial education to micro-entrepreneurs in the Dominican Republic. One approach provided standard accounting training, while the other taught simple financial management rules of thumb. One year after the program, the authors find no difference between the financial behaviors of the group that received the accounting-based financial education and those of a control group. In contrast, the group that received the rules-of-thumb financial education program exhibited significant improvements in financial behavior relative to the control group.

In a field experiment with farmers in China, Cai and Song (2017) find that an educational intervention that helps farmers calculate the value of weather insurance under different scenarios has no impact on subsequent insurance take-up. In contrast, playing a multi-round game in which farmers draw a random weather shock and then experience a payout from that shock based on whether they purchased insurance nearly doubles insurance demand. Moreover, whether a participant experienced a weather shock in the later rounds of the game is the most important driver of this effect. This study suggests that financial education could be more effective if it is in some way experiential[36] and if principles are made more salient. Relatedly, Berg and Zia (2017) attribute the effectiveness of their South African soap opera intervention to the emotional connection that viewers had with its main character.[37]

Carpena et al. (2015) evaluate a five-week financial education intervention in India ten months after the program ended. As previously mentioned, the baseline financial education intervention increases financial awareness and attitudes, but has no impact on financial acumen or behaviors. They also study the effect of coupling financial education with an intervention in which respondents are asked to set a target date for achieving several concrete financial planning goals and to mark those dates on a calendar. Consistent with the psychological literature on goal setting (Locke and Latham, 2002), they find that this dual intervention leads to some changes in financial behavior. Pairing financial education with individualized financial counseling is somewhat more effective than pairing education with the target-date intervention. The combination of all three interventions—financial education, goal setting, and counseling—is the most effective, increasing the likelihood of making a regular monthly budget by 4.8 percentage points (75%), having informal savings by 6.4 percentage points (80%), having formal savings by 9.0 percentage points (30%), and purchasing life insurance by 5.4 percentage points (163%). In a similar vein, Carlin and Robinson (2012) conduct a less methodologically rigorous study of the Junior Achievement financial education program for teenagers and find that financial education

[36] Although not a study of financial education, Choi et al. (2009b) find evidence that decisions about how much to save are consistent with a model of experience-based reinforcement learning.

[37] See Lerner et al. (2015) for a review of the more general literature on emotions and decision-making.

is more effective when coupled with decision support. These results suggest that one factor contributing to the mixed effectiveness of financial education programs is that the cognitive limitations that financial education addresses are not the only barrier to better financial outcomes.

A body of literature has studied lower-touch interventions designed to provide financial information to consumers. These papers often examine the effect of providing written materials that require less time and attention from recipients than financial education programs.

Bertrand and Morse (2011) study a trio of behaviorally informed interventions targeted at customers of a payday lender. One treatment, designed to address borrower overconfidence about the likelihood of timely repayment, provides borrowers with an infographic on the distribution of how many times a new payday loan is rolled over. The other two treatments provide simple comparisons of the cost of a payday loan relative to other sources of credit. Relative to a control group, all three interventions reduce future payday borrowing by 11-13% at the lender studied.

We previously discussed in the subsection on mutual fund choice the laboratory experiment of Choi et al. (2010), where subjects allocated a portfolio across four S&P 500 index funds. They find that providing a single page with information about the funds' fees causes subjects to choose a portfolio with modestly lower fees than those in the control group who did not receive the fee summary, but the vast majority of the treatment group still fail to minimize fees by allocating 100% to the lowest-cost fund. This suggests that making relevant information salient is somewhat effective at changing investor behavior but does not eliminate financial mistakes. Giving subjects instead a single page highlighting the funds' annualized returns since inception shifts their portfolios toward funds with higher annualized returns since inception, even though variation in this statistic is driven primarily by variation in the fund's inception date, and in this experiment, annualized returns since inception are *positively* correlated with fund fees. This highlights the problems that can be created when information is provided by sources whose own interests are not aligned with those of consumers.

Beshears et al. (2011) conduct a methodologically similar experiment that compares investor decisions when given a set of regular full-length mutual fund prospectuses versus when given a much more concise set of summary prospectuses. If most investors largely ignore the information in prospectuses because they are so long (and therefore make worse decisions), then shorter, more user-friendly prospectuses could improve investment outcomes. Beshears et al. (2011) find no impact of the summary prospectus on investment decision quality, although it reduces the time that subjects spend making their decision.

Choi et al. (2011) examine an intervention in which employees were asked to complete a survey about their 401(k) plan. As part of the survey, a random subset of respondents who were not contributing enough to the 401(k) to receive the maximum possible employer matching contribution were asked to calculate how much match money they would forego each year if they contributed nothing to the 401(k). The thought was that doing this calculation would make the cost of not receiving the maximum possible match more salient and motivate employees to increase their contribution. But there is no significant difference in the 401(k) contributions of the treatment versus control groups in the three months following the experiment, although a low survey completion rate may be at least partially responsible for this weak effect.

On the other hand, Duflo and Saez (2003) find small positive effects when they offer randomly selected university employees a payment if they go to a benefits fair that provides information about the school's retirement savings plan. This informational intervention increases retirement savings plan participation in incentivized employees' departments by 1 percentage point (about 4%) on an intent-to-treat basis. Goda et al. (2014) also find small intent-to-treat effects of providing information to university employees. Those randomly assigned to receive general information on saving for retirement and their retirement savings plan, as well as projections for how additional contributions would affect balances and income at retirement, were 1.2 percentage points more likely to change their contribution rate, raising their average contribution rate by 0.15% of salary.

Drawing on the psychological literature on planning and implementation intentions (Gollwitzer, 1999; Rogers et al., 2015), Lusardi et al. (2009) study a simple one-page planning aid designed to shepherd new employees through the process of enrolling in their employer's supplemental retirement account. Relative to employees hired in the seven months before the aid was introduced, employees given the planning aid were 16 percentage points (55%) more likely to have opened an account 60 days after hire. These results, along with those of Carpena et al. (2015) discussed earlier, suggest that follow-through may be an equally important or even greater barrier than lack of financial knowledge to achieving better financial outcomes. Motivated by query theory (Weber et al., 2007), which posits that people tend to favor options they consider earlier over options they consider later, Johnson et al. (2016) study hypothetical decisions about when to claim Social Security. They find that people are more likely to state a preference to claim Social Security early when given a list of reasons to do so followed by a list of reasons not to do so, rather than when they receive these two lists in the reverse order. Moreover, the effects are large: Those who first receive the list with reasons to claim early prefer to claim 18 months earlier.

Altogether, the literature suggests that financial education and informational interventions can be effective tools for improving financial outcomes for consumers, but the effects are often small or null and appear to depreciate rapidly with time. This has caused some to question whether high-touch financial education is cost-effective (Willis, 2011; Benartzi et al., 2017).

VII. Peer Effects and Social Influence

Given the accumulating evidence that peers influence individuals' decisions in financial and other domains, it seems that a natural policy instrument is the dissemination of information about one's peers, an approach that has been called "social norms marketing." Social norms marketing could work if it corrects inaccurate beliefs that people hold about their peers, or simply makes peer actions more salient. Social norms marketing has been shown to cause people to move towards their peers' behavior in entrée selections in a restaurant, contributions of movie ratings to an online community, small charitable donations, music downloads, towel re-use in hotels, taking petrified wood from a national park, stated intentions to vote, and energy use (Frey and Meier, 2004; Cialdini et al., 2006; Salganik et al., 2006; Goldstein et al., 2008; Cai et al., 2009; Gerber and Rogers, 2009; Chen et al., 2010; Allcott, 2011; Allcott and Rogers, 2014).

Even so, social norms marketing can have perverse effects. Beshears et al. (2015c) run a field experiment where they sent information to a randomly selected subset of a firm's low-saving employees about what fraction of coworkers in their age group were contributing to the 401(k) plan or contributing at least 6% of their pay to the plan. They find that while peer information has a marginally significant positive effect on 401(k) contributions for some people, it has a perversely significant negative effect for others. Surprise that so few people are saving does not seem to drive the negative effect, since exogenous increases in the reported fraction of peers contributing decreases subsequent contributions in the negatively affected subpopulation. Because the negative effect is stronger among those who have low incomes relative to their local coworkers, Beshears et al. (2015c) hypothesize that discouragement from comparisons that make one's low economic status salient drives the negative effect. Other field experiments have also generated perverse peer effects. For example, Bhargava and Manoli (2015) find that the likelihood of claiming the Earned Income Tax Credit is reduced by telling households eligible for the credit, "Usually, four out of every five people claim their refund."

VIII. Product Design

Firms can influence households' financial decisions by making some product attributes salient (e.g., one-year investment returns during a bull market) and by shrouding others (e.g., the expense ratio). A firm can also introduce noise or complexity into its marketing (Carlin, 2009; Gabaix et al., 2016) to induce some potential customers to overestimate the quality or underestimate the price of the firm's products (e.g., a mutual fund advertisement that implies without evidence that active management is superior to passive management).

There are many situations in which households have been shown to overweight salient attributes and underweight shrouded attributes. For example, adjustable rate mortgage borrowers are more attentive to initial rates than to reset rates (Gurun et al., 2016). Investors are more sensitive to mutual fund front-end loads than to ongoing costs embedded in the expense ratio (Barber et al., 2005, although see Christoffersen et al., 2013). Making salient the existence of a 50% *discount* on overdraft fees *reduces* overdraft usage, consistent with customers overlooking the fact that overdrafts have a positive price, whereas making salient the availability of overdrafts without mentioning their cost increases usage (Alan et al., 2016). In general, marketing raises demand for financial products and lowers their price elasticity of demand; Hastings et al. (2017) demonstrate these effects in the Mexican mutual fund market.

