How a Cognitive Bias Shapes Competition: Evidence from Consumer Credit Markets

Victor Stango and Jonathan Zinman*

Abstract

We document evidence suggesting that many U.S. consumers have *payment/interest bias*: they systematically underestimate the interest rate associated with a loan principal and repayment stream. Biased consumers hold loans with higher interest rates, but only when borrowing from nonbank lenders. This result holds both across and within households, and is robust to controls for income, wealth, default risk and a rich set of other household and loan characteristics. Our findings fit with the stylized fact that nonbank lenders emphasize monthly payments rather than interest rates—often suppressing interest rate information, even when doing so runs afoul of Truth-in-Lending laws. The links between payment/interest bias, actual loan rates, and lender behavior support the emerging view that cognitive biases shape market equilibria, even in highly competitive settings.

* *Stango:* Associate Professor of Business Administration, Tuck School of Business, Dartmouth College, Hanover NH 03755. *Email:* victor.stango@dartmouth.edu. *Zinman*: Assistant Professor of Economics, Dartmouth College, Hanover NH 03755. *Email:* jzinman@dartmouth.edu. A previous version of this paper was titled: "What Monthly Payment Gets You in This Car? Payment/Interest Bias and the Market for Consumer Loans." We are grateful to Andrew Bernard, Doug Staiger, and seminar participants at The Federal Reserve Board of Governors, Dartmouth, the Federal Reserve Banks of Chicago, Philadelphia and Boston, and the Federal Trade Commission for helpful comments. Thanks also to Bob Avery and Arthur Kennickell for helpful discussions regarding the Survey of Consumer Finances. Special thanks to the legal and research staff at the Federal Trade Commission, including Matias Barenstein, Lynn Gottschalk, Jesse Leary, and Carole Reynolds, for pointing us toward legal actions and institutional details.

"Respondent...in numerous instances including but not limited to Exhibit A, has disseminated... advertisements that state initial, low monthly payment amounts and promote the 'luxury of low payments.' Respondent's Gold Key Plus advertisements fail to disclose the annual percentage rate for the financing."

Federal Trade Commission v. Herb Gordon Auto World, Inc., Docket C-3734, 1997.

1 Introduction

How do cognitive biases influence economic behavior?[1] An emerging literature studies this question, asking both whether these biases exist and how they shape market equilibria.[2] Here we provide new evidence on both points. We document a pervasive cognitive bias in how consumers interpret loan terms. More important, we show that bias matters in the market; at the household level, bias is correlated with the terms of actual loan contracts.

The cognitive bias we document is *payment/interest bias*: consumers' systematic tendency to underestimate the annual percentage rate (APR) associated with a loan principal and stream of repayments. Prior evidence of such bias exists but has been overlooked by researchers and policymakers.[3] We provide the most comprehensive evidence of payment/interest bias to date, using the most recent nationally representative survey that asks respondents to calculate an APR from payments (the 1983 Survey of Consumer Finances). The SCF enables us to quantify bias at the household level. Bias is prevalent and economically large: when asked to infer an APR from monthly payments, nearly all households err on the low side by several hundred basis points.

We also link payment/interest bias to the terms of the actual loan contracts held by SCF households. This addresses whether bias matters even in what appears to be a highly competitive

[1] See, e.g., Campbell (2006); McFadden (2006) for perspectives and reviews on the role of bias in intertemporal consumer choice.

[2] See Gabaix and Laibson (2006) for theory, and Glaeser (2004) and Ellison (forthcoming) for reviews. Empirical studies include Oster and Scott-Morton (2005) and Shui and Ausubel (2005), which find that firms tailor contracts to consumers with present-biased preferences. Simmons and Lynch (1991) provides evidence that suppressing information can affect consumers' perceptions. Bertrand, Karlan, Mullainathan, Shafir, and Zinman (2005) finds that product presentation can affect borrowing decisions and dull price sensitivity. Ahlee and Malmendier (2006) finds that Ebay auction mechanisms induce bidding behavior that violates neoclassical predictions.

[3] See Juster and Shay (1964), Kinsey and McAlister (1981) and Parker and Shay (1974) for evidence and discussions. While these studies contain evidence of payment/interest bias, they emphasize computational *mistakes* rather than bias as the phenomenon of interest. Prior work also does little to relate mistaken or biased misperceptions to credit market outcomes.

market.[4] We find that biased households' loan rates are 200-400 basis points higher than unbiased households' rates, but only for loans obtained from non-bank finance companies; there is no bias/rate relationship for bank loans. This result is quite robust. The SCF contains a rich set of loan, transaction, and household characteristics, allowing us to condition the bias/rate relationship on a rich set of covariates. The loan and transaction characteristics include loan size, maturity, product purchased with the loan and year of origination. The household characteristics include demographics, financial characteristics such as assets and debts, and other variables that might be related to borrowing behavior. These include several proxies for liquidity constraints.

Unobserved household characteristics do not seem to drive the relationship between bias, rates, and lender type. We also estimate a household fixed effects model using the subsample of households with loans from both a finance company and a bank. This controls for time-invariant household characteristics that are correlated with loan rates. We find that unbiased households pay similar rates on loans from banks and finance companies, but biased households pay roughly 700 basis points more when borrowing from finance companies. This result is robust to controls for product purchased, loan size, loan maturity, and year of origination. It is also robust to interactions of lender type with income, wealth, default risk and loan characteristics.

Our results provide a partial microfoundation for the prevailing regulatory approach to consumer loan markets: mandated disclosure of loan terms. The Truth in Lending Act (TILA) stipulates how lenders must present information to consumers in contracts and loan advertisements. TILA was motivated by the widespread lender practice of emphasizing payments and suppressing APRs (National Commission on Consumer Finance, 1972). Payment/interest bias gives lenders a specific motive for this practice of "payments marketing," because biased consumers can drastically underestimate APRs when they must infer them from payments. APR-based and payments-based loan offers can therefore appeal differently to biased and unbiased borrowers, enabling price discrimination across or within lenders (see Figures 1 and 2 for examples of differences in APR and payment emphasis).[5]

Our results also fit with differences across lender type in how TILA is enforced. It appears that prior to the enactment of TILA in 1968, both banks and finance companies presented loan offers emphasizing payments and suppressing APRs (National Commission on Consumer Finance, 1972; see Figures 9 and 10 for examples). While TILA applies to both banks and finance companies *de*

[4] The consumer loan market had of tens of thousands of lenders in 1983 (this applies currently as well), and nearly all local loan markets were served by multiple competing firms. See Section 3 for more details.

[5] Presumably such price discrimination is sustainable as a long-run equilibrium under free-entry because rent-seeking (e.g., marketing) expenditures associated with targeting biased consumers offset the ex-post gains from charging biased consumers higher rates. See Section 5.1 for related discussion.

jure, it appears to bind more for banks *de facto*, due to differences in regulatory oversight. Banks find it more costly to cheat due to higher detection probabilities and the value of the bank charter. On the other hand many finance companies still engage in payments marketing, even when doing so violates Truth-in-Lending.[6] This fits with our empirical result that the bias/rate relationship exists only for finance company loans. It also suggests that despite the existence and active enforcement of Truth in Lending, bias still matters in the market.

Adaptive behavior by consumers does not render bias irrelevant either. Our results suggest that consumers are at most partly aware of their bias. This is in line with other work examining how biased consumers operate in markets (DellaVigna and Malmendier [2004, 2006]). But we are circumspect about making particular policy prescriptions, because we lack evidence on the counterfactuals needed to evaluate welfare and potential interventions. For example, we have no direct evidence on how greater disclosure of APRs might change consumer behavior.

As such our main contribution is showing how a cognitive bias can shape market outcomes, even in a highly competitive setting. Firms provide frames that cater to bias, and biased consumers sort into different contracts than unbiased consumers. This leads to segmentation across firms in how they present information to consumers, which customers they attract, and equilibrium prices.

2 Payment/Interest Bias: Results and Interpretation

The 1983 Survey of Consumer Finances contains an "Interest Rate Quiz" with two questions.[7] The first is:

> *"Suppose you were buying a room of furniture for a list price of $1,000 and you were to repay the amount to the dealer in 12 monthly installments. How much do you think it would cost in total, for the furniture after one year – including all finance and carrying charges?"*

Consumers' responses to this question are lump sum "repayment totals" (e.g., $1200). Given the predefined maturity and principal amount, the repayment total answer yields what we call the

[6] See Fortney (1986) for summary evidence on finance company TILA violations during our sample period. The FTC web site, www.ftc.gov, contains details of recent actions. We are unable to find any evidence of recent actions against banks for TILA violations.

[7] The SCF is a nationally representative household survey taken every three years. We use the 1983 survey because it is the only one in which the Interest Rate Quiz appeared. See the empirical section below for more detail on the data.

actual APR: the annual percentage rate (APR) calculated from the payment stream.[8] Figure 3 shows the distribution of the actual APR across all households. The mean is 57 percent, which corresponds to a stream of payments over the year totalling roughly $1350. The modal actual APR is 35% ($1200), with other frequent rates corresponding to round repayment totals (1300, 1400, 1100, etc.). The twenty-fifth percentile is 35% and the seventy-fifth is 81% ($1500).

The next question in the survey is:

"What percent rate of interest do those payments imply?"

We refer to this response as the *perceived APR.* Figure 4 shows the distribution of perceived APRs. The modal answer is 18%, with the twenty-fifth percentile at 12% and the seventy-fifth at 19%. Very few respondents give an answer above 20%.

2.1 Quantifying Payment/Interest Bias

The internal consistency of the two quiz answers provides a measure of a consumer's ability to relate a stream of payments to an interest rate. The calculation is technically difficult, as the monthly payments imply that the principal balance declines over the year. Thus the simple "add-on" interest rate (e.g., 20% on a repayment total of $1,200) substantially understates the true borrowing cost.[9]

Given the difficulty of the APR calculation we are not surprised to find that consumers often make *mistakes.*[10] What is surprising, and motivates our empirical work, is that given a stream of payments consumers systematically perceive an APR that is lower than the actual APR: they display *payment/interest bias.*

Figure 5 shows the scatter plot of actual and perceived APRs. Correct (unbiased) answers lie on the forty-five degree line. Nearly all responses fall below the line, meaning that the perceived APR is below the actual APR. Both the degree of bias and its size are striking. Roughly 98% of respondents underestimate the actual APR. The median bias is 25 percentage points (2500 basis

[8] We assume that the monthly installment payments are equal when calculating the implied rate. Different assumptions about the size of payments do not change our results (even if we assume that the first eleven payments are zero, and the last completely repays the loan).

