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Education Levels and Mortgage Application Outcomes: Evidence of Financial Literacy

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Abstract

This paper uses 2005 Home Mortgage Disclosure Act data aggregated by census tract to measure the relationship between census tract-level college completion rates and the rates at which first lien refinance mortgage applicants submit incomplete loan applications, withdraw loan applications before they are reviewed, and reject lender approved loan offers. This paper also explores the relationship between tract-level college completion rates and the mean interest rate borrowers received for a subset of high-cost loans. The results indicate that first lien refinance loan applicants in tracts with higher rates of college completion are less likely to submit incomplete applications, to withdraw applications before they are reviewed by the lender, and to reject lender-approved loan offers. Tracts with higher rates of college completion pay lower mean interest rates as reported by lenders for high-cost loans. Consumers in census tracts with lower rates of college completion may engage in different search strategies for mortgage credit options than consumers in tracts with higher college completion rates. To the extent education is correlated with financial capability, these findings suggest loan applicants with lower educational attainment lack financial literacy concerning refinance mortgage application search strategies.

Keywords: financial literacy, mortgage markets

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INTRODUCTION AND PURPOSE

Few financial transactions are as confusing as applying for and closing on a mortgage, yet mortgages are a critical tool for households' financial development. Mortgage contracts are complex instruments that vary significantly in structure and cost; a mortgage is typically the largest credit obligation households will undertake. Access to homeownership and appreciation in home equity leveraged through a long-term mortgage has historically been a primary mechanism for low- and middle-income households to accumulate financial assets (Joint Center for Housing Studies, 2000); however, mortgages involve risks and may absorb a significant portion of a household's budget. The selection of an appropriate mortgage loan can lower housing costs by tens of thousands of dollars over a 30-year loan, which in turn improves the borrower's financial circumstances.

The mortgage market has changed significantly in the last decade. In the early 2000s, the number of home loan options available to consumers increased considerably (Quercia, Stegman, and Davis, 2004). The advent of subprime lending ushered in credit to higher-risk borrowers who were previously unable to obtain mortgage credit (Hogarth and Hilgert, 2002). During the early 2000s, consumers often obtained loans through non-bank institutions, including national commercial lenders relying on third-party mortgage brokers to solicit borrowers and complete loan transactions (Quercia et al.). By the late 2000s, the mortgage market had contracted sharply due to slumping housing markets and lax lending policies. The rapid expansion and subsequent contraction of the mortgage and housing markets has spurred a vigorous debate about how well consumers can navigate the mortgage market and whether some lending institutions and/or loan products are not in borrowers' best interests (GAO, 2004). Of primary concern tend to be borrowers who lack knowledge of and experience with mortgage markets and who are therefore more vulnerable to the markets' challenges.

This paper examines the role of the college completion rate of residents in a census tract on consumers' behavior during the first lien refinance mortgage loan application process. This analysis uses data on first lien refinance mortgage loans as reported under the Home Mortgage Disclosure Act (HMDA). Application behavior—especially applications that fail to deliver any information about a loan approval—may be another useful proxy or indicator of the level of a consumer's financial literacy or capacity. The results of this study are instructive for state and federal policymakers, as well as for advocates concerned about consumer welfare in the mortgage market. Further illustrations of financial literacy are discussed regarding census tract-level control variables such as race, income, age, and the share of residents in owner-occupied homes.

LITERATURE REVIEW

Mortgage Search Processes and Education Levels

Traditional economic theory suggests that consumers will search for mortgage loan options by reviewing available information on price and other features. Consumers are generally expected to search for and process information up to the point at which the marginal cost of acquiring and processing further information equals the marginal benefit of that information for making a decision (Stigler, 1961). Much of this theory, however, is based on a consumer's ability to obtain complete information. Information in the mortgage market tends to be heterogeneous across loan types, involves technical terms, and requires calculations of the long-term time value of money. Searching for a mortgage requires consumers to incur the costs of learning about types of loans and loan terms, or paying a specialist for such advice. Even consumers who seek out advice may be misled. All too common is the story of a borrower who signs a mortgage contract that a mortgage broker promoted based on the broker's own financial incentives rather than the borrower's needs.

It is unlikely that refinance mortgage applicants have acquired significant insights from their past experiences in the mortgage market. Most borrowers engage in mortgage transactions infrequently,

resulting in a lack of familiarity with the mortgage market and few opportunities to develop proficiency at shopping for a mortgage (Gibler and Nelson, 2003). The mortgage market could be an example of a market in which consumers have access to weak forms of information during the search process. In such markets, producers have fewer incentives to compete over the positive attributes of their product. Consumer welfare can be reduced, since these markets may not allocate products efficiently to various classes of consumers (Beales, Craswell, and Salop, 1981). Even in relatively competitive non-concentrated lending markets, the extent to which consumers lack information (or the ability to process available information) can result in mortgage lenders exerting market power and earning supra-normal profits (Inderst, 2005).

Formal education may be an important predictor of how loan applicants search for and obtain mortgages. Higher levels of education may facilitate better comprehension of loan options and the solicitation of more options. Russo, Staelin, Nolan, Russell, and Metcalf (1986) found that consumers engage in three activities when searching for a product or service: (1) collection, (2) computation, and (3) comprehension. The last activity is dependent on the consumer's ability to process information, relative to other information, and use the information to make a decision. The ability to comprehend information varies according to the consumer's knowledge and cognitive capacity. This comprehension stage is best managed by better educated and higher income consumers, who tend to be the most aggressive in collecting information and more adept at computation (Crosby and Taylor, 1981). Prior studies indicate strong associations among income, education, and performance across a variety of financial capability measures (Hilgert, Hogarth, and Beverly, 2003; Lusardi and Mitchell, 2007).

In research on consumers' financial capability, the concept of financial literacy has become increasingly prevalent. "Financial literacy" is a commonly used term but arguably an imprecise one. It borrows from the reading literacy field in assuming that literacy can be taught, can be measured, and is a cumulative skill set that individuals acquire as they move from infancy, through school, and into adulthood. Unlike reading literacy, there is no broadly accepted set of criteria for judging or testing

financial literacy. The President's Advisory Council on Financial Literacy (2009) defines financial literacy as, "the ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being." There is an important debate in the financial literacy field concerning the extent to which financial literacy can and should be judged on the basis of knowledge versus behavior. The President's Advisory Council (2009) observes that financial literacy includes knowledge and actions in response to context. Similar to the case for reading literacy, which is advocated as a tool for participating successfully in society, financial literacy is a set of skills that inform decisions, affect behavior, and ultimately lead to beneficial outcomes. Given the potential costs and long-term nature of mortgage contracts, a consumer's behavior in the mortgage market is arguably one of the most important contexts in which differences in financial literacy may become observable.