In classical models, consumers should infer that information shrouded by the seller is likely to be bad news for the consumer about price or quality. But the evidence suggests that consumers frequently fail to make this inference. This mis-inference is closely related to Eyster and Rabin's (2005) concept of cursed equilibrium.

As one would expect, firms exploit these propensities by designing products and contracts that make appealing attributes salient while shrouding fees and quality problems (Ellison, 2005; Gabaix and Laibson, 2006; Ellison and Ellison, 2009; Bordalo et al., 2012, 2016; Heidhues and Kőszegi, 2015; Heidhues et al., 2016a, 2016b; Ru and Schoar, 2017). Other products and contracts attempt to exploit consumers' naïveté (DellaVigna and Malmendier, 2004; Eliaz and Spiegler, 2006; Heidhues and Kőszegi, 2015) or overconfidence with respect to future consumption (Grubb, 2009). For example, credit card companies exploit consumers' biases by back-loading or shrouding fees (Ru and Schoar, 2017). In the banking industry, competition can have the perverse effect of increasing shrouding (Agarwal et al., 2016b; Di Maggio et al., 2016).

IX. Advice and Disclosure

If financial mistakes result from cognitive limitations, psychological biases, or lack of knowledge, advice from experts who are less subject to these weaknesses could improve financial outcomes. The 2013 Survey of Consumer Finances finds that 26% of households say they used advice from financial planners to make savings and investment decisions, 9% from brokers, 33% from bankers, and 10% from accountants (Panis and Brien, 2016).[38]

Kim et al. (2016) develop a rational actor model in which individuals can choose to manage their own financial assets with an age-varying time cost of doing so, or delegate that management at some monetary cost to a financial expert who always acts in the best financial interests of the client. Within this framework, there is demand for delegated management that varies with the opportunity cost of time, the decision-making efficiency of individual investors (which varies

[38] Each household could give multiple answers to this question, so percentages need not add to 100%.

with age), and the level of financial wealth. The potential for delegated management improves consumer welfare. Although this is an interesting benchmark model for thinking about the demand for financial advice, it assumes away many interesting aspects of the real world: There are no investor biases, and advisors always optimize outcomes for their clients.

In contrast to the model of Kim et al. (2016), a growing body of evidence suggests that advisors often do a poor job for their clients. Several papers have found that consumers earn lower risk-adjusted returns and/or pay higher fees when investing with an advisor (Bergstresser et al., 2009; Chalmers and Reuter, 2012b; Hackethal et al., 2012; Del Guercio and Reuter, 2014; Reuter, 2015). Foerster et al. (2017) show that advisor fixed effects are a much more important determinant of clients' asset allocations than investor-specific attributes such as risk tolerance, age, or financial sophistication. These results suggest that advisors provide very little customized advice despite the fees charged for their services.

Why aren't financial advisors optimizing outcomes for their clients? The predominant explanation in the literature is that the compensation structure for advisors, which often relies on commissions that vary by product, motivates advisors to recommend products that pay them more even if they are not the best products for the client. Studies in diverse settings show that advisors are swayed by financial incentives that generate conflicts of interest. In an audit study of life insurance agents in India, Anagol et al. (2017a) find that agents recommend unsuitable products that are strictly dominated from the consumers' standpoint but generate higher commissions for the agents. In an audit study of financial advisors in the U.S., Mullainathan et al. (2012) find that advisors reinforce the mistaken beliefs of their clients and argue against their correct beliefs when doing so is in the advisor's financial interest.

Models of commission-based compensation find that from a theoretical standpoint, such incentive schemes are neither unambiguously good nor unambiguously bad. In particular, the degree to which consumers are attentive to advisors' incentives influences the models' predictions. Inderst and Ottaviani (2012a, 2012b) find that if consumers are wary of advisors' conflicted motives, contingent commissions create incentives for advisors to learn about which products best meet their clients' needs, which can improve consumer welfare. But if consumers believe that advisors provide unbiased advice, commission-based incentive schemes can be used to exploit their naïvete. In the model of Chang and Szydlowski (2016), consumers are rational, so competition partially disciplines advisors' conflicts of interest. Placing limits on the extent to which advisors can earn conflicted compensation leads advisors to charge higher upfront fees and may not improve consumer welfare.

The empirical evidence on whether consumers are wary or naïve about adviser incentives comes down more on the side of the latter. Chater et al. (2010) find that investors are largely ignorant of advisors' potential conflicts of interest. Similarly, Hung et al. (2011) find that many consumers do not understand the legal duties different types of financial advisors owe to their clients.

Another reason financial advisors may not act in their clients' interests is that advisors must first win a client's business before being compensated. If catering to a client's biased beliefs will help secure the client's business, advisors will be much less likely to challenge those beliefs, at least initially. The audit studies of Anagol et al. (2017a) and Mullainathan et al. (2012) both find evidence of this type of catering.

A less sinister reason why advisors may not act in their clients' interests is that advisors may themselves lack competence. Linnainmaa et al. (2016) find that most advisors invest their personal portfolios in accordance with the advice given to their clients. They trade frequently, chase past returns, and invest in expensive, actively managed funds over lower cost index funds. Their conclusion is that many advisors are sincere in their poor recommendations.

If advisors are not providing competent advice, are they providing anything valuable to consumers? Gennaoli et al. (2015) posit that advisors are selling trust. Having a trusted advisor reduces perceptions of an investment's risks, giving risk-averse investors the peace of mind to make higher-risk, higher-expected-return investments than they would be willing to make on their own. Managers pander to biased investor beliefs because doing so causes investors to invest more and pay higher fees. Although financial advisors underperform the market net of fees, investors nonetheless prefer using a financial advisor to investing on their own, and may even be better off doing so because it enables them to take more risk. Gennaioli et al. (2015) also find that trust reduces competitive pressures in the market for advisors, so that fees charged exceed the cost of providing advice in equilibrium.

Previous empirical research has documented the important role trust plays in financial market investment more generally (Guiso et al., 2008). In a survey of U.S. investors, Hung et al. (2011) find that respondents have high levels of trust in their financial advisors. Do individuals have greater trust in advisors who are both more competent and more likely to act in their clients' interests? The limited empirical literature that speaks to this question is not particularly encouraging. Bhattacharya et al. (2012) find that unbiased financial advice offered to German retail investors by their brokerage firm was ignored. Agnew et al. (2016) conduct a survey experiment in which subjects were given conflicting advice from two different advisors about the best choice in hypothetical financial situations. They find that respondents are poor judges of advisor quality. First impressions matter: Subjects are more likely to follow bad advice in later rounds if they received good advice in earlier rounds. Respondents are more likely to follow advice if a credential is displayed, even though many are unable to distinguish between legitimate and fake credentials. And they are more likely to accept bad advice on topics where the quality of the advice is more difficult to assess. Stolper and Walter (2017) find that individuals are more likely to follow the financial advice of advisors who are demographically similar to them. The results of these last two studies suggest that it may be easy for unscrupulous advisors to adopt client acquisition tactics that will promote trust.

The fact that trust can be fostered by factors other than competence and integrity may help explain the findings of Egan et al. (2016). They document a segmented market for financial advice: Firms with low rates of advisor misconduct exist alongside firms that are much more tolerant of misconduct. Advisor misconduct is concentrated in firms with retail customers in counties whose populations are less educated, older, and have higher incomes. They interpret this as evidence that some firms cater to unsophisticated consumers—a market segment in which they can get away with higher levels of misconduct—while other firms use their less blemished records to attract sophisticated consumers for whom the track record of their advisor matters more.

The importance of commission-based payments in financial markets and the potential they create for conflicts of interest have motivated regulation to require disclosure of some or all of these conflicts. Such regulations have strong support from consumers: Hung et al. (2011) find that 86% of investors believe that advisors should be required to disclose their financial conflicts of interest.

Whether or not disclosure solves the problems created by financial conflicts of interest is a matter of some debate.[39] In the model of Inderst and Ottaviani (2012b), mandated disclosure of advisor commissions turns naïve customers into wary ones, increasing consumer welfare. In a related paper, Inderst and Ottaviani (2009) show that when consumers rationally expect advisors to be biased, firms themselves may prefer a regime with mandatory disclosure. The rationale is that when consumers expect advisors to be biased, their willingness to pay for products that may ultimately prove unsuitable will be lower. Mandatory disclosure of commissions acts as a commitment device to reduce advisors' inclination to recommend unsuitable products, which in turn increases consumer willingness to pay—a benefit that accrues to advisors and the providers of financial products. However, firms' tendency to politically oppose regulations mandating disclosure contradicts the prediction of this model. Sah and Loewenstein (2014) posit another mechanism that may make disclosure effective: If advisors are averse to being viewed as biased, disclosure can deter advisors from accepting conflicts of interest so that their only disclosure is that they have no conflicts.

Inderst and Ottaviani (2012c) model a different channel through which disclosure may affect welfare: the efficiency of supply. They show that mandatory disclosure reduces the commissions that all firms are willing to pay, and this reduction is larger for the most cost-efficient firm. The cost-efficient firm loses market share as a result. If advisors have sufficiently high concern that

[39] See Loewenstein et al. (2014) for a more comprehensive review of the literature on disclosure.

their recommendations be suitable for customers, then in the absence of mandatory disclosure, the cost-efficient firm's market share is inefficiently low, and mandatory disclosure exacerbates this inefficiency. Conversely, if advisors don't care much about suitability, then the cost-efficient firm has too much market share in the absence of mandatory disclosure, so mandatory disclosure improves efficiency.

