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ABSTRACT

We assess whether borrowers know their mortgage terms by comparing the distributions of these variables in the household-reported Survey of Consumer Finances (SCF) to the distributions in lender-reported data. We also examine the characteristics of SCF respondents who report not knowing these contract terms. Although most borrowers seem to know basic mortgage terms, borrowers with adjustable-rate mortgages appear likely to underestimate or to not know how much their interest rates could change. Borrowers who could experience large payment changes if interest rates rose are more likely to report not knowing these contract terms. Difficulties with gathering and processing information appear to be a factor in borrowers' lack of knowledge.

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1. Introduction

Adjustable-rate mortgages (ARMs) have become more prevalent in recent years. From 2001 to 2007, the share of prime mortgages outstanding that were adjustable-rate rose from 8 to 14 percent, and the share of subprime adjustable-rate mortgages rose from 36 to 53 percent.¹ Adjustable-rate mortgages have also become more complex, as variants such as hybrid, option, and interest-only ARMs have become more widely available.²

Borrowers may prefer adjustable-rate mortgages because the initial payments are generally lower than on fixed-rate mortgages. However, borrowers may be exposed to more risk with these mortgages because the payments can change as interest rates in the

overall economy fluctuate. Borrowers may benefit from this risk when interest rates fall, as their payments can decrease without the hassle of refinancing. But when interest rates rise—either because overall interest rates rise or because the mortgage's initial lower-rate period expires—borrowers may be hurt. Borrowers who are not prepared for higher payments and cannot lower these payments through refinancing may be forced to reduce their spending or default on their mortgages. Indeed, interest rate hikes at ARM reset dates have been fingered as a possible culprit in the rise in mortgage delinquencies that accelerated in mid-2007.³

Whether borrowers are prepared for increases in their monthly payments depends, in part, on whether they understand the terms of their mortgage contracts. In this paper, we examine whether borrowers appear to understand their contract terms and consider why borrowers might not understand some terms fully. Although other studies have noted that borrowers appear to have difficulty with some aspects of their mortgage contracts, we are the first to consider explicitly whether borrowers understand the interest rate risk embedded in ARMs.

We begin by comparing the distributions of mortgage terms as reported by borrowers in the 2001 Survey of Consumer Finances (SCF) to the distributions of the same contract terms as reported by lenders in two data sources: the 2001 Residential Finance Survey (RFS) and the 2001 administrative records of large mortgage servicers as compiled by LoanPerformance (LP) Corporation. These comparisons do not establish conclusively whether borrowers understand loan terms, as borrower errors could offset each other in such a way that the borrower- and lender-reported distributions still align. However, we interpret differences in the borrower- and

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¹ Source: LoanPerformance. Numbers shown are the December values.

² These ARM types offer different payment options for an initial period, usually 2 to 10 years, after which the payment is re-set to the fully amortizing amount that ensures that the balance is paid off by the end of the mortgage. In a hybrid ARM, the interest rate is fixed for the initial period. In an interest-only ARM, the payment covers only the interest for the initial period. In an option ARM, borrowers have the choice during the initial period to make a fully amortizing payment each month, an interest-only payment, or a smaller minimum payment.

³ See Mayer et al. (forthcoming) for a discussion of the factors behind the rise in mortgage defaults.

lender-reported distributions as evidence that some borrowers are uncertain (or at least, forgetful) of specific mortgage terms. To provide further evidence on the prevalence of borrower uncertainty, we also examine the share of SCF respondents who reported not knowing each mortgage term. These comparisons provide insight into the extent of measurement error in borrower-reported mortgage data as well as into borrower knowledge of their loan terms.

We find that borrowers appear to report the broad terms of their mortgages reasonably well. The distributions of mortgage types (ARM vs. fixed), current payments, and maturities reported by borrowers in the SCF match lender-reported distributions well, and very few borrowers report on the SCF that they do not know these mortgage terms. However, borrowers with adjustable-rate mortgages appear to underestimate or to not understand the extent of possible rate increases from year to year or over the life of the loan. Many SCF borrowers in 2001 believed that their interest rates could increase by one percentage point or less a year, whereas lenders indicate that interest rates on most ARMs outstanding in 2001 could increase by two or more percentage points. In addition, more than one-third of adjustable-rate borrowers responded "don't know" when asked what their mortgage interest rate caps were. This high level of borrower uncertainty suggests that ARM borrowers might be taken by surprise in the event of a sharp rise in interest rates.

We conclude the paper by exploring why borrowers with adjustable-rate mortgages might not know the extent to which their interest rates could change. As a framework for thinking about this question, we assume that borrowers report not knowing their interest rates because the cost of acquiring this information exceeds the benefit. We consider this framework to be a loose interpretation of the "rational inattention" model formalized by Sims (2003), Mankiw and Reis (2002), and Reis (2006).⁴

This framework nests at least four possible explanations. First, if interest rate changes will have only a minor effect on borrower finances, the benefit from acquiring this information may be small. Second, borrowers may find it costly to acquire or mentally process information about their mortgages. Third, if borrowers are short-sighted, they may be more concerned about their immediate payments than how their payments might change in the future. Finally, if borrowers have a bias toward optimism, they may believe that they are unlikely to experience financial misfortune and so perceive little benefit from learning about possible interest rate increases.

To test these hypotheses, we first simulate the effect of a rise in interest rates on mortgage payments relative to income. We use the simulation results to identify the groups that might be most affected by a rise in interest rates. We then explore which groups are most likely to report that they don't know their per-period interest rate caps, lifetime interest rate caps, or ARM indexes. We relate the patterns in the types of borrowers who are more likely to report that they don't know these ARM terms to the predictions of the four hypotheses.

The results suggest that all four explanations potentially play at least a small role in explaining borrower knowledge of their loan terms. However, we find the most support for the second explanation: ARM borrowers who do not know the terms governing their future interest rates tend to be those who find it more costly to gather and process financial information. Our simulation indicates that borrowers in this category are also more likely to experience large payment increases relative to income in the event of an interest rate rise. These findings suggest that the ARM borrowers that are most financially vulnerable to an increase in interest rates, as

measured by our simulation, are also those with the least understanding of their contract terms.

2. Data and methods

2.1. Data sources

Our empirical work is based on three data sources. The Federal Reserve's *Survey of Consumer Finances* is the most comprehensive and highest quality dataset available on U.S. household wealth. The survey has been conducted every three years since 1983, with a consistent survey design since 1989. The survey design features both a standard, geographically based random sample and an oversample of households likely to be relatively wealthy. These wealthier households are over-represented in the data in order to improve the accuracy of estimates of the types and amount of wealth concentrated among wealthy families. We use the SCF-provided nonresponse-adjusted analysis weights to make the estimates representative of the overall U.S. household population.

Data on the survey are reported by households, and missing data are imputed using multiple imputation techniques.⁵ The 2001 survey included 4442 households, of whom 3166 were homeowners, 1562 had fixed-rate mortgages, and 238 had adjustable-rate mortgages.⁶ For our analysis of why many borrowers with ARMs do not understand the extent to which their interest rates can change, we add an additional 538 borrowers with first-lien ARMs from the 1998 and 2004 waves. Kennickell et al. (2000), Aizcorbe et al. (2003), and Bucks et al. (2006) provide overviews of the 1998, 2001, and 2004 data. We use the revised data released February 27, 2006.

The *Residential Finance Survey* is conducted every ten years by the U.S. Census Bureau. The survey is designed to be representative of all non-farm residential properties in the United States. It included data on 16,929 properties in 2001. Households selected for the RFS sample are required by law to participate, unlike the SCF, where participation is voluntary. As might be expected given this difference in legal status, response rates are higher in the RFS than the SCF (86 percent vs. 68 percent).⁷ U.S. Census (2005) describes the 2001 RFS data in greater detail. We use the revised data released October 5, 2005.

The RFS collects general information on the property and the mortgage from the homeowner and detailed information on the mortgage from the lender. The lender-reported data are missing for roughly half of all mortgages. These data could be missing because the borrower did not provide information about the mortgage lender or because the mortgage had been sold and the RFS staff could not find the current servicer. In other cases, the RFS was able to find the current servicer, but the servicer did not have access to the original loan documents and therefore could not report all variables. Thus loans that the originating lender did not sell—that is, loans kept in portfolio—are likely to be over-represented in the RFS data. The RFS does not impute missing data for most lender-reported variables, although it imputes missing data for some household-reported variables. Our tabulations of RFS variables exclude observations with missing values.

The data from *LoanPerformance Corporation* are collected from administrative records of large mortgage servicers. The mortgages

⁵ The SCF imputes five values for each missing data value, thereby allowing users to estimate the uncertainty associated with the imputation. All counts shown in the paper are averages across the five imputations. See Kennickell (1991, 1998) for more information on multiple imputation in the SCF.

⁶ We classify an additional 77 mortgages with balloon features as balloon mortgages. These mortgages may have either fixed or adjustable interest rates.

⁷ The RFS response rate is taken from U.S. Census (2005, Table 25, p. D-16). The SCF response rate is for the geographically based random sample only and is taken from Kennickell (2003, p. 4).

⁴ See DellaVigna (forthcoming) for a summary of the related "limited attention" literature.

are originated by a wide variety of institutions and include both prime and subprime loans. All mortgages guaranteed by Fannie Mae or Freddie Mac are represented in the data. In total, the December 2001 data covered about 80 percent of U.S. home mortgages. Because LoanPerformance does not release the loan-level microdata underlying this product, the numbers reported here are based on aggregated tabulations provided by the company. All numbers shown are weighted averages of the estimates from the prime and subprime databases, with a weight of 0.88 given to the prime estimates and 0.12 to the subprime estimates.⁸

In the RFS and SCF data, we limit the sample to first mortgages backed by owner-occupied primary residences and exclude mortgages backed by mobile homes, farms or ranches.⁹ In the LoanPerformance data, seven percent of the mortgages are backed by non-owner-occupied properties, including second homes and investment properties, and less than one percent are second liens. Because the data are aggregated, we cannot exclude these mortgages, but the small number of such mortgages suggests that they do not have a substantial effect on the estimates.