Low socioeconomic status consumers may face a number of informational disadvantages in credit markets. Financial knowledge measures tend to be lower for lower-income consumers (Agnew and Szykman, 2005; Bernheim, 1998; Lusardi and Mitchell, 2005; Mandell, 2004). Understanding how interest accrues and is charged tends to be a particular area of weakness (Moore, 2003). Bucks and Pence (2006) show that low-income mortgage borrowers with adjustable rate mortgages are the most likely to underestimate how much the interest rate on their loan could change relative to their contract. The authors find low-income borrowers were 28 percent more likely to be unaware of their interest rate than higher income borrowers. Furthermore, the authors find a lack of education exacerbates this problem. Low-income consumers with less than a college degree were among the least informed about the terms of their mortgage. The authors also suggest borrowers of a non-white race have similarly low knowledge levels regarding their mortgage terms.

Of course, formal education is not the only indicator of financial capability and comprehension. Consumers may rely on external sources of information during the mortgage search process, including their family and friends. Some consumers may also obtain information from brochures and other sources (Beales et al., 1981). For mortgage applicants, an important external source of information may be

neighbors who own homes. Given that neighborhoods tend to be homogenous along housing and household types, nearby homeowners may have experiences with refinancing a mortgage that influence their own mortgage shopping behavior—neighbors may serve as a "check-in" to verify loan terms or alternatives. Loan applicants in census tracts with greater proportions of homeowners may be more likely to have access to informal information and advice relative to refinance mortgage loan applicants in areas with lower rates of homeownership. Because homeownership rates are correlated with socioeconomic status, controlling for income, education, and other factors will be important in order to isolate the effects of homeownership as a proxy for the prevalence of informal advice.

One category of loan applicant worthy of particular consideration is elderly persons. Senior citizens are cited as one population victimized by predatory mortgage loans they do not understand and that were pushed upon them by an aggressive lender or broker (GAO, 2004). One may expect that older homeowners would have an advantage in mortgage markets given their longer tenure as homeowners and the potential for more extensive experience in the home mortgage market. However, the nature of the mortgage market, with its wide array of loan types and lending institutions, provides few opportunities for applied learning over time. In fact, Bucks and Pence (2008) suggest that seniors "are substantially more likely not to know their mortgage terms," which could be a signal of financial literacy failures (p. 227). The authors show that 60 percent of borrowers aged 65 or older do not know the details of their mortgage, compared with 30 percent of younger borrowers. Other studies affirm that older borrowers are more likely to have reduced cognitive abilities (Christelis, Jappelli, and Padula, 2009; Korniotis and Kumar, 2007, 2008). Older individuals also appear more prone to making financial mistakes in credit markets by failing to use and pay off credit optimally (Agarwal, Driscoll, Gabaix, and Laibson, 2007). Given Bucks and Pence's (2008) finding that lower income mortgage borrowers, borrowers with lower levels of education, and minority borrowers have lower levels of financial literacy related to mortgage markets, the additional factor of age is important to consider in models of financial behavior.

Previous studies have analyzed direct measures of financial literacy, including factual questions (Lusardi and Mitchell, 2007; Mandell and Klein, 2009). Others studies have examined financial behaviors that could be reasonably associated with lower levels of financial literacy (Hogarth and Hilgert, 2002; Lusardi and Mitchell, 2005; Lusardi, Tufano, and Field, 2009). Mortgage application decisions have not been a focus of the literature in the past, although this is a critical area and one with far reaching effects. Mortgages represented almost 90 cents of every dollar of an average household's total debt obligations in 2004 (Crook and Hochguertel, 2007). This is a domain of financial literacy that could have profound implications for consumers. Importantly, past research suggests that interest rate calculations and comparisons, core tasks in the refinance decision, are areas of financial capability that are particularly problematic (Campbell, 2006; Lusardi et al., 2009; Moore, 2003; Stango and Zinman, 2006).

Lower financial literacy may not impede consumers from obtaining refinance mortgages, but it may make the process of shopping for a loan, assimilating information, and understanding alternatives more costly and time consuming. Borrowers who fail to fully process and understand their mortgage terms may take out higher cost mortgages than they otherwise could have qualified for (Lax, Manti, Raca, and Zorn, 2004). Other borrowers may not refinance even if their terms are less attractive than current market rates and terms (Campbell, 2006). Woodward (2003) finds that shopping for a mortgage may be less likely among minority and less-educated borrowers, and as a result these borrowers pay significantly higher rates and fees.

Refinance loans are a particularly important segment of the market to study. First, these borrowers are remaining in their current home, and the mortgage is not tied to a home sale, making the analysis more straightforward. Second, the refinance market generally has a wide array of lenders, brokers, and credit unions offering products in almost all markets, including telephone- and Internet-based providers. Third, refinance products have great variation in terms, fees, interest rates, and the ability to finance more than the existing loan in order to 'cash out' home equity (at least in periods of rising

home values, as evidenced in 2005). Thus, there is variation in the terms consumers might compare across loan alternatives but less variation in terms of situational contexts.

Prior Research on Mortgage Searches

There are few studies examining consumers' mortgage search behaviors. Lee and Hogarth (1999, 2000) analyzed mortgage borrowers' shopping behavior using self-reported survey data. The authors' data analysis indicates wide variation in consumers' search behaviors. The authors also found that borrowers with more education conducted wider searches, and that borrowers who expected to be denied for a loan engaged in more limited searches (Lee and Hogarth, 2000).

