



Borrowers from a different shore: Asian outcomes in the U.S. mortgage market



Marsha Courchane^{a,*}, Rajeev Darolia^b, Adam Gailey^c

^a Charles River Associates, 1201 F Street NW, Suite 700, Washington, DC 20004, United States

^b University of Missouri, United States

^c Charles River Associates, United States

ARTICLE INFO

Article history:

Received 22 July 2014

Revised 11 December 2014

Accepted 20 January 2015

Available online 30 January 2015

JEL classification:

G21

G28

J15

Keywords:

Mortgage markets

Asians

Minority borrowers

Discrimination

Fair lending

ABSTRACT

Even though Asians are now the largest minority group participating in United States mortgage markets, research on differences in underwriting and pricing outcomes in mortgages typically focuses on the outcomes of African American and Hispanic borrowers. One explanation for the lack of attention on Asian outcomes follows from the perceived relative economic prosperity of this minority group, which may lead to the belief that they are less in need of consumer protection or policy support. While simple group averages of economic characteristics support this belief, documented heterogeneity of Asian experiences suggests that the use of other measures may be needed to account for the varied outcomes of Asians in the U.S. housing markets. Using a unique proprietary source of lender data, we examine these Asian outcomes. We find that Asians face challenges in mortgage markets in ways that may be unique as compared to other minority groups. For example, while an examination of unadjusted average denial rates indicates favorable outcomes for Asians compared to other minority groups, we find that after accounting for loan and borrower characteristics, Asians have denial rates as high as other minority groups.

© 2015 Elsevier Inc. All rights reserved.

1. Introduction

An extensive housing finance literature focuses on whether borrowers from different racial and ethnic groups experience disparate mortgage market outcomes in the United States. These studies have highlighted differences among available resources across groups, motivated policy initiatives to protect minority borrowers, and impelled litigious and regulatory responses. In either research studies or regulatory supervisory reviews, researchers commonly compare the outcomes of non-Hispanic white (“NHW”) borrowers to those of African American/Black (“African American or AA”) or Hispanic/Latino

(“Hispanic”) borrowers.¹ The experiences of Asian borrowers receive much less attention, even though this group has comprised the largest minority group share of U.S. mortgage market activity since 2009.

In this paper, we assess empirically the outcomes of Asians in U.S. mortgage markets. Using unique proprietary lender data, we test for differences in the prices (as measured by annual percentage rates on mortgages) and approval rates compared with other racial and ethnic groups, while controlling for key economic factors such as creditworthiness and type of loan products. We pay

¹ For ease of exposition, throughout we refer to African American or Black as “African American,” Hispanic or Latino as “Hispanic,” and Asian or Asian American as “Asian.” These categorizations are consistent with those used in the [Home Mortgage Disclosure Act \(HMDA\) \(2013\)](#) data on which we rely for our analyses.

* Corresponding author.

E-mail address: mcourchane@crai.com (M. Courchane).

particular attention to the question of whether outcomes differ at different points in the socioeconomic distribution. We also test for differential outcomes based on the Asian composition of borrowers' neighborhoods and analyze differences among Asian countries of origin to test for heterogeneous experiences within the broad categorization of Asian race.

Asians were the fastest-growing racial or ethnic group in the country in 2012, reaching approximately 5% of the U.S. population (U.S. Census Bureau, 2013). In the mortgage market, Asians applied for and obtained a larger share of purchase money mortgages than either African American or Hispanic borrowers in recent years, measured in both number and dollars.² This pattern has existed for some time, particularly in heavily Asian geographies (Dymski and Mohanty, 1999). In a recent study released by the Federal Reserve Board ("FRB"), economists found that "across racial or ethnic groups, the largest increase in home-purchase loan activity was experienced by Asians and non-Hispanic whites; the number of home-purchase loans extended to borrowers in each of these groups increased about 15%, while lending to blacks and Hispanic whites increased at a rate of less than half this value" (Bhutta and Canner, 2013, p. 25).

Asians are included as a protected class under most U.S. consumer protection laws.³ However, the lack of research and regulatory attention for Asian mortgage borrowers may mean the unique challenges faced by this group are not well understood, leading to less targeted support or a lower level of consumer protections for Asians in the housing market. Indeed, a report from the U.S. Equal Employment Opportunity Commission (2008) called Asians the "forgotten minority" and the U.S. Commission on Civil Rights (1992) indicated that "there has been widespread failure of government at all levels" to protect the rights of Asians.

There are a number of possible reasons why Asians have received less attention in mortgage discrimination studies. The relatively large loan activity by this group suggests that understanding the experiences of Asian borrowers is important; however, this might be a reflection that this group faces comparatively less restrictive access to the mortgage market. Additionally, earlier studies of mortgage market outcomes may have contributed to the lack of current research on Asians. For example, researchers have found that Asian borrowers are less likely to have obtained subprime loans as compared to African Americans or Hispanic borrowers (Courchane et al., 2004). Moreover, as group credit score averages for Asians mirror those of non-Hispanic whites (e.g., Bhutta and Canner, 2013) there might be less expectation of pricing and approval differentials.