2.2. Comparison of distributions

We begin by comparing the distributions of mortgage variables in the borrower-reported SCF data with the distributions in the lender-reported LoanPerformance and RFS data. We assume that the lender data represent the distribution of *actual* mortgage characteristics and the borrower-reported data represent the distribution of borrower *perceptions* of these variables. We assume that the lender data are more accurate because they are drawn from administrative records. We interpret disparities between the lender- and borrower-reported distributions as evidence of borrower misperception of their mortgage terms. This interpretation is strong, as lender data may also contain inaccuracies, and factors such as differences in sample design, question wording, and in how lenders and borrowers interpret questions may also underlie some of the disparities. We note throughout the paper when we think these other factors may explain some of the discrepancies.

Non-matching distributions may also indicate non-random measurement error in the data. If so, then regression coefficients estimated on these data may be biased; Black et al. (2003) and Bollinger and Chandra (2005) provide a more rigorous discussion of these issues. Our paper thus provides a case study of measurement error in survey data.

Of course, if borrowers make offsetting errors, the distributions could match even if many borrowers are confused about their mortgage terms. Our comparisons are similar to those of Gustman and Steinmeier (2004) and Chan and Stevens (2008), who compare employer and worker reports of pension characteristics and find widespread differences between these reports. Pensions, like mortgages, are complex financial contracts, and the discrepancies between the worker and employer reports can be large. These studies, like ours, assume that the administrative data (employer-reported in their studies, lender-reported in ours) are more accurate than the individual-reported data. Unlike our study, these

authors are able to compare each worker's report with the corresponding employer report, and they find these reports can be quite different even when the overall distributions match well.

In our comparison of distributions, we consider the possibility that these distributions might diverge for reasons other than borrower confusion, such as differences in sample coverage. By virtue of its sample design, the Survey of Consumer Finances may have more comprehensive coverage than the Residential Finance Survey of the mortgages of wealthier households. The RFS data may be less likely to include mortgages that have been sold or securitized, whereas securitized mortgages are likely overrepresented in the LoanPerformance data.

The distributions may also diverge because the surveys treat missing data differently. The SCF imputes all missing data. The RFS imputes one value for most borrower-reported missing data but does not impute values for most lender-reported missing data. Consequently, we exclude from our tabulations of RFS lender-reported variables the 50 to 60 percent of observations with missing values for these variables. As a result, the lender-reported RFS data may have a greater selection problem than the SCF.¹⁰

For the variables for which imputed values are provided, we include them in our estimates unless otherwise noted because the imputations may mitigate non-response bias. The imputations also provide the survey staff's best assessment of the true values of these variables. We assume that the distribution of a given borrower-reported variable, including imputed values, matches the distribution that would have been obtained if respondents who did not answer a question instead provided their best estimates.¹¹

These sample coverage and missing values issues raise the concern that the RFS data are not representative of mortgages overall. As a rough gauge of the severity of these issues, we compare the distributions of mortgage terms common to our two lender-reported data sets—the RFS and Loan Performance (Tables 1 and 3)—and the distributions of demographic variables common to the RFS and the SCF (appendix Table A). As we discuss later in the paper, the similarity of the mortgage term distributions on the lender-reported data sets suggests that the RFS data represent mortgages fairly accurately.

The demographic comparisons are also mostly reassuring. The age and race distributions on the RFS and SCF align almost exactly: both indicate that the older spouse was between the ages of 45 and 64 in about 57 percent of households with first-lien mortgages, and that in about 80 percent of these households, the head of the household was white.¹² Although the SCF weights take age and race into account, the weights in the RFS do not. The age, race, and income distributions in the RFS are essentially similar when calculated over all mortgage borrowers or over the smaller set of borrowers for whom the RFS could find the mortgage lender.

Income in the SCF, however, is higher than that in the RFS throughout the distribution. All individual income components, such as wage income and investment income, are also higher in the SCF than the RFS (not shown). Removing capital gains income—which is not recorded in the RFS—from the SCF income has almost no effect on the discrepancy. We cannot determine whether the income distributions do not align because the SCF sample includes

⁸ These weights are calculated by Federal Reserve staff from Mortgage Bankers' Association data.

⁹ We exclude loans backed by mobile homes because many are installment loans that more closely resemble auto loans than traditional residential mortgages. This sample restriction excludes 58 mortgages on the SCF (7 of which are ARMs) and 217 mortgages on the RFS (28 of which are ARMs). We exclude farms and ranches on the SCF because the RFS survey design excludes these dwellings. We also drop 3 reverse mortgages and 111 "other" mortgages on the RFS. Although one or more reverse mortgages exist on the SCF, they cannot be identified from the information in the public data set. We include them in our tabulations so that other users can replicate our results.

¹⁰ More specifically, by dropping missing values in the RFS, we assume that the probability of non-response does not depend on the characteristics of the household, lender, or mortgage, and consequently statistics based on non-missing data are unbiased estimates. Similarly, when we include imputed values, we assume that the imputation model and covariates capture systematic differences in the probability of non-response so that the imputed values are unbiased estimates of the missing responses.

¹¹ This is a weaker assumption than assuming that the imputed values for a given respondent are unbiased.

¹² Demographic data on the RFS, unlike data on mortgage terms, are reported by the borrowers.

more affluent households or because the SCF is more successful in getting households to reveal their income truthfully. Nonetheless, we show later in the paper that higher-income households are more knowledgeable about their mortgage terms than lower-income households. This income discrepancy then, if anything, likely biases us against finding that borrowers misunderstand their terms.

We determine whether the differences between the SCF and RFS estimates are statistically significant by bootstrapping the variance of each estimate for each dataset and then summing the two variances.¹³ We calculate bootstrap standard errors of sampling variances in the SCF using the replicates and weights provided on the SCF web site that are constructed in accordance with the sample design. We also incorporate imputation uncertainty into the estimates, again using tools provided by the SCF.¹⁴ We do not make these adjustments for the RFS because analogous tools are not available.

2.3. Tabulation of "don't know" responses

As supplementary evidence of borrower uncertainty, we examine the share of SCF borrowers who responded "don't know" when asked about a given mortgage term. These tabulations are based on the detailed flags provided for nearly all SCF variables, which indicate whether a response has been edited or imputed, as well as the reason why an imputed value was originally missing. These codes also indicate when a respondent gave a range for a dollar value, such as the amount of the mortgage payment.¹⁵ The response rates are calculated over all households for whom the question was applicable; only the 65 percent of SCF homeowners who had mortgages, for example, were asked whether their mortgages were fixed or adjustable-rate.

Responses are divided among six categories:

- Original value: the original value provided by the respondent was deemed acceptable and included in the survey.
- Range: the respondent provided a range rather than an actual value, or auxiliary information used in the editing process was sufficient to bound the value. This option is available only for questions for which the response is a dollar value.
- Edited value: the respondent provided enough information in auxiliary or related fields that the correct value could be inferred by the SCF staff with a high degree of confidence.
- Missing due to editing: either an implausible value was set to a missing value or insufficient information was available for a given variable when the appropriate question sequence was altered in editing.
- Don't know: the respondent did not know the answer to the question. This category includes both households who did not know the answer to a particular question and households who were not asked the question because they did not know the answer to a question earlier in the sequence. Households who did not know whether their mortgages were fixed or ad-

justable, for example, were not asked the index to which their mortgages were tied.

- Refused: the respondent refused to answer the question. As with the "don't know" responses, this category includes both households who refused to answer a question and households who were not asked a question because they refused to answer a question earlier in the sequence.

We assume that most "don't know" responses reflect genuine uncertainty on the part of respondents. Respondents may have other reasons for replying "don't know," such as privacy concerns or impatience with the length of the interview. However, as long as the share of respondents who respond "don't know" for these other reasons is relatively constant across questions, variation in "don't know" rates across questions will reflect differences in uncertainty.¹⁶

The "don't know" tabulations also complement the comparisons of data distributions. Questions with high rates of "don't know" responses may also be questions for which respondents were more likely to guess at the answer, and these guesses may be less accurate. When we observe high shares of "don't know" responses, we assume that borrower confusion plays a role in any disparities between the lender- and borrower-reported data.

Importantly, although we interpret "don't know" as indicating that respondent did not know the answer to a question at the time of the survey, we do not assume that respondents never knew the answer. Respondents who do not know the index to which their ARMs are linked, for example, may have known this information when they signed the mortgage contracts. Similarly, borrowers who reported "don't know" when asked at the time of the survey may be able to readily obtain this information if financial or other circumstances prompted them to do so.¹⁷

3. What do borrowers know about their mortgages?

We first examine terms and features applicable to all mortgages and then focus on features specific to adjustable-rate mortgages.

3.1. Terms and features common to all first mortgages

Borrowers appear to have a reasonably accurate understanding of the broad terms of their mortgages (Table 1). The borrower-reported Survey of Consumer Finances data and lender-reported Residential Finance Survey and LoanPerformance data agree that roughly 85 percent of first mortgages were fixed-rate in 2001, slightly more than 10 percent were adjustable-rate, and the rest were balloon.¹⁸ Borrowers and lenders also agree that about a quarter of mortgages in the aggregate had an amortization period of 15 years or fewer in 2001, between 64 and 70 percent had a 26–30 year amortization period, and the rest were scattered across different categories. Likewise, annual mortgage payments align closely throughout the distribution, with a median of \$8520

¹³ To ensure that our results are robust to the method used to estimate the standard errors, we also experimented with bootstrapping the variance of the difference. The estimates from this approach are comparable to our preferred approach. Bootstrapping the difference, however, does not easily allow for incorporation of the imputation variance.