Although the literature on consumers' mortgage search processes is scarce, it appears that consumers searching for refinance mortgages engage in similar behaviors as consumers in the market for other mortgage products. Early research on refinance searches focused on consumers' slow response to decreases in interest rates and their sluggishness to refinance when it would be optimal to do so. In the early 2000s, a significant proportion of households continued to pay interest rates that exceeded the available rates considerably. Campbell (2006) estimates that during the late 1990s and early 2000s, between 36 percent and 45 percent of households paid an interest rate that was at least 1.5 percentage points higher than the available rate. Further, between 6 percent and 8 percent of households paid rates that were more than 3 percentage points higher than the available rate. Lee and Hogarth (2000) compared the mortgage search behaviors of refinancers to the behaviors of other mortgage borrowers. While 23 percent of other mortgage borrowers contacted only one lender, 14 percent of refinancers contacted just one lender. The authors found no difference in the mean or median number of information sources borrowers consulted, though the types of information sources varied between refinancers and other borrowers. For instance, other mortgage borrowers were four times more likely to report obtaining information from real estate agents, and refinancers were twice as likely to report getting information from advertisements. In an earlier study, Lee and Hogarth (1999) found that greater search efforts led to

lower interest rates for refinancers but not for other mortgage borrowers. The authors also found that refinancers were more likely to engage in lengthier searches than other mortgage borrowers, likely due to the relative differences in time pressures. Woodward (2003) compares the fees paid for refinance mortgages and purchase loans, finding that although refinancings are simpler the fee is higher on average, in part due to differences in shopping behavior.

Home Mortgage Disclosure Act (HMDA) data have been used for many papers analyzing mortgage applications and denial rates by race and income. Avery et al. (2005) provide one of the most comprehensive analyses of HMDA data on a national scale, including special forms of HMDA data available to the Federal Reserve Board such as census tract-level credit scores. The authors did not control for tract-level education levels or age, however. Calem, Gillen, and Wachter (2004) perform an analysis of HMDA data in a limited number of areas with a focus on neighborhood effects, finding strong intra-tract correlations in mortgage application denial rates and the growth in subprime lending. The authors utilize a number of tract-level variables from the 2000 census, including the percentage of the population over age 25 with a college degree. Nevertheless, the authors examined neither incomplete and withdrawn applications nor annual percentage rate (APR) spreads. More recently, Ding, Ratcliffe, Stegman, and Quercia (2008) examined HMDA data for the Atlanta metropolitan area, including APR spreads. They found that census tracts with lower mean incomes and higher proportions of minority loan applicants tend to have larger APR spreads.

METHODOLOGY

Hypotheses

This paper explores four hypotheses about the relationship between first lien home mortgage refinance loan applicants' behavior and education level by tract, as measured by HMDA and census data, respectively:

> H1. Tract rates of college completion are negatively associated with the mean rate of borrowers submitting incomplete first lien refinance mortgage applications in the tract,

> controlling for tract mean levels of borrower race/ethnicity, borrower income, age reported in the census, and the prevalence of homeownership in the tract.

Incomplete applications may be one of the clearest signs of a lack of financial sophistication. Submitting partial applications incurs time costs of completing paperwork and gathering documents, as well as nonrefundable application fees. Submitting an incomplete application is potentially a waste of the consumer's time and resources. Federal regulations require lenders to send a written notice of incompleteness (under section 202.9(c)(2) of Regulation B, Equal Credit Opportunity) and to request the applicant respond to a request for additional information within a specified period of time. If the consumer fails to respond, the application is closed and filed as incomplete. The rate of applicants in a tract submitting incomplete applications should provide an indication of the prevalence of borrowers failing to navigate the mortgage application process. The rate of incomplete mortgage application submissions is hypothesized to be negatively associated with the share of the tract population with a bachelor's degree.

> H2. Tract rates of college completion are negatively associated with the mean rate of applicants withdrawing completed first lien refinance mortgage applications in the tract, controlling for mean levels of borrower race/ ethnicity, borrower income, age reported in the census, and the prevalence of homeownership in the tract.

Whereas incomplete applications are defined by the lender, withdrawn applications result from borrowers' actions. A withdrawn application suggests the consumer requested the file to be closed (in person, on the telephone, or in writing) before a credit application was made. The lender may or may not have had enough information to act on the application, but the applicant never received a decision. This could be due to a change in circumstances, but given the up-front costs of making the application, it would be reasonable to wait for the lender's decision. Consumers may shop multiple lenders and submit several applications in order to explore terms and pricing, but this represents an inefficient application strategy given the time and financial costs of completing an application. The rate at which loan applicants withdraw their submitted mortgage applications is hypothesized to be negatively associated with the share of the tract population with a bachelor's degree.

> H3. Tract rates of college completion are positively associated with the mean rate of applicants rejecting lender approved first lien refinance loans in the tract, controlling for mean levels of borrower race/ethnicity, borrower income, age as reported in the census, and the prevalence of homeownership in the tract.

Rejecting an approved loan offer is a borrower-driven decision in which a complete application is submitted and fully approved by the lender. The borrower then rejects the lender's approval and does not close the loan. This outcome is more challenging to interpret than the two previous outcomes. Some consumers who reject an approved offer will have submitted multiple applications and will then have selected the best approved offer. Because this paper analyzes first lien refinance mortgage loans, applicants are not required to obtain a loan. Applicants may decide not to take out any loan at all. As with withdrawn applications, there are costs for loan applicants to reach this stage in the process; searching among terms and rates might be more efficient before making an application. Alternatively, rejecting an approved loan offer may suggest some consideration of the loan terms and conditions, and would therefore entail a level of information processing that may be facilitated by formal education. Therefore, the rate at which mortgage applicants reject approved loan offers is hypothesized to be positively associated with the share of the tract population with a bachelor's degree.

> H4. Tract education levels are negatively associated with the mean interest rate reported by lenders for originated high-cost loans in the tract, controlling for race/ethnicity, income, age, and the prevalence of homeownership in the tract.

In the HMDA data, interest rates are provided for a subset of loan applications. Lenders only report an interest rate for loans that were approved and originated and only if the rate was at least 300 basis points greater than the10-year Treasury rate. Lenders do not report the actual interest rate, but rather the difference between the APR and the Treasury bond benchmark rate. As tract mean education levels increase, borrowers may become savvier in searching among high-cost loans and engage in more searching and shopping. Thus, the mean APR spread is hypothesized to be negatively associated with the share of the tract population with a bachelor's degree.

Data

Each year, the Federal Financial Institutions Examination Council (www.ffiec.gov) releases the HMDA database, which documents loan applications recorded by regulated mortgage lenders. Previous studies have used HMDA data to examine mortgage origination and denial patterns, trends in lending by type of financial institution, and general trends in loan volumes and borrower characteristics. Included in these data are several measures that are rarely cited in the literature: borrowers who submit incomplete applications as determined by lending institutions, borrowers who withdraw their applications before receiving an evaluation, and borrowers who reject approved loan offers. These three measures can be viewed as indicators of consumer behavior. In 2004, HMDA began reporting the spread between the APR on the loan and the 10-year Treasury rate, though only for loans that were approved and originated and only if the APR spread was at least 300 basis points.