[9] There is a simple "doubling heuristic"—doubling the add-on rate implied by the repayment total—that gets close enough to the actual APR to be counted as unbiased in our empirical specifications below. But only 1% of the sample gives the answer produced by the doubling heuristic.

[10] See Maki (1996) and Pence (2002) for other uses of the interest rate quiz as a measure of financial literacy. Neither focuses on the bias we identify.

points), and the mean bias is 38 percentage points. Bias exists even relative to the add-on rate (shown by the flatter line); while roughly one-fifth of respondents give the add-on rate, those who supply something other than the add-on rate tend to underestimate both the actual APR and the add-on.

Table 1 shows summary data on responses and bias, stratifying the sample into quintiles by degree of payment/interest bias. There is also a set of consumers who fail to report either a perceived APR, an actual APR or both; these are in the "n/a" column. The table highlights the source of variation in bias. While the repayment total (and hence the actual APR) varies widely, there is relatively little variation in perceived rates across bias quintiles. It appears that consumers anchor effectively on a market interest rate; the modal perceived rate is 18 percent, which was indeed the modal credit card rate at the time.[11] Consumers seem to have some information about what constitutes a "fair" market interest rate for at least one type of consumer credit, but little ability to map payments onto fair rates.

2.2 Previous Evidence, and Interpretation of Bias

A natural concern is whether what we label payment/interest bias is actually an artifact of the SCF survey. The lack of comparable data limits our ability to corroborate post-1983.[12] But several pre-1983 studies contain corroborative evidence of bias.[13] Such evidence has been discussed in passing, if at all, because the studies focus on mistakes rather than bias as the critical metric of consumer awareness. The emphasis on mistakes rather than bias in prior work is typical in the

[11] Knittel and Stango (2003) show that over eighty percent of credit card issuers charged an eighteen percent APR during the mid-1980s. We do not know of any comparable data collected from issuers of the non-mortgage installment loans that we focus on here.

[12] We do have one bit of contemporary evidence on payment/interest bias: following an internal presentation of this paper, a skeptical colleague gave a modified version of the Interest Rate Quiz to students in a finance class that had recently covered discounting. Of thirty-seven students, all underestimated the APR: one gave a rate above the add-on rate, twelve gave the add-on rate, and the remainder underestimated both the APR and the add-on rate. Bernheim (1995), Bernheim (1998), and Moore (2003) find other evidence consistent with limited understanding of loan terms, including interest rates.

[13] Juster and Shay (1964) contains questions similar to those in the 1983 SCF but asks respondents to base their answers on an actual recent loan. This setup produced evidence of a smaller bias (mean: 1500 basis points) than we find in the 1983 SCF sample (mean: 3800 basis points). The difference may be due to Juster and Shay's self-selected sample from the Consumers' Union, a group that should be relatively knowledgeable about loans. Several other studies from the 1970s find that respondents systematically underestimate APRs when shown a stream of monthly payments: see Day and Brandt (1974), Parker and Shay (1974), and Kinsey and McAlister (1981) for findings and reviews.

broader literature relating cognition to economic outcomes.[14]

One might wonder whether our measure of bias simply captures differences in mathematical ability as traditionally defined (based on accuracy or response times, not bias). The data suggests otherwise. For example, it does not appear that consumers chose to give the "easy" answer– the add-on rate, which is always lower than the APR– despite understanding the Quiz correctly. If this were the case we should see more add-on rate responses, or a least a more even distribution around the add-on rate. Nor does it appear that the repayment total responses reflect different information than the perceived APR responses. One might conjecture, for example, that consumers provide a repayment total based on their loans with regular monthly payments, but an APR based on their non-installment loans such as credit cards. This process would be difficult to reconcile with our fixed effects results below, which show that the within-household correlation between bias and loan rates depends on whether the loan was issued by a bank or finance company. In short, while we are unable to state definitively how consumers answer the Quiz, answers appear to reflect a bias that could affect borrowing decisions.

Of course, even pervasive payment/interest bias may not matter in the market. Truth-in-Lending, lender competition, or consumer heuristics could make bias irrelevant. We test whether bias impacts market outcomes in Section 4, after presenting some institutional details regarding consumer installment loan markets.

3 The Market for Consumer Loans

Roughly half of all U.S. households hold at least one installment loan at any point in time.[15] Most installment loans in our sample—60% by dollar volume—fund new or used car purchases, with the remainder funding household appliances, educational expenses, home improvement and a variety of other household uses. In 1983 households owed $325 billion in installment debt, an amount that

[14] For example, labor economics tends to measure ability using test scores that are based on the proportion of correct answers; see also Benjamin and Shapiro (2006). For reviews of the cognitive neuroscience literature on mathematical computations see Daheane (1997), Campbell and Xue (2001), and DeStefano and LeFevre (2004). The findings in Peters et al. (2006) do suggest that standard measures of ability and bias avoidance are positively correlated: more numerate individuals are less susceptible to framing influences in laboratory experiments.

[15] *Installment* loans have fixed repayment schedules that require periodic payments. Most often, installment loans have fixed interest rates, fixed repayment periods and fixed monthly payments. In contrast, *revolving* loans such as those on credit cards or home equity lines of credit have flexible repayment schedules. Thus, monthly payments are less determinate and the role for marketing based on payments is diminished.

dwarfed revolving debt.[16] Even today consumer installment credit remains the dominant form of non-mortgage borrowing, despite the increased availability of substitutes such as credit cards and home equity lines of credit. In 2004 total installment debt outstanding was roughly $1.3 trillion, compared to $800 billion in credit card debt and $400 billion on home equity lines of credit.

There are two broad types of lender in these markets. Banks, thrifts and credit unions, which we collectively label "banks," are deposit-taking institutions who lend and provide a variety of other services. Finance companies and other non-bank institutions (which we collectively label "finance companies") also lend but do not take deposits. The other primary difference between the lender types is regulatory, an issue we discuss in some detail below.[17] In 1983 finance companies held roughly thirty percent of all consumer installment debt, with banks holding the remainder. Today finance companies hold almost 50% of non-mortgage installment debt.[18] They now also originate a large share of mortgage loans, but were not significant mortgage lenders during our sample period.

3.1 Competition and Price-setting in Consumer Loan Markets

Roughly 15,000 banks nationwide offer consumer loan products; the number was substantially higher in 1983. Data limitations make it difficult to identify the precise number of finance companies engaged in consumer lending activity, but it was almost certainly in the tens of thousands in 1983 and is likely higher today.[19] Most local markets were unconcentrated by antitrust standards; the mean (median) county was served by 35 (9) financial institution establishments in 1983. Moreover, entry barriers for both banks and finance companies are quite low. Consumer options have become more numerous over time as banking deregulation and the internet have expanded market boundaries. In short, both during 1983 and currently, prospective borrowers have choices.

Loan rate-setting at both banks and finance companies is consumer- and product-specific. Lenders use readily observable household characteristics to assess and price default risk, deny-

[16] The source for the aggregate data we discuss here is the Federal Reserve's G.19 *Consumer Installment Credit* release. All figures are nominal.

[17] In our empirical work we ignore the small number of loans issued by mutual funds, pension plans, and insurance companies.

[18] These figures include not only debt on the books, but also securitized debt. The total debt figures for our "finance companies" add the figures for finance companies proper from the Federal Reserve G.20 statistical release to the figures for nonbank lenders in the G.19 release.

[19] Census County Business Patterns data shows that in 1983 there were roughly 60,000 nondepository financial establishments (i.e., non-banks) nationwide. This figure may include some institutions that do not make consumer installment loans (such as business finance companies), and counts lenders with multiple offices as multiple establishments. Census data from 1997 suggest that the figure has remained nearly constant over time.

ing the riskiest customers loans. The product purchased, amount borrowed and loan maturity also affect rates (again, through their impact on default risk). Some features of contracting seem to differ across bank and finance companies. Banks tend to use more uniform pricing (conditional on product type and consumer risk, see Section 5.2 for evidence). In contrast, finance companies seem to have more flexibility in adjusting terms "on the spot" when the loan is granted.[20] It is also more common for finance company loans to be tied to the product purchased, because retailers typically affiliate with only a few finance companies; however, there is no evidence in our data that finance company loan terms are related to retail prices.[21]

Both banks and finance companies advertise heavily in print and other media, and such advertising almost always contains representative loan terms. As discussed above, finance companies frequently use "payments marketing" that displays monthly payments prominently, and APRs in the fine print or not at all. Figures 1 and 2 provide some illustrative examples. The bank ad in Figure 1 displays APR information prominently, and provides the additional information on maturity and downpayment requirement that one would need to calculate the monthly payment for a desired loan amount. The finance company ad in Figure 2 shows only a monthly payment, omitting the other information needed to calculate the APR. As we detail below, we observe numerous recent instances of payments marketing that violates TILA by finance companies, but none by banks.

3.2 Payment/Interest Bias in Competitive Loan Markets

Given the different ways in which loan terms can be framed and negotiated, a natural question is how payment/interest bias might lead to equilibrium differences in loan contracts across households. To fix ideas, consider a single lender offering loan contracts to potential borrowers, some of whom have payment/interest bias. Even if bias is unobservable the lender may be able to offer a menu of contracts that maximizes profits by separating borrowers based on bias. For example, suppose all consumers wish to borrow $1000 and repay in twelve monthly installments (as in the SCF quiz). The lender makes two offers—one featuring an APR of 25%, and one featuring monthly payments of $100. Unbiased borrowers will recognize that the second offer has an APR of 35% and take the first. Biased borrowers, however, may perceive a rate lower than 25% on the second offer and take

[20] See Cohen (2005) for a discussion.

[21] We observe purchase price as well as loan terms for car and home improvement loans, and also observe whether a finance company loan was obtained independently or through a retailer. There is no evidence of a relationship between payment/interest bias, purchase price and loan terms. Nor do our results change if we condition on whether a finance company loan was linked to a retailer.

it.[22] Again, we lack hard data on how prevalent this practice is, but Figure 6 provides an example. The advertisement quotes a payment-based offer, and APR-based offers. It does not state the APR on the payment-based offer.