However, further examination of Asian borrower and applicant experiences in the U.S. mortgage market is warranted. Many believe that Asian experiences are distinctive

among American minority groups, characterized as being "strangers from a different shore" (Takaki, 1998), and therefore need to be uniquely analyzed. Government reports have contradicted the impression that Asians are treated fairly in the United States (U.S. Commission on Civil Rights, 1992) and documented the many barriers to Asians' workforce success (U.S. Equal Employment Opportunity Commission, 2008). Turner and Ross (2002) and Turner et al. (2013) provide evidence of challenges Asians face in housing markets, specifically. Using an experimental matched paired testing strategy, the authors of the former study find that Asian homebuyers faced discrimination in areas such as housing availability and assistance with financing that exceeded that faced by Hispanic homebuyers and at a level comparable to that faced by African American homebuyers. Using a similar research approach in the latter study, researchers continued to find unfavorable treatment by real estate agents and rental property owners against Asians, especially for those with names and speech patterns that are more easily identifiable as non-white.

Additionally, customary research methodologies that compare the average outcomes among minority and NHW groups may not well capture Asian outcomes because of their heterogeneous backgrounds. Many believe that differences across key factors such as time since immigration and country of origin produce a bi-modal economic distribution among Asians where only select members enjoy observed average successful socioeconomic outcomes (e.g., Fong, 2008; Ishimatsu, 2013; National Coalition for Asian Pacific American Community Development, 2013). In this way, the positive experiences of a relatively small number of elite Asians can bias average statistics upwards, whereas the bottom of the distribution suffers disadvantages comparable to the similarly situated members of other minority groups. The focus on mean outcomes, as well as social constructions such as the "model minority myth," may have led to Asians having an overstated perception of success and a resultant lack of social policy targeting.

In this study, we first document measures of Asian housing and mortgage market participation rates and discuss reasons why Asians may uniquely face challenges in the measurement of mortgage outcomes. We then analyze unique proprietary lender application and pricing records to test for mortgage market outcome differences for Asians. Finally, we conclude with directions for research and policy.

2. Asian borrowers in the mortgage market

Asian borrowers are the largest minority group participating in the mortgage market in recent years. In Fig. 1, we display the share of origination volume (based on the count of loans) for mortgage who identify themselves as Asian, African American or Hispanic from 2004 to 2011. Trends for origination dollars, application volumes, and application dollars are quite similar. From 2004 until 2007, Asians had the lowest number of originations among the displayed minority groups. The share for African

² This is based on conventional, 1–4 family and manufactured home dwellings from HMDA data, available at: <http://www.ffiec.gov/hmda/hmdaproducts.htm>.

³ For example, the Equal Credit Opportunity Act ("ECOA") of 1974 prohibits discrimination in credit markets on the basis of race, color, or national origin, among other factors. See 15 USC 1691.

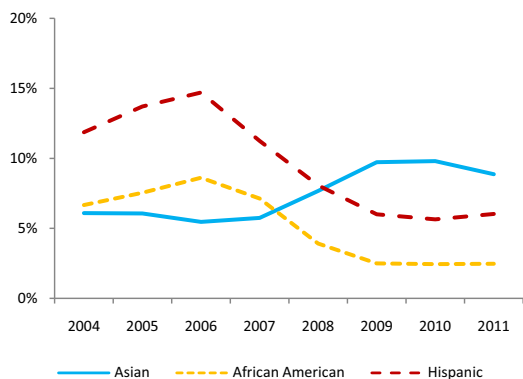


Fig. 1. Share of HMDA originations for minority borrowers. *Source:* HMDA data for conventional, 1–4 family, owner-occupied, first lien, purchase money loans.

Americans and Hispanics grew as house prices grew and the development of the subprime market offered more options for obtaining home mortgages. However, as housing prices declined, leading to a collapse of subprime lending and tightening of credit standards, Asians have grown to comprise the largest minority group share in terms of application and origination dollars (since 2008) and application and origination loan counts (since 2009).

We focus on mortgage market outcomes in this study, but note that participation rates in the mortgage market reflect preferences for both homeownership and debt. In addition, differences in mortgage market participation may also reflect disparities in wealth, education, and financial literacy or market experiences such as discouragement to apply for a mortgage. Based on findings from focus groups, *Freddie Mac* (2005) found that Asians generally expressed an aversion to debt, with a need to feel financially stable, and a preference for fully understanding the home buying and financing process before buying homes. These observations suggest that Asians may be relatively cautious before entering the mortgage market. The *Freddie Mac* report also revealed distinct preferences among respondents from different countries of origin.