Sample

Data from 2005 loan applications from 50 states was aggregated at the census tract level for first lien refinance loan applications for 66,000 tracts. This aggregation accomplished several functions. First, measures of education are unavailable through HMDA data, and the closest available proxy was mean census tract levels of education. By aggregating the data, the dependent and independent variables are measured at the same unit of analysis. Second, HMDA data at the loan level is quite large, and using a loan-level dataset is computationally intensive. Using data aggregated by census tract creates a more manageable dataset. Finally, examining data aggregated by geographic area reduces the high degree of correlation across mortgage applicants' characteristics. The central tendencies of race, income, education, and credit status are less correlated by census tract than by individual mortgage borrowers.

The analysis was conducted only on first lien refinance mortgage loans. Applicants seeking home purchase loans were excluded because these borrowers have a pending home purchase and are under time pressures that are unobservable and may contribute to differential loan search and application behaviors.

Applicants for home improvement mortgages were also excluded because these loans vary significantly, from small loans for home repairs to large loans for extensive rehabilitation. The heterogeneity across home improvement loans makes this class of loan especially challenging to analyze. Refinance loans are a more discretionary segment of the mortgage market. Refinance loan applicants generally seek a lower (or more stable) interest rate, shorter loan terms, and/or equity to fund current consumption. Compared with purchase loan applicants, refinance borrowers have less time pressure, can search more, and have at least some previous experience with mortgages (Lee and Hogarth, 2000).

HMDA regulations require lenders to report loan applications in Metropolitan Statistical Areas (MSAs). Some lenders also submit loan records for rural, non-metropolitan areas. To eliminate any bias associated with lenders' reporting decisions, non-metropolitan area tract-loan type combinations were dropped from the analysis, leaving 379 MSAs. In addition, the analysis is first presented for all tracts and then only for tracts with at least 30 loan applications in the HMDA data. The mean number of applications per tract was 173, with only 5 percent of tracts having fewer than 30. Since the outcome variables depend on loan applications as a denominator, tracts with small numbers of applications could bias the analysis with large proportional values. Also, these low-volume tracts are likely located in areas with few owner-occupied homes and may not represent the context of the typical mortgage transaction.

The resulting dataset of 52,532 census tracts from 50 states was matched with census tract variables for the education level of residents aged 25 or older, as well as other demographic characteristics from the 2000 census including the share of owner-occupied homes and the share of households headed by individuals aged 65 or older. The final dataset represents more than 11.6 million loan applications that were submitted in 2005. Table 1 displays the number of loan applications by state, including each state's mean rate of loan applications that were incomplete, withdrawn, or rejected. The significant variations by state suggest a need to control for unobserved differences across states.

Table 1
Number of Mortgage Refinance Applications, Census Tracts, and Application Outcomes by State in 2005

State	Number of Applications	Number of Tracts	% Incomplete	% Withdrawn	% Rejected
Alabama	125,414	749	6.84	16.16	23.21
Alaska	15,951	86	7.61	15.82	12.77
Arizona	411,842	974	7.5	13.92	12.25
Arkansas	47,256	347	3.33	16.74	17.05
California	2,289,909	6,844	4.99	16.23	14.62
Colorado	225,976	899	4.66	20.68	13.42
Connecticut	153,391	736	7.28	21.78	15.18
Delaware	36,883	160	9.38	17.69	17.26
Florida	958,078	2,956	7.9	18.55	15.35
Georgia	331,791	1,228	6.83	17.45	18.64
Hawaii	29,311	210	5.45	20.37	10.92
Idaho	41,053	168	4.53	17.98	16.03
Illinois	510,587	2,468	4.47	15.29	14.53
Indiana	206,904	1,064	6.47	17.78	17.42
Iowa	60,728	399	7.5	15.63	15.47
Kansas	71,011	431	3.85	20.98	15.45
Kentucky	83,736	535	3.66	14.58	15.64
Louisiana	109,958	840	7.56	17.03	22.38
Maine	37,371	185	4.32	19.24	11.66
Maryland	386,493	1,147	4.13	20.22	12.89
Massachusetts	295,030	1,345	5.85	19.23	10.45
Michigan	458,815	2,201	7.42	17.16	18.01
Minnesota	179,198	908	7.5	17.65	12.6
Mississippi	36,793	257	5.15	19.17	22.88
Missouri	217,315	929	3.63	20.43	15.73
Montana	9,320	75	3.91	18.16	13.57
Nebraska	33,716	268	6.64	17.02	14.08
Nevada	159,990	420	4.88	20.28	13.6
New Hampshire	43,778	160	8.95	15.87	11.93
New Jersey	418,963	1,930	5.55	19.15	15.09
New Mexico	47,951	276	3.45	19.09	14.59
New York	474,680	4,378	9.07	20.21	18.57
North Carolina	213,233	1,070	5.36	14.95	17.89
North Dakota	6,490	66	9.08	13.1	12.55
Ohio	394,832	2,404	4.24	18.17	19
Oklahoma	78,686	640	3.55	25.32	15.44
Oregon	125,627	554	5.02	18.19	14.96
Pennsylvania	433,975	2,648	4.77	19.03	18.87
Rhode Island	64,291	233	5.46	25.34	11.17
South Carolina	111,184	643	7.92	16.37	17.47
South Dakota	10,734	69	5.92	15.74	14.4
Tennessee	181,379	902	4.4	22.61	18.49
Texas	568,034	3,614	9.21	19.85	16.21
Utah	88,652	424	7.55	14.21	15.07
Vermont	7,149	44	6.29	12.28	9.78
Virginia	343,770	1,307	3.15	15.45	14.13
Washington	273,723	1,115	5.84	17.3	13.87
West Virginia	30,134	264	2.29	12.89	17.9
Wisconsin	178,239	927	8.39	14.64	10.83
Wyoming	6,917	35	4.06	19.81	12.89
Total	11,626,241	52,532	6.15	18.04	15.97

Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applications.

Variables

The dependent variables used in the analysis include the following:

- *Incomplete*, the tract mean rate of all first lien refinance applications in the HMDA data that result in a lender labeling the application as incomplete.
- *Withdrawn*, the tract mean rate of all first lien refinance applications in the HMDA data that result in a lender labeling the application as complete but withdrawn.
- *Rejected*, the tract mean rate of all first lien refinance applications in the HMDA data that result in a lender approving the application but the borrower rejecting the loan offer.
- *Rate Spread*, the tract mean APR spread to the benchmark Treasury rate for high-cost loans for all approved and originated first lien refinance applications in the HMDA data (at least 300 basis points over the benchmark rate).