The stylized nature of our examples also highlights why payment/interest bias might *not* matter in the market. First, even if consumers consistently misinterpret payments-based information, competition among lenders will push rates toward the marginal cost of lending. Essentially, payment/interest bias can be viewed as generating differences in willingness to pay for loan contracts, depending on how the terms are framed. Such differences exist in any product market but are often irrelevant due to competition. On the other hand, price discrimination can exist even in free-entry markets.[23] Whether it does here is an empirical question.

A second countervailing influence is regulation. Truth-in-Lending legislation, originally passed in 1968 and amended in 1980, stipulates full disclosure of loan terms before credit is extended.[24] Truth-in-Lending law mandates that loan contracts must contain APRs and applies to advertising as well. It is possible that such regulation prevents lenders from making loan offers that discriminate between biased and unbiased consumers.

Finally, even if the supply side of the market is conducive to segmentation based on payment/interest bias, biased consumers might develop effective mitigating strategies. They might forego borrowing altogether.[25] They might learn to avoid offers quoted in payments. Or they might develop heuristics that enable them to approximate true borrowing costs.[26]

In short, the mere existence of payment/interest bias does not imply that it matters in the market. Factors on the supply side, the policy side, or the demand side might attenuate lenders' ability to segment consumers based on bias. This motivates our empirical tests of whether and how

[22] Of course, lenders could target biased customers by (isomorphically) varying other loan terms such as maturity, or amount borrowed. In the empirical work below we focus on APRs and condition on maturity, loan amount and product purchased. While some contemporary actions against payments-based deception allege that lenders exploit consumers by extending maturities, in 1983 there was relatively little variation in maturity, conditional on product purchased.

[23] See Borenstein (1985) and Holmes (1989) for theoretical models of price discrimination in non-monopoly markets. Borenstein (1991) and Shepard (1991) show that price discrimination exists in retail gasoline markets. Borenstein and Rose (1994) find that airline pricing fits models of price discrimination in monopolistically competitive markets.

[24] Regulation Z stipulates disclosure rules for loan contracts (12 CFR Section 226.17) and advertisements (12 CFR Section 226.24). Terms that must be disclosed include the finance charge, APR, amount financed, repayment total, and total sales price.

[25] Stango and Zinman (2006) find that if anything, the opposite is true. E.g., conditional on having made a large recent purchase, biased consumers are more likely to have borrowed.

[26] Kahneman (2003) reviews evidence suggesting that heuristics can exacerbate biases rather than correct them.

bias correlates with market outcomes. And because of the apparent differences between banks and finance companies in how they use payments marketing, we also explore the role of lender type.

4 Empirical Evidence on Bias, Loan Rates and Lender Type

We test whether payment/interest bias is related to the terms and sourcing of actual loans by linking our measure of bias to complementary data in the SCF. The SCF contains data on all loans held by each household in the sample. For each loan, we observe the APR, amount borrowed, maturity, item purchased, lender type, and year of origination.[27] The SCF's method of collecting interest rate information on non-mortgage installment loans is particularly useful for our purposes. The surveyor asks the household head for the original amount borrowed, the monthly payments on the loan, and the number of payments. Because this provides enough information to calculate the APR, household heads are not asked to supply the rate. This allows us to independently determine the APR using the respondent's self-supplied principal, payment and maturity information. We discard observations for which respondents fail to supply enough useful information to calculate the interest rate on the loan.[28] The SCF also contains detailed data on the product purchased with the loan—whether it was a vacuum cleaner or a refrigerator, whether it was used for home improvement, a new car, a used truck, etc. The product information proves valuable, as product type is highly correlated with both loan risk (auto loans are collateralized, refrigerator loans are not) and lender type (certain items are much more likely to be purchased with loans from finance companies).

In addition to loan terms and product characteristics, the SCF provides extensive coverage of household demographics, financial variables (such as assets, debt, borrowing history and other measures of default risk), and attitudes toward borrowing and saving. This set of variables probably subsumes the information set used by lenders to assess credit risk, particularly in 1983. The Data Appendix describes these variables.

[27] The vast majority of loans in the sample are fewer than two years old.

[28] The most common reporting problem is failing to report loan maturity. We drop loans with no reported maturity from the sample. A more subtle issue is that in some cases the APR implied by the respondent's "raw" loan terms differs from those reported in the final version of the SCF (both the raw and the final, imputed data are publicly available for the 1983 survey). Our discussions with SCF staff indicate that in most cases, this reflects a correction based on "margin notes" taken during the interview (but not reported in either version of the dataset). Thus, we use the SCF's imputed APRs and other loan terms. However, we discard observations for which the deviation between the raw and imputed APR is greater than five hundred basis points. This has no qualitative effect on the results, although it does increase the point estimates of the bias/rate relationship.

4.1 Payment/Interest Bias and Household Characteristics

Table 2 shows the relationship between bias and household characteristics for the entire SCF. As one might expect, there is a strong unconditional relationship between bias and household characteristics such as education, wealth and income. In the "unbiased" quintile (1), far more households have college degrees than have no high school education; this relationship is reversed for those in the most biased (fifth) quintile. Those who fail to supply either a perceived or actual APR (or both) are even less likely to be highly educated. While there is little systematic relationship between age and bias, there is a strong relationship between bias, income, and wealth: biased households earn less, and have a higher ratio of debt to assets.

We take two things from this table. First, these data reinforce the notion that our definition of bias is sensible. Consumers in the best group are those who we would intuitively expect to be less biased; in particular, they are more educated than those without bias. Unbiased consumers are also more successful financially.[29] A second lesson from this table is that our measure of bias is correlated with observable variables in economically meaningful ways. The differences across quintiles are striking.

4.2 Bias, Lender Type, and Loan Terms

Table 3 presents summary statistics for loans, lender type, and loan terms for two subsamples of interest in our data. The top frame shows data for all households with at least one non-mortgage consumer installment loan outstanding. The number of loans per household is essentially uncorrelated with bias. However, households with bias (i.e., quintiles 2-5) are more likely to have at least one loan from a finance company, and hold a greater share of their total borrowing from finance companies.[30] Loan rates are higher for households with greater bias. This reflects a combination of factors; households with bias are more likely to obtain loans from finance companies (which may charge higher rates), and also pay higher rates conditional on lender type (in part because they are worse credit risks).

The second frame of the table shows similar data for the subsample of households that hold at least one loan bank loan and at least one finance company loan. These households naturally have

[29] Stango and Zinman (2006) explores the impact of bias on wealth accumulation.

[30] We measure total borrowing here as the sum over all outstanding loans of the original amount borrowed (rather than the current amount outstanding). Thus, if a household has two loans outstanding, one from a bank for $10,000 with $5000 outstanding, and one from a finance company for $5000 with $4000 outstanding, we measure that household as having two loans, total borrowing of $15,000, and a share from finance companies of 0.33.

a greater number of loans overall. As in the larger sample, households with bias have more debt from finance companies. The most striking feature of the subsample is the average loan rate from each type of lender. There is essentially no relationship between rates and bias among bank loans. For finance company loans, households with bias have loans with higher rates.

These descriptive statistics thus reveal two key patterns. First, biased households borrow more from finance companies. Second, biased households pay higher interest rates when borrowing from finance companies, but not from banks. Below we estimate whether these relationships persist after controlling for a rich set of household and loan characteristics.

4.3 The Cross-sectional Relationship between Bias and Loan Rates

Our primary empirical tests correlate household bias with interest rates on actual loans held by households, controlling for other household- and loan-level characteristics that affect interest rates. We do so in two ways. First, we condition on a rich set of household- and loan-level variables, in the cross-section of households with at least one loan. This estimates a level effect: do biased households hold loans with higher rates than unbiased households? Second, we examine the subset of households with loans from both banks and finance companies. For this subsample, we can use household fixed effects to control for unobserved household-level characteristics that might affect rates. This model therefore estimates the relationship between bias and *relative* interest rates on loans from the two types of lender.

In the first model, the unit of observation is the loan; the sample therefore includes all households with at least one loan, and contains multiple observations for each household with more than one loan.[31] We estimate a linear relationship between loan rates, bias, and our set of controls:

$$r_{lh} = \alpha_i Bias_{hi} + \gamma Addon_h + X_h\beta + Z_l\delta + \varepsilon_{lh},$$

where r_{lh} is the interest rate on loan l held by household h, $Bias_{hi}$ is the vector including the household-level bias quintile dummy variables and a dummy for "no quiz response" ($i = 1, ..., 6$) and α_i is the vector of coefficients on these variables. We also include a dummy variable $Addon_h$ equal to one if the household supplied the add-on rate. The vector X_h includes household-level characteristics correlated with loan rates. These include standard demographics (including education, race, gender, state of residence, and income), financial attitudes, and proxies for credit risk

[31] One could envision estimating a first stage selection equation that estimates the likelihood that a household holds loans. While we do find that biased households are more likely to be borrowers, we do not pursue this strategy because there are no good candidates for the exclusion restriction in the first stage.

and liquidity constraints (including wealth, debt levels, a recent denial of credit, and possession of a credit card). We also include a novel variable measuring whether a household shops for loans based on monthly payments or APRs.[32] Conditioning on payments shopping is useful to the extent it helps capture the fact that credit constrained consumers may rationally focus on payments and essentially ignore interest rates.[33] Of course, shopping on payments may also be related to payment/interest bias; if this is true then conditioning on the latter will "over-control" and our estimate of α_i may understate the true effect of bias on loan market outcomes.[34] The vector Z_l includes loan characteristics: amount borrowed, maturity, and product purchased with the loan.[35] We correct the estimated standard errors for clustering at the household level.

The first column of Table 4 presents our estimate of α_i from a model that includes the complete set of controls in $X_h$and Z_l. The unbiased quintile is the omitted category. The second column adds a dummy variable for lender type, while the third and fourth columns split the sample by lender type. In the full sample (Columns 1 and 2) there is little systematic relationship between bias and rates. Models (3) and (4) show the primary empirical result: bias matters at finance companies but not banks. Biased households pay roughly 300 basis points more than their unbiased counterparts when borrowing from finance companies. Although the non-result in the bank sample is not a precisely estimated zero, the bias coefficients are significantly different across the bank and finance company samples.

4.4 Intra-Household Variation in Rates by Bias and Lender Type

A natural concern with the cross-sectional relationship is that it confounds imperfectly observed household-level characteristics such as default risk or time preference with $Bias_{hi}$, producing spuriously positive estimates of α_i. We address this identification problem by exploiting the fact that some households have loans from both banks and finance companies. This enables us to control

[32] The SCF asks consumers this question: *"... in choosing an automobile loan, which of the credit terms listed on this card would be most important to you if you were going to use credit to purchase a car?"*

Consumers list their top three choices from a list of over ten. The most popular responses are "interest rate" and "size of the monthly payment," which together comprise roughly half of all responses. Others include: the total size of interest/loan payments, the size of the loan, and fees for late or early payment.