¹⁴ Thus, the total estimated variance for each SCF estimate is $(6/5)6(imputation\ variance) + (sampling\ variance)$, where *imputation variance* is the variance of the SCF point estimates across the five imputations and *sampling variance* is the bootstrapped variance estimate. See Kennickell (2000) for more information on variance estimation procedures in the SCF and Montalto and Sung (1996) for a discussion of calculating point estimates and variances in the SCF.

¹⁵ See Kennickell (1997) for further description and analysis of range responses in the SCF.

¹⁶ This assumption that the share of "don't know" responses generated by reasons other than ignorance is relatively constant across questions may be particularly plausible for our variables because they are on similar topics and are asked together at the same point early in the interview. Kennickell (1997) notes that the number of "don't know" responses dropped substantially when the SCF introduced an expanded set of range responses in the 1995 survey. This finding suggests that "don't know" responses for these variables had been capturing some degree of respondent uncertainty.

¹⁷ SCF respondents are encouraged but not required to consult records, such as loan documents, during the interview.

¹⁸ Adjustable-rate mortgages may be a bit more prevalent in the RFS because lenders are more likely to hold these mortgages on their books than securitize them.

Table 1

Comparison of mortgage terms across data sets: all first mortgages

	LoanPerformance (December 2001) Administrative data	Residential Finance Survey (2001) As reported by lenders	Survey of Consumer Finances (2001) As reported by borrowers
<i>Mortgage type</i>			
Fixed	86	83	87***
Adjustable	11	13	11**
Balloon	3	5	2***
<i>Amortization period (years)</i>			
1–15	23	25	27**
16–20	4	4	5**
21–25	1	1	2***
26–30	70	69	64***
30+	2	1	1
<i>Annual mortgage payment</i>			
10th percentile	3840	3840	
25th percentile	5760	5760	
Median	8520	8400	
75th percentile	13,200	12,400	
90th percentile	18,000	19,200	
<i>Interest rate (percentage points)</i>			
10th percentile	6.50	6.38**	
25th percentile	6.88	6.88	
Median	7.50	7.25***	
75th percentile	8.25	8.00***	
90th percentile	9.88	9.00***	
<i>Year of loan origination</i>			
2001	20	12	11
2000	9	11	11
1999	14	16	16
1998	19	16	14**
1997	6	7	8
Earlier	31	38	40**
<i>Government guaranteed?</i>			
FHA	10	11	23***
VA or other	3	7	7
Conventional	87	81	70***
<i>Private mortgage insurance</i>			
Yes	16	12	23***
No	84	88	77***

Notes. Mortgages backed by mobile homes, farms or ranches are excluded from the SCF and RFS tabulations. RFS and SCF estimates are weighted with sampling weights. Differences in proportions relative to the RFS are statistically different from zero at the ***1 percent level or **5 percent level. Standard errors are bootstrapped with 999 replicates; those for the SCF are drawn in accordance with the sample design and adjusted for imputation uncertainty.

in the RFS data and \$8400 in the SCF data.¹⁹ These three data sources are not benchmarked against each other, so the close correspondence is not an artifact of the weighting scheme of any of the data sets.

The fact that less than 1 percent of borrowers said that they did not know these mortgage terms (Table 2) provides additional evidence that borrowers have a good grasp of these concepts. As a robustness test of our results, we verify that a similarly small share of borrowers in the pooled 1998, 2001, and 2004 surveys reported not knowing these terms (appendix Table B). Earlier studies have also established that borrower knowledge of payment amount and amortization period appears accurate (Fronczek and Koons, 1976; Lam and Kaul, 2003), a finding that may reflect past borrower experience with these concepts from other loans such as automobile or student loans.

¹⁹ The RFS and SCF measures are not completely comparable because the SCF estimate includes homeowner insurance payments for some households. Further, the mortgage payment variable on the RFS combines reports from both lenders and borrowers.

The distributions of interest rates are also similar in the SCF and RFS, with a median of 7.5 percent in the RFS and 7.25 percent in the SCF, although the SCF estimates are lower than the RFS estimates by a statistically significant amount.²⁰ The weighted average coupon (the average interest rate weighted by the outstanding loan balance) in the SCF matches the aggregate estimate calculated by the Bureau of Economic Analysis (BEA) almost exactly: 7.35 in the SCF, compared with 7.36 in the BEA.²¹

Nonetheless, borrowers appear less informed about interest rates than other basic terms, as 9 percent of SCF borrowers responded “don’t know” when asked their interest rates. The share of “don’t know” responses is higher among ARM borrowers, with 18 percent of these borrowers stating that they don’t know their interest rates compared with 8 percent of fixed-rate borrowers. The borrower-reported American Housing Survey (AHS) shows a similar pattern as the SCF: the overall distribution of interest rates appears plausible (Lam and Kaul, 2003), but a fair share of borrowers either report their interest rates inconsistently over time or report implausibly low values (Lam and Kaul, 2003; Campbell, 2006; Schwartz, 2006). Interest rates are also reported inconsistently over time in the Survey of Income and Program Participation (Leary et al., 2004).

The distributions align less closely for other broad mortgage terms. The RFS and SCF show similar distributions for the “year of loan origination” variable, but LoanPerformance shows more 2001 originations. It is possible that the SCF and RFS may show fewer 2001 loans because households could have taken out mortgages in 2001 after completing the survey.²² In an attempt to address this issue, we dropped from the LoanPerformance data mortgages originated in the fourth quarter of 2001, but the data still show more 2001 originations.

The SCF shows more mortgages guaranteed by the Federal Housing Administration (FHA)—23 percent—than do the lender-reported data sets (10 percent). This discrepancy is a puzzle. Borrower confusion does not seem to be the answer, as only 4 percent of SCF respondents responded “don’t know” to this question, and borrowers do not appear to misreport FHA guarantees in the American Housing Survey (Lam and Kaul, 2003).²³

The share of mortgages carrying private mortgage insurance (PMI) is also substantially higher in the SCF (23 percent) than in the LoanPerformance data (16 percent) or the RFS (12 percent). PMI coverage may be higher in the LP data than the RFS because mortgages securitized by Fannie Mae and Freddie Mac—which require PMI for mortgages with loan-to-values (LTVs) over 80 percent—are overrepresented in the LP data. The high coverage rates in the SCF, however, may also stem from borrowers confusing these products with other types of insurance. For example, although PMI is not typically required of borrowers with LTVs below 80 percent, 81 percent of SCF borrowers who report PMI also report a current LTV below 80 percent.²⁴ Nine percent of borrowers responded “don’t know” to the PMI question or reported a value deemed inaccurate by the SCF staff.

²⁰ The SCF and RFS estimates do not include upfront fees or points. We exclude imputed interest rates from the RFS calculation because the imputed values seem implausible: 63 percent of these imputed values are set to an interest rate of 5 percent and 11 percent are set to 20 percent. In the unimputed data, less than 1 percent of mortgages have interest rates with these values.

²¹ We use the 2001 third quarter number from the BEA, available at <http://www.bea.gov/national/xls/mortfax.xls>.

²² SCF interviews were conducted June–December 2001; RFS interviews were conducted April 2001–January 2002.

²³ Lam and Kaul (2003) document that the 1995 SCF also shows a higher FHA market share than the corresponding AHS.

²⁴ Some of these borrowers may be reporting PMI coverage that has been canceled.

Table 2Reporting rates for mortgage characteristics: 2001 SCF (*Data reported by borrowers*)

Variable (percent applicable)	Original value	Range	Edited value	Don't know	Refused	Missing due to editing
<i>Mortgage terms and features</i>						
Adjustable rate (65%)	98.8			0.8	0.2	0.2
Amortization period (65%)	98.4		0.1	0.9	0.3	0.3
Amount of regular payment (64%)	90.7	5.5	0.3	0.8	2.2	0.6
Annual interest rate (65%)	89.8		0.6	9.0	0.3	0.3
Year mortgage obtained (65%)	97.8		0.1	0.9	0.4	0.7
Government guarantor (19%)	95.7			3.8	0.2	0.3
Private mortgage insurance (45%)	91.0			5.6	0.2	3.2
<i>Adjustable rate mortgage terms and features</i>						
Frequency rate can change (7%)	82.4		0.2	16.7	0.5	0.2
Negative amortization allowed (7%)	93.6			4.9	0.5	1.0
Maximum rate can rise at once (7%)	62.1		0.7	35.1	1.1	1.0
Maximum rate can be charged (7%)	55.6			41.1	2.2	1.0
Original interest rate (7%)	75.7			20.2	2.2	1.9
On what index does it depend (6%)	69.1			28.3	0.4	2.2
Convertible mortgage (7%)	83.0		<0.1	15.5	0.5	1.0

Number of obs.: 2931

Notes. Estimates are weighted with sample weights. Mortgages backed by mobile homes, farms, and ranches are excluded. Reporting rates are calculated over the sample of observations for which the question was applicable.

3.2. Terms and features specific to adjustable-rate mortgages

Our comparisons across data sets and tabulations of response rates both suggest that borrowers are aware of some ARM-specific terms. Respondents on both the RFS and the SCF report that the interest rate can change monthly on about 15 percent of ARMs and annually on 50 to 60 percent of ARMs (Table 3).²⁵ The three datasets also agree that only a small number of mortgages have negative amortization features, although this result should be interpreted with particular caution due to substantial differences in how these questions were asked across surveys.²⁶ Response rates suggest that borrowers generally believe that they know these two terms (Table 2), with 17 percent reporting that they do not know how often their interest rates can change and 5 percent indicating that they are unaware of whether their mortgages include negative amortization features. These response rates are a similar magnitude when we pool the 1998 and 2004 data with the 2001 data (appendix Table B).