The literature also identifies some perverse effects of disclosure that arise from psychological factors. Cain et al. (2005) show in a laboratory experiment that when conflicts of interest are disclosed, advisors give even more biased advice, perhaps because they feel they have the moral license to do so once advisees have been informed of their conflicts, or because advisors expect clients to discount their recommendations and so a more extreme recommendation is needed to compensate. However, advisees in the experiment do not discount advice as much as they should when the conflict is disclosed, making them worse off as a result of the disclosure.

Loewenstein et al. (2011) posit that disclosure can actually increase the trust clients place in their advisors if the act of disclosure is interpreted as a sign of honesty. Furthermore, clients may feel more compelled to follow advice after a disclosure of financial conflicts has been made lest they be perceived as lacking trust, a phenomenon they refer to as the "burden of disclosure." They also note that if clients don't know how they should act after receiving a disclosure about a financial conflict, they may simply ignore the disclosure.

Lacko and Pappalardo (2004) point to another way in which disclosure could backfire. If consumers are facing information overload, disclosing commissions may limit the attention they give to other information relevant for a decision, diminishing decision quality. The fact that there is a commission might lead some consumers to avoid those products altogether, even when they may be particularly suitable for those clients' needs.

Finally, advisors may strategically avoid following the spirit of disclosure rules. Anagol et al. (2017a) evaluate a natural experiment requiring disclosure of commissions for some products sold by advisors, but not all products. They find that advisors respond to this disclosure requirement by recommending alternative products not subject to the disclosure requirement but that nonetheless have high commissions.

Laboratory experiments have identified some mechanisms that can reduce these perverse effects. Church and Kuang (2009) show that coupling disclosure with sanctions against advisors who are caught giving self-interested advice greatly reduces advisors' strategic exaggeration. Koch and Schmidt (2010) find that with repeated advisor-client interactions, advisors' reputational concerns also decrease strategic exaggeration. Sah et al. (2013) show that the pressure clients feel to comply with advice is reduced if: "(a) the disclosure is provided by an external source rather than from the advisor, (b) the disclosure is not common knowledge between the advisor and advisee, (c) the advisee has an opportunity to change his/her mind later, or (d) the advisee is able to make the decision in private."

X. Choice Architecture

Defaults

Samuelson and Zeckhauser (1988) report that only 28% of participants in TIAA-CREF retirement plans had ever changed the asset allocation in their plan, which translated into only 2.5% of participants making a change per year. They argue that this extreme reluctance to act is an example of "status quo bias."

Madrian and Shea (2001) were the first to document that exogenously changing the status quo—that is, the default—in a 401(k) plan has a dramatic effect on savings outcomes. At the company they study, if employees took no action, the original default outcome was not to contribute to the 401(k). The company then changed its policy so that if newly hired employees did not opt out, they would start contributing 3% of their salary to the 401(k), and these contributions would by default be invested in a money market fund. Fifteen months after the institution of automatic enrollment, among employees hired after the change, 86% were participating in the 401(k), 65% were contributing exactly 3% of their salary, and 80% of their 401(k) balances were invested in the money market fund. In contrast, among employees hired in the year before the change (and hence never subject to automatic enrollment), only 49% were participating in the 401(k), only 4% were contributing exactly 3% of their salary, and only 8% of their 401(k) balances were invested in the money market fund.

Choi et al. (2004b) study the longer-run effects of automatic 401(k) enrollment at the Madrian and Shea (2001) company plus two others that instituted a default 2 or 3% contribution rate invested entirely in a stable value fund.[40] As tenure at a company increases, the automatic enrollment effect on 401(k) participation diminishes—not because automatically enrolled participants drop out of the 401(k), but because those subject to opt-in enrollment gradually join the plan in greater numbers. Nevertheless, even four years after hire (at the one company with a sufficiently long span of data), the fraction of employees who have ever contributed to the 401(k) plan is 28 percentage points lower under opt-in enrollment than under automatic enrollment. Almost half of employees hired in the automatic enrollment regime remain at the default contribution rate and asset allocation at four years of tenure.

[40] The most common default contribution rate in automatic enrollment 401(k) plans is 3% of income (Vanguard, 2017). This is not the result of a societal or regulatory effort to optimize defaults, but rather an arbitrary historical starting point that was enshrined in legislation/regulation and is now institutionally sticky. Firms keep the default contribution rate low in part to reduce their resulting matching contributions; firms that offer matching contributions most frequently match the first 6% of income that employees contribute themselves (Vanguard, 2017).

A positive default contribution rate pulls up the contributions of those who would have contributed less under an opt-in regime, but it also pulls down the contributions of those who would have contributed more. Therefore, after a couple of years of tenure, the average contribution rate under a low 2-3% contribution rate default is only modestly higher than under a 0% contribution default. Beshears et al. (2009) find that raising the default contribution rate from 3% to 6% significantly raises average contribution rates without much effect on opt-outs. Clark et al. (2015) report results broadly consistent with many of these findings in a sample of over 500,000 employees across 460 defined contribution pension plans.

Defaults can be dynamic rather than static. An example of a dynamic default is auto-escalation, which automatically raises 401(k) contributions at regular intervals. Those who start out in auto-escalation tend to stick with the program, so their contribution rates rise dramatically over the course of the next few years (Thaler and Benartzi, 2004). Clark et al. (2015) present corroborating evidence. Benartzi et al. (2012) find that the participation rate in auto-escalation is much higher if enrolling in auto-escalation is the default rather than not the default—83% versus 27%.

Many different mechanisms could explain the effects of defaults, and it is likely the confluence of multiple mechanisms that make defaults so powerful. Candidate mechanisms (many of which are discussed in Samuelson and Zeckhauser, 1988) include the following:

(1) Opting out of a default requires paying an effort cost. Blumenstock et al. (2017) find that contribution rate opt-outs increase particularly after employees receive a financial consultation, suggesting that a significant portion of the effort cost consists of figuring out the implications of alternative choices. Choi et al. (2009c) and Beshears et al. (2013) find that offering individuals a simplified choice menu increases opt-out rates. Nevertheless, plausible levels of effort costs seem too small to justify staying at a savings default for four years. But time-inconsistent preferences can cause minor costs to create enormous delays, particularly if agents irrationally believe that they will be less time-inconsistent in the future (Laibson, 1997; O'Donoghue and Rabin, 1999). Choi et al. (2003) and Carroll et al. (2009) model default effects as arising from opt-out costs interacting with time inconsistency. Brown et al. (2016a), Brown and Previtero (2016), and Blumenstock et al. (2017) find that measures of time inconsistency are correlated with the propensity to remain at a default. Choi et al. (2002) find that survey respondents are overly optimistic about their likelihood of raising their 401(k) contribution rate in the future, consistent with naiveté about future time inconsistency.

(2) Individuals may believe that the default is a choice recommended by the default setter. The extent to which this channel could matter will obviously depend upon the individual's belief about the default setter's benevolence and knowledge, and the strength of the individual's own convictions about her optimal choice. Consistent with the default carrying an

"endorsement effect," Madrian and Shea (2001) find that the 401(k) automatic enrollment default asset allocation seems to influence the asset allocation of even those not subject to automatic enrollment. At the firm they study, employees hired before April 1998 were never automatically enrolled. Nonetheless, those in this cohort who opted into contributing to the 401(k) after *other* employees began to be automatically enrolled were much more likely to choose an asset allocation equal to the automatic enrollment default (100% in a money market fund) than pre-April 1998 hires who opted in before the start of automatic enrollment. Brown et al. (2011) report that 20% of University of Illinois employees who stayed at the default when making an irrevocable choice among three pension plans say they did so because they perceived the default to be a recommendation.

However, an endorsement effect is not necessary for defaults to be effective. Beshears et al. (2009) report that there appears to be no endorsement effect for contribution rates in the Madrian and Shea (2001) company. Blumenstock et al. (2017) find a powerful default effect for contributions even though employees knew that their default was randomly assigned and therefore could not contain an endorsement.

(3) Some people may be unaware that the default exists, and therefore fail to opt out of it. Brown et al. (2011) find that 19% of University of Illinois employees who ended up in the default pension plan were unaware that they could choose a pension plan. But defaults do not require unawareness to be effective. Blumenstock et al. (2017) find large default effects despite employees receiving in-person training about their savings account and repeated text message reminders about their current contribution amount and how to change their contribution rate.

(4) Starting with Tversky and Kahneman (1974), a large literature has found that asking people to consider an arbitrary number (an "anchor") will bias subsequent judgments and estimations towards this number. The default may be such an anchor. Choi et al. (2016) and Goda et al. (2014) show in field experiments that employees raise their 401(k) contribution rates if they are exposed to arbitrary high contribution examples in communications. Bernheim et al. (2015) argue that a model with anchoring is able to explain default effects better than a model where defaults are driven by opt-out costs and time inconsistency.

(5) The default may become a reference point around which gains and losses are evaluated. Loss aversion would then cause people to be reluctant to move away from the default. Kahneman and Tversky (1982) argue that negative consequences of action are more aversive than negative consequences of inaction.

(6) In order to simplify their decision, individuals may consider only a subset of the possible choices, and the status quo may be disproportionately likely to be included in that subset,

causing the status quo to be chosen more often. The fact that individuals are prone to choose a 401(k) contribution rate that is a multiple of five—such as 5%, 10%, or 15% of their income—suggests that many possible contribution rates are often not considered (Choi et al., 2002; Benartzi and Thaler, 2007).