We classify a household as "shopping on payments" if it lists payments among the top two characteristics but not interest rates. We have used a number of other definitions with no effect on the results.

[33] See Attanasio, Goldberg, and Kryiazidou (2004) and Karlan and Zinman (2005) for discussions of this issue.

[34] See Angrist and Krueger (1999) for a discussion of over-controlling. We may be over-controlling with other covariates as well here; e.g., with balance sheet variables such as wealth and its components. Stango and Zinman (2006) estimates the relationship between bias and these variables.

[35] We include the natural logarithm of amount borrowed, and use a set of dummy variables for maturities.

for any household-level characteristics (observed or unobserved) that are constant across loans. We estimate the within-household relationship between bias, lender type, and loan rates using the following base model:

$$r_{lh} = z_i \left(Bias_{hi} \cdot Finco_{lh} \right) + Finco_{lh} w + Z_l \delta + \upsilon_h + \varepsilon_{lh},$$

Again r_{lh} is the interest rate on loan l held by household h, and $Bias_{hi}$ is the vector of household-level bias dummies ($i = 2, ..., 6$). $Finco_{lh}$ is a dummy variable taking on a value of one if the loan is from a finance company. The coefficients of interest are now z_i, the vector on the interactions between bias and lender type. The inclusion of household fixed effects υ_h implies that z_i estimates the within-household difference between loan rates from finance companies and loan rate from banks, across bias quintiles. In other words, we estimate how much the bank/finance company rate gap differs across bias quintiles. The model also include the loan-level characteristics Z_l. We estimate the model using the 414 loans held by 153 households with a loan from both a bank and a finance company.[36]

Table 5 shows results from these models. Model (1) includes only the dummy variable $Finco_{lh}$ indicating whether the loan is from a finance company. Model (2) includes the bias/finco interactions, with the unbiased interaction omitted. Models (3)-(5) include a wider set of interactions that may capture whether finance companies price loans differently based on other observable variables such as assets, debt, amount borrowed, maturity, product purchased with the loan, or default risk. The inclusion of these interactions has little effect on the main result.

The results suggest a strong link between bias and the gap between bank and finance company loan rates. In most specifications the bias/finco interactions are positive and significant for quintiles 4 and 5. On average, the high-bias rate gap is 500-700 basis points higher than the unbiased rate gap.

4.5 Bias, High Rates, and Foregone Consumption

Table 6 translates the higher interest rates paid by biased consumers on finance company loans into monthly payments, total interest costs, and foregone consumption in 1983 dollars. The third row shows the predicted difference in loan payments for high bias and unbiased consumers, for the four most common finance company loans in our sample: a home improvement loan, a new car loan,

[36] While this is a small share of the total sample of loans, it is not rare for households to hold loans from both types of lender. Among households with more than one loan, 36% hold both a finance company and bank loan.

a used car loan and a household durable (e.g., furniture) loan.[37] The table shows that monthly payments increase by $3 to $19 (in 1983 dollars) for typical loans. These translate into large ($137 to $894) increases in interest costs over the life of the loan. Because the change in interest costs is not discounted, we also estimate foregone consumption by calculating how much more a high-bias household could borrow at unbiased rates, holding monthly payments constant (row 5). If we start with the median new car loan of $6,000 the calculation implies that high-bias households could borrow $682 more, or 11% of the base.[38] The consumption loss is smaller for shorter-term loans, falling to 5% ($46) on the typical eighteen-month household durable loan. But in any case the potential impact of bias on household consumption can be substantial.

5 Interpreting the Results: Competition, Pricing and Regulation

Our two main results are that consumers display a substantial cognitive bias when inferring APRs from loan payments, and that this bias is correlated with market outcomes. This leaves several questions. First, how does the correlation between bias and rates exist in a free-entry market? Second, how do finance companies segment biased consumers? Third, why does the relationship between bias and rates exist for finance companies but not banks? We address these questions in turn.

5.1 The Bias/Rate Relationship in Competitive Equilibrium

How does the correlation between bias and interest rates exist in a free-entry market? The correlation between bias and loan rates suggests that lenders can effectively price discriminate on bias. As mentioned earlier, both theory and empirics have shown that discrimination can persist in a highly competitive market, if consumers have shopping or switching costs. The question is whether our setting has the requisite frictions. We do find some evidence that biased consumers are more likely to be credit constrained as measured by several different proxies. This suggests that biased borrowers may face relatively high switching costs.[39] Biased borrowers are also significantly less

[37] We have estimated the model in Table 4 separately for the subsamples of each loan type, and can not reject the restriction that the bias/rate relationship is equal across loan (product) type. We are unable to estimate the fixed effect model in Table 5 for such subsamples, as it is only identified when households hold multiple loans of each type from different sources; there are too few such households.

[38] For comparison's sake, in the 2004 SCF the median new car loan was $23,000.

[39] The correlation between bias and credit constraints is strong unconditionally, but gets substantially weaker (and insignificant) when we condition on household characteristics such as income, education and debt.

likely to comparison shop for loans.[40] It therefore seems plausible that the sufficient conditions for price discrimination on bias are satisfied. We stress however that high rates for biased borrowers do not necessarily imply high profits; the *ex ante* costs associated with attracting or serving biased borrowers might offset any *ex post* benefits.

5.2 Banks, Finance Companies and Loan Pricing

How do finance companies segment biased consumers? We begin with some relatively general evidence on how banks and finance companies appear to price loans differently, motivated by the notion that if finance companies can segment consumers based on bias, they should also segment relatively effectively based on other household characteristics. Table 7 suggests that loan rates from finance companies are generally more sensitive to household characteristics than bank rates. The table presents summary results from models similar to those estimated in Table 4, columns 3 and 4—the split sample cross-section regressions of interest rate on household and loan characteristics. To highlight the effect of observable characteristics we omit the bias quintile variables.[41]

The first panel of Table 7 shows the raw variation in rates across households, presents measures of fit, and decomposes the r-squared of the regression for each lender type. The raw variance in rates is similar across banks and finance companies. The r-squared decomposition also shows an important similarity: loan characteristics explain variation in rates almost equally in bank and finance company subsamples. But household characteristics explain significantly more variation in loan rates for finance companies than for banks. Given that banks offer a wider range of products and hence probably have access to more information on (prospective) borrowers than finance companies, it appears that finance companies use information more intensively and/or offer richer menus of contracts that end up sorting borrowers in ways that are correlated with observables.

The second panel of Table 7 provides further evidence on the flexibility of rates across lender types. We first estimate rate regressions for each lender type (again, omitting bias), and calculate fitted values from the regressions. Then we calculate fitted values out of sample: using the finance company coefficients for bank customers, and vice versa. This exercise predicts rates for the bank (finance company) consumers if they obtained finance company (bank) loans. The results confirm

[40] For a subsample of households who recently borrowed for a large ($500+) purchase, the SCF asks whether the respondent "tried to obtain information" about credit terms from alternative lenders before borrowing. Roughly one-third of households respond 'yes' to this question. A probit model suggests that, conditional on our full set of household and loan characteristics, a household in the fourth or fifth bias quintile is 7-9 percentage points less likely to have shopped than one in the unbiased quintile.

[41] The results including bias are very similar.

greater flexibility in rates for finance companies, as measured by the standard deviation of fitted values. In the counterfactual where bank loan holders get loans from finance companies (Panel B, second column), the projected standard deviations of rates are much greater than when the actual bank loan coefficients are used (first column), regardless of which combinations of explanatory variables are included. A similar pattern holds when we consider the sample of finance company loans: these rates vary more using the finance company coefficients (fourth column) than using the bank coefficients (third column). Figures 7 and 8 illustrate these differences by plotting the histograms of fitted values for bank loan customers, using both household and loan characteristics as explanatory variables. To facilitate comparison the histogram equates the mean of each distribution. The distribution using finance company coefficients (Figure 7) is much more dispersed, suggesting that finance companies are much more flexible in their pricing, conditional on observable characteristics.

These results suggest that the bias/rate relationship is not driven by the fact that biased consumers are more likely to borrow from finance companies in an unconditional sense (as in Table 3). Finance companies price more flexibly, even conditional on borrower mix. This is also evident in our main regression specifications, where we condition on borrower characteristics. Table A1 provides relatively direct evidence that any selection of biased borrowers into finance companies is weak, once we condition on other characteristics (Columns 3 and 4).

5.3 Finance Companies and Loan Pricing: Cross-firm v. In-firm Segmentation

What does a finance company do with a given borrower mix? Do *most* finance companies price discriminate on bias, or is our finding that finance company loan pricing varies with bias *on average* driven by a subgroup of lenders? While we can not be definitive, some results mentioned earlier bear repeating. Finance companies are often tied to a particular product (e.g., new v. used cars) or brand (e.g., the "captive" auto finance companies). We do not find a different pattern of results if we estimate our models separately by product type, or if we condition on the presence of a finance company/retailer affiliation. While these results do not rule out specialization *across* finance companies in dealing with biased customers, it is certainly consistent with an important role for the segmentation of biased borrowers *within* lenders. It seems likely that a given finance company prices loans differently for borrowers with different degrees of bias.

5.4 Lenders and the Regulatory Environment

Why then do banks and finance companies price loans differently? As noted above, we find evidence of differential pricing across lender type, not only with respect to payment/interest bias (Tables 4

and 5) but also with respect to household characteristics more generally (Table 7).

While we lack hard evidence on what drives these differences, our discussions with industry experts and regulators point to regulatory constraints. Although the Truth in Lending Act (and various other consumer protection laws) apply to all lenders, banks are subject to routine examination and supervisory audits under separate federal banking agency rules. Consequently banks face regular reporting requirements and supervision that measures compliance with Truth in Lending (TILA) and with laws prohibiting discrimination and redlining, among others. Violations by banks can be addressed through enforcement actions, burdensome examinations, and revocation of a bank's charter. Finance companies, in contrast, face a different environment. Jurisdiction for finance company TILA violations lies with the Federal Trade Commission (FTC). The FTC is a law enforcement agency that conducts targeted investigations and brings court and administrative actions. While the FTC brings many such actions, it does not have routine audit or examination authority over the tens of thousands of consumer lenders under its purview. Consequently, finance companies face no regular reporting or examinations on TILA and related requirements. The legal penalties that the FTC can impose on finance companies can be severe, but there is little threat of closure.[42]

Not surprisingly, evidence from regulatory authorities and our casual inspection of loan marketing practices suggests that finance companies are presently more likely than banks to emphasize payments, and also to violate TILA by suppressing APRs.[43] However the National Commission on Consumer Finance (1972, p. 169) documents that the Law's passage was motivated by practices at *both* banks and finance companies (see Figures 9 and 10 for examples). This suggests TILA has had a greater effect on banks.