We display home ownership rates from 2000 to 2010 by race/ethnicity in *Table 1*. Here, we observe that even though Asian borrowers may be relatively cautious when considering borrowing, this group nonetheless had the highest home ownership rates among minority groups, with this gap growing over the recent decade. The remaining gap between whites and Asians may be due to the concentration of Asians in areas with higher costs of homeownership (*Coulson, 1999*).⁴

Asians clearly have a large share of the housing market, and an increasing share of the mortgage market. Given this, the lack of focus on Asians as a group may reflect several competing explanations. A lack of salience about Asians' struggles may stem from Asians' relative reticence

to report discrimination, as well as the scarcity of nationally recognized Asian issue advocates or Asians in prominent leadership positions who can campaign for a focus on Asian issues (*Asian American/Pacific Islander Policy Research Consortium ("AAPIPRC"), 2012; Kim, 2011; Lai et al., 2001; Wu, 2002*).⁵

Furthermore, a likely hypothesis for the diminished focus on Asian borrowers follows from their perceived relative economic success compared to other minority groups in the United States. Empirical analysis supports this belief, with average household incomes and education levels typically found to be higher for Asians in the U.S. than for other groups, as shown in *Table 2*.

There are a number of reasons, however, that these broad level group statistics do not well reflect the experiences of large numbers of Asians. For example, Asians tend to have more household members, and therefore more wage earners, on average, leading to higher household incomes that may not reflect higher per capita incomes. While average total household incomes are almost \$12,000 higher for Asian than for non-Hispanic white households in the U.S. (*Pew Research Center, 2012*), Asian incomes per capita are about 93% of non-Hispanic whites (*AAPIPRC, 2012*).⁶ The geographic distribution of Asians can also contribute to misleading averages, as Asians tend to live in relatively higher income areas. When comparing average incomes in just the ten metropolitan areas with the highest number of Asian residents, Asian incomes per capita are about 71% of those of non-Hispanic whites (*AAPIPRC, 2012*). These issues have led to concern that the use of aggregate statistics and broad characterizations of Asians "could lead policymakers, the media and the public to draw conclusions that reflect inaccurate stereotypes about Asian Americans being only a community with high levels of achievement and few challenges" (*AAPIPRC, 2012*).

This reflects the concern that the success of a select group of Asians perpetuates a belief that all Asians experience prosperity, masking the struggles of many Asians. By only examining average outcomes, Asians in the U.S. may appear to be relatively high achievers, while differences among groups within the Asian population remain unrecognized.⁷ The heterogeneity of Asian groups has induced researchers in other contexts, such as labor markets, to call for more research on the relative outcomes of Asian ethnic subgroups (e.g., *Altonji and Blank, 1999*).

In the panels of *Fig. 2a and b*, we display differences across U.S. residents by Asian countries of origin for 2010 median household incomes and home ownership rates.

⁵ For example, the *U.S. Commission on Civil Rights (1992)* reported that Asians often do not report hate crimes because of distrust of police or because they are culturally conditioned to feel shame for being victimized. *Kim (2011)* claims that cultural norms lead Asian Americans to underreport employment discrimination, which leaves them underprotected by employment laws. That same conditioning may lead to underreporting any mortgage market discrimination.

⁶ The 2012 *Pew Report* (at 3) states that Asians compared to all other U.S. adults have higher median annual household income (\$66,000 versus \$49,800) and higher median household wealth (\$83,500 versus \$68,529).

⁷ Time since immigration and country of origin are two factors which may have historically led to a bi-modal distribution, but more recently there appears to be little difference between native born and recent immigrant Asians (*Pew Research Center, 2012*).

⁴ *Coulson (1999)* also finds that immigration status plays a role in the homeownership of Asians; although *Painter et al. (2001, 2003)* do not find evidence to support this. Notably, these latter authors find variation in homeownership rates by Asian country of origin that are not explained by economic endowments.

Table 1
Homeownership rates by race and ethnicity of householder.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
U.S. total %	67.4	67.8	67.9	68.3	69.0	68.9	68.8	68.1	67.8	67.4	66.9
White	71.1	71.6	71.8	72.1	72.8	72.7	72.6	72.0	71.7	71.4	71.0
NHW	73.8	74.3	74.5	75.4	76.0	75.8	75.8	75.2	75.0	74.8	74.4
Black	47.2	47.4	47.3	48.1	49.1	48.2	47.9	47.2	47.4	46.2	45.4
Asian or Pacific Islander	52.8	53.9	54.7	56.3	59.8	60.1	60.8	60.0	59.5	59.3	58.9
Hispanic	46.3	47.3	48.2	46.7	48.1	49.5	49.7	49.7	49.1	48.4	47.5
Non-Hispanic	69.5	69.9	70.0	70.8	71.5	71.2	71.2	70.5	70.3	69.8	69.4

Note: The homeownership rate is the percentage of homeowning households among all households in the given demographic group. Source: U.S. Census Bureau data.

Table 2
U.S. Education and income in 2010, by race/ethnicity.

Educational attainment: % with Bachelor's degree or more	
U.S. population	28%
Asians	49%
Whites	31%
Blacks	18%
Hispanics	13%
Median household income	
U.S. population	\$49,800
Asians	\$66,000
Whites	\$54,000
Blacks	\$33,000
Hispanics	\$40,000

Note: % with Bachelor's degree includes ages ≥ 25 . Source: Pew Research Center (2012).