(7) Cognitive dissonance (Festinger, 1957) may cause people who find themselves at the default to manufacture reasons why the default is the right choice for them, increasing persistence at the default. Blumenstock et al. (2017) find that employees randomly assigned to a positive default contribution rate subsequently are more likely to report that the savings account increased their desire to save and that they are not too financially constrained to save, which could be consistent with cognitive dissonance.

The effect a default in one savings account has on the rest of the household balance sheet remains an outstanding research question. To what extent are the extra contributions induced by automatic enrollment financed by reduced consumption (the presumed goal of the intervention) rather than the shifting of assets from one account to another or increased debt?

Blumenstock et al. (2017) find that automatic enrollment increases total household wealth in their sample of workers in Afghanistan by an economically meaningful amount, but their wealth data are so noisy that their point estimate is less than one standard error away from zero. Chetty et al. (2014) find that when a worker switches to a firm that imposes a higher compulsory pension contribution rate than his previous employer, his total savings rate increases by approximately 80% of that marginal contribution even though he is able to offset the savings elsewhere. In addition, there is no change in this pass-through rate for up to a decade after the switch. Although compulsory contributions are not the same policy as automatic enrollment, this result suggests that passive marginal savings induced in one part of the balance sheet are only weakly offset elsewhere.

Beshears et al. (2017b) study the effects of automatic enrollment into the federal Thrift Savings Plan (TSP) on debt for U.S. Army civilian employees by comparing employees hired during the year after the Army began automatically enrolling new hires to employees hired during the year prior. They find that automatic enrollment has no statistically significant effect on debt excluding auto loans and first mortgages (e.g., credit card debt), nor does it affect credit scores or delinquencies. However, they do find a modest increase in auto debt and a larger increase in first mortgage debt. Because these latter two categories of debt are associated with asset purchases, it is unclear to what extent increases in those liabilities indicate decreases in net worth.

Active Choice

If agents faced with a choice have the option of not actively expressing a preference, then setting a default is inevitable, since *some* outcome must be implemented in the absence of an active choice. An active choice mechanism removes the option of not expressing a preference after a certain deadline. Carroll et al. (2009) study a company that required newly hired employees to actively state a 401(k) enrollment preference within 30 days of hire. They conclude that active choice results in participation rates that lie between those achieved under opt-in enrollment and automatic enrollment. Under active choice, the 401(k) participation rate for employees three months after hire is 69%. When the company later switched to an opt-in enrollment scheme, the 401(k) participation rate at three months of tenure fell to 41%. Even at 42 months of tenure, the active choice cohort has a participation rate 5 percentage points above the opt-in cohort's.

Unlike default enrollment schemes, active choice does not create disproportionate clustering of choices at a single outcome. Conditional on demographics, the contribution rate in effect under active choice at three months of tenure is on average similar to the contribution rate that would be in effect at thirty months of tenure under opt-in enrollment. Carroll et al. (2009) present a model where default effects arise from opt-out costs interacting with time inconsistency. They find that active choice is normatively preferable to default enrollment when time inconsistency is strong and the optimal choice (in the absence of opt-out costs) is highly heterogeneous in the population.

The U.S. Executive Office of the President (2016) evaluates an intervention that required U.S. Army service members transferring to a new base to make an active choice about enrolling in the Thrift Savings Plan. Active choice increased Thrift Savings Plan participation rates at four weeks after orientation by 8.3 percentage points, compared to an enrollment rate at three control bases of no more than 1.9%.

<u>*Commitment Devices*</u>

Bryan et al. (2010) define a commitment device as "an arrangement entered into by an agent who restricts his or her future choice set by making certain choices more expensive, perhaps infinitely expensive, while also satisfying two conditions: (a) The agent would, on the margin, pay something in the present to make those choices more expensive, even if he or she received no other benefit for the payment, and (b) the arrangement does not have a strategic purpose with respect to others." A demand for commitment devices is predicted by models of time inconsistency (Strotz, 1955; Laibson, 1997), temptation (Gul and Pesendorfer, 2001, 2004), and dual-self models where a long-run planning self is in conflict with a short-run doing self (Thaler and Shefrin, 1981; Benhabib and Bisin, 2005; Fudenberg and Levine, 2006).

The scarcity of explicit, stand-alone commitment devices in household finance (and even outside of household finance), at least in developed countries, poses a challenge for the above theories. Laibson (2015) offers an analysis that shows how a combination of partial naiveté about future time inconsistency, uncertainty, and direct costs of setting up a commitment can eliminate the demand for commitment. A number of authors have argued that rotating savings and credit associations (ROSCAs), an arrangement in the developing world where group members regularly meet to contribute savings to a common pot that is disbursed to one of the members at the end of the meeting, are commitment devices to save (Ambec and Treich, 2007; Gugerty, 2007; Basu, 2011; Kast et al., 2016). Even so, alternative explanations exist; for example, ROSCAs may lock down assets and prevent other family members from claiming them (Anderson and Baland, 2002).

One demonstration of a demand for commitment is found in Ashraf et al. (2006), who offer rural Filipinos a savings account that restricts withdrawals until either a future date arrives or they save up to a specified account balance. Twenty-eight percent of those who receive the offer take up the account, and take-up of the account increases subsequent savings.

In laboratory experiments on U.S. subjects, Beshears et al. (2015a) find a demand for commitment. Subjects allocate a monetary endowment between a liquid account that does not restrict withdrawals and either one or two commitment accounts that impose a penalty on withdrawals prior to a self-chosen commitment date. They find that when all the accounts pay the same interest rate, commitment accounts attract more money as their withdrawal penalty rises. On the other hand, when the commitment account pays a higher interest rate than the liquid account, they find no relationship between commitment account deposits and illiquidity. They explain this phenomenon by the presence of time-inconsistent individuals who fail to anticipate their future time inconsistency and hence have no demand for commitment (O'Donoghue and Rabin, 1999). When the commitment accounts pay the same interest rate as the liquid account, these naifs never deposit any money to the commitment accounts, so the aggregate relationship between illiquidity and commitment account deposits is driven by those who are sophisticated about their future time inconsistency and thus demand commitment. When the commitment accounts pay a higher interest rate, naifs allocate a positive amount to the commitment accounts that diminishes with illiquidity. The combination of the naifs' negatively sloped demand for illiquidity and sophisticates' positively sloped demand for illiquidity results in an overall flat relationship between deposits and illiquidity.

XI. Interventions that Directly Target Prices or Quantities

Traditional economic approaches to influencing consumer financial outcomes by directly targeting either the prices that consumers face or market quantities are widespread. Price-based mechanisms include direct subsidies, indirect subsidies (and penalties) through the tax code, price caps, and behaviorally informed pricing strategies to encourage certain types of behavior. We also see attempts to directly influence market quantities through bans against certain types of financial products and mandates for others. The effectiveness of these more traditional policy tools depends on many of the behavioral factors that we have already discussed. For example, incentives can be more or less effective depending on how they are framed, how salient they are, and how complicated they are to understand.[41]

Many countries use their tax code to provide incentives for certain behaviors and discourage others. In the domain of household finance, tax incentives are used to encourage saving for retirement, home ownership, and having health insurance, while tax penalties are used to discourage actions such as early withdrawals from retirement savings accounts and foregoing insurance. These tax incentives can be quite large: tax expenditures for retirement savings, health insurance coverage, and home ownership (through the mortgage interest and property tax deductions) cost the U.S. federal government $180 billion, $161 billion, and $90 billion, respectively, in 2016 (Joint Committee on Taxation, 2017). In addition to tax incentives, governments subsidize financial behaviors in a number of other ways, including direct subsidies (e.g., for health insurance, college tuition, and deferred interest on student loans) and indirect subsidies such as loan guarantees (e.g., for mortgages eligible for securitization and for student loans).

How effective are these incentives at encouraging the behaviors they are designed to motivate? Friedman (2017) reviews the research on tax incentives and retirement savings outcomes, which has reached contradictory conclusions about their effects. Exploiting variation created by newly enacted tax incentives for IRA and 401(k) savings in the U.S., Engen et al. (1994, 1996) conclude that tax incentives have had little to no impact on national savings, and that these incentives largely crowd out other forms of existing savings. Using more recent data from Denmark, Chetty et al. (2014) draw similar conclusions about the impact of retirement saving tax incentives in that country. In contrast, Feenberg and Skinner (1989), Venti and Wise (1990), and Poterba et al. (1994, 1995) find that most of the savings generated by tax preferences for IRA and 401(k) plans represented new savings.

In the face of this inconsistent empirical evidence, Friedman (2017) develops a framework to articulate the conditions under which tax incentives are likely to be more versus less effective drivers of behavior change. The three key parameters are the effect of the tax incentive on the behavior of optimizing consumers, the fraction of consumers who pay attention to the tax incentive and optimize accordingly, and the extent to which the tax incentive affects individuals who are furthest from what is optimal. The empirical evidence on these three key parameters suggests that tax incentives are likely to be less effective drivers of savings behavior than "nudge-like" approaches such as automatic enrollment.