Descriptive and anecdotal evidence thus suggest that: (1) prior to Truth-in-Lending both banks and finance companies emphasized payments and suppressed APRs, and (2) Truth-in-Lending spurred fuller compliance by banks. Segmentation of the bias/rate relationship by lender type appears to be driven by a response to regulatory constraints.

[42] Penalties include injunctions or cease and desist orders; consumer redress; and civil penalties But finance companies are licensed under state law, and hence may remain in business even if found to be in substantial noncompliance by FTC and/or the courts.

[43] The FTC web site's section on "Commission Enforcement Activities Under Truth in Lending" provides annual summaries of enforcement activity. See Fortney (1986) for summary evidence on our sample period, and GAO (2004) for some more recent evidence. We are unable to find a single recent instance of a comparable action against a bank.

6 Discussion and Conclusion

Both the AFA and AEA Presidential addresses in 2006 suggest that cognitive bias can play an important role in intertemporal household decision making and related market outcomes (Campbell 2006; McFadden 2006). We follow this line of inquiry and find that consumers display payment/interest bias: a tendency to underestimate the interest rate associated with a loan principal and repayment schedule. Payment/interest bias is pervasive and affects the terms of loans held by borrowers. Our results also suggest that the institutional environment is important. The rate/bias relationship exists only for finance company loans and not for bank loans. This is consistent with anecdotal evidence that banks and finance companies market loans differently. Finance companies also seem to be more flexible in contracting than banks, even after holding customer mix constant. Neither competition among lenders or adaptive behavior by biased households completely counteracts the effects of bias. Nor does Truth-in-Lending law, although its differential enforcement seems to generate the observed segmentation across lender type. In all, our results support the emerging view that consumer biases shape competition and market equilibria, even in highly competitive markets.

Our results seem applicable to other financial product markets. While there is little evidence of a bias/rate relationship for mortgage loans in our data,[44] the mortgage market has evolved considerably since 1983. Finance companies now originate a large share of mortgage loans, and contracts are now far more flexible with respect to maturities, pricing, and downpayment requirements. Recent work suggests that some consumers are susceptible to other biases in financial calculations. For example, mortgage holders seem to systematically underestimate the degree to which their variable rates can rise.[45] They may also have biased views of how much their monthly payments will change following a change in their APR (Consumer Federation 2004). Our work motivates exploration of the relationship between such biases and the apparent prevalence of costly mistakes in mortgage markets.[46] Regulators and watchdog groups also perceive payments marketing to be a significant problem in new markets, and have taken corrective actions related to subprime mortgages, payday loans, auto title loans, and refund anticipation loans. Payment/interest bias may also be closely

[44] In collecting mortgage information the SCF asks for payments, maturity, principal and rate. Consumers' responses to these questions are extremely accurate—it appears that they have very good information about their mortgage rates. Nor are rates related to bias in our sample (though nearly all mortgage loans are made by banks in our data).

[45] See Bucks and Pence (2006) for evidence on this point and others related to what consumers know about house values and mortgages.

[46] See Campbell (2006) and Agrawal, Driscoll, and Laibson (2006) for discussions of refinancing, and Woodward (2003) for a discussion of the the points vs. rate trade-off.

related to other cognitive problems that affect savings and consumption.[47] More work documenting biases, their interactions, and their relationship to market outcomes would be useful.[48]

More directly we believe our findings raise two sets of important questions. First, have payment/interest bias and its impacts persisted in the face of technological innovations? Today's consumers have access to cheap calculators and shopping aids. But marketing and loan contracts have become far more sophisticated as well. New data collection will be required to assess the contemporary importance of payment/interest bias.

Second, what are the welfare implications of any bias? Viewed as pure price discrimination, segmenting based on payment/interest bias might be efficient. But DellaVigna and Malmendier (2004, 2006) show that biased decision making can lead to market inefficiency if consumers are not (fully) aware of their bias. Several of our results are consistent with limited awareness. Biased consumers could avoid paying higher rates by borrowing from banks rather than finance companies, but do not seem to pursue this strategy on average (e.g., Table A1). Biased consumers could limit their borrowing or withdraw from the formal market altogether, but our related work suggests that the opposite is true (Stango and Zinman 2006). There we do find evidence that biased consumers are more likely to seek outside financial advice. But it is not clear that this advice actually improves loan market outcomes. In sum it seems likely that consumers are not readily able to identify or correct their payment/interest bias.

A critical piece of missing evidence is whether biased consumers actually behave differently if and when they are aware of the true cost of borrowing. Without such information we can not estimate the welfare effects of bias in the market, or recommend any (particular) corrective action. Strategic surveys, lab experiments, and field experiments would help reveal the mechanics of biased decision-making and identify (the need for) any welfare-improving interventions.

---

[47] See Lusardi and Mitchell (2006) on compound interest and savings decisions, and Shafir, Diamond, and Tversky (1997) and Fehr and Tyran (2001) for survey and lab evidence on money illusion.

[48] E.g., as noted earlier, in related work we are exploring the implications of payment/interest bias for borrowing and savings decisions and long-run wealth accumulation (Stango and Zinman 2006).

References

[1] Agarwal Sumit, John C. Driscoll, and David Laibson (2006). "When Should Borrowers Refinance Their Mortgages?," working paper.

[2] Ahlee, Hahn and Ulrike Malmendier (2006). "Do Consumers Know Their Willingness to Pay? Evidence from EBay Auctions," working paper.

[3] Angrist, Joshua D. and Alan B. Krueger (1999). "Empirical Strategies in Labor Economics." *Handbook of Labor Economics, Volume 3*. O. Ashenfelter and D. Card, Elsevier Science B. V. 3: 1277-1366.

[4] Attanasio, Orazio P., Penelopi K. Goldberg and Ekaterini Kryiazidou (2004). "Credit Constraints in the Market for Consumer Durables: Evidence from Micro Data on Car Loans." Working Paper.

[5] Ausubel, Lawrence and Haiyan Shui (2004), "Time Inconsistency in the Credit Card Market," mimeo.

[6] Benjamin, Daniel and Jesse Shapiro (2006), "Who is 'Behavioral'? Cognitive Ability and Anomalous Preferences," mimeo.

[7] Bernheim, Douglas (1995). "Do Households Appreciate their Financial Vulnerabilities? An Analysis of Actions, Perceptions, and Public Policy." *Tax Policy and Economic Growth*. Washington, DC, American Council for Capital Formation.

[8] Bernheim, Douglas (1998). "Financial Illiteracy, Education and Retirement Saving." *Living with Defined Contribution Pensions*. O. Mitchell and S. Schieber. Philadelphia, University of Pennsylvania Press.

[9] Bertrand, Marianne, Dean Karlan, Sendhil Mullainathan, Eldar Shafir and Jonathan Zinman (2005). "What's Psychology Worth? A Field Experiment in the Consumer Credit Market," working paper.

[10] Borenstein, Severin (1985), "Price Discrimination in Free-Entry Markets," *RAND Journal of Economics* 16(3): 380-97.

[11] Borenstein, Severin (1991), "Selling Costs and Switching Costs: Explaining Retail Gasoline Margins," *RAND Journal of Economics* 22(3): 354-69.

[12] Borenstein, Severin and Nancy Rose (1994), "Competition and Price Dispersion in the U.S. Airline Industry," Journal of Political Economy 102(4):653-83.

[13] Bucks, Brian and Karen Pence (2006). "Do Homeowners Know Their House Values and Mortgage Terms?" Federal Reserve Board of Governors Finance and Economics Discussion Series.

[14] Campbell, John Y. (2006). "Household Finance," *Journal of Finance*, forthcoming.

[15] Campbell, Jamie and Qilin Xue (2001). "Cognitive Arithmetic Across Cultures," *Journal of Experimental Psychology: General*, 130(2), 299-315.

[16] Cohen, Mark (2005). "Imperfect Competition in Auto Lending: Subjective Markup, Racial Disparity, and Class Action Litigation," working paper.

[17] Consumer Federation of America (2004). "Lower-Income and Minority Consumers More Likely to Prefer and Underestimate the Risks of Adjustable Rate Mortgages," press release, July 26.

[18] Daheane, Stanislas (1997). *Number Sense*.

[19] Day, George S. and William K. Brandt (1974). "Consumer Research and the Evaluation of Information Disclosure Requirements: The Case of Truth in Lending," *Journal of Consumer Research* 1:21-33.

[20] DellaVigna, Stefano and Ulrike Malmendier (2004). "Contract Design and Self-Control: Theory and Evidence," *Quarterly Journal of Economics*, CXIX, 353-402.

[21] DellaVigna, Stefano and Ulrike Malmendier (2006). "Paying Not to Go to the Gym," *American Economic Review*, 96(3).

[22] DeStefano, Diana and Jo-Anne LeFevre (2004). "The Role of Working Memory in Mental Arithmetic," *European Journal of Cognitive Psychology*, 16(3), 353-386.

[23] Ellison, Glenn (forthcoming). "Bounded Rationality in Industrial Organization," in Whitney Newey, Torsten Persson, and Richard Blundell eds., *Advances in Economics and Econometrics: Theory and Applications*, Ninth World Congress (Cambridge, UK: Cambridge University Press).

[24] Fehr, Ernst and Jean-Robert Tyran (2001). "Does Money Illusion Matter?" *American Economic Review*, 91(5), 1239-1262.

[25] Fortney, Anne (1986). "Consumer Credit Compliance and the Federal Trade Commission: Continuing the Process of Education and Enforcement," *The Business Lawyer* 41 (May): 1013-1022.

[26] Gabaix, Xavier and David Laibson (2006). "Shrouded Attributes, Consumer Myopia and Information Suppression in Competitive Markets," *Quarterly Journal of Economics*, 121 (2), May 2006, p. 505-540.