There is substantial variation in these metrics. Residents with countries of origin of Myanmar and Thailand have median incomes of almost \$20,000 less than the all Asian median, while those with origins in India have median incomes over \$30,000 more than the all Asian median. The median Indian household, therefore, will be expected to face a different set of financial constraints than the median Thai household when considering housing finance options. The second panel of Fig. 2a and b shows differences in home ownership rates for different countries of origin. We observe that Vietnamese and Indonesian households have relatively high homeownership rates, even though they have relatively low household incomes. Overall, these figures suggest distinct available financial resources and housing preferences among households from different Asian countries of origin.

The perception of success of all Asians in the US is related to the oft-critiqued “model minority myth,” which suggests that Asians are “too successful” to be regarded as disadvantaged.⁸ Research indicates that the social construc-

⁸ The characterization of Asians as a “model minority” is frequently traced back to media stories highlighting how Asians were able to experience relative vocational and economic success due to characteristics such as a strong work ethic, frugality, and family values, as for example, in “Success Story of One Group in the US” (U.S. News and World Report, 1966). This rhetoric extended into the public sphere, with President Ronald Reagan claiming that Asians espouse the “bedrock values” of America, including “community spirit and the responsibility of parents and schools to be teachers of tolerance, hard work, fiscal responsibility, cooperation, and love” (Reagan, 1984).

tion of groups can affect policy targets and design (e.g., Schneider and Ingram, 1993). Being viewed as more economically prosperous or successful than other races or ethnicities may have led to some social privilege benefits for Asians; however, these positive stereotypes can negatively impact social services provided, including the need for housing supports. Wu (2002) summarizes this concern, lamenting that “although everyone claims to have no wish to compare suffering in a contest of victims, Asian-Americans are presumed to be unaffected by significant prejudice, or, at worst, deprived to a much lesser degree than African-Americans and Hispanics are... It seems almost offensive to raise Asian-American concerns except appended as a matter of last priority.”

Therefore, with high rates of immigration, a broad distribution by Asian country of origin around income and homeownership, increasing rates of mortgage market participation, and a perceived economic status that does not well-capture many members of the groups, it is important to understand whether Asians are impacted by potential discrimination in credit markets. Researchers often broadly view discrimination in two different forms: taste-based discrimination related to the preferences of the discriminating party for one group versus another (e.g., Becker, 1971) and statistical discrimination that is related to the differential costs of acquiring information about certain groups (e.g., Arrow, 1972; Phelps, 1972). To the extent that Asians have a positive social construction in terms of reflecting values of hard work and family, this may lead to less expected taste-based discrimination against Asians in relation to other minority groups in the mortgage market. On the other hand, while Asians may be viewed as well-performing in certain contexts, evidence suggests that attitudes towards Asians are often negative, for example that they are taking away jobs from whites or are not loyal to the United States (e.g., Wong and Halgin, 2006).⁹ These beliefs would be expected to increase taste-based discrimination against at least some Asian subgroups.

The relatively positive social construction of Asians may also influence the statistical discrimination behavior of creditors. Because acquiring information on the default risk of each prospective borrower is costly, lenders may employ forms of statistical discrimination if they rely on group-level indicators of repayment probability. If Asian

⁹ Anti-Islamic sentiments generically held by some about all Asian groups have prompted a rise in anti-Asian sentiment in communities and other contexts (SAALT, 2010).

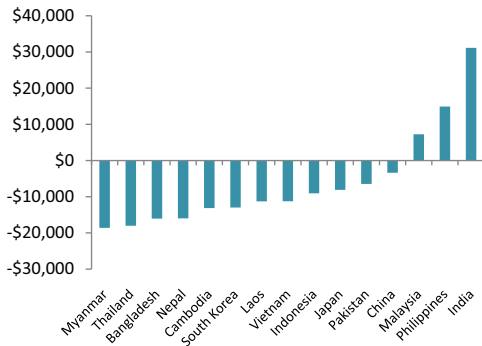


Fig. 2a. 2010 median household income, difference from all Asian median. *Source:* U.S. Census Bureau, 2010 American community survey 1-year Estimates.

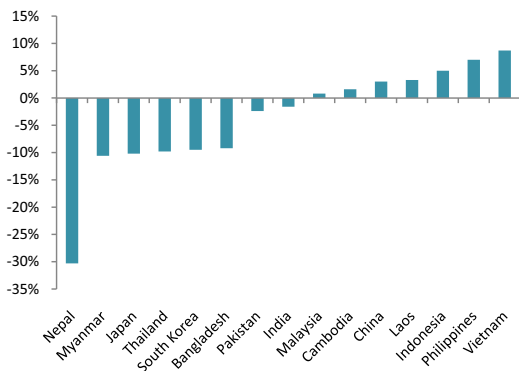


Fig. 2b. 2010 home ownership rate, difference from all Asian median. *Source:* U.S. Census Bureau, 2010 American community survey 1-year estimates.

repayment signals are, on average, positive because of high average incomes and economic achievement, then this would be expected to advantage Asian borrowers with lenders who practice statistical discrimination. Conversely, noisy signals because of the relatively heterogeneous repayment indicators of the Asian borrower group would be expected to increase default risk and therefore credit market costs.