One factor that can undermine the effectiveness of tax incentives is the complexity of the tax code. In a laboratory experiment designed to assess the impact of simple versus complex tax

[41] See Gneezy, Meier and Rey-Biel (2011) and Kamenica (2012) for reviews of the literature on behavioral economics and incentives.

incentives, Abeler and Jäger (2015) show that individuals are much less responsive to tax incentives embedded in a complicated tax regime than to equivalent incentives embodied in a simpler tax code.[42] Beshears et al. (2014a) show that individuals in the U.S. have a poor understanding of the tax incentives to save in retirement accounts; they suggest that, as a result, savings behavior is not particularly responsive to changes in these incentives. Duflo et al. (2006) study one particular tax incentive for saving in the U.S., the Saver's Credit, which can equal as much as half of an individual's retirement savings contribution. The credit is economically equivalent to a matching contribution, a common feature in many employer-sponsored retirement savings plans, but the complicated rules governing the Saver's Credit's effective match rate and credit eligibility make it both more difficult to understand and less salient than a matching incentive. Duflo et al. find that individuals react more to randomly assigned matches for saving in an IRA as part of a field experiment than they do to the Saver's Credit. An increase in the experimental IRA match rate from 20% to 50% increases IRA participation by 6 percentage points, but an increase in the effective match rate of the Saver's Credit from 25% to 100% increases IRA participation by 1.3 percentage points at most.

In a related field experiment, Saez (2009) finds that taxpayers are less responsive to a 33% rebate on IRA contributions than to a 50% match, even though the financial incentives are nearly economically equivalent. The key difference is that the rebate condition requires a bigger initial outlay and a two-week wait to receive the rebate. The Saez experiment also varies whether taxpayers were notified in advance about the match and finds that the match is more effective among those who receive advance notice.

Despite being more effective than complex tax incentives and equivalent rebates, matching contributions are only a moderately effective tool when compared to other interventions that more directly tackle the psychological frictions that impede saving. Madrian (2013) and Choi (2015) survey the research on the impact of matching contributions on retirement savings. Madrian (Madrian, 2013) provides a summary number: a matching contribution of 25% increases savings plan participation by roughly 5 percentage points (Choi et al., 2002, 2004a, 2006; Duflo et al., 2006; Engelhardt and Kumar, 2007), an effect much smaller than that of the choice architecture interventions discussed earlier.

From a behavioral standpoint, the most interesting impact of matching contributions is their effect on the distribution of savings rates. In savings plans where contributions are chosen as a fraction of pay, the most common contribution rates tend to be multiples of five: 5%, 10%, 15%, and so on. But in plans where there is a match, the modal contribution rate is usually the match threshold—the contribution rate beyond which there is no match (Choi et al., 2002, 2004a, 2006). These results suggest focal points play a strong role in determining how much individuals

[42] In this experiment, complexity is measured as the number of different rules used to determine an individual's tax rate.

save rather than the match rate per se.[43] We also see hints that focal points matter in the mortgage market, where there is excess mass of mortgages at the conforming loan limit[44] and at a loan-to-value ratio of 80% (Adelino et al., 2012; Defusco and Paciorek, 2017).

In addition to tax incentives to save for retirement, the tax code in the U.S. imposes a 10% penalty on early withdrawals (usually before age 59½) from tax-qualified retirement savings plans. Despite this penalty, Argento et al. (2015) estimate that for every dollar contributed to a tax qualified retirement plan by individuals under the age of 55, between $0.30 and $0.40 leaks out of the system through pre-retirement withdrawals (this excludes loans from these plans that are eventually repaid). This stands in marked contrast to the retirement savings systems in several other countries where pre-retirement withdrawals are entirely proscribed, greatly limited, or more harshly penalized.[45]

The international heterogeneity in retirement system liquidity raises an obvious question of how much liquidity is desirable. Beshears et al. (2018) consider a stylized setting where a benign social planner is designing a savings system for naïve present-biased households. The planner faces a tradeoff between making savings illiquid because of self-control problems and making savings liquid in case households face uninsurable marginal utility shocks (e.g., health costs, divorce, and other sources of financial hardship) before retirement. When the degree of present bias is heterogeneous in the population, the socially optimal savings system is well-approximated by one liquid account, one completely illiquid account, and one account with an early withdrawal penalty of approximately 10%. This solution is surprisingly close to the U.S. system, which features liquid accounts, Social Security, and IRAs/401(k)s with a 10% early withdrawal penalty. However, the net contribution of the partially illiquid account to social welfare is almost zero, which may explain why other countries do not have such an account.

The evidence on the impact of the mortgage interest deduction on home ownership suggests that here, too, tax policy may be an ineffective tool. Glaeser and Shapiro (2003) note that although the value of the federal mortgage interest deduction in the U.S. has changed significantly over time (due to changes in tax law, inflation, and the evolution of house prices), the homeownership rate has been essentially flat for decades; home ownership rates by state are also unrelated to the

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[43] Of course, even absent behavioral factors we would expect to see bunching at the match threshold because of the kink in the budget set it generates. However, no such explanation exists for the excess mass at contribution rates that are multiples of five.

[44] In U.S. mortgage markets, the conforming loan limit is the maximum loan size eligible for securitization through Fannie Mae or Freddie Mac. There is both geographical variation in the conforming loan limit and variation over time. Because mortgages above this limit are more expensive to underwrite, there is a discrete jump in mortgage interest rates for loans above this amount. Adelino et al. (2012) show that the demand for conforming mortgages is significant enough to affect house prices. Homes that would likely be eligible for financing with a conforming loan with a standard 80% loan-to-value ratio transact at higher prices than similar homes that would not be eligible for a conforming loan.

[45] See Beshears et al. (2015b) for a comparison of the pre-retirement liquidity in the retirement systems of these countries.

magnitude of state tax incentives for home ownership. Why are households seemingly unresponsive to tax incentives for home ownership? One explanation is that house prices adjust to reflect the value of the mortgage interest deduction, particularly in areas with inelastic housing supply (Green et al., 1996; Hilber and Turner, 2014). For households facing a down payment constraint, this increase in house prices can have the perverse effect of actually reducing home ownership (Bourassa and Yin, 2008). The mortgage interest deduction appears to increase home ownership only for wealthy households living in areas with elastic housing supply (Hilber and Turner, 2014).

One interesting private-sector manipulation of pricing in the household finance domain comes in the form of prize-linked savings products.[46] The basic idea is that instead of or in addition to a sure interest rate on their savings, savers are given a periodic probabilistic chance of winning a large prize that is proportional to their savings balance. In contrast to traditional gambling products, prize-linked savings investors retain their capital even if they don't win.

There are at least three aspects of such products that might make them more attractive to consumers than traditional savings products: (1) if individuals overweight the low probability of winning, their valuation of a prize-linked savings product will exceed that of a standard savings account with a fixed return of the same expected value, (2) as with traditional gambling products, individuals may derive value from the anticipation of winning big, even if they don't actually win, and (3) there may be entertainment value to participating in a game of chance that makes saving seem fun (Kearney et al., 2010). In a laboratory experiment, Filiz-Ozbay et al. (2015) find that a prize-based incentive makes subjects more willing to defer payment to a later date than an equivalent expected value fixed interest rate. Atalay et al. (2014) conduct an online experiment and find that introducing a prize-linked savings product to a budget allocation task both increases savings and reduces lottery expenditures. This latter finding has also been documented in real world financial outcomes by Cookson (2017), who finds that casino gambling dropped by 3% after a prize-linked savings product was introduced in Nebraska in 2012.

In addition to encouraging financial outcomes deemed to be in consumers' best interests, governments proscribe certain outcomes that they consider harmful. One common type of price-based proscription is a limit on the fees that financial institutions can charge for their products and services. Dating back to the Old Testament, usury laws, which restrict the interest rate that may be charged on a loan, are the canonical example of a price cap. In the classical economic model, there is no reason to prohibit a private agreement between a willing borrower and a willing lender. Such a transaction does not in general impose negative externalities on other parties, nor is there reason to believe that high interest rates are in general the consequence of lenders' market power. Perhaps usury laws achieve some distributional goal, but the more direct justification for usury laws is that borrowers may not fully appreciate the consequences of

[46] Kearney et al. (2010) survey the history and use of prize-linked savings products throughout the world.

agreeing to a high interest rate—perhaps because of present bias, over-optimism regarding their future ability to repay, a misunderstanding of loan terms, or exponential growth bias—and hence lenders may be able to take advantage of borrowers if not for usury laws.[47] Consistent with standard economic models of credit supply, more stringent restrictions on interest rates empirically reduce credit availability (e.g., Benmelech and Moskowitz, 2010; Rigbi, 2013).

The Military Lending Act is one specific example of a recently enacted usury law in the U.S. Under this law, payday lenders can charge no more than a 36% annual percentage rate (APR) on loans to members of the U.S. armed services and their families. The motivation for this law as articulated by the U.S. Department of Defense, which lobbied for its passage, is that payday loans are predatory and create financial distress, which compromises military readiness and increases vulnerability to bribes and blackmail (U.S. Department of Defense, 2006). Despite the intentions behind the law, Carter and Skimmyhorn (Carter and Skimmyhorn, 2017) estimate that it has had no impact on a variety of labor market or credit outcomes for members of the U.S. Army.

The Credit Card Accountability Responsibility and Disclosure (CARD) Act of 2009 is another variant of a usury law. In addition to limiting interest rate increases for credit cards, the CARD Act placed restrictions on non-interest credit card fees—including over-limit fees, late payment fees, and inactivity fees. In contrast to much of the literature on usury laws, Agarwal et al. (2015b) estimate that these restrictions reduced the fees paid to credit card companies without leading to lower credit volume or offsetting increases in interest rates or other fees, thereby saving U.S. consumers $12 billion per year.

Some investment products are also subject to fee restrictions. For example, Tapia and Yermo (2008) document the limits placed by several countries on the fees that financial institutions participating in defined contribution pension schemes can charge investors.