In contrast, ARM borrowers seem to underestimate significantly how much their interest rates can increase. Forty percent of SCF respondents believe that their interest rates can increase, at most, one percentage point or less per period. The RFS suggests that less than 2 percent of ARMs have caps this low. Instead, 47 percent have caps of two percentage points per period, and most of the rest have caps higher than two percentage points.

SCF respondents also appear to underestimate the lifetime caps on their interest rate changes.²⁷ Fifty-seven percent of SCF respondents believe the cap on lifetime changes is less than five percentage points. The RFS data, though, indicate only 6 percent of ARMs have lifetime caps this low. Instead, 51 percent of ARMs in the RFS have a cap of five to six percentage points. A further 25 percent

of ARMs in the RFS have a lifetime cap greater than 12 percentage points or no cap at all; only 2 percent of SCF respondents believe that their mortgage fits in this category.²⁸ These discrepancies suggest substantial, non-classical measurement error in the data on per-period and lifetime interest rate caps as well as considerable borrower confusion about these terms.

Other studies have also documented borrowers' tendencies to underestimate interest rates or their potential financial consequences (AFL-CIO, 2007; Campbell, 2006; Consumer Federation of America, 2004; Lusardi and Tufano, 2008; Schwartz, 2006; Stango and Zinman, 2007). We assess later whether a lack of financial sophistication or a behavioral tendency towards optimism might underlie this underestimation. Another possibility that we do not examine in this paper is that borrowers underestimate their interest rates because of shame at the size of their potential rate increases. Martinelli and Parker (forthcoming), for example, suggest that embarrassment may explain the tendency of applicants to a poverty-alleviation program in Mexico to report falsely that their dwellings have running water. We are not aware, however, of any significant stigma associated with mortgage interest rate caps.

Beyond underestimating the possible extent of their interest rate changes, many ARM borrowers in the SCF report that they don't know these contract terms. Thirty-five percent of ARM borrowers did not know the value of the per-period cap on interest rate changes.²⁹ Similarly, 44 percent of respondents (not shown in Table 2) reportedly did not know the values of one or both of the two variables used to calculate the lifetime cap on interest rate changes. Specifically, 41 percent of respondents did not know the maximum interest rate that could be charged over the life of the loan, and 20 percent did not know the interest rate at origination.

Borrowers also appear uncertain about what indexes their ARMs are tied to and whether their ARMs are convertible to fixed-rate mortgages. The LoanPerformance and RFS data agree that approximately two-thirds of adjustable-rate mortgages are

²⁵ Collapsing the SCF responses to these categories required several assumptions, but the results are robust to minor permutations of these assumptions.

²⁶ The SCF asks, "When the interest rate on your mortgage changes, does the size of your monthly payment also change?" The RFS asks, "Does this mortgage allow negative amortization?" However, the RFS only asks this question of the 33 respondents who answered "yes" to the question, "Can the regular principal and interest payments change during the life of the mortgage other than through a change in the interest rate?" We run the tabulation over this sample only; the results would likely differ if the RFS asked the question for all ARMs.

²⁷ This question differs substantially on the SCF and RFS. The SCF asks, "What is the highest the rate can go over the course of the loan?" and "What was the interest rate on this mortgage when you first got it?" We construct the lifetime cap as the difference between these two rates. The RFS asks, "What are the caps on the interest rate change over the life of the mortgage?"

²⁸ Some ARM borrowers may be unaware of the caps on interest rate changes because negative amortization features of the mortgages mask the interest rate changes. However, the RFS and SCF distributions remain quite different even when mortgages with negative amortization features are excluded.

²⁹ Of this 35 percent, 33.5 percentage points came from households who did not know the value of the cap, and 1.5 percentage points came from households who did not know if their mortgages were adjustable (1.2 percentage points) or if they had a mortgage (0.3 percentage points), and thus were never asked about the cap. As noted above, we assume that these households would not know the value of the cap if asked.

Table 3

Comparison of mortgage terms across data sets: adjustable-rate first mortgages

	LoanPerformance (December 2001) Administrative data	Residential Finance Survey (2001) As reported by lenders	Survey of Consumer Finances (2001) As reported by borrowers
<i>Frequency with which interest rate can change</i>			
Monthly		15	15
Quarterly or every six months		10	15
Annually		60	52**
3 or 5 years		12	14
Other		3	5
<i>Negative amortization allowed</i>			
Yes	9	16	13
No	91	84	87
<i>Caps on interest rate changes per period</i>			
Less than 1 ppt.		1	12***
1 ppt.		0.5	28***
Between 1 & 2 ppts.		5	3
2 ppts.		47	23***
Between 2 & 9 ppts.		18	15
9 ppts +		10	11
No caps		18	7***
<i>Caps on lifetime interest rate changes</i>			
Less than 5 ppts.		6	57***
5 ppts.		25	6***
5.01–6 ppts.		26	17**
6.01–11.99 ppts.		9	18**
12 ppts.		8	0.3***
Greater than 12 ppts.		13	2***
No caps		12	0***
<i>ARM Index</i>			
Treasury bills	67	64	14***
Cost of Funds Index	19	15	4***
LIBOR or CD	14		7
Prime			48
Consumer Price Index			10
“Going” rate			5
Federal funds rate			5
<i>Convertible to a fixed-rate mortgage?</i>			
Yes		9	47***
No		91	53***

Notes. Mortgages backed by mobile homes, farms or ranches are excluded from the SCF and RFS tabulations. RFS and SCF estimates are weighted with sampling weights. Differences in proportions relative to the RFS are statistically different from zero at the *** 1 or ** 5 percent level. Standard errors are bootstrapped with 999 replicates; those for the SCF are drawn in accordance with the sample design and adjusted for imputation uncertainty.

linked to the rates on U.S. Treasury bills, with the rest linked to a bank cost-of-funds index or the London InterBank Offered Rate (LIBOR). However, only 25 percent of SCF adjustable-rate borrowers report that their mortgages are linked to any of these rates. The modal answer, with 48 percent of respondents, is the prime rate, and 20 percent report implausible indexes or colloquial terms (the Consumer Price Index, the “going” rate, or the Federal Funds rate). Likewise, only 9 percent of adjustable-rate mortgages are reported as convertible to a fixed-rate mortgage on the RFS, yet nearly half of SCF adjustable-rate borrowers indicate that their contracts include this option. Perhaps many SCF borrowers consider their mortgages “convertible” if they can refinance without paying prepayment penalties. A sizeable share of borrowers say they do not know what indexes their mortgages are tied to (28 percent) or whether their mortgages are convertible (16 percent).

A small part of the reason why “don’t know” rates are higher for ARM-specific mortgage terms is that ARM borrowers tend to be less knowledgeable about all mortgage terms than fixed-rate borrowers. For example, 1 percent of fixed-rate and 2 percent of ARM borrowers did not know their amortization schedules; 5 percent of fixed-rate and 10 percent of ARM borrowers did not know if their mortgages included private mortgage insurance. However, even among ARM borrowers, don’t know rates are much

higher for per-period and lifetime caps than for other mortgage terms.

4. Why don’t ARM borrowers appear to not understand how much their interest rates can change?

We explore four scenarios for why borrowers might not understand the extent to which their interest rates can change. To guide our thinking and structure the discussion, we use as a framework a model in the spirit of the “rational inattention” model. Roughly put, we consider the notion that borrowers do not know certain mortgage terms because the costs of acquiring the information exceeds the benefits. The four scenarios provide different reasons for why this relationship holds. These scenarios are not mutually exclusive, and in fact we find at least a bit of evidence that may be considered consistent with all four explanations. In addition, as our sample sizes are small and our measures for each scenario only approximate the underlying concepts, we consider our evidence here suggestive rather than conclusive.

4.1. Scenario one: The financial consequences of an interest rate rise are small

If borrowers believe that a rise in their mortgage interest rates will have little effect on their personal finances, there may be lit-

tle benefit to remembering the details of interest rate adjustments. As Glaeser (2004) notes in a broader context, "False beliefs will be more common when making the right decision does not yield large benefits to individuals." In line with this hypothesis, Wakefield and Inman (1993) document that lower-income consumers, who presumably have tighter budgets, are more aware of grocery prices than higher-income consumers. Agarwal et al. (2006) study credit card borrowers choosing between a contract with a fee and a low interest rate and a contract with no fee and a high interest rate. As the financial penalty increased for choosing the more expensive contract, more borrowers selected the cheaper contract.

4.1.1. Simulating the effect of an interest rate rise

To gauge what types of ARM borrowers might benefit most from understanding their interest rate parameters, we simulate the effect of a rise in interest rates on the payments relative to income of borrowers in the RFS and SCF samples. We assume that interest rates increase two percentage points a year—the annual cap cited most commonly by lenders—for two consecutive years, for a cumulative four percentage point increase. This cumulative rise is slightly larger than the approximately 3-1/4 percentage point rise in the U.S. one-year constant-maturity Treasury, the most common ARM index, from mid-2003 to the end of 2005.³⁰ As complex products such as option and interest-only ARMs were relatively rare in 2001, the interest rates on most ARMs in our sample adjust only because of changes in market rates.

We allow nominal income to increase 2.5 percent per year from 2000 to 2003, but otherwise assume that the ARM index is the only factor that changes.³¹ Our static calculations do not factor in behavioral adjustments by borrowers, such as moving or refinancing their mortgages. If we allowed for such responses, the rise in interest rates might be associated with a smaller increase in mortgage payments than we calculate.