Table 2 illustrates the tract-level means for the four dependent variables by education level. Education level is measured as the share of each tract's population with a four-year college degree. This summary table suggests that incomplete and withdrawn applications have the predicted negative relationship with education level. Rejecting lender-approved loan applications appears to have the opposite relationship than hypothesized.

Independent variables used in the analysis include the following:

- *Non-white*, the tract mean rate of all first lien refinance loan applications in the HMDA data submitted by a loan applicant in which the lender reported a race but that race was not white or Caucasian.
- *Log Income*, the natural log of the tract mean loan applicant income for all first lien refinance applications reported in the HMDA data.
- *Hispanic*, the tract mean rate of all first lien refinance loan applications in the HMDA data submitted by a loan applicant where the lender reported race/ethnicity and the applicant was labeled as Hispanic/Latino.
- *Homeowner Rate*, the tract mean rate of households reporting owning their own home in the 2000 decennial census.
- *Share College*, the tract mean rate of population over age 25 reported to have completed a four-year college degree in the 2000 decennial census.
- *Share 65 or Older*, the tract mean rate of the population reporting to be at least age 65 in the 2000 decennial census.

Table 2
Tract Mean Rate of College Education by Tract Mean Incomplete, Withdrawn, and Rejected First-Lien Refinance Loan Applications

Loan Status	0–5% College	6–10% College	11–15% College	15% + College
Incomplete	6.0	6.4	6.4	5.8
Withdrawn	19.4	19.0	18.0	15.8
Rejected	20.3	16.3	14.4	12.7
Mean APR	5.00	4.87	4.81	4.75

Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applicants by census tract.

Tables 3 and 4 display summary statistics and correlations, respectively. The correlations suggest some caution regarding the collinear relationship between education and income, as should be expected.

Statistical Methods

Each outcome variable has the same basic specification, with variations in fixed effects and standard errors:

*Y (Mean Proportion Applications Incomplete, Mean Proportion Applications Withdrawn by Applicant, Mean Proportion Applications Rejected by Applicant, Tract Mean APR Spread) = ß1 * Log Mean Tract Application Income + ß2 * Proportion of Non-white Applicants + ß3 * Proportion of Hispanic Applicants + ß4 * Proportion of Tract Population College Graduate + ß5 * Proportion of Tract Population 65 or Older + ß6 * Proportion of Homes in Tract with a Mortgage + ßn State Fixed Effects + α + ε*

All models use robust standard errors to correct for heteroskedasticity and are estimated using ordinary least squares (OLS) specifications. State fixed effects are included in selected models as noted, but the coefficients for each state are not shown in the tables for clarity of presentation. Additional specifications using Tobit, Logit, and an OLS with log-log transformations generated similar results. The log-log transformation was problematic for tracts with 0 percent shares of key variables. Similar specifications using MSA or county fixed effects did not alter the results. State fixed effects were used primarily to control for unobserved state mortgage lending policies, but also to serve as a limited indicator of local housing market conditions. Clustering standard errors at either the state or MSA levels produced similar results, but MSA clustering was retained as a better approximation of local housing markets. Checks for multicollinearity using variance inflation factors also yielded results within acceptable bounds.

RESULTS

The results of each series of regressions are displayed in Tables 5–8. The results suggest that education level by tract has modest effects on the specified outcomes, generally as hypothesized, with the strongest effects for withdrawn applications and conflicting results for rejected loan offers. Income, race, and tract homeownership rates are related to the dependent variable as might be expected in most cases.

Table 3
Summary Statistics for Dependent and Independent Variables

Variable	*n*	*M*	*SD*	Range
Incomplete	52532	6.15	4.53	0.00–100.00
Withdrawn	52532	18.04	7.22	0.00–100.00
Rejected	52073	15.97	9.03	0.00–100.00
Rate Spread	50622	4.87	0.53	3.00–18.64
Non-white	52407	21.29	24.48	0.00–100.00
Log Income	52508	11.25	0.43	8.70–14.81
Hispanic	52412	13.40	20.15	0.00–100.00
Homeowner Rate	51270	59.71	23.65	0.00–100.00
Share College	51357	10.59	7.34	0.00–166.67
Share 65+	51357	12.45	7.27	0.00–100.00

Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applicants by census tract.

Table 4
Summary of Correlations Statistics for Dependent and Independent Variables

Variable	Incomplete	Withdrawn	Rejected	Rate Spread	Non-white	Log Income	Hispanic	Homeowner Rate	Share College
Incomplete	—								
Withdrawn	-0.127	—							
Rejected	-0.007	0.097	—						
Rate Spread	0.008	0.079	0.159	—					
Non-white	0.013	0.076	0.347	0.162	—				
Log Income	0.053	-0.252	-0.346	-0.185	-0.239	—			
Hispanic	0.084	0.017	0.043	0.026	-0.030	-0.042	—		
Homeowner Rate	-0.036	-0.060	-0.199	-0.077	-0.323	0.177	-0.236	—	
Share College	-0.030	-0.260	-0.335	-0.173	-0.256	0.673	-0.288	0.248	—
Share 65+	-0.044	-0.008	-0.017	0.004	-0.133	0.012	-0.195	0.085	0.098

Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applicants by census tract.

Incomplete Applications

Table 5 presents the results for the rate of incomplete mortgage applications by tract. As the share of the tract population aged 25 or older with a bachelor's degree increases, the proportion of incomplete applications declines for purchase and refinance loans in either the first or subordinate positions. A 10 percentage point increase in the proportion of college graduates is associated with about a one-half percentage point reduction in the share of incomplete applications in the tract, both including and excluding state fixed effects. These results comport with the hypothesis that education is negatively correlated with incomplete applications, although the relationship is weak in magnitude.

Other covariates are also statistically significant but small in magnitude. Both a greater share of homeowners and a higher proportion of older residents are associated with a lower rate of incomplete loan applications. Surprisingly, the natural log of mean applicant income is associated with a higher rate of incomplete applications. The share of minority loan applicants and the share of applicants of Hispanic ethnicity have negligible effects in the more robust models. The variable for tract mean homeownership rate has small effects but suggests that tracts with higher homeownership rates have lower rates of incomplete applications. The tract share of the population aged 65 or older is associated with lower rates of incomplete applications. These results suggest that the rate of incomplete applications may be consistent with financial literacy deficiencies. It should be noted that the coefficient for college education rates remained statistically significant even after dropping smaller tracts, adding state fixed effects, and clustering robust standard errors at the MSA level.