Only a few studies have included Asians explicitly when studying discrimination in housing and mortgage markets. [Calem et al. \(2004\)](#) looked at whether Asians (and other minority groups) were more likely to receive subprime mortgage products. They found mixed evidence depending on whether they defined Asian as a percent of Census tract population or as individual borrower race. Relatedly, [Courchane et al. \(2004\)](#) find that Asians were less likely to have subprime loans as compared to African Americans or Hispanic borrowers. [Turner and Ross \(2002\)](#) found evidence of discrimination in various aspects of housing markets when engaging in matched pair testing of Asians. Specifically, they found that “Asians and Pacific Islanders face significant levels of discrimination when they search for housing in large metropolitan areas nationwide... Asian and Pacific Islander homebuyers experience consistent adverse treatment 20.4% of the time, with systematic discrimination occurring in housing availability,

inspections, financing assistance, and agent encouragement. This level of discrimination is comparable to the level experienced by African American homebuyers, and significantly higher than the level of discrimination against Hispanics” (p. iii). In a more recent similar study also using matched pair testing, [Turner et al. \(2013\)](#) present evidence that Asians continue to experience unfavorable housing search and rental outcomes relative to whites, but appear to have similar or relatively favorable outcomes as compared to African Americans and Hispanics. [Bhutta and Canner \(2013\)](#) find that Asians were much less likely to receive higher priced loans or to be denied for mortgage loans than were African Americans or Hispanics. The outcomes observed from these last authors, however, were not adjusted by controls for loan or borrower characteristics.

3. Data and methodology

3.1. Data

Our analysis uses proprietary loan level records from a population of representative mortgage lenders over the 2004–2012 period which is aggregated to protect confidentiality.¹⁰ These data contain information on many fields critical for conducting analyses of pricing and underwriting decisions, but not available in public data sources, such as annual percentage rate (“APR”), the credit score used in underwriting and pricing decisions, debt-to-income (“DTI”) ratio, loan term, documentation type, amortization type, and loan-to-value (“LTV”) ratio. We restrict data to 1–4 family, purchase money, first lien, conventional loans.

The race/ethnicity of borrower comes from data these lenders report as part of Home Mortgage Disclosure Act compliance. Borrowers are identified by all races/ethnicities they report; therefore, borrowers can be included in multiple minority groups.¹¹ For example, a borrower who reports as both African American race and Hispanic ethnicity would be coded as both African American and Hispanic in the data. Non-Hispanic white borrowers have reported no other race than white and no other ethnicity except “not Hispanic or Latino.”

We include in [Table 3](#) summary statistics for the sample. Asians represent about 6% of the borrowers in our data, with African Americans comprising about 8% and Hispanics about 12%. The remaining borrowers are non-Hispanic white, comprising about 74% of our sample. Most mortgages are 30 year term, and the average LTV ratio is just above 80%. Credit scores over the entire period average 712. We include about 29% adjustable rate mortgages (“ARM”) with 65% known to be fixed term (“FRM”). The remainder have unknown term.

We also include a comparison of certain fields in the proprietary lender data to HMDA data. HMDA does not

¹⁰ Some lenders provided only originations data so the sample size for the APR analysis is larger than that for the denial analysis.

¹¹ Asian race is separately identified from Native Hawaiian/Pacific Islander race in HMDA reporting. Our indicator for Asian applicants includes all applicants who identify as Asian, but not applicants who only identify as Native Hawaiian/Pacific Islander.

Table 3
Summary statistics.

Borrower/loan characteristic	Analysis data		HMDA data	
	Mean	Standard deviation	Mean	Standard deviation
Denial rate	11.52%	0.32	16.6%	0.37
APR	7.03	1.77	–	–
Asian	6.34%	0.24	6.7%	0.25
African American	7.78%	0.27	7.8%	0.27
Hispanic	12.26%	0.33	12.6%	0.33
Non-Hispanic white	63.5%	0.48	62.2%	0.48
Income	102,785	147,054	99,979	143,449
Credit score	711.58	66.90	–	–
LTV	81.08	14.06	–	–
Loan term	29.23	4.43	–	–
DTI	37.38	13.46	–	–
Full documentation	39.72%	0.49	–	–
Limited/no documentation	36.91%	0.48	–	–
Unknown documentation	23.37%	0.42	–	–
ARM	28.79%	0.45	–	–
Balloon	0.10%	0.03	–	–
Fixed rate	65.39%	0.48	–	–
Amortization type unknown	5.72%	0.23	–	–
Year	2006.79	1.71	2006.58	2.30

Source: Proprietary lender and HMDA data, 1–4 family, purchase money, first lien, conventional loans.

include data on APR or a number of key credit fields, such as credit score, loan-to-value ratio (“LTV”), debt-to-income ratio (“DTI”), or loan product characteristics. Our analysis data has a lower denial rate than the HMDA data, but is similar among its proportion of borrowers and applicants across racial and ethnic groups. As well, average income in the analysis data is close to the average income among HMDA data observations.