In order to carry out the simulation, we drop all RFS observations with data missing on any mortgage terms; this restriction decreases the sample size from 1321 to 320. We do not drop any SCF observations because all missing data are imputed in the SCF. Excluding SCF households with imputed values from the simulation has only a minor effect on our results. These sample exclusions do not appear to affect materially the representativeness of the two samples, as the median mortgage balance, annual income, and payment relative to income (Table 4, columns 2–4) still match closely on the data sets.

As a benchmark, we first examine the change in payment relative to income for all ARM borrowers. Although the interest rate scenario is somewhat extreme, many borrowers in the simulation experience only moderate payment increases: the simulated median change in payments according to the lender-reported RFS data is 2.8 percent of income (column 5). The median change in the SCF data, which corresponds to the more optimistic expectations of borrowers, is only somewhat lower, at 1.7 percent of income. The discrepancy between the RFS and SCF estimates suggests that borrowers might be surprised by the extent of their interest rate increases, but that for the typical borrower the surprise will be on the order of one percent of income.

The relatively small payment increases are partly explained by the fact that mortgage payments for many borrowers were already low relative to income in 2001 (column 4): the median payment

to income in both datasets is around 12 percent. Further, one quarter of borrowers had a remaining mortgage maturity of 15 years or less; payments on these shorter-maturity mortgages are less sensitive to interest rate fluctuations.

A subset of borrowers, however, experience more substantial changes in mortgage payments. At the 90th percentile (column 6), the RFS data indicate that 10 percent of borrowers would have experienced payment changes exceeding 8.8 percent of income. The 90th percentile of the SCF distribution indicates that 10 percent of ARM borrowers anticipate payment increases exceeding only 6.7 percent of income. Some of these borrowers may be more surprised by the extent of their payment increases than the borrowers experiencing the median increase.

4.1.2. Simulating the effects for subgroups

We next explore which subgroups are more likely to experience large payment increases. We focus on demographic characteristics recorded on the RFS—income, age, race, and year of mortgage origination—because we want to assess actual rather than anticipated payment changes. For robustness, we also show results from the SCF, although differences across groups in the SCF may capture differences in borrower uncertainty about mortgage terms as well as differences in payment increases. For the income simulation, we divide borrowers into those in approximately the bottom half of the income distribution of ARM borrowers (\$50,000 or less), the 50th–90th percentiles (\$50,000–\$150,000), and the top decile (\$150,000 and up). Although some of these samples are small—especially the highest-income group in the RFS—the median mortgage balance and income correspond well across the RFS and SCF samples for all three income groups. We show the 90th percentile to provide suggestive evidence of the range of the payment change to income distribution, but we caution that this statistic is likely to be measured imprecisely, particularly for small groups.

Lower-income borrowers are more vulnerable than higher-income borrowers to potentially burdensome payment increases, presumably because their mortgage balances and thus their payments are large relative to their incomes. This higher vulnerability is most evident at the 90th percentile of the payment change to income distribution. At this percentile point, the predicted payment change in the RFS is 13.6 percent of income for borrowers in the bottom half of the distribution, compared with about 6.5 percent for borrowers in the top half of the distribution. The median payment increase is more similar across income groups: 3.3 percent of income for borrowers in the bottom half of the distribution and 2.5 percent for borrowers in the top half.

As a robustness check, we exclude from the RFS sample any borrowers whose mortgage payments in 2001 were 50 percent or more of their year 2000 incomes, as we worry that the low-income result may be driven by borrowers with temporarily low prior-year income. Excluding these borrowers decreases the 90th percentile of the payment-change-to-income distribution from 13.6 percent to 9.5 percent for the lower-income group and decreases the median from 3.3 to 3.0. As a similar check on the SCF, we calculate a measure of "typical" income, set equal to actual income if the borrower reports that his prior year income was about normal or to his reported typical income otherwise. When we use this typical income as the denominator, the 90th percentile of the payment-change-to-income distribution for lower-income borrowers falls from 11.8 to 8.7 and the median falls from 2.8 to 2.4. For both datasets, these adjustments have little to no effect on the simulated payment increases of upper-income households. These decreases suggest that our primary estimates may overstate the vulnerability of lower-income borrowers to payment shocks, but lower-income borrowers nonetheless remain more vulnerable than higher-income borrowers even with these adjustments.

³⁰ Four percentage point increases in the U.S. one-year Treasury rate were seen most recently in the 1970s and early 1980s.

³¹ 2.5 percent is the annualized increase in nominal median household income from the 2001 to the 2004 Survey of Consumer Finances. The survey asks about prior year income.

Table 4

Simulated effect of an interest rate increase on payments across subgroups

Subgroup	N	Median					90th percentile	
		Mortgage balance	Annual income	Mortgage payment as a percent of monthly income	Change in mortgage payment relative to income	Change in mortgage payment relative to income		
		(1)	(2)	(3)	(4)	(5)		
<i>All ARM borrowers</i>								
RFS	320	67,000	52,000	11	2.8	8.8		
SCF	223	70,000	52,000	12	1.7	6.7		
<i>By position in the income distribution</i>								
<i>Bottom half</i>								
RFS	154	52,000	32,200	14	3.3	13.6		
SCF	68	52,000	30,000	17	2.8	11.8		
<i>50th–90th percentile</i>								
RFS	142	81,000	75,000	9	2.4	6.6		
SCF	66	80,000	69,000	11	1.4	4.4		
<i>Top decile</i>								
RFS	24	310,000	200,000	6	2.5	6.4		
SCF	88	290,000	202,000	9	1.4	6.3		
<i>By age</i>								
<i>25–40</i>								
RFS	65	64,000	50,000	10	3.0	7.7		
SCF	63	60,000	50,000	12	1.7	6.3		
<i>41–64</i>								
RFS	196	74,000	57,490	11	2.9	10.1		
SCF	139	71,000	59,000	12	1.7	6.8		
<i>65+</i>								
RFS	48	48,200	50,000	10	2.4	8.8		
SCF	21	63,000	35,000	13	2.0	14.0		
<i>By race</i>								
<i>White</i>								
RFS	267	62,000	52,000	10	2.5	8.1		
SCF	185	70,000	52,000	12	1.7	7.1		
<i>Non-white</i>								
RFS	49	100,000	53,000	14	4.2	10.1		
SCF	38	60,000	43,000	13	1.9	6.3		
<i>By year mortgage was originated</i>								
<i>2000 or 2001</i>								
RFS	47	133,000	60,900	14	5.3	13.6		
SCF	58	85,000	46,000	14	1.4	11.4		
<i>1999 or earlier</i>								
RFS	273	61,000	50,000	10	2.5	7.7		
SCF	165	69,000	55,000	12	1.7	6.6		

Vulnerability to payment increases varies less across age groups than income groups. All three age groups have a median payment-to-income ratio of around 11 or 12 percent, and are projected, under the assumptions of the simulation, to have a median payment-change-to-income ratio of around 2 to 3 percent. Borrowers in the 45–64 age group may be a bit more vulnerable to payment increases, as the 90th percentile of the payment-change-to-income ratio is 10.1 percent for this group, compared with 7.7 percent for borrowers in the 25–44 age group and 8.8 percent for the 65 or older age group.

In the RFS, non-white borrowers experience larger payment changes than white borrowers, but in the SCF the payment changes of the two groups are roughly the same. As discussed later, a large share of mortgage terms for minority borrowers are imputed in the SCF because these borrowers were more likely to say that they did not know their mortgage terms. The imputed values of the lifetime cap for some borrowers appear too low and thus may hold down the simulated payment changes for non-white households. We therefore place more weight on the RFS simulation results, although the small samples of non-whites suggest that both sets of results are likely imprecise.

Borrowers who obtained their mortgages recently have much larger mortgage balances than borrowers with more seasoned mortgages and thus are more vulnerable to interest rate increases. These borrowers also appear more susceptible to underestimating the extent to which their payments might increase. The median projected payment increase for borrowers who obtained their mortgages in 2000 or 2001 was 5.3 percent of income, compared with a median anticipated increase of 1.4 percent of income. In contrast, the median projected payment increase for borrowers who obtained their mortgages in 1999 or earlier was 2.5 percent of income and the anticipated increase was 1.7 percent of income. This discrepancy persists into the tails, where the 90th percentiles of the projected and anticipated payment increases are about 5 percentage points higher for borrowers with new mortgages than for borrowers with older mortgages.