A more extreme version of a limit on fees is an outright ban on certain types of fees. Anagol and Kim (2012) trace the impact of a series of reforms to the types of fees that Indian mutual funds could charge. The final reform that they evaluate, which prohibited one previously allowed fee, was rationalized by regulators in behavioral terms: "to bring more transparency and clarity to investors." Anagol et al. (2017b) study an Indian investor protection reform that banned the distribution fees charged by mutual fund companies for the purposes of paying broker commissions. They find no evidence that eliminating these fees redirected subsequent mutual fund flows away from formerly high-fee funds and toward formerly low-fee funds. They do find some evidence that fund companies increased other types of commissions to partially offset the

[47] Benmelech and Moskowitz (2010) posit a different rationale for usury laws in 19th century America: to advance the private interests of wealthy incumbents with political power by restricting market entry and lowering their cost of capital. Glaeser and Scheinkman (1998) paint usury laws as a type of social insurance used to effect redistribution from the rich to the poor.

new regulation. Motivated by concerns about financial advisors' conflicts of interest discussed earlier and the inadequacy of disclosure in mitigating those conflicts, Australia and the U.K. have both banned the payment of commissions to financial advisors by financial product providers (Bowen, 2010; Collinson, 2012).

Governments have in some cases prohibited certain types of products or sales to certain types of consumers entirely. Some U.S. states ban payday lending, although research suggests that this has the unintended consequence of causing consumers to substitute toward even higher-cost credit like overdrafts (Morgan et al., 2012) and pawnshop loans (Bhutta et al., 2016). Until recently, prize-linked savings products were not legal in the U.S. Many political jurisdictions prohibit certain types of gambling. In addition to limiting credit card fees as discussed above, the CARD Act restricts credit card issuance to individuals under the age of 21 without either an adult co-signer or proof of income sufficient to repay any accrued debt.

At the other end of the spectrum, a variety of mandates are designed to improve consumer financial well-being. Retirement savings system participation is mandatory in many countries. Many divorced or separated parents are required to pay child support. Consumers are often required to have certain types of insurance coverage, such as homeowners, flood, or car insurance. Although insurance mandates are frequently motivated by concerns about market failure in the presence of adverse selection, an additional behavioral rationale is that the circumstances that make insurance valuable are often not salient in consumers' minds until after an insurable event has occurred. For example, as noted earlier, Gallagher (2014) finds that flood insurance take-up increases substantially in the years immediately after an area has been hit by a flood. Compliance with some of these mandates is often far from complete. Better understanding the behavioral factors that affect compliance with mandates is an interesting question for future research.

XII. Conclusion

The financial decisions that households make serve as a powerful lens through which to study foundational theories of behavior. The first part of this chapter documented an array of economically important contexts in which theories from the field of behavioral economics help to explain otherwise puzzling outcomes. In the second part of the chapter, we examined the evidence on the effectiveness of various interventions to improve financial outcomes for consumers that are largely inspired by behavioral theories.

We conclude by highlighting a few themes that have emerged from this literature. First, many of the deviations from classical behavior that we presented are economically meaningful. The field of household finance encompasses some of the most consequential economic decisions households make over their lifetimes, including choices about lifecycle and buffer stock saving, asset allocation, and borrowing. The evidence assembled in this chapter serves as a reminder that successful models need to explain why households fail to optimize even when mistakes have large welfare costs.

Second, there remains a host of interesting puzzles for which neither a classical nor a behavioral theory has provided a complete quantitative explanation. For example, despite the myriad models attempting to explain the magnitude of consumption-income co-movement, most of these studies appear only to explain several of the empirical facts taken in isolation. Oftentimes, models that can explain one set of facts have additional testable predictions, and these predictions are not borne out in the data. Future work should distinguish among competing models by analyzing their quantitative predictions (instead of focusing solely on their qualitative predictions), as well as by favoring models that can parsimoniously explain numerous features of the data spanning multiple decision-making domains. We anticipate that there will be no single magic bullet that explains all the data. The household finance data seem to be generated by many different behavioral and non-behavioral mechanisms. Researchers should seek to understand the relative contributions of each factor.

Third, many behavioral interventions have had only modest success in affecting behavior. Choice architecture, in particular, has famously powerful effects on behavior, but countervailing unintended consequences can undermine the direct effect of this approach (e.g., Beshears et al., 2017b). Other behavioral interventions, including the provision of financial education, have very modest effect sizes or only a transitory impact. The subsection on price and quantity controls argued that even a traditional incentive may have weak effects if the intervention's designer is not sensitive to the psychological principles that govern how those incentives are received. If policymakers desire a large behavioral response, they should consider policies that jointly deploy both classical incentives/regulations as well as psychologically effective mechanisms.

Finally, an important challenge is to assess the welfare implications of interventions that affect household outcomes (see the chapter on public finance for additional discussion of these conceptual issues). These challenges are hardly unique to the field of household finance, but from a methodological perspective, household finance has recently entered a golden age of research where substantial progress is possible. As new detailed data sources on household decisions become increasingly available (e.g., longitudinal records of each household's credit card, checking, and savings account transactions), the current generation of research is transforming our understanding of household behavior and the associated consequences for household welfare.

Table 1: Net Wealth Percentiles by Age

Age Bucket	Variable	*Percentile* 25	50	75
Ages 21-30	NW1	-313 [-719; 92]	1,000 [787; 1213]	7,330 [6,096; 8,564]
	NW2	-13,795 [-17,112; -10,479]	40 [-156; 237]	6,360 [3,992; 8,729]
	NW3	-3,827 [-6,339; -1,316]	7,611 [5,195; 10,026]	41,616 [34,691; 48,541]
Ages 31-40	NW1	-1,183 [-1,747; -620]	957 [695; 1,220]	12,793 [10,632; 14,954]
	NW2	-6,339 [-8,325; -4,353]	1,213 [416; 2,009]	38,535 [30,145; 46,925]
	NW3	1,525 [5; 3,046]	34,543 [29,000; 40,086]	134,311 [112,948; 155,675]
Ages 41-50	NW1	-1,861 [-2,909; -813]	1,231 [803; 1,659]	18,271 [13,478; 23,063]
	NW2	-488 [-1,029; 54]	9,158 [5,783; 12,533]	118,203 [96,519; 139,887]
	NW3	12,317 [8,376; 16,257]	101,486 [88,919; 114,052]	325,719 [284,485; 366,953]
Ages 51-60	NW1	-693 [-1,158; -228]	1,953 [1,218; 2,688]	39,710 [30,483; 48,937]
	NW2	26 [-60; 112]	22,493 [16,962; 28,023]	211,997 [184,035; 239,959]
	NW3	22,808 [16,054; 29,562]	155,805 [134,342; 177,269]	552,180 [471,810; 632,550]
Ages 61-70	NW1	14 [-66; 94]	6,719 [3,964; 9,475]	87,549 [65,062; 110,035]
	NW2	460 [192; 728]	36,942 [22,077; 51,808]	299,652 [246,501; 352,804]
	NW3	41,561 [31,566; 51,556]	209,227 [183,602; 234,851]	682,127 [585,007; 779,247]

NW1 is all financial assets excluding retirement accounts and whole life insurance minus all debt excluding collateralized debts and student loans. NW2 is all financial assets excluding whole life insurance minus all debt excluding collateralized debts. NW3 is all assets minus all debt. Households are grouped by the age of the household head. Brackets contain 95% confidence intervals computed with 999 bootstraps using the method detailed in Web Appendix B, including a degrees-of-freedom correction. Units are 2016 dollars. Source: 2016 Survey of Consumer Finances.

Web Appendix A: Assets and Debt by Age Bucket and Percentile

Table A1: Assets Percentiles by Age

Age Bucket	Variable	Percentile 25	Percentile 50	Percentile 75
Ages 21-30	A1	708	2,703	9,600
		[576; 840]	[2,319; 3,087]	[8,420; 10,780]
	A2	980	4,336	19,160
		[770; 1,190]	[3,475; 5,197]	[16,265; 22,055]
	A3	8,002	24,686	114,464
		[6733; 9,271]	[22,117; 27,255]	[95,009; 133,919]
Ages 31-40	A1	826	4,498	19,260
		[635; 1,017]	[3,892; 5,104]	[16,544; 21,976]
	A2	1,378	12,032	55,826
		[926; 1,831]	[9,695; 14,369]	[49,020; 62,632]
	A3	19,866	110,262	283,076
		[16,762; 22,970]	[99,888; 120,636]	[260,092; 306,060]
Ages 41-50	A1	1,126	5,662	27,500
		[937; 1,315]	[4,691; 6,633]	[21,165; 33,835]
	A2	1,846	25,988	141,496
		[1,383; 2,309]	[20,308; 31,668]	[122,287; 160,705]
	A3	38,590	222,712	524,592
		[30,085; 47,095]	[203,495; 241,929]	[479,296; 569,888]
Ages 51-60	A1	888	6,822	45,320
		[723; 1,053]	[5,585; 8,059]	[35,530; 55,110]
	A2	1,825	34,568	226,200
		[1,399; 2,251]	[26,316; 42,819]	[189,997; 262,403]
	A3	48,002	258,900	720,647
		[37,169; 58,836]	[238,587; 279,214]	[628,021; 813,273]
Ages 61-70	A1	1,350	11,408	99,080
		[1,120; 1,580]	[9,029; 13,787]	[73,875; 124,285]
	A2	1,898	48,048	319,453
		[1,081; 2,715]	[32,058; 64,038]	[266,735; 372,171]
	A3	89,705	288,842	782,282
		[73,409; 10,6001]	[264,766; 312,918]	[698,972; 865,592]

A1 is all financial assets excluding retirement accounts and whole life insurance. A2 is all financial assets excluding whole life insurance. A3 is all assets. Households are grouped by the age of the household head. Brackets contain 95% confidence intervals computed with 999 bootstraps using the method detailed in Web Appendix B, including a degrees-of-freedom correction. Units are 2016 dollars. Source: 2016 Survey of Consumer Finances.