Withdrawn Applications

Table 6 presents the results for the rate of withdrawn mortgage applications by tract. The relationship between college education rates and the rate of withdrawn applications is modest, although larger than in the models for incomplete applications. As the proportion of the tract population with a

Table 5
Predictors of the Proportion of Submitted Applications that were Incomplete

	All Tracts	At Least 30 Applications in Tract		
Tract-Level Variable				
Share College Education	**-0.0504**	**-0.0477**	**-0.0483**	**-0.0483**
	-9.22	*-8.85*	*-8.8*	*-4.86*
Share Non-white Applicant	0.0017	0.0011	**0.0031**	0.0031
	1.68	*1.13*	*3.17*	*1.01*
Log Mean Applicant Income	**1.2278**	**1.0666**	**1.3465**	**1.3465**
	12.08	*10.76*	*11.44*	*6.59*
Share Hispanic Applicant	**0.0096**	**0.0091**	**0.0084**	0.0084
	7.58	*7.44*	*6.05*	*1.52*
Homeowner Rate	**-0.0045**	**-0.0043**	**-0.0047**	**-0.0047**
	-3.5	*-3.21*	*-3.63*	*-2.09*
Share 65+	**-0.0163**	**-0.0176**	**-0.0224**	**-0.0224**
	-5.22	*-5.84*	*-7.79*	*-3.51*
Constant	**-6.8391**	**-5.0215**	**-8.1105**	**-8.1105**
	-6.32	*-4.78*	*-6.42*	*-3.57*
State Fixed Effects			X	X
MSA Clustered *SE*				X
R^2 *(adjusted)*	0.01545	0.01424	0.2413	0.2413
n	51,155	48,348	48,348	48,348

Note: OLS estimates of coefficients and t-test (italics). Bolded coefficients significant at 1%.
Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applicants by census tract.

Table 6
Predictors of the Proportion of Submitted Applications Withdrawn by the Applicant

	All Tracts	At Least 30 Applications in Tract		
Tract-Level Variable				
Share College Education	**-0.1432**	**-0.1468**	**-0.1362**	**-0.1362**
	-18.22	*-18.88*	*-16.49*	*-11.94*
Share Non-white Applicant	-0.003	-0.0023	**-0.0049**	-0.0049
	-1.79	*-1.42*	*-2.72*	*-1.33*
Log Mean Applicant Income	**-1.7733**	**-1.8171**	**-2.9055**	**-2.9055**
	-12.63	*-12.95*	*-16.97*	*-11.7*
Share Hispanic Applicant	**-0.0141**	**-0.0178**	**-0.0364**	**-0.0364**
	-6.72	*-8.91*	*-13.41*	*-6.77*
Homeowner Rate	**-0.0114**	**-0.0152**	**-0.0101**	**-0.0101**
	-5.45	*-7.02*	*-4.71*	*-3.23*
Share 65+	-0.0024	-0.0022	**-0.0264**	**-0.0264**
	-0.46	*-0.45*	*-5.07*	*-3.53*
Constant	**40.4958**	**41.3435**	**53.7648**	**53.7648**
	26.51	*27.07*	*28.51*	*19.07*
State Fixed Effects			X	X
MSA Clustered *SE*				X
R^2 *(adjusted)*	0.06556	0.08288	0.2294	0.2294
n	51,155	48,348	48,348	48,348

Note: OLS estimates of coefficients and t-test (italics). Bolded coefficients significant at 1%.
Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applicants by census tract.

college education increases by 10 percentage points, the occurrence of withdrawn applications declines by about 1.5 percentage points. This may suggest that withdrawn loans signal poor application strategies or other problems. Similar to the model for incomplete applications, the share of applicants of a non-white race has little effect. As the mean loan applicant income in a tract increases, the rate of withdrawn applications declines, controlling for other factors. This finding is the opposite of the prior models for incomplete applications and is more consistent with what may be predicted. The variable for the tract rate of Hispanic loan applicants is weakly associated with the rate of withdrawn applications. A 10 percentage point increase in the mean rate of Hispanic loan applicants in the tract is associated with an increase in withdrawn applications of less than one-tenth of a percentage point. The share of owner-occupied homes is negatively related to withdrawn loan applications. A 10 percentage point increase in homeownership rates is associated with a 1 percentage point increase in withdrawal rates, perhaps suggesting some intra-neighborhood knowledge sharing. A greater share of older residents in the tract is also associated with a lower rate of withdrawn loan applications. These results are generally as hypothesized and support the notion that as education levels increase the rate of withdrawn applications declines. The strength of these models may also suggest that the rate of withdrawn applications in the HMDA data could be a useful measure of financial literacy deficiencies in future studies.

Approved Applications Rejected by the Borrower

Loan applicants rejecting an approved loan offer could be interpreted in multiple ways, as discussed previously. If borrowers shop for the best combination of rates and terms after receiving a loan offer, rejecting approved loan offers could signal appropriate search behavior and better financial judgment. Alternatively, the most financially literate borrowers may be more selective prior to submitting applications and may only apply for the most attractive loan products that they know they will agree to in advance. Since completing a mortgage application incurs time costs and application fees, shopping prior to applying for a mortgage loan may be a more efficient strategy for a typical first lien refinance loan. The

data support the latter explanation over the former. Table 7 presents the results for the rate of approved mortgage applications rejected by the loan applicant. As the share of college graduates in the tract increases by 10 percentage points, the share of rejected loan offers declines by about 1.5 percentage points. In contrast, a 10 percentage point increase in the share of the population aged 65 or older is associated with a one-third percentage point increase in loan offer rejections. Interestingly, the share of owner-occupied homes in the tract is negatively associated with rejected loan offers. A 10 percentage point difference in tract homeownership rates is associated with about a 0.4 percentage point higher rate of borrowers rejecting lender offers. To the extent more homeowners in a tract present more neighbors with experiences in the mortgage market, this may indicate that applicants have the advantage of checking with neighbors. Controlling for other factors, the homeownership rate in the tract seems to be consistent with borrowers being more likely to back out of an offer. Tract mean applicant income also has a negative relationship with rejecting approved loan offers, which is consistent with the effects of education rates. While tract rates of non-white loan applicants are related to more rejections of loan offers, the rate of Hispanic applicants has small coefficients of low significance and changing direction with fixed effects and more robust modeling. The rejection of an approved loan offer may be a more complicated process than submitting an incomplete application or withdrawing an application, but the results suggest there are differences in tract search and rejection strategies related to education levels.