4.1.3. Which subgroups report not knowing how their interest rates can adjust?

These simulations suggest that borrowers with less income, borrowers with recent mortgages, and perhaps minority borrowers might be more affected by interest rate increases. If the “borrow-

Table 5Share of "don't know" responses by subgroup (*data reported by borrowers*)

	Per-period cap	Lifetime cap	Index	N
<i>All ARM borrowers</i>				
Income of mortgage borrower				
Less than \$50k	41***†††	48***†††	32***†††	190
\$50k-\$150k	28	35	16	280
More than \$150k	23	31	12	290
Age of mortgage borrower				
40 or younger	28***	34***	23	206
41–64	31***	38***	19**	485
65 or older	60	68	36	70
Race or ethnicity				
White, non-Hispanic	30***	37***	19***	654
Nonwhite or Hispanic	46	50	37	107
Year of mortgage origination				
This year or previous year	39**	43	25*	271
Two or more years ago	30	38	20	489
Chance stay at residence next 2 years				
80 percent or less	35	38	19	241
90 percent or higher	32	40	23	520
Expected the level of interest rates to be the same five years from now				
Yes	36	36	18	182
No	32	41	23	579
Expected change in income relative to prices over the next year				
Greater	28††	34†††	17***	271
Same	37	46***	20*	326
Less	32	35	31	163
Education				
College education	25***	36**	13***	499
Less than college	41	44	33	262
Understanding of questions less than "Excellent"				
Yes	41***	47***	29***	245
No	27	35	17	516
Documents consulted during interview				
Loan documents	27*	38	15**	131
Other relevant documents	28	39	25	71
Other or no documents	35	40	23	559
Do almost no comparison shopping when making borrowing decisions				
Yes	51***	50*	28	77
No	31	39	21	684
Decided not to apply for credit because thought might be turned down				
Yes	46***	49**	36***	80
No	30	38	19	680
Could not borrow \$3000 from friends or family in an emergency				
Yes	48***	52***	36***	95
No	33	38	19	406
Not willing to take risk with investments				
Yes	48***	55***	44***	121
No	28	35	16	639
Focus on next few months when planning saving and spending decisions				
Yes	37	50**	38***	80
No	32	38	19	681
Has been turned down for credit in the last five years				
Yes	31	37	26	163
No	33	41	20	598
Reason chose lender				
Rate	26	37	15	304
Qualify	35	37	24	82
Other	36	42	26	375

(continued)

ers don't know because the benefit is small" hypothesis is correct, these groups should be more knowledgeable about the mechanics of their interest rate adjustments. However, the average "don't

Table 5 (continued)

	Per-period cap	Lifetime cap	Index	N
<i>Sometimes or hardly ever pay off credit card balance in full each month</i>				
Yes	32	41	21	252
No	32	38	22	453
No credit card	41	43	23	56
<i>Ever filed for bankruptcy?</i>				
Yes	0.22**	0.32*	0.18	52
No	0.34	0.41	0.22	697
<i>Were any loan and mortgage payments not made on time last year?</i>				
Yes	45***	41	35***	99
No	30	39	18	662
<i>Lucky in financial affairs</i>				
Very	35	42	16††	342
Somewhat	32	39	27	248
Not	31	38	21	170
<i>Puri-Robinson optimism measure</i>				
Optimist	21†	29***	17	115
Rationalist	31	36*	23	222
Pessimist	30	47	22	110

Notes. Data are pooled from the 1998, 2001, and 2004 Surveys of Consumer Finances and are weighted. Sample size is for the per-period and lifetime cap questions; the ARM index question is asked only of the 612 ARM borrowers who said their interest rate depended on another rate. "Other relevant documents" = account statements, real estate records, and other documents. Differences relative to final category within a group are statistically significant at the *** 1, ** 5, or * 10 percent level; differences relative to the middle category are significant at the ††† 1, †† 5, or † 10 percent level. Standard errors are bootstrapped with 999 replicates in accordance with the sample design and are adjusted for imputation uncertainty. "Could not borrow \$3000 from friends or family in an emergency" not asked on 1998 survey. Puri-Robinson optimism measure not calculated for the 2004 data.

know" rates across the groups tell a different story (Table 5).³² For example, 41 percent of borrowers with income below \$50,000 say that they don't know their per-period interest rate caps, compared with 28 percent of borrowers with income between \$50,000 and \$150,000 and 23 percent of borrowers with income over \$150,000. Similar gaps are apparent for the lifetime cap and the ARM index.

Likewise, 39 percent of borrowers who originated their mortgages within the last two years reportedly do not know their per-period caps, compared with 30 percent of borrowers who originated their mortgages less recently. Borrowers who originated mortgages less recently may be more aware of their caps because they have already experienced interest rate changes.³³ Forty-six percent of minority borrowers, compared with 30 percent of white borrowers, do not know these caps. Finally, although the simulation did not indicate a clear relationship between age and vulnerability to payment shocks, households headed by an individual aged 65 or older are substantially more likely not to know their mortgage terms: 60 percent of these borrowers do not know their per-period cap, compared with around 30 percent of younger borrowers. Thus the simulation results generally do not support the "benefit is small" hypothesis: groups that are most vulnerable to large payment shocks appear to also be those with the least knowledge of their interest rates.

We emphasize the simple across-group comparisons of "don't know" rates in this part of the analysis, as these comparisons correspond most closely to the simulations. However, to gauge whether these differences across groups stem from other factors,

³² For these tabulations, we pool the 1998 and 2004 waves of the SCF with the 2001 SCF to increase the sample size. The income thresholds are adjusted for inflation for the 1998 and 2004 waves.

³³ Borrowers who originated their mortgages recently may be better informed about terms that are most salient at time of mortgage origination; Lam and Kaul (2003) found that AHS respondents' knowledge of their initial mortgage balances deteriorated over time.

Table 6OLS regression estimates of "don't know" rates (*Data reported by borrowers*)

	Per-period cap	Lifetime cap	Index
Income <\$50k	.04 (.05)	.09 (.05)	.02 (.05)
Income \$50k-\$150k	-.02 (.05)	.00 (.05)	-.03 (.05)
Age 41–64	.09*** (.04)	.08* (.04)	-.02 (.04)
Age 65 or older	.35*** (.07)	.35*** (.06)	.16** (.08)
Nonwhite or Hispanic	.09** (.05)	.05 (.05)	.12** (.05)
Mortgage originated this or previous year	.11*** (.04)	.09** (.04)	.10** (.04)
Chance of staying at residence next two years 80 percent or less	.13*** (.03)	.06* (.03)	.01 (.04)
Expect interest rates to be the same five years from now	.07** (.04)	-.04 (.04)	-.04 (.05)
Expect income to rise more than prices over next year	-.02 (.05)	.05 (.05)	-.08* (.05)
Expect income to rise the same as prices over the next year	.04 (.04)	.15*** (.05)	-.08* (.05)
No college	.08* (.04)	-.01 (.04)	.09** (.03)
Had difficulty comprehending survey	.05 (.04)	.06 (.04)	.04 (.05)
Consulted loan documents during interview	-.05 (.04)	.01 (.05)	-.04 (.04)
Consulted selected other documents	-.08 (.06)	-.02 (.06)	-.03 (.06)
Do almost no comparison shopping when making borrowing decisions	.13** (.06)	.03 (.07)	-.02 (.07)
Did not apply for credit because thought might be turned down	.15*** (.05)	.15** (.06)	.10* (.06)
Not willing to take risk with investments	.11** (.05)	.14*** (.05)	.21*** (.06)
Focus on next few months when planning saving and spending decisions	-.03 (.06)	.06 (.06)	.09 (.07)
Has been turned down for credit in the past five years	-.08* (.05)	-.08 (.05)	-.00 (.05)
Chose lender because of interest rate	-.05 (.04)	-.02 (.04)	-.06* (.03)
Chose lender because could qualify for the loan	-.04 (.05)	-.07 (.06)	-.07 (.05)
Sometimes or hardly ever pay off credit card balance in full	-.01 (.04)	.05 (.04)	-.11*** (.04)
No credit card	-.07 (.06)	-.01 (.07)	-.24*** (.09)
Filed for bankruptcy	-.17*** (.05)	-.09* (.05)	-.13** (.06)
One or more loan payments not made on time last year	.15*** (.05)	-.01 (.06)	.14*** (.05)
Very lucky in financial affairs	.06 (.04)	.05 (.05)	-.01 (.04)
Somewhat lucky	.03 (.04)	.03 (.04)	.08* (.05)
Year = 2001	.06 (.04)	.03 (.04)	.02 (.05)
Year = 2004	.10** (.04)	.02 (.05)	-.06 (.05)
Constant	-.03 (.08)	.05 (.07)	.21*** (.07)
Adjusted R ²	.18	.12	.21
N	761	761	612

Notes. Data are pooled from the 1998, 2001, and 2004 Surveys of Consumer Finances and are weighted. Adjusted R-squared based on regression over all 5 SCF implicants. Standard errors are bootstrapped with 999 replicates and are adjusted for imputation uncertainty. *** Statistically significant at the 1 percent level; ** 5 percent level; * 10 percent level.

we regress indicator variables for "don't know per period cap," "don't know lifetime cap," and "don't know index" on the full set of characteristics (Table 6). The low-income and minority coefficients are substantially smaller in the regressions than in the comparison of means, and the low-income coefficient is not statis-

tically significant in any specification. However, the "65 or older" and "mortgage originated this or previous year" coefficients are the same size as in the means comparisons and are statistically significant in all specifications. These results suggest that other factors explain a fair amount of the gap in knowledge across income and race groups, but not across age and year of mortgage origination groups.

As an additional test of the "benefit is small" hypothesis, we examine three other groups of ARM borrowers who may think that knowledge of the mechanics of their future interest rates is unimportant for their financial health—those who say that they are likely to move in the next two years; those who expect interest rates in five years to be the same as in the survey year; and those who expect their incomes to increase faster than prices over the next year. The support for the "benefit is small" hypothesis among these groups is mixed. The regression analysis indicates that ARM borrowers who expect to move—defined as those who perceive an 80 percent or less chance that they will be in their residence in two years—are more likely to say that they don't know the per-period or lifetime caps on their interest rates. Likewise, borrowers who expect interest rates to be at the same level in five years are less likely to know their per-period caps (although not less likely to know their lifetime caps). But both groups are as knowledgeable as their counterparts about their ARM indexes. And borrowers who expect their income to rise faster than prices over the next year are either less likely or as likely to say "don't know" than borrowers with more pessimistic income expectations.

4.1.4. Discussion

Taken as a whole, the estimates in this section offer little support for the hypothesis that borrowers are unaware of the possible extent of future interest rate changes because these changes will not affect them. Unlike the finding of Wakefield and Inman (1993) that low-income consumers are more aware of grocery prices, in this context low-income borrowers and other groups more likely to experience large payment increases are also more likely to say that they don't know their interest rate parameters. The only evidence consistent with this hypothesis is the fact that ARM borrowers who expect to move soon are more likely to say that they don't know their interest rate caps. If these borrowers move within the next couple years, as they expect, knowing about the future trajectory of their mortgage payments may be unnecessary.