Table A2: Debt Percentiles by Age

Age Bucket	Variable	Percentile 25	Percentile 50	Percentile 75
Ages 21-30	D1	0 [-8; 8]	948 [738; 1,158]	3,919 [3,272; 4,567]
	D2	500 [307; 693]	5,917 [4,898; 6,935]	25,020 [22,691; 27,349]
	D3	2,298 [1,530; 3,067]	23,188 [20,234; 26,143]	72,114 [62,179; 82,049]
Ages 31-40	D1	145 [30; 260]	2,227 [1,983; 2,472]	7,798 [7,139; 8,457]
	D2	1,083 [744; 1,422]	7,091 [5,946; 8,235]	23,639 [21,435; 25,842]
	D3	6,698 [5,119; 8,276]	47,917 [39,887; 55,946]	162,158 [151,472; 172,844]
Ages 41-50	D1	303 [193; 412]	3,072 [2,578; 3,565]	9,782 [8,926; 10,637]
	D2	903 [653; 1,154]	6,158 [5,312; 7,004]	22,943 [20,562; 25,324]
	D3	10,000 [7,448; 12,552]	77,574 [66,955; 88,193]	204,500 [183,390; 225,610]
Ages 51-60	D1	164 [44; 285]	2,700 [2,327; 3,073]	9,719 [8,697; 10,742]
	D2	383 [218; 548]	3,673 [3,234; 4,112]	14,957 [13,662; 16,252]
	D3	4,068 [2,312; 5,824]	44,347 [35,382; 53,313]	154,282 [137,949; 170,615]
Ages 61-70	D1	287 [194; 379]	2,388 [2,105; 2,671]	7,515 [6,770; 8,260]
	D2	369 [209; 528]	2,662 [2,338; 2,986]	8,611 [7,511; 9,710]
	D3	1,661 [1,113; 2,210]	19,727 [14,227; 25,227]	95,093 [85,408; 104,777]

D1 is all debt excluding collateralized debts and student loans. D2 is all debt excluding collateralized debts. D3 is all debt. Households are grouped by the age of the household head. Brackets contain 95% confidence intervals computed with 999 bootstraps using the method detailed in Web Appendix B, including a degrees-of-freedom correction. Units are 2016 dollars. Source: 2016 Survey of Consumer Finances.

Web Appendix B: Point Estimates and Standard Errors under Multiple Imputation in the Survey of Consumer Finances

This appendix explains how to construct accurate point estimates and standard errors using the Survey of Consumer Finances. It combines information from work by Donald Rubin and others, guidance the SCF provides on its website and in working papers, and the documentation for the SCF standard errors program *scfcombo*. The Stata program used to compute estimates and confidence intervals, titled scfses, is available on GitHub.

Background and Point Estimates

The Federal Reserve imputes some data for the following reasons: (1) some questions include left- or right-censoring; (2) the Fed adjusts some data to preserve respondent anonymity; and (3) the survey suffers from significant non-response.

To fill in missing data, the Federal Reserve uses multiple imputation (MI) when it generates the SCF datasets (Kennickell, 1998, 2000). Compared with not imputing, MI provides more efficient estimates that (under certain ignorability conditions) are less likely to suffer from non-response bias. In particular, the Federal Reserve uses its FRITZ software, which employs a modified EM algorithm, to impute distributions and expectations for missing observations. FRITZ iteratively generates five copies of the SCF data, each of which contains a different imputation, or "implicate," for each missing observation. The FRITZ model is described in Kennickell (2000).

To obtain a point estimate $\hat{\theta}$ for some parameter θ from a survey with M implicates (in the case of the SCF, $M = 5$), one takes the mean across implicates:

$$\hat{\theta} = \frac{1}{M}\sum_{i}^{M} \hat{\theta_\iota}$$

where i indexes implicates and $\hat{\theta_\iota}$ refers to the computation of the estimated θ_i considering only implicate i.

Computing the total uncertainty associated with a parameter estimate in the SCF requires combining imputation error with sampling error.[48]

Imputation Error

We compute the imputation variance associated with $\hat{\theta}$ as follows:

[48] In Barnard and Rubin (1999) and other work by Rubin, the imputation error is called "between error," while the sampling error is denoted "within error."

1. We obtain the variance of the point estimate from each implicate dataset by using the regular formula for the sample variance of a point estimate:

$$B_{\hat{\theta}} = \frac{\sum_i^M (\hat{\theta}_i - \hat{\theta})^2}{M-1}. \tag{1}$$

   Here, $B_{\hat{\theta}}$ is the imputation variance of $\hat{\theta}$, i indexes each implicate, M is the total number of implicates, $\hat{\theta}_i$ is the point estimate of the parameter of interest θ obtained from implicate i, and $\hat{\theta}$ is the mean of the point estimates $\hat{\theta}_i$ over M implicate draws.

2. When combining this variance with the sampling variance, we scale up this variance by $\frac{M+1}{M}$, where M denotes the number of implicate draws. This scaling factor corrects for the (possibly small) number of multiple imputations drawn (Barnard and Rubin, 1999).

<u>*Sampling Error*</u>

Following the Federal Reserve's guidance, we obtain standard errors from sampling in the SCF via the replicate weights, in a process similar to bootstrapping. What distinguishes this bootstrap is that the SCF uses sampling weights. In a naive bootstrap, the weights in any given bootstrap draw may not sum to the number of households in the United States, and the bootstrap sample may not reflect the SCF's survey design. Kennickell and Woodburn (1999) describe the process of generating replicate weights for each bootstrap such that the weights capture the complex sampling process of the SCF. The Federal Reserve provides 999 replicate weights; these correspond to 999 bootstrap draws. These replicate weights, when multiplied by the number of times each observation was drawn with replacement from the original survey, sum to the count of the households in the United States.

Using the replicate weights, we bootstrap sampling error in the usual way. By taking up to 999 bootstraps draws, we obtain an estimate $\hat{\theta}_1'$ that approximates the point estimate $\hat{\theta}_1$.[49] To compute the sampling variance, we use a modification of equation (1); this time, we compute the sampling variance $U_{\hat{\theta}}$ over all J bootstrap draws:

$$U_{\hat{\theta}} = \frac{\sum_k^J (\hat{\theta}^k - \bar{\theta})^2}{J-1}. \tag{2}$$

In this case, $\hat{\theta}^k$ refers to the point estimate of θ drawn from bootstrap k. $\bar{\theta}$ is the mean of those point estimates over all J; i.e., it is the expectation of θ drawn via the bootstrap.

[49] Note that the Federal Reserve provides these replicate weights only for the first data set, which is why the bootstrap draws only converge to $\widehat{\theta_1}$. Technically, within variance requires averaging the variance computed within each of the implicate draws. Because the Federal Reserve does not provide replicate weights for each of the five implicates, we must settle for variance in one dataset.

The total variance T is simply the sum of the imputation variance, scaled up to account for a possibly small number of implicates M, and the sampling variance:

$$T_{\hat{\theta}} = \frac{M+1}{M} B_{\hat{\theta}} + U_{\hat{\theta}}. \qquad (3)$$

The standard error is the square root of the total variance.

Hypothesis Testing

We derive the confidence interval around a univariate[50] parameter using the *t*-distribution:

$$[\underline{\theta}, \bar{\theta}] = \left[\hat{\theta} - t_{\nu,\frac{\alpha}{2}} \sqrt{T_{\hat{\theta}}}, \hat{\theta} + t_{\nu,\frac{\alpha}{2}} \sqrt{T_{\hat{\theta}}}\right].$$

In this case, α is the probability of Type I error (the significance level), and $t_{\nu,\frac{\alpha}{2}}$ is the t-statistic from the t-distribution with ν degrees of freedom given as follows:

$$\nu = \nu_{com} \left(\left(\frac{\nu_{com}+3}{\nu_{com}+1} \right) \left(1 - \frac{M+1}{M} \frac{B_{\hat{\theta}}}{T_{\hat{\theta}}} \right)^{-1} + \frac{\nu_{com}}{M-1} \left(\frac{M+1}{M} \frac{B_{\hat{\theta}}}{T_{\hat{\theta}}} \right)^{2} \right)^{-1}. \qquad (4)$$

where ν_{com} is the degrees of freedom in the full dataset, including imputed data. Note that this equation incorporates both a small-sample correction and a correction for the number of implicates. See Barnard and Rubin (1999) for the derivation.

Web Appendix C: Scaling Credit Card Debt in the Survey of Consumer Finances

This appendix describes how the credit card debt variable was rescaled to generate an accurate estimate of uncollateralized debt in the Survey of Consumer Finances.

Zinman (2009b) observes that aggregate annual credit card debt reported to the SCF is smaller than the average revolving debt in the Federal Reserve's G.19 Consumer Credit release, and Brown et al. (2015) find that the SCF's total credit card debt does not match the administrative estimates in the Consumer Credit Panel. To generate accurate estimates of household debt, we produce a scalar multiplier that yields larger estimates of credit card debt than is reported in the SCF directly; in particular, we multiply each person's reported credit card debt by this scalar to come closer to matching administrative sources. Underreporting of credit card debt may be associated with unobservable characteristics, so it is not immediate that multiplying credit card

[50] For more information on computing multidimensional parameters, see Barnard and Rubin (1999) and Monalto (1996).

debt by a scalar reduces bias from underreporting of credit card debt. Even so, we choose to adopt one method of rescaling to obtain aggregate credit card debt estimates.