[27] General Accounting Office (2004). "Consumer Protection: Federal and State Agencies Face Challenges in Combating Predatory Lending." Report to the Chairman and Ranking Minority Member, Special Committee on Aging, U.S. Senate.

[28] Glaeser, Edward (2004). "Psychology and the Market," *American Economic Review* 94(2): 408-413.

[29] Holmes, Thomas (1989), "The Effects of Third-degree Price Discrimination in Oligopoly, *American Economic Review* 79(1): 244-50.

[30] Juster, F. Thomas and Robert Shay (1964). "Consumer Sensitivity to Finance Rates: An Empirical and Analytical Investigation," National Bureau of Economic Research Occasional Paper no. 88.

[31] Kahneman, Daniel (2003). "Maps of Bounded Rationality: Psychology for Behavioral Economics," *American Economic Review* 93(5): 1449-1475.

[32] Karlan, Dean and Jonathan Zinman (2005). "Elasticities of Demand for Consumer Credit." Working Paper.

[33] Kinsey, Jean and Ray McAlister (1981). "Consumer Knowledge of the Costs of Open-End Credit," *Journal of Consumer Research* 15(2): 249-270.

[34] Knittel, Chris and Victor Stango (2003). "Price Ceilings, Focal Points, and Tacit Collusion: Evidence from Credit Cards," *American Economic Review* 93(5), December 2003: 1703-1729.

[35] Lusardi, Annamaria and Olivia Mitchell (2006). "Financial Literacy and Planning: Implications for Retirement Well-being," Working Paper.

[36] Maki, Dean (1996). "Portfolio Shuffling and Tax Reform," *National Tax Journal* 49(3): 317-29.

[37] McFadden, Daniel (2006). "Free Markets and Fettered Consumers," *American Economic Review* 96(1): 5-29.

[38] Moore, Danna (2003). "Survey of Financial Literacy in Washington State: Knowledge, Behavior, Attitudes, and Experiences." Technical report 03-39, Social and Economic Sciences Research Center, Washington State University.

[39] National Commisssion on Consumer Finance (1972). *Consumer Credit in the United States.* Washington, D.C.: U.S. Government Printing Office.

[40] Oster, Sharon and Fiona Scott Morton (2005). "Behavioral Biases Meet the Market: The Case of Magazine Subscription Prices," *Advances in Economic Analysis and Policy,* 5(1).

[41] Parker, George and Robert Shay (1974). "Some Factors Affecting Awareness of Annual Percentage Rates in Consumer Installment Credit Transactions," *The Journal of Finance* 29(1): 217-225.

[42] Peters, Ellen, Daniel Vastfajall, Paul Slovic, C.K. Mertz, Ketti Mazzocco and Stephan Dickert (2006). "Numeracy and Decision Making." *Psychological Science* 17(5): 407-413.

[43] Pence, Karen (2002). "Nature or Nurture: Why Do 401(k) Participants Save Differently than Other Workers?," *National Tax Journal* 55(3):597-615.

[44] Shafir, Eldar, Peter Diamond, and Amos Tversky (1997). "Money Illusion." *Quarterly Journal of Economics*, 112(2): 341-74.

[45] Shepard, Andrea (1991), "Price Discrimination and Retail Configuration," Journal of Political Economy 99(1): 30-53.

[46] Simmons, Carolyn and John G. Lynch, Jr. (1991). "Inference Effects without Inference Making? Effects of Missing Information on Discounting and Use of Presented Information," J*ournal of Consumer Research* XVII: 477-91.

[47] Stango, Victor and Jonathan Zinman (2006). "Fuzzy Math and Red Ink: Payment/Interest Bias, Financial Decisions, and Wealth Accumulation," Working Paper.

[48] Woodward, Susan (2003). "Consumer confusion in the Mortgage Market," mimeo, Sand Hill Economics.

A Tables

Table 1. Interest Rate Quiz answers by quintile of.payment/interest bias

	Quintile					
	1	2	3	4	5	n/a
Stated payment total (P+I)	1136	1200	1255	1398	1772	1492
Actual APR	24	35	44	66	114	76
Add-on rate	14	20	26	40	77	49
Perceived APR	16	18	17	18	15	16
Bias relative to APR	9	16	27	48	99	—
Bias relative to add-on	-2	2	9	22	62	—
Share correct relative to APR	0.05	0	0	0	0	—
Share supplying add-on rate	0.60	0.42	0.09	0.02	0	—
Range of bias in quintile	[-5, 14]	[14, 20]	[20, 33]	[33, 63]	[63, 290]	—
n	679	713	662	729	612	689

Notes: Sample includes all households in the SCF. Rates and bias are in hundreds of basis points. Quintiles are by bias relative to APR. "n/a" bin includes households who fail to supply either a repayment total or a perceived APR, or report neither. Observations per quintile differ due to clustered values of bias.

Table 2: Bias and selected household characteristics

	Quintile					
	1	2	3	4	5	n/a
Share with:						
No high school education	0.13	0.12	0.20	0.24	0.33	0.54
HS education only	0.24	0.26	0.34	0.32	0.34	0.26
Some college	0.20	0.23	0.22	0.22	0.17	0.11
College degree or beyond	0.43	0.40	0.24	0.21	0.16	0.09
Age	49	46	45	44	46	56
Income	35796	32800	23000	22000	17100	9754
Financial assets	15525	7800	3241	2000	1225	649
Total debt	9156	12434	4812	5302	2085	0
Consumer debt:						
All households	623	1373	710	800	400	0
Households with debt	3886	4012	2769	2580	2041	1180

Notes: Sample includes all households in the SCF. Quintiles are by bias relative to APR. "n/a" bin includes households who fail to supply either a repayment total or a perceived APR, or report neither. Dollar amounts are medians within quintile, in 1983 dollars.

Table 3. Bias, borrowing, lender type, and loan terms

	Bias Quintile					
	1	2	3	4	5	n/a
All households:						
Loans per household	1.67	1.81	1.68	1.63	1.50	1.48
Share of households with finance company loan	0.27	0.35	0.34	0.35	0.42	0.46
Share of household debt from finance companies	0.18	0.23	0.23	0.26	0.35	0.38
Average loan rate	13.0	14.3	14.3	14.9	15.5	15.9
Total Loans in Bias Quntile	257	330	245	330	229	137
HHs with both bank and finco loan:						
Loans per household	2.79	2.88	2.72	2.49	2.64	2.34
Share of household debt from finance companies	0.39	0.39	0.36	0.41	0.49	0.42
Average bank loan rate	15.8	16.5	15.9	16.1	15.4	16.3
Average finance company loan rate	16.6	17.8	17.9	18.9	18.2	20.8
Total Loans in Bias Quntile	57	122	79	76	60	20

Notes: Top panel includes households with at least one consumer installment loan. Second panel includes households with at least one loan from a bank and at least one loan from a finance company. Number of loans is household's total outstanding number of consumer installment loans. Share of debt is measured using amount originally borrowed on all outstanding loans. Average loan rates are weighted by original amount borrowed. Rates are in percentage points.

Table 4: Bias and Loan Rates in the Cross-Section

	(1)	(2)	(3)	(4)
Bias quintile 2	0.65	0.67	2.44*	0.23
	(0.59)	(0.59)	(1.33)	(0.74)
Bias quintile 3	0.24	0.26	3.37**	-0.53
	(0.69)	(0.69)	(1.56)	(0.88)
Bias quintile 4	0.81	0.82	4.17***	-0.28
	(0.69)	(0.69)	(1.56)	(0.93)
Bias quintile 5	0.62	0.61	2.61	0.44
	(0.71)	(0.71)	(1.68)	(0.94)
No quiz answer	0.63	0.63	3.63**	0.10
	(0.87)	(0.87)	(1.23)	(0.94)
Add-on rate	0.58	0.58	2.80**	0.03
	(0.55)	(0.55)	(1.23)	(0.71)
Loan from finance company		0.39		
		(0.40)		
N	1438	1438	480	958
R-squared	0.31	0.31	0.57	0.36

Notes: Each column reports the results of a single OLS regression using a version of the cross-section model specified in Section 4.3. Dependent variable in each case is the level interest rate on a consumer installment loan. Covariates are those listed in the row headings, plus the full set of household- and loan-specific controls listed in the Data Appendix. Observations are at the loan level. Standard errors are clustered by household. Models (1) and (2) include loans from banks and finance companies. Model (3) includes only loans from finance companies. Model (4) includes only loans from banks.

*** - significant at 1% ** - significant at 5% * - significant at 10%

Table 5: Bias, Lender Type, and Loan Rates with Household Fixed Effects

	(1)	(2)	(3)	(5)
Loan from finance company	-2.23	-8.22	-5.78	-1.74
	(2.04)	(9.60)	(9.60)	(12.83)
Bias quintile 2 * finance company	2.59	3.29	2.92	4.06
	(2.38)	(2.42)	(2.45)	(2.96)
Bias quintile 3 * finance company	2.76	3.52	3.66	3.38
	(2.54)	(2.58)	(2.57)	(3.01)
Bias quintile 4 * finance company	3.64	5.05**	5.49**	6.61**
	(2.53)	(2.57)	(2.60)	(3.18)
Bias quintile 5 * finance company	5.58*	6.27**	6.86**	7.15**
	(2.91)	(2.94)	(3.00)	(3.48)
No quiz answer * finance company	-5.21	-7.17	-4.41	13.64
	(6.09)	(6.60)	(7.66)	(14.01)
Controls:				
Household fixed effects	yes***	yes***	yes***	yes***
Loan characteristics	yes***	yes***	yes***	yes***
Loan characteristic/finco interactions	no	yes***	yes***	yes***
Default risk/finco interactions	no	no	yes (0.31)	yes (0.49)
Asset/finco, debt/finco interactions	no	no	no	yes (0.70)
r-squared (within)	0.39	0.43	0.44	0.48

Notes: Each column reports the results of a single OLS regression using a version of the fixed effects model specified in Section 4.4. Dependent variable in each case is the level interest rate on a consumer installment loan. Covariates are those listed in the row headings. Standard errors are clustered by household. Sample includes loans held by households with at least one bank loan and at least one finance company loan. Observations are at the loan level; the sample analyzed here contains 414 loans held by 153 households.