Next, in Table 4, we examine the distributions of key factors that can affect mortgage outcomes across races/ethnicities. We find that the average and the range of values for the key characteristics of Asians closely resemble that of the NHW group. Asians have relatively higher credit scores, lower DTI ratios, and lower LTV ratios than the other minority groups. Notably, the 75th percentile of LTV for Asian borrowers was 80%, indicating that relatively fewer Asian borrowers obtained loans with LTVs greater than 80%. This is consistent with the focus groups studied by Freddie Mac (2005), which indicated Asians were less comfortable with taking on debt and more interested in making larger down payments. The credit scores likely also reflect this behavior, over time. The resulting lower average APR for Asians reflects their higher credit worthiness and more conservative mortgage behavior.

In the last column of this table, we display the interquartile range (“IQR”).¹² We see mixed evidence of the dispersion of Asian economic characteristics in our sample. Asian borrowers have the relatively tightest distribution of credit scores, as well as LTV ratios. Income IQR is largest for Asians, however, with the range 20% wider than non-Hispanic whites, over 30% wider than Hispanics, and over 60% wider than African Americans. At each percentile, however, Asians have relatively the highest income. Therefore, while we find evidence of relative heterogeneous Asian incomes,

in our sample, we observe relatively high incomes for applicants in this group at various points in the distribution.

3.2. Empirical analysis

We follow a commonly used econometric methodology to examine whether the probability of denial and price of credit (as measured by APR) differ for Asian borrowers by controlling for available factors that can affect these outcomes and examining the “unaccounted” portion of the differential that is related to being Asian. We caution against interpreting results as conclusive evidence of discrimination, because of the well-documented difficulties of identifying discrimination in credit markets based on non-experimental data (for example, see Yezer, 2010). These models, however, are commonly used by researchers and government regulators to identify whether the evidence of differential outcomes warrants further investigation.

We regress outcomes, y , on an indicator variable identifying as Asian, A , vectors of other minority races/ethnicities (African American and Hispanic), M , and a vector of covariates, X , including loan and borrower characteristics that can affect the outcome.¹³

$$y_{its} = \alpha + \beta A_i + \gamma_1 M_i + \gamma_2 X_i + d_t + d_s + \varepsilon_{its} \quad (1)$$

Here, i indexes borrower, t indexes year, and s indexes state. We include vectors of dummy variables to account for variation in the outcome common across years, d_t , and common across states over time, d_s . We estimate the model of APR using OLS and can interpret the fitted parameter on our outcome of interest, β , as the effect of being

¹² IQR measures the difference between the values of the 75th and 25th percentiles.

¹³ We note that borrowers may belong to more than one race or ethnicity group, so the effect estimated here and in all regression and logit analyses for one race/ethnicity is that compared to non-Hispanic white controlling for membership in another race/ethnicity group.

Table 4
Distributions of key analysis variables.

Borrower/loan characteristic	Race/ethnicity	Mean	Percentiles					IQR
			10th	25th	50th	75th	90th	
APR	Asian	6.62	5.24	5.94	6.48	7.09	7.84	1.15
	African American	8.38	6.08	6.76	7.69	10.05	11.77	3.29
	Hispanic	7.75	5.92	6.59	7.32	8.50	10.79	1.91
	Non-Hispanic White	6.82	5.13	6.00	6.59	7.28	8.63	1.28
DTI	Asian	37.14	22.30	31.17	38.76	44.70	49.74	13.53
	African American	40.89	26.54	34.30	41.70	47.76	52.79	13.46
	Hispanic	39.88	26.74	34.26	40.71	46.00	50.42	11.74
	Non-Hispanic White	36.59	20.45	29.00	37.61	44.78	50.63	15.78
Credit score	Asian	729	661	698	734	770	791	72.00
	African American	661	575	610	657	710	758	100.00
	Hispanic	691	611	648	693	736	772	88.00
	Non-Hispanic White	720	627	678	729	773	795	95.00
Income	Asian	116,667	44,000	61,000	91,000	140,000	208,000	79,000
	African American	79,011	31,000	42,000	60,000	90,000	134,000	48,000
	Hispanic	92,435	36,000	50,000	74,000	109,000	157,000	59,000
	Non-Hispanic White	103,055	35,000	49,000	74,000	114,000	181,000	65,000
LTV	Asian	78.61	65.00	78.49	80.00	80.00	90.00	1.51
	African American	86.56	79.65	80.00	83.00	97.17	100.00	17.71
	Hispanic	83.37	75.00	80.00	80.00	92.49	100.00	12.49
	Non-Hispanic White	80.38	62.96	79.74	80.00	90.00	100.00	10.26

Source: Proprietary lender data, 1–4 family, purchase money, conventional loans.

Asian on the outcome as compared to being non-Hispanic white (the omitted race/ethnicity group), holding other factors constant. For the binary outcome of being denied or not, we estimate a logit model based on Eq. (1) and report the average marginal effects of key variables.