We largely follow Zinman (2009b), though due to data limitations, we make several small adjustments to Zinman's approach.[51]

First, we obtain the estimate of revolving debt in the June issue of the G.19 survey in every year the SCF is issued. The G.19 is thought to be accurate (as it is composed of administrative data from issuers), but it reports several sources of revolving debt that the SCF excludes from its measure of credit card debt. We will exclude those sources of debt and then generate the scalar multiple of the SCF such that the yearly SCF aggregate precisely matches the G.19 survey. The G.19 includes the following additional sources of revolving debt:

1. Seasonal revolving debt
2. Non-credit card revolving debt
3. Credit card debt owed by businesses on personal credit card accounts
4. Recent transactions

We will obtain an estimate for items 1-4 to subtract from the G.19 and render it comparable to the SCF. Throughout, we subtract the maximum reasonable amount from the G.19 in order to obtain the smallest possible scalar and hence a lower bound on credit card debt. We are arguing that households' net wealth positions are quite low. Generating a smaller scalar implies that we provide an *upper bound* on median household wealth in the United States.

We handle seasonal debt by employing the June G.19, which is the month that Zinman (2009b) argues best matches the patterns observed in the SCF.

Zinman (2007b) uses the methodology outlined in Furletti and Ody (2006) to reconstruct aggregate non-credit card revolving lines using private Federal Reserve data; we use his estimates in 2001 and 2004. In every other year, we use the estimate in the SCF (i.e., the revolving debt obtained by combining SCF variables X1108, X1119, and X1130).[52]

From issue 776 of the Nilson Reports, we obtain the total credit card debt outstanding for business-related expenses. As Zinman notes, this overstates the amount of credit card debt in the G.19 that is not in the SCF, as neither survey contains estimates from commercial cards. But as

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[51] Zinman (2007b), which is the working paper version of Zinman (2009b), gives a better sense of the process Zinman uses to combine the data sources in the published paper. As a result, we follow the method in the working paper.

[52] Note that Zinman (2009b), rather than using the SCF, linearly interpolates or extrapolates for years before 2001, where Fed data were insufficiently granular to construct aggregate non-credit card revolving line measures. We prefer to use a noisy measure (which Zinman employs in his working paper draft) over linear interpolation or extrapolation.

there is no way to disaggregate business-related expenses on personal cards alone, we use this overestimate and emphasize that this simply yields a smaller (more conservative) scalar. Because this value is not available for subsequent years, we simply apply the 3-year rate of growth for all unadjusted revolving debt; that is, we assume that business-related credit card debt grows at the same rate as all revolving credit in the G.19.

We next obtain a measure of monthly transactions, modifying Zinman's approach slightly. Zinman uses the Nilson estimate of recent transactions and subtracts elements from the Nilson data to render them comparable to the G.19 survey. With the same aim of obtaining conservative estimates of credit card debt, we generate as *large* an estimate of recent transactions as possible in order to produce as *small* a scalar as possible, but we also wish to obtain a reasonable estimate. We begin by computing 1/12 of the Nilson estimate of annual purchasing volume on credit cards.[53] We use the data reported in Zinman (2007b) for the years 1989-2004. Our estimates reflect rounding in the data reported in these papers. For the later years, we use Nilson issues 914, 984, 1051, and 1119.[54] The measure of monthly transactions includes monthly spending on business purchases on personal lines and commercial purchases. Because commercial lines are not included in the G.19, we subtract these from the cash transactions (so that we do not subtract cash transactions not included in the G.19 survey). Commercial transactions are given in Zinman (2007b) for the years 1989-2004, and Nilson issues 902, 965, 1049, and 1114 for subsequent years.[55] Finally, we do *not* subtract transactions on personal lines for business purposes from our estimate of the total amount of monthly transactions. That is because we ultimately subtract the total transactions from the G.19 when deriving our estimate, and the G.19 would include this form of spending. Therefore, this spending will not be included as part of our estimate.[56]

After obtaining an adjusted Nilson estimate of the total monthly spending, we multiply the Nilson estimate by 1.35, following Zinman, to obtain a minimal reasonable scalar.[57]

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[53] All Nilson estimates are reported annually, so we compute 1/12 of all their data.

[54] Note that purchasing volume, the data reported in Nilson, is total volume minus cash advances. Zinman (2009b) subtracts a proportion of cash advances from total transactions; to limit judgment in our scalar computation, we subtract all cash advances from transactions, and we use the difference between total volume and purchasing volume data to obtain cash advances where Nilson does not report the figure directly

[55] The estimate of commercial credit card purchasing volume reported in Nilson also includes prepaid and debit cards. For years prior to 2016, there is no way to disaggregate credit card transactions from those on debit/prepaid cards. Nilson issue 1114 separately records 2016 commercial credit and debit card purchasing volume. Credit cards are responsible for approximately 80% of total commercial purchasing volume. In our baseline estimate of the G.19 scalar, we do not adjust for the debit card portion of commercial purchases. When we do subtract only commercial credit card debt using the disaggregated 2016 data, the scalar changes from 1.49 to 1.40.

[56] Note that Zinman (2009b) uses the Survey of Small Business Finances (SSBF) in this section. As this survey is no longer available, and to obtain a parsimonious estimate of the credit card scalar, we do not employ the SSBF.

[57] 1.35 comes from the following observation: if a person who holds credit card debt makes use of a 15-25 day grace period, the *average* amount of debt held will be between 1 and 1.4 times her monthly spending, even if she pays down the full bill. We use 1.35, the number Zinman employs for his maximal correction. See Zinman (2009b) for details.

Tables C1-C3, in the style of the tables in Zinman (2009b), illustrate the process we use and the scalars we obtain.

Table C1: Scalar by Year

Year	SCF Scalar	=	Adjusted G.19	/	CC Debt in the SCF
1989	1.4	=	99.2	/	69.7
1992	1.9	=	180.6	/	97.0
1995	2.0	=	277.8	/	139.9
1998	2.2	=	410.1	/	186.3
2001	2.6	=	502.8	/	195.6
2004	2.0	=	536.7	/	265.9
2007	1.6	=	623.6	/	392.1
2010	1.5	=	502.7	/	328.3
2013	1.8	=	480.2	/	267.8
2016	1.5	=	469.1	/	315.8

Notes: Table C1 displays the scalars we generate for each year that the SCF is issued. To obtain the scalars, we divide the adjusted G.19 totals by the total credit card debt in the SCF. See Tables C2 and C3 for details on computing the adjusted G.19. Numbers in nominal billions of dollars. Source: Survey of Consumer Finances.

Table C2: Adjusted G.19 by Year

Year	Adjusted G.19	=	CC Debt in the G.19	-	Other Revolving Debt	-	Businesses' CC Debt	-	Adjusted Monthly Charges
1989	99.2	=	195.9	-	44.7	-	14.2	-	37.8
1992	180.6	=	267.8	-	24.7	-	19.4	-	43.2
1995	277.8	=	401.8	-	17.9	-	29.1	-	76.9
1998	410.1	=	559.9	-	16.1	-	40.6	-	93.2
2001	502.8	=	709.0	-	32.0	-	51.4	-	122.9
2004	536.7	=	774.3	-	33.0	-	56.1	-	148.5
2007	623.6	=	916.4	-	48.3	-	66.4	-	178.1
2010	502.7	=	841.1	-	115.9	-	61.0	-	161.6
2013	480.2	=	814.6	-	78.5	-	59.0	-	196.9
2016	469.1	=	902.8	-	127.2	-	65.4	-	241.1

Notes: Table C2 displays the method by which we adjust the G.19 Consumer Credit release to render it comparable to the SCF. Other revolving debt comes from Zinman (2007b) and the SCF. Businesses' credit card debt comes from Nilson issue 776 and is grown at the same rate as the unadjusted G.19. Adjusted monthly charges are computed from Nilson; see Table C3 for details. Numbers in nominal billions of dollars. Source: Survey of Consumer Finances.

Table C3: Adjusted Monthly Charges by Year

Year	Adjusted Monthly Charges	=	1.35	X	(	Nilson Total Charges	-	Cash Advances	-	Charges on Corporate Lines	)
1989	37.8	=	1.35	X	(	35.0	-	2.0	-	5.0	)
1992	43.2	=	1.35	X	(	44.0	-	3.0	-	9.0	)
1995	76.9	=	1.35	X	(	72.0	-	9.0	-	6.0	)
1998	93.2	=	1.35	X	(	95.0	-	14.0	-	12.0	)
2001	122.9	=	1.35	X	(	127.0	-	18.0	-	18.0	)
2004	148.5	=	1.35	X	(	157.0	-	23.0	-	24.0	)
2007	178.1	=	1.35	X	(	199.1	-	23.2	-	43.9	)
2010	161.6	=	1.35	X	(	179.8	-	8.8	-	51.3	)
2013	196.9	=	1.35	X	(	228.6	-	8.9	-	73.9	)
2016	241.1	=	1.35	X	(	287.4	-	13.8	-	95.1	)

Notes: Table C3 displays the method by which we adjust monthly charges to subtract from the G.19 Consumer Credit release. We subtract total cash advances and charges on corporate lines from total monthly credit card charges; these data come from multiplying Nilson annual estimates by 1/12. We scale what remains by 1.35, following Zinman (2009b). Numbers in nominal billions of dollars. Source: Survey of Consumer Finances.

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