*** - significant at 1% ** - significant at 5% * - significant at 10%

Table 6. Effects of Payment/Interest Bias for Typical Loans in the Sample

	Home Imp.	New Car	Used Car	Durable
Monthly payment (unbiased)	$88.42	$163.96	$102.53	$61.92
Monthly payment (high bias)	100.68	182.58	111.49	64.76
Difference in monthly payment	12.26	18.62	8.96	2.85
Increased interest, life of loan	735.44	893.92	322.48	51.26
Implied loan increase	526.79	681.51	262.10	46.00
Implied loan increase (%)	14%	11%	9%	5%

Notes: Typical loans have sample median amount borrowed and maturity. Median home improvement loan is $3800 repaid over 60 months. Median new car loan is $6000 repaid over 48 months. Median used car loan is $3000 repaid over 36 months. Median household durable loan is $1000 repaid over 18 months. "Unbiased" rate is 14%, "high bias" rate is 20%. "Implied loan increase" is the increase in amount borrowed at the unbiased rate that renders monthly payments equal to those at the high bias rate.

Table 7. Channels, Observables and Loan Rates

Panel A: Observable characteristics and variance in rates

	Bank	Finco
Mean rate	16.81	18.77
S.d. of rate	5.05	5.72
R–squared:		
HH chars only	0.17	0.29
Loan chars only	0.18	0.22
HH and loan chars	0.31	0.45

Panel B: Fitted values within and across subsamples

Subsample =>	Bank		Finco	
Coefficients =>	Bank	Finco	Bank	Finco
HH chars only:				
Mean fitted value	16.96	19.00	17.03	18.97
s.d. of fitted value	2.14	3.53	2.42	3.10
Loan chars only:				
Mean fitted value	16.90	17.16	17.45	18.78
s.d. of fitted value	2.07	4.30	2.02	2.68
Both HH and loan chars:				
Mean fitted value	16.96	17.45	17.23	17.93
s.d. of fitted value	2.83	5.17	2.95	4.79

Notes: Statistics in Panel A refer to subsamples from Models (3) and (4) of Table 4. "HH chars" are the demographics and credit constraints, and the financial attitudes variables listed in the Data Appendix. "Loan chars" are the other loan characteristics. Panel B fits rates across lender type. For example, the first column takes the bank loan coefficients from model (4) and uses them to fit rates for the bank loan subsample. The second column fits rates for the same subsample using the finance company coefficients from model (3).

Table A1: Bias and Debt from Finance Companies

	(1)	(2)	(3)	(4)
Bias quintile 2	0.09**	0.04	0.03	0.00
	(0.04)	(0.03)	(0.04)	(0.03)
Bias quintile 3	0.08*	0.05	-0.02	-0.01
	(0.04)	(0.04)	(0.05)	(0.03)
Bias quintile 4	0.08*	0.10***	-0.02	0.03
	(0.04)	(0.04)	(0.05)	(0.04)
Bias quintile 5	0.16***	0.19***	0.02	0.03
	(0.04)	(0.05)	(0.05)	(0.05)
No quiz answer	0.20***	0.23***	-0.03	0.03
	(0.05)	(0.05)	(0.05)	(0.05)
Add-on rate	-0.00	-0.00	0.00	0.01
	(0.03)	(0.04)	(0.04)	(0.03)
Shops on payments	0.13***	0.08**	0.08**	0.04*
	(0.02)	(0.02)	(0.03)	(0.02)
N	1985	1985	1985	1985

Notes: Each column reports the results of a probit model. Observations are at the household level, for the subsample of households with at least one loan. In models (1) and (3) the dependent variable is equal to one if the household has any loans from a finance company; in Models (2) and (4) the dependent variable is equal to one if the household has all of its loans from finance companies. Models (1) and (2) include only the shown covariates, while Models (3) and (4) include the full set of household-level covariates listed in the data appendix.

B Data Appendix

The data source is the Survey of Consumer Finances (SCF), conducted every three years by the Board of Governors of the Federal Reserve. The SCF surveys approximately 4000 households, oversampling those with high income. We include the following household- and loan-level control variables in our primary specifications:

Demographics and Credit Constraints

Age: Dummy variables for household head ages 16-24, 25-34, 35-44, 45-54, 55-64, and 65+

Income: Natural logarithm of household income in 1983

Race: Dummy variables for white, Hispanic, African-American, Asian and Eskimo/Native American

Gender: Dummy variable

Marital status: Dummy variable for married

Employed: Dummy variable equal to one if household head is employed full-time

Self-employed: Categorical variable equal to one if household head is self-employed

Industry: Categorical variable indicating which of 37 industries employs household head

Occupation: Categorical variable indicating which of 9 occupational positions household head holds

State: State of primary residence of household head

Creditworthiness

Assets: Categorical variable indicating household asset decile

Debt: Categorical variable indicating household debt decile

Homeowner: Dummy variable equal to one if household owns home

Mortgage holder: Dummy variable equal to one if household carries a mortgage

Credit card: Dummy variable equal to one if household holds at least one credit card

Recent late payment: Dummy variable equal to one if household has at least one late debt payment within the last year

Recently turned down: Dummy variable equal to one if household has been turned down after applying for credit within the last year

Loan shops on payments: See footnote 32 for a detailed definition.

Financial Attitudes

General credit attitude: Categorical variable measuring whether household head believes borrowing on the installment plan is a "good/mixed/bad" idea.

Risk attitude: Categorical variable measuring willingness to trade risk for return

Liquidity attitude: Categorical variable measuring willingness to trade liquidity for return

Loan Characteristics

Maturity: Categorical variable for loan maturity in months (one category for each month)

Amount borrowed: Natural logarithm of amount borrowed, in 1983 dollars

Product/Purpose: Categorical variable indicating which of 58 product categories was purchased with the loan

Year of origination: Year in which the loan was originated

B.1 Figures

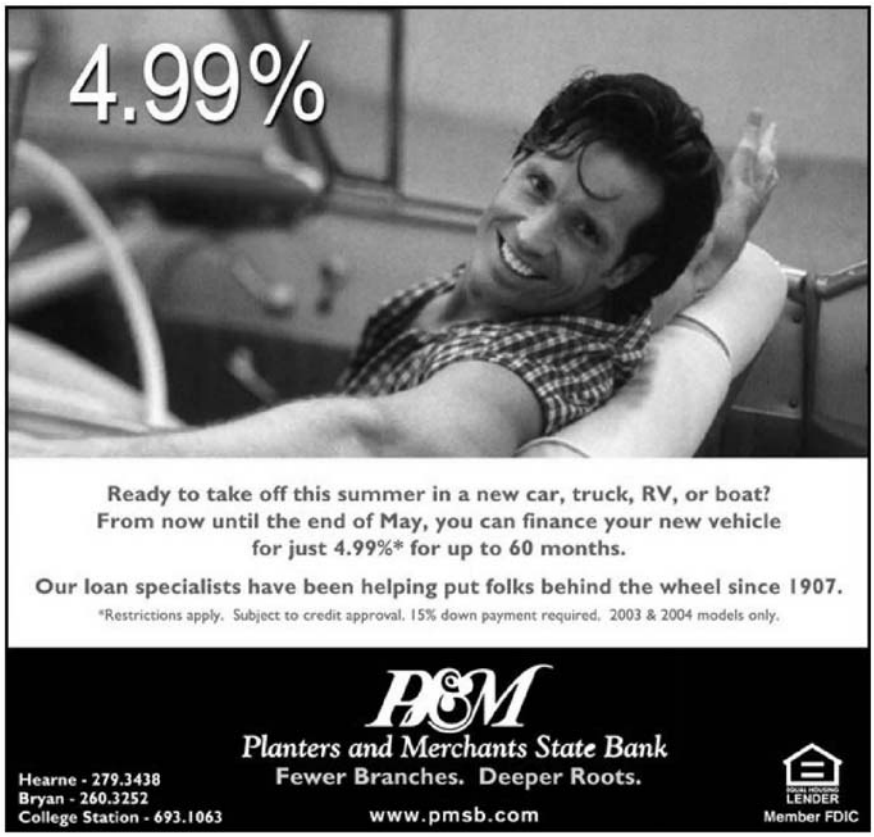

Figure 1. Bank loan ad emphasizing APR.

Figure 2. Finance company ad emphasizing payments.

Number in star shape indicates "vehicles available at this price."

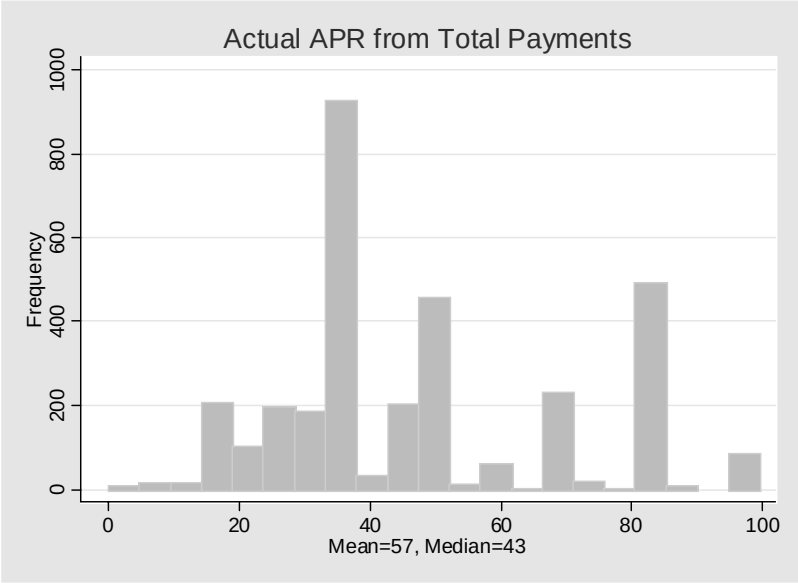

Figure 3

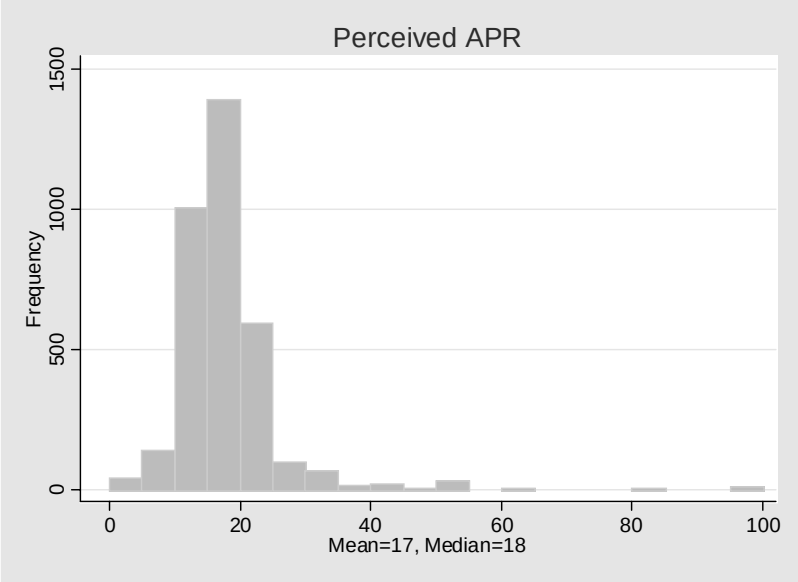

Figure 4

Notes: Figure 3 shows APRs calculated (by the SCF) from the lump sum answers to the first interest rate quiz question. Figure 4 shows respondents' perceptions of the APRs represented by their lump sum answers.