4.2. Scenario Two: Acquiring information is costly

Previous studies suggest that borrowers with low levels of cognition or low levels of financial literacy may find it more costly to gather and process the information necessary to understand their interest rates. Individuals with less education and older borrowers appear to have lower cognitive abilities (Christelis et al., 2006; Korniotis and Kumar, 2008a, 2008b). Memory and quantitative ability drop with age (Korniotis and Kumar, 2008a), and older individuals appear more prone to making financial mistakes (Agarwal et al., 2007). Borrowers with less income and education, older borrowers, and minority borrowers appear to have lower levels of financial literacy (Hogarth and Hilgert, 2002; Lusardi and Mitchell, 2006; Lusardi and Mitchell, 2007; Lusardi and Tufano, 2008). Calculations involving interest rates appear to be particularly difficult for individuals (Moore, 2003; Campbell, 2006; Schwartz, 2006; Stango and Zinman, 2007; Consumer Federation of America, 2004; Lusardi and Mitchell, 2006, 2007; Lusardi and Tufano, 2008).

4.2.1. Which subgroups report not knowing how their interest rates can adjust?

Groups of borrowers more likely to have lower levels of cognition or lower levels of financial literacy—older borrowers, borrow-

ers with less income or education, and minority borrowers—are also more likely to say that they don't know their interest rate details. For example, 25 percent of borrowers with a college education and 41 percent of borrowers without a college education do not know the per-period caps on their interest rates (Table 5).³⁴ The "no college" coefficient remains statistically significant, albeit smaller in magnitude, in the regression analysis (Table 6). As noted earlier, older, lower-income, and minority borrowers are less likely to know their mortgage terms.

We also examine other groups for whom the costs of gathering information about their mortgages may be higher—those whom the interviewer noted had difficulty comprehending the survey; those who did not consult loan documents during the interview; and those who do almost no comparison shopping when making mortgage decisions. We assume that some borrowers may not consult their documents because they find them hard to understand, and that borrowers who avoid comparison shopping are indicating, through revealed action, that gathering information is costly. Borrowers in all three groups are more likely to say that they don't know their mortgage terms. For example, 41 percent of borrowers who had difficulty comprehending the survey did not know their per-period caps, as opposed to 27 percent of those who did not have difficulty. In the regression analysis, however, these variables are generally statistically insignificant.

4.3. Scenario Three: Borrowers are focused on their short-term payments

When borrowers take out mortgages, they may focus more on the short-term payments than on the longer-term financial consequences and thus may not pay attention to the extent to which their payments might rise in the future. Miles (2003) attributes some of the popularity of adjustable-rate mortgages in the United Kingdom to the fact that borrowers tend to focus disproportionately on the initial cost of the mortgage. Adams et al. (forthcoming) find that subprime auto loan borrowers are extremely sensitive to downpayment requirements but not to deferred payments; borrowers in this market dislike a \$100 increase in downpayment requirements as much as a \$3000 increase in the car price. Attanasio et al. (2008) note that liquidity-constrained auto buyers are more concerned about the size of their immediate payments than interest rates.

Borrowers may care more about the short-term because they are short-sighted: they place excessive weight on the present relative to the future (Laibson, 1997). Borrowers may be short-sighted for a number of reasons, including because they are impatient by nature or because they have an immediate need for cash but no good borrowing options. Focus groups of subprime borrowers conducted by Moore (2003) and Lacko and Pappalardo (2007), for example, suggest that many subprime borrowers entered into their contracts because they were desperate and felt that they did not have good options. Advertisements for subprime mortgage products often suggest that these products will resolve borrowers' financial difficulties, whereas ads for prime mortgages emphasize interest rates and helping borrowers achieve dreams (Perry and Motley, 2008). If borrowers are primarily focused on resolving immediate difficulties, they may not perceive much benefit to considering the longer-term consequences of their contracts.

The cognition/financial literacy and the short-sighted scenarios overlap to a certain extent. Benjamin et al. (2006) suggest that individuals with lower cognitive skills are more likely to overweight the present relative to the future. The groups of borrowers more likely to have difficulty obtaining loans—borrowers with

less income and education and minority borrowers (Jappelli, 1990; Attanasio et al., 2008; Johnson and Li, 2008)—are also those more likely to have lower levels of financial literacy. Minorities may also have more difficulty obtaining financial support from informal networks; for example, minorities are less likely than whites to receive parental assistance with a house downpayment (Charles and Hurst, 2002).

4.3.1. Which subgroups report not knowing how their interest rates can adjust?

The SCF contains several variables that may identify households with short time horizons. Following Jappelli (1990), Jappelli et al. (1998), and Johnson and Li (2008), we use as indicators of credit constraints the SCF questions on whether in the past five years the borrower was either turned down for credit or did not apply because he might be turned down. We also examine the questions on whether the borrower's most important time horizon for saving and spending is the next few months; whether the borrower could get financial assistance of \$3000 or more from friends or family in an emergency; whether the borrower chose her lender because of the relative ease in qualifying for the mortgage; whether the borrower made all mortgage payments on time in the previous year; whether the borrower has ever filed for bankruptcy; and whether the borrower sometimes or often does not pay off his credit card balance in full. Finally, we consider borrowers who are not willing to take any risk with their investments as having short time horizons under the assumption that these borrowers avoid risk because they cannot afford to lose any assets, even over short periods. However, this measure may also capture a lack of financial literacy if borrowers do not understand that taking some risk with investments is likely to lead to greater lifetime wealth.

Borrowers who did not apply for credit because they thought they might be turned down ("discouraged" borrowers in the terminology of Jappelli, 1990) are more likely not to know their mortgage terms. For example, 46 percent of borrowers who did not apply for credit because they might be turned down did not know their per-period caps, compared with 30 percent of borrowers who did not anticipate being rejected (Table 5). Likewise, 48 percent of borrowers who could not borrow \$3000 from friends or family in an emergency did not know their per-period caps, compared with 33 percent of borrowers with the ability to borrow from friends or relatives. Forty-eight percent of borrowers not willing to take risk with their investments did not know their per-period caps, compared with 28 percent of those willing to take on at least some risk. Borrowers who focus on the next few months in planning saving and spending decisions are also more likely not to know their loan terms, although the difference is not statistically significant in all specifications. In the regression analysis, the "anticipate rejection" and "take no risks" coefficients are large, positive, and statistically significant in all specifications (Table 6).³⁵

However, this same pattern is not apparent for borrowers who have been turned down for loans in the past ("rejected" borrowers in the terminology of Jappelli, 1990) and borrowers who have had difficulty paying their bills. Borrowers who have been turned down for credit in the last five years; borrowers who chose a mortgage lender based on the ability to qualify for a loan, rather than on, e.g., the interest rate; and borrowers who sometimes or hardly ever pay off credit card balances in full each month are about as likely as borrowers not in these categories to think that they know their interest rate details. Borrowers who have filed for bankruptcy are less likely to say "don't know." Borrowers who did not make

³⁴ A college-educated household is defined as one in which either the head or spouse has at least a bachelor's degree.

³⁵ "Could you borrow \$3000 or more from friends or relatives in an emergency?" was not asked in 1998. To estimate the effect of this variable, we run the regression over 2001 and 2004 only (results not shown). The coefficient is small and statistically insignificant, and the other coefficients are largely unchanged.

all loan payments on time in the previous year are more likely to say that they don't know their per-period caps and their ARM indexes, but are as likely to know their lifetime caps. In the regression analysis, borrowers who have been turned down for a loan or filed for bankruptcy are less likely, depending on the specification, to say they don't know their mortgage terms, whereas borrowers who made some loan payments late are more likely to say "don't know."

Rejected borrowers appear to be a more financially sophisticated group than discouraged borrowers. Jappelli (1990) documents that rejected borrowers have more income and wealth than discouraged borrowers. Unlike discouraged borrowers, rejected borrowers by definition have applied for loans, a fact that suggests that they thought that their applications could be accepted. In addition, borrowers with a past history of not paying off loans fully have also, by definition, been approved for loans in the past and may have become more financially savvy through these experiences.

4.3.2. Discussion

Although short time horizons and limited financial options appear to play a role in explaining why borrowers may not know their interest rate parameters, this statement may be true only for a particular subset of these borrowers. Borrowers who are experienced in applying for loans—even if some of those applications are rejected—appear in most cases to be as knowledgeable as borrowers whose applications are always approved. Only borrowers who anticipate rejection are more likely to respond that they don't know these contract terms. This result suggests the correlation between difficulty obtaining loans and "don't know" responses may stem as much from a lack of financial expertise as from shortsightedness.

4.4. Scenario Four: Optimistic borrowers believe that bad events will not happen to them

As we document in this paper, ARM borrowers appear to underestimate the extent to which their interest rates can increase. If borrowers have a bias towards optimism or overconfidence, they may believe that they are unlikely to experience bad financial events and thus do not need to learn about their potential financial exposure. Likewise, many borrowers in the Lacko and Pappalardo (2007) focus groups began the interview with the optimistic belief that they had selected good mortgages but became progressively less happy as they understood their mortgages more fully.

Optimism and overconfidence appear to be factors in other financial mistakes. Brunnermeier and Parker (2005) derive a theoretical model that suggests that optimism and overconfidence lead individuals to save too little. Barber and Odean (2000) attribute to overconfidence the fact that individual investors trade too often and thus underperform the market. Chan and Stevens (2008) find that individuals believe that they can retire earlier under their retirement plans than they actually can. Finally, Puri and Robinson (2007) suggest that moderate optimism prompts individuals to invest in their futures, for example through saving, but that excessive optimism may prompt individuals to take risks such as engaging in stock day-trading.