In order to examine whether Asian borrowers at different income levels face differential experiences in mortgage markets, we add interactions of Asian or the other minority races/ethnicities with six income levels, I_τ (0–≤\$50K, \$50–≤\$100, \$100–≤\$150k, \$150–≤\$250k, >250k, and Unknown Income), with estimated parameters δ_τ and θ_τ for τ equal to one to six.

$$y_{its} = \alpha + \sum_{\tau=1}^6 \{ \delta_\tau (A_i \times I_\tau) + \theta_\tau (M_i \times I_\tau) + I_\tau \} + \beta A_i + \gamma_1 M_i + \gamma_2 X_i + d_t + d_s + \varepsilon_{its} \quad (2)$$

We interpret the parameter estimates δ_τ as the marginal effect of being Asian in each income category, as compared to non-Hispanic white outcomes for that same income category.

Finally, we use the neighborhood level racial/ethnicity composition from 2000 decennial Census, rather than individual level race/ethnicity, to examine outcomes. The purpose of this analysis is to examine whether outcome differentials are related to the racial composition of where applicants live (akin to a redlining analysis) and also allows us to use the detailed country of origin data available in Census to analyze variation across Asian subgroups.

First, we substitute the proportion of Asian residents in tract, T_A , and a vector of the proportion of African American, Hispanic, and other minority race/ethnicity residents in the tract, T_M , for the individually reported race/ethnicity indicators in Eq. (1).

$$y_{itsg} = \alpha + \omega_1 T_{Ag} + \omega_2 T_{Mg} + \gamma X_i + d_t + d_s + \varepsilon_{itsg} \quad (3)$$

Here, g indexes tract and ω_1 and ω_2 are parameter estimate vectors. From these regressions, we interpret our outcome of interest, ω_1 , as the effect of being a borrower from a neighborhood with an increasing proportion of Asian residents. Next, we examine outcomes based on different Asian countries of origin. We use the neighborhood composition based on Asian countries of origin (since we do not have individually reported countries of origin in the data) to construct a vector, O , of the probability of being from different countries of origin for Asian borrowers.

$$y_{itsg} = \alpha + \kappa O_g + \omega T_{Mg} + \gamma X_i + d_t + d_s + \varepsilon_{itsg} \quad (4)$$

Here, we can interpret our parameter vector on our outcomes of interest, κ , as the marginal effect of being an Asian borrower from a neighborhood with an increasing proportion of residents from the specific Asian country of origin.

4. Findings

We begin with an examination of unadjusted relationships between outcomes and race. In Figs. 3 and 4, we display the denial rates and average APRs for minority borrowers from 2004 to 2011. Across all years, non-Hispanic white borrowers had the lowest denial rates, followed by Asians, then Hispanic, and African American borrowers. Fig. 4 includes the distributions by race/ethnicity of APR over the period from 2004 to 2012. The relative position is similar in the examination of average APR. As now well known in the industry, with the tightening of credit standards, borrowers with riskier profiles and lower credit scores are simply unable to obtain mortgage loans. In earlier years, these borrowers would have received

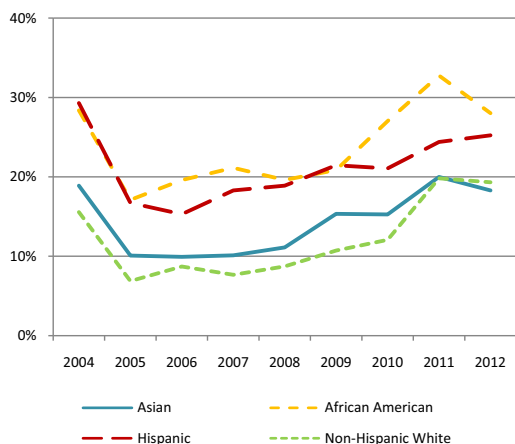


Fig. 3. Denial rates 2004–2012. Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans.

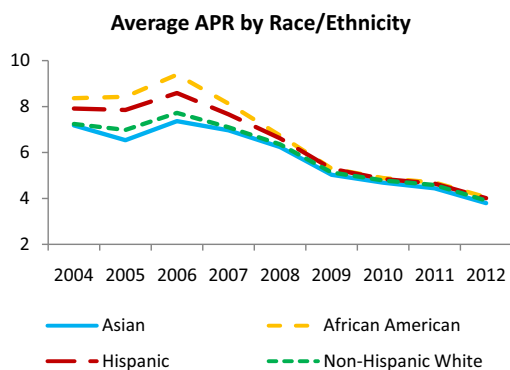


Fig. 4. Average APR 2004–2012. Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans.

higher priced loans reflecting risk-based pricing. As the risk profiles become more similar over time, resembling the better credit worthiness, on average, of borrower as lenders prepare to meet newer standards imposed by Dodd Frank legislation, the differences become negligible across race/ethnicity categories.