APR Spreads for High-Cost Originated Loans

Interest rates for high-cost loans, defined as loans with annual interest rates at least 3 percentage points greater than a 10-year Treasury note (the only rates reported in the HMDA data and a fair approximation for subprime loans) are another potential indicator of financial behavior among a subset of borrowers shopping for higher-cost mortgages. Table 8 presents the results of the models for the mean APR spread by the tract-level outcome variable. As the share of college graduates in the tract increases by 10 percentage points, the mean APR spread decreases by about 5 basis points (where 100 basis points = 1

Table 7
Predictors of the Proportion of Lender Approved Loan Offers Rejected by the Applicant

	All Tracts	At Least 30 Applications in Tract		
Tract-Level Variable				
Share College Education	**-0.1465**	**-0.1556**	**-0.1303**	**-0.1303**
	-16.88	*-19.27*	*-14.94*	*-9.68*
Share Non-white Applicant	**0.0795**	**0.0793**	**0.0791**	**0.0791**
	34.89	*37.33*	*34.45*	*9.37*
Log Mean Applicant Income	**-3.475**	**-3.3085**	**-2.7479**	**-2.7479**
	-21.39	*-21.59*	*-14.67*	*-6.54*
Share Hispanic Applicant	**-0.0056**	**-0.0082**	**0.0107**	0.0107
	-2.21	*-3.38*	*3.58*	*1.61*
Homeowner Rate	**-0.0327**	**-0.0406**	**-0.0431**	**-0.0431**
	-13.01	*-15.96*	*-17.08*	*-13.06*
Share 65+	**0.0334**	**0.0286**	**0.0216**	**0.0216**
	5.43	*5.28*	*3.73*	*2.47*
Constant	**56.6327**	**55.4813**	**48.9072**	**48.9072**
	32.03	*33.29*	*23.74*	*10.17*
State Fixed Effects			X	X
MSA Clustered *SE*				X
R^2 *(adjusted)*	0.1731	0.2102	0.2763	0.2763
n	50,879	48,072	48,072	48,072

Note: OLS estimates of coefficients and t-test (italics). Bolded coefficients significant at 1%.
Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applicants by census tract.

Table 8
Predictors of Tract-Level Mean Annual Percentage Rate Spread

	All Tracts	At Least 30 Applications in Tract		
Tract-Level Variable				
Share College Education	**-0.0049**	**-0.0052**	**-0.0041**	**-0.0041**
	-8.83	*-9.85*	*-7.27*	*-4.57*
Share Non-white Applicant	**0.0027**	**0.0026**	**0.0021**	**0.0021**
	22.66	*24.00*	*18.92*	*4.6*
Log Mean Applicant Income	**-0.1399**	**-0.1237**	**-0.1856**	**-0.1856**
	-12.45	*-11.09*	*-14.25*	*-7.0*
Share Hispanic Applicant	**0.0003**	**0.0003**	**-0.0017**	**-0.0017**
	2.22	*2.08*	*-11.39*	*-3.4*
Homeowner Rate	0	-0.0002	-0.0002	-0.0002
	-0.23	*-1.32*	*-1.6*	*-0.91*
Share 65+	**0.0023**	**0.0024**	**0.0014**	**0.0014**
	5.81	*6.68*	*3.8*	*2.54*
Constant	**6.4011**	**6.2306**	**6.9646**	**6.9646**
	52.47	*51.49*	*48.87*	*24.16*
State Fixed Effects			X	X
MSA Clustered *SE*				X
R^2 *(adjusted)*	0.05238	0.05663	0.1501	0.1501
n	49598	47664	47664	47664

Note: OLS estimates of coefficients and t-test (italics). Bolded coefficients significant at 1%.
Source: Author's tabulations of 2005 HMDA data for first-lien refinance loan applicants by census tract.

percentage point). This small effect is approximately one-tenth of a standard deviation, but it remains statistically significant after controlling for other factors. By comparison, a 10 percentage point greater share of non-white loan applicants in the tract is associated with about a 2 to 3 basis points greater mean APR spread. Tracts with greater log mean loan applicant incomes have lower APR spreads for the high-cost loans studied. The tract share of loan applicants of Hispanic ethnicity has very small and mixed effects that vary by model. A 10 percent greater share of the population aged 65 or older is associated with tract mean APR spreads that are about 1 to 2 basis points greater. The share of owner-occupied homes in the tract has no clear association with tract-level mean APR spreads. Because interest rates are determined by unobserved risk-based factors that may be correlated with race, income, and census tract location, the interpretation of this model should be subject to caution. Nonetheless, there is evidence that tracts with greater education levels pay lower mean interest rates for high-cost loans reported in the HMDA data.

IMPLICATIONS

Based on a tract-level analysis of 2005 HMDA data for first lien refinance mortgage applications paired with 2000 census data, several findings are worthy of discussion. Hypothesis H1, that tract education levels (defined as completion of a four-year college degree among individuals aged 25 or older) are negatively associated with the mean rate of borrowers submitting incomplete loans, is weakly supported. Hypothesis H2, that tract education levels are negatively associated with the mean rate of borrowers withdrawing loan applications, is supported. This outcome appears to offer a useful measure of behavior that could serve as a proxy for financial literacy among mortgage loan consumers. Hypothesis H3, that tract education levels are positively associated with the mean rate of borrowers rejecting approved loans, is largely rejected. The data support the alternative explanation that borrowers with more education are better able to engage in searches prior to submitting loan applications and are more likely to apply to lenders from whom they are most likely to accept an offer. Hypothesis H4, that tract education

levels are negatively associated with interest rates on high-cost loans, is also supported, although the findings are small in magnitude. Other variables generally perform as predicted and support the direction of the effects of each dependent variable as a signal of behaviors that reflect greater or lesser levels of financial literacy.