4.4.1. Which subgroups report not knowing how their interest rates can adjust?

We assess the role of optimism with two measures. The first measure is whether borrowers believe that they are luckier in their financial affairs than other people of their generation and

background.³⁶ We classify borrowers as "very lucky" if they agree strongly with this statement, "somewhat lucky" if they agree somewhat, and "not lucky" if they neither agreed or disagreed, or disagreed outright. The second measure, developed by Puri and Robinson (2007), is the difference between a borrower's expected and actuarial life expectancies. We divide borrowers into quartiles based on this measure, and label borrowers in the bottom quartile "pessimists," in the middle two quartiles "rationalists," and in the top quartile "optimists." Optimists under this measure are more likely to believe that they are very lucky in their financial affairs, a correlation that suggests that the Puri-Robinson measure is capturing some component of optimism.

We find little support for the optimism scenario as an explanation for why ARM borrowers don't know the parameters that govern their future interest rates. In fact, the simple comparisons indicate that "very lucky" and optimistic borrowers are less likely to say "don't know" than more pessimistic borrowers (Table 5). The "very lucky" variable is not statistically significant in any of the regressions, but optimists are statistically significantly less likely than pessimists to say that they don't know their lifetime caps (Table 6).³⁷ The fact that optimists appear a bit more informed about their mortgage terms is consistent with the Puri-Robinson hypothesis that moderate amounts of optimism provide individuals with an incentive to plan for their futures. Unfortunately, our sample size is too small to test their hypothesis that extreme optimism is associated with more risky behavior. The fact that optimists appear more knowledgeable, not less, about their mortgage terms suggests that ARM borrowers may tend to underestimate their interest rate risk for reasons other than optimistic beliefs.

5. Discussion

Borrowers appear to be confident and accurate in reporting the basic terms of their mortgages. The close correspondence of these loan terms across data sources is somewhat remarkable, given the inherent differences in design and methodology. Borrowers with adjustable-rate mortgages, however, appear to underestimate or to not know the extent to which their interest rates can change. This borrower confusion may be a concern to researchers as well as to policymakers, as our results suggest that borrower-reported data may not provide an accurate portrait of complicated features of adjustable-rate mortgages. Our results also suggest that the measurement error in these ARM-specific data is not random, thereby implying that regression coefficients estimated on these data may be biased.

From a policy perspective, borrower confusion may be of little practical importance for some adjustable-rate mortgage terms and for some borrowers. Lack of knowledge of specific ARM indexes, for example, may not matter much because indexes tend to move together over the long run. For borrowers who have low current mortgage payments or enough wealth to weather market fluctuations, awareness of ARM terms may also be less important.

For other borrowers, this confusion might have more serious consequences. Borrowers who experience unexpected payment increases may reduce their spending or default on their mortgages. In addition, borrowers who are uncertain about their mortgage terms might make other mistakes: they may take out subprime

³⁶ About 68 percent of all SCF households believe that they are luckier in financial affairs than their peers.

³⁷ The Puri-Robinson measure is only calculated for 1998 and 2001. The optimism results are from a regression estimated over 1998 and 2001 only (results not shown). The coefficients on other variables are generally unchanged when we restrict the sample to these years and include the Puri-Robinson measures. In the per-period cap specification, the optimist coefficient is -0.10 and has a *t*-statistic of -1.64, which suggests that with three years of data, we might find that optimists are also less likely to report that they don't know their per-period caps.

mortgages when they could have qualified for less costly mortgages (Lax et al., 2004), may refinance sluggishly (Campbell, 2006; Schwartz, 2006), and may pay too many points when they originate their mortgages (Woodward, 2003).

The groups of ARM borrowers who appear less certain of their interest rate exposure are common subjects of policy concern: borrowers with less income and less education; older borrowers; and minority borrowers. We find little support for the hypothesis that these borrowers are less certain because rate changes will not affect them. For the most part, these borrowers appear more likely to experience large payment changes, as a share of their income, than other borrowers in the event of a rise in market interest rates.

Instead, at least in part, ARM borrowers appear not to know the extent to which their interest rates might adjust because gathering and processing information is costly—either because these borrowers have lower cognitive abilities or levels of financial literacy, or perhaps because they are less experienced with the financial system. In the regressions, four variables consistently have a large, positive, and statistically significant association with borrower uncertainty about interest rate changes: older than 65; originated mortgage in the current or previous year; did not apply for credit because thought might be turned down; and not willing to

take any risk with investments. Older households appear to make more cognitive mistakes in their financial decisions (Agarwal et al., 2007). Borrowers who originated their mortgages recently may be more likely to be financial novices. Borrowers who do not apply for loans because they think that may be turned down and borrowers who do not take any risk with their investments potentially may be groups that are less familiar with the financial system.

Short time horizons—perhaps because borrowers are primarily focused on current financial difficulties—do not appear to explain why ARM borrowers are unaware of how much their interest rates could rise, even though some of the demographic groups more likely to have difficulty obtaining credit are the same as those less likely to know their loan terms. Borrowers who do not apply for loans because they think that they might be turned down, obviously, have more limited financial options. But older households are generally considered to be relatively wealthy (Gale and Pence, 2006). And borrowers with poor credit histories—those who have been turned down for credit, who chose their mortgage lender because they could qualify for the loan, or who have declared bankruptcy—are either as knowledgeable or more knowledgeable than borrowers with less tarnished credit histories. These borrowers with troubled credit may be experiencing financial difficulties, but their interactions with the financial system suggest some knowledge of and comfort with loans.

The rise in subprime ARM delinquencies that accelerated in mid-2007 has focused attention on whether borrowers understood the interest rate risks inherent in these products. In fact, some of the groups that we find are less likely to know their mortgage terms are also more likely to obtain subprime mortgages, although this pattern is not new to this credit cycle. Subprime mortgage originations were more prevalent in low-income and minority communities in both the 1990s (U.S. Department of Housing and Urban Development, 2000) and the most recent credit cycle (Mayer and Pence, 2008).

Subprime mortgage contracts tend to be more complicated than prime mortgage contracts. Lacko and Pappalardo (2007) found that both prime and subprime borrowers had difficulties understanding sample disclosure forms for subprime mortgages. These complicated features may benefit subprime borrowers if the features enable lenders to offer loans to borrowers who might otherwise be credit-constrained. Lenders may be able to offer lower interest rates to borrowers who accept a prepayment penalty, for example, and thereby lower monthly payments to a level that stretched borrowers can afford (Mayer et al., 2008). Although these features

Appendix Table A

Demographic characteristics of the Residential Finance Survey and Survey of Consumer Finances samples

	Residential Finance Survey (2001) (As reported by borrowers)	Survey of Consumer Finances (2001) (As reported by borrowers)
<i>Age</i>		
25–44	30	32
45–64	57	58
65+	9	9
<i>Race</i>		
White	80	80
Non-white	20	20
<i>Income (thousands of dollars)</i>		
10th percentile	14	24
25th percentile	34	40
50th percentile	58	65
75th percentile	88	100
90th percentile	130	155

Notes. Sample restricted to homeowners whose principal dwelling has a first-lien mortgage and is not a ranch, farm, or mobile home. Estimates are weighted.

Appendix Table B

Reporting rates for mortgage characteristics: Pooled 1998, 2001, and 2004 SCFs (Data reported by borrowers)

Variable (percent applicable)	Original value	Range	Edited value	Don't know	Refused	Missing due to editing
<i>Mortgage terms and features</i>						
Adjustable rate (65%)	98.8		0.1	0.8	0.1	0.2
Amortization period (65%)	98.2		0.3	1.0	0.2	0.3
Amount of regular payment (65%)	91.0	5.4	0.4	0.8	1.7	0.6
Annual interest rate (65%)	92.5		0.5	6.4	0.2	0.4
Year mortgage obtained (65%)	98.2		0.3	0.7	0.3	0.5
Government guarantor (18%)	95.5		0.2	3.3	0.2	0.7
Private mortgage insurance (47%)	89.8		1.6	6.2	0.2	2.2
<i>Adjustable rate mortgage terms and features</i>						
Frequency rate can change (%)	84.5		0.2	13.1	0.4	1.9
Negative amortization allowed (%)	94.7		0.6	2.7	0.2	1.9
Maximum rate can rise at once (%)	60.1		1.5	32.8	0.7	4.8
Maximum rate can be charged (%)	56.0		0.6	39.6	1.2	2.6
Original interest rate (%)	82.8		0.9	13.6	1.1	1.6
On what index does it depend (%)	70.0		0.2	21.3	0.6	7.9
Convertible mortgage (%)	86.8		0.4	10.8	0.4	1.6

Number of obs.: 8762

Notes. Estimates are weighted with sample weights. Mortgages backed by mobile homes, farms, and ranches are excluded. Reporting rates are calculated over the sample of observations for which the question was applicable.

may provide advantages for borrowers, it is important to recognize that they are often paired with the borrowers who may have the most difficulty understanding them.

Market forces alone may not be enough to encourage the development of products that both improve access to credit and are transparent. Gabaix and Laibson (2006) and Campbell (2006) argue that many financial products implicitly involve a cross-subsidy from naïve to financially savvy households. For example, savvy households may benefit more than naïve households from fixed-rate mortgages because savvy households know to refinance their mortgages when interest rates fall. A company that educates borrowers will lose the profits it makes on naïve households, but will gain no additional revenue from savvier households. As a result, neither lenders nor savvy households have an incentive to design or advocate for products that are more transparent, and competition does not drive out confusing or misleading products. Our paper underscores the fact that designing, promoting, and regulating products that fit the needs of disadvantaged borrowers is inherently challenging.

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