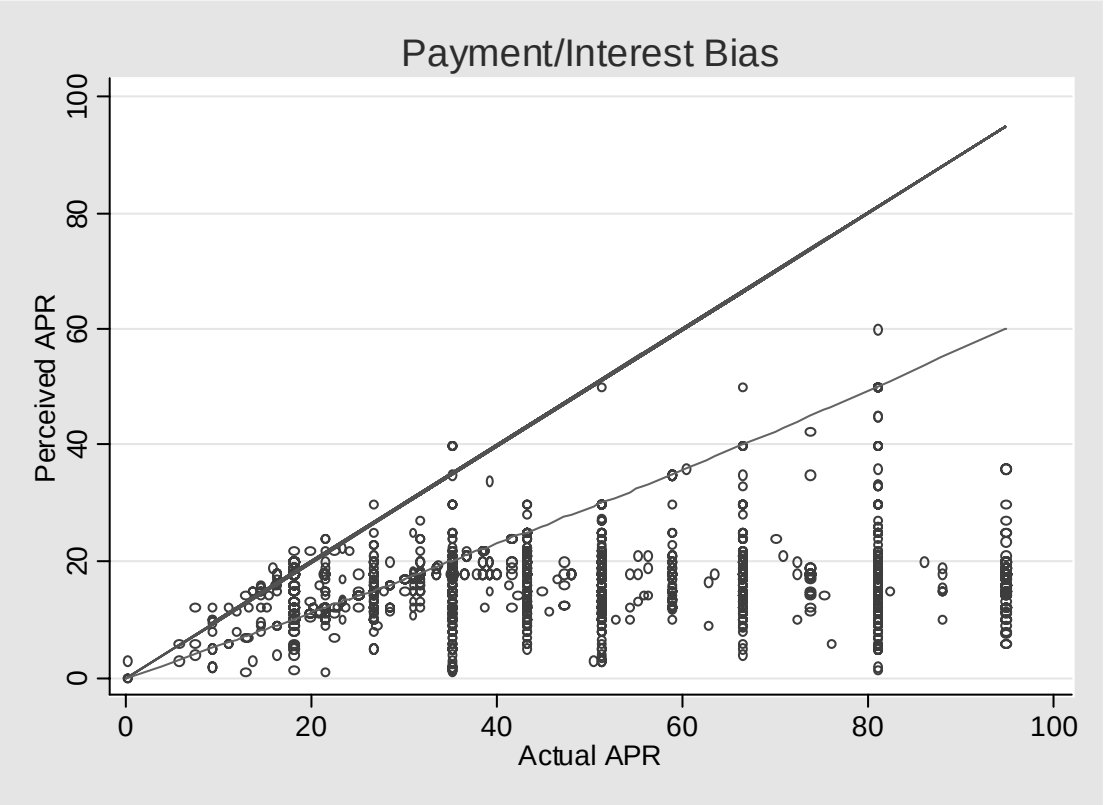

Figure 5

Notes: Circles represent responses relating actual to perceived APRs. Accurate responses lie on the 45° (top) line; payment/interest bias is the vertical distance between a response and the 45° line. Flatter line shows correspondence between actual APR and add-on rate.

Figure 6

Notes: APR offers are for 48 months; payment-based offers are for 60 months (detailed in small print, not shown). Small print also lists down payment associated with payment-based offer, but not APR.

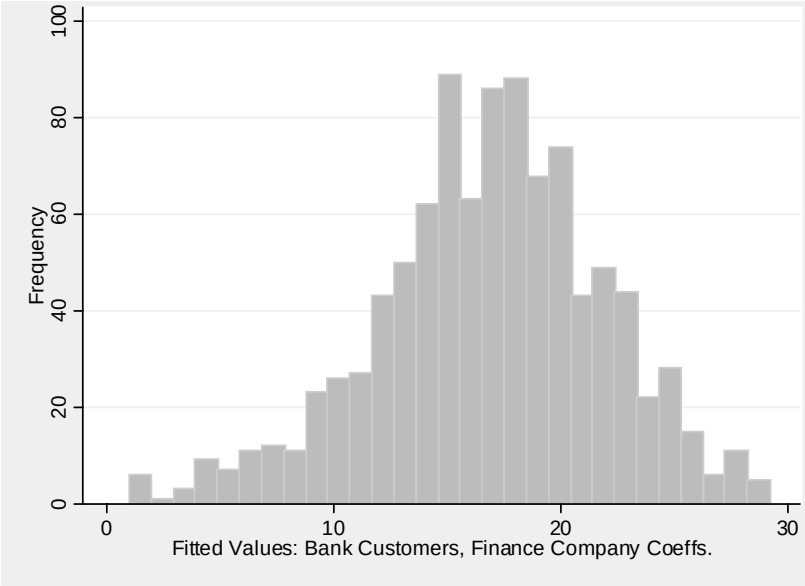

Figure 7

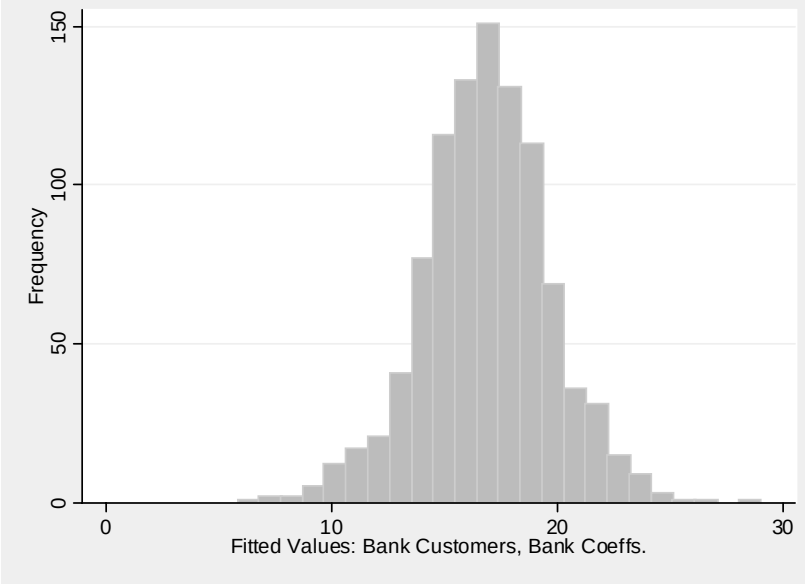

Figure 8

Notes: Figure 7 shows fitted values for the subsample of loans obtained from banks, using the finance company loan coefficients. Figure 8 shows fitted values for the subsample of loans obtained from banks, using the bank loan coefficients. Models used to obtain fitted values include the full set of household- and loan-specific covariates, but not the bias variables.

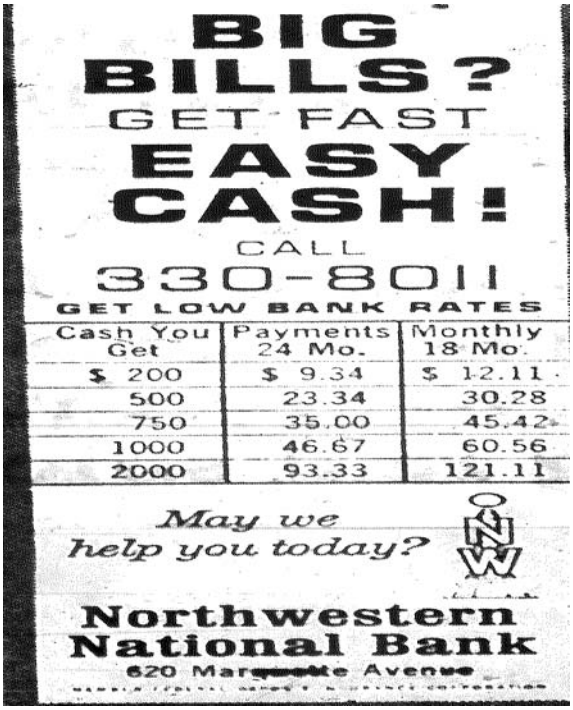

Figure 9. Pre-TILA bank ad emphasizing monthly payments.

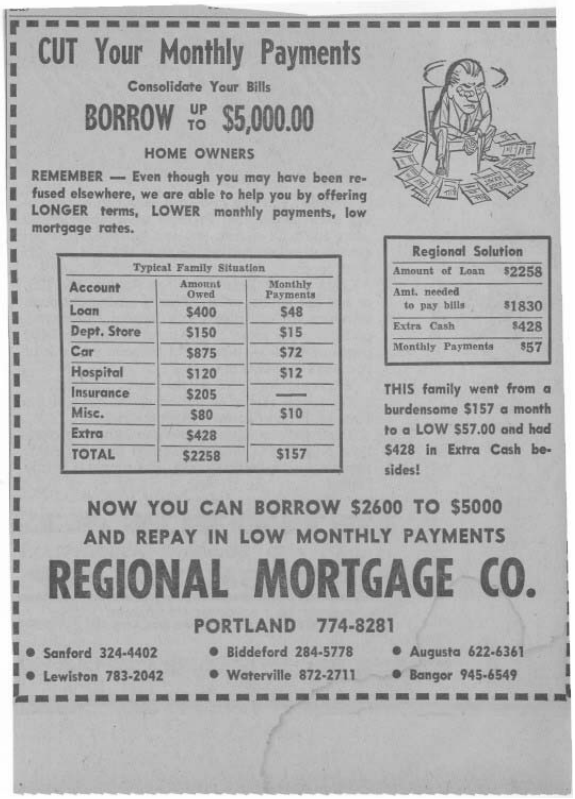

Figure 10. Pre-TILA finance company ad emphasizing payments.