This study makes several contributions to the literature. First, the use of incomplete, withdrawn, and rejected loan applications in the HMDA data is a novel approach that was previously untested in the literature. Second, this study explicitly tests tract-level college completion rates as a proxy for the effects of education on loan application outcomes, finding small but statistically significant effects. These results suggest that tracts with lower-educated loan applicants display differing application behaviors regarding first lien refinance loans, even after controlling for other factors. Third, the results indicate that if higher-educated consumers are shopping for mortgages, it is occurring before the loan application stage and not after the lender makes a loan offer. Lower-educated consumers may be engaging in inefficient application strategies by submitting incomplete applications, withdrawing applications, and rejecting approved refinance offers from lenders after investing resources into an application. This study also finds that tract-level homeownership rates influence mortgage application decisions. This may reflect the fact that as an applicant is in an area with more homeowners, there is a greater likelihood of gaining information about alternatives. This study's final contribution to the literature is its analysis of withdrawn applications in the HMDA data as a signal of financial literacy problems. A withdrawn application suggests the consumer requested the file to be closed before a credit application was made; the applicant never received a decision. This could be due to a change in circumstances, but given the up-front costs of making the application, it would be reasonable to wait for the lender's decision. Alternative interpretations include that borrowers discovered they may not be approved, and wished to withdraw an application rather than be subjected to the emotional toll of being denied. Federal regulations require a lender to code an application as denied if such a decision was made, however. Another possibility is that mortgage borrowers who did not pay fees to lock in a specific interest rate feared that interest rates were rising and

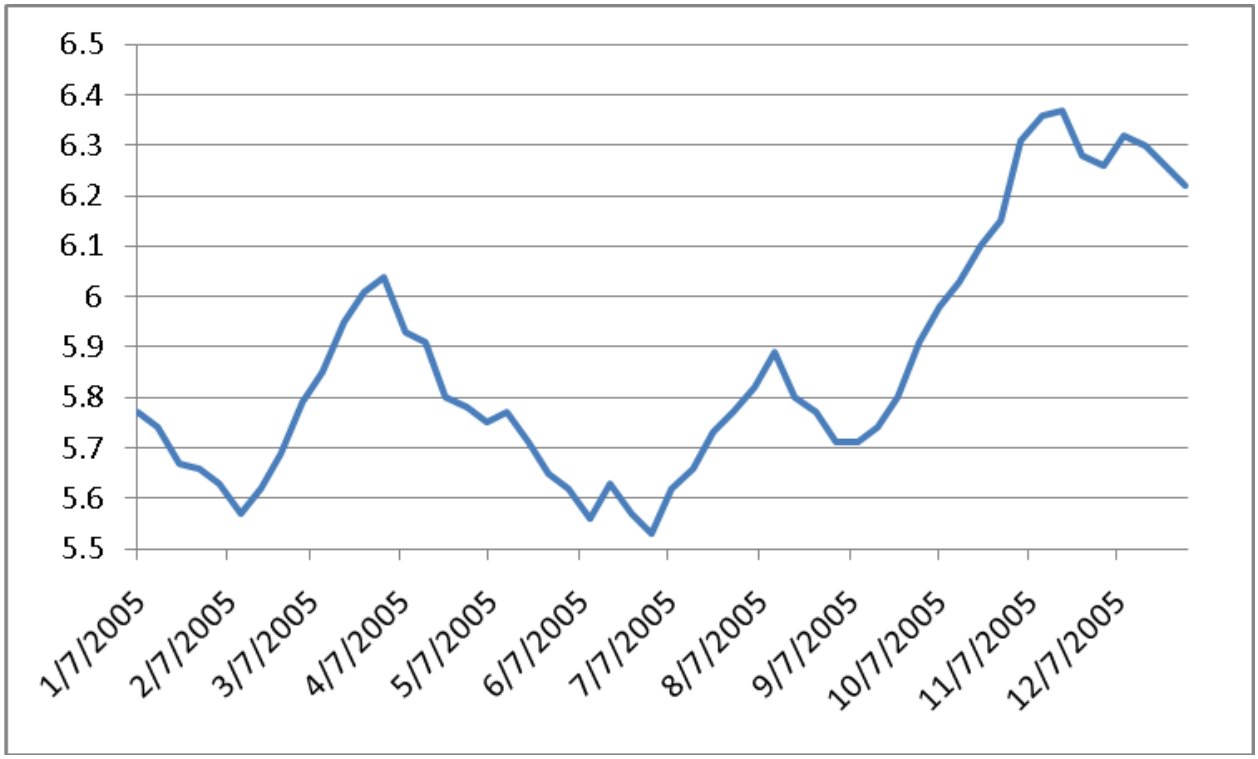
were no longer in the market to refinance. During 2005, interest rates were within an average of 5.5 percent to 6.5 percent for a 30-year fixed rate mortgage. Given this minimal variation and no rapid turning points (see Figure 1), this is an unlikely alternative explanation for withdrawn applications during the period analyzed.

HMDA data are intended to monitor loan approvals and denials, which are the HMDA variables typically used in past studies. The incomplete, withdrawn, and approved but rejected variables have not been widely employed in the literature. This analysis is a preliminary attempt to derive informational value from these variables. Future research using these data at the loan application level, or aggregated to alternative levels of geography, may yield useful findings. These analyses could also be repeated for other classes of loans. Future studies could employ more robust and timely tract-level covariates as new census data become available and could explore HMDA data after the mortgage market crisis. Ideally, data on race and income could be interacted with education level to better isolate the effects of education from other factors.

CONCLUSION

This study uses HMDA data to provide evidence that first lien refinance loan applicants located in tracts with lower education levels are more likely to engage in inefficient loan application strategies, resulting in more incomplete and withdrawn applications, more rejections of loan offers from lenders, and higher interest rates on high-cost loans. The results indicate that potential borrowers with lower educational attainment engage in lower levels of searching for and processing of information about their mortgage options, resulting in wasted application efforts and marginally higher costs of credit. Clearly, a

Figure 1
Market Trends in 30-Year Fixed-Rate Mortgages



Source: Federal Home Loan Mortgage Corporation's (Freddie Mac) Weekly Primary Mortgage Market Survey (PMMS), Average Values. Data from: http://www.freddiemac.com/dlink/html/PMMS/display/PMMSOutputYr.jsp.

lack of financial literacy can harm consumers when they apply for and take out home mortgages that they do not understand or cannot sustain. The extent of consumer financial literacy challenges in the mortgage market is an important component of the policy debate about regulating subprime lending and other forms of credit. To the extent problems with loan applications among consumers with lower incomes and education levels present a public policy problem, education, counseling, and disclosures are potential responses. Pre-application education and counseling, clearer pre-application and pending application disclosures, and the availability of advice may all be remedies that could aid lower-educated consumers during the loan application process.

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