These unadjusted metrics, of course, should not be interpreted as evidence of discrimination by lenders, as they do not account for the many factors that may affect denial and APR, including lender specific risk models. Nonetheless, they provide evidence that, when comparing overall averages, Asians appear to have more positive outcomes relative to Hispanic and African American borrowers, but disadvantageous relative to non-Hispanic Whites. Differences between APRs and denial rates of Asians and NHW borrowers reflect, in part, differences in credit quality. Across the range of credit scores, Asians are more likely to be denied than non-Hispanic white borrowers with similar scores (see Appendix 2). However, we find that regardless of whether Asians are denied more often given similar credit scores, once Asians are approved for mortgage loans, they are priced nearly identically to those received by NHW borrowers with similar credit scores.

We next consider estimates of the differentials among races/ethnicities based on regression estimates. In Table 5, we display average marginal effects and p -values from our analysis of underwriting. Here, the dependent variable for the binary outcome equals one if the applicant is denied and zero otherwise. Column 1 provides an estimate of the marginal effects from the model that includes race and ethnicity but no other controls. We observe that the probability of being denied is higher for each of the minority groups in the model, as compared to non-Hispanic white applicants. Though higher than the probability of denial of non-Hispanic whites, Asian applicants have a relatively lower probability of denial (2.8%) compared to Hispanic (8.4%) and African American (10.6%) applicants. This reflects the relatively advantageous average credit scores and socioeconomic characteristics we observe for this group.

After adding a robust set of controls for loan and economic factors that can affect underwriting decisions, we improve the ability of the model to correctly predict the actual underwriting decision as the pseudo R-squared increases from 0.02 to 0.41. Lender specific models, which allow for adjustment to specific lender based underwriting standards, predict better than models with aggregation, but we cannot report results from such models due to data sharing agreements. However, most of the variables perform as one would expect in our aggregated model. We find that borrowers are more likely to be denied as LTV increases and for those with the highest DTI ratios. Denial probabilities are also increased when the loan product lacks full documentation (usually this means income or assets or employment were not verified at the time of approval). The shorter the loan term, the more likely the loan was to be denied. Credit score controls are included as linear splines, such that the interpretation of coefficients on these terms are the marginal effect of a one point change in credit score on underwriting denial in that range. In each range, increasing credit scores decreased the probability of denial, and coefficients suggest that a 100 point increase in credit score (about 1.5 standard deviations) decreases denial probability by about 1%.

We observe different relationships between race and denial once we add loan and borrower characteristics. While all minority groups continue to have a relatively higher probability of denial when compared to non-Hispanic whites, the conditional probabilities of denial for Hispanic (1.6%) and African American applicants (1.8%) become effectively the same as the denial probability for Asian applicants (1.9%). Thus, while average Asian underwriting outcomes at first appear advantageous compared to other minority groups, Asians fare similarly, and perhaps even slightly worse, when comparing similarly situated applicants.¹⁴ This is consistent with findings from empirical analyses of Asian labor market outcomes that indicate that Asians have relatively low returns to their educational investments (e.g., Hirschman and Wong, 1984). Other factors that are not available in the data, but that are likely to vary by race/ethnicity, such as assets, down

¹⁴ By similarly situated, we mean that we have controlled for loan type, LTV, credit and other factors in the determination of the underwriting decision.

Table 5
Analysis of denial by race/ethnicity.

Loan/borrower characteristic	Comparison group	Raw model		Credit model	
		Marginal effect (1)	p-Value (2)	Marginal effect (3)	p-Value (4)
Asian	Non-Hispanic white	0.028	0.000	0.019	0.000
Hispanic		0.084	0.000	0.016	0.000
African American		0.106	0.000	0.018	0.000
LTV ≤ 60	60 < LTV ≤ 80			−0.013	0.000
80 < LTV ≤ 85				0.015	0.000
85 < LTV ≤ 90				0.018	0.000
90 < LTV ≤ 95				0.025	0.000
95 < LTV ≤ 100				0.006	0.000
100 < LTV				0.211	0.000
Term ≤ 10	20 < Term ≤ 30			0.239	0.000
10 < Term ≤ 15				0.026	0.000
15 < Term ≤ 20				0.022	0.000
30 < Term				0.000	0.961
Credit score spline to 580	NA			−0.00113	0.000
Credit score spline 580–640				−0.00064	0.000
Credit score spline 640–700				−0.00080	0.000
Credit score spline above 700				−0.00050	0.000
38 ≤ DTI < 50	DTI < 38			−0.004	0.000
50 ≤ DTI				0.089	0.000
DTI missing/unknown				0.035	0.000
Full documentation	Low documentation			−0.029	0.000
Unknown documentation				0.238	0.000
Pseudo R-Sq.		0.0167		0.4058	
# of observations		594,392		594,228	

Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans. Models used to estimate results in column (3) include amortization type (FRM, ARM, Balloon, unknown), lender, year, and state controls.

payment amount, and loan product, could explain differentials in denial rates. As well, cultural differences across race/ethnicities may lead to diverse interactions with loan officers and mortgage brokers that are not captured in the data. These considerations reinforce the need for detailed and contextualized analysis when testing for discrimination.

We also estimate models where we control for applicants' metropolitan statistical area/metropolitan division (MSA/MD) instead of state using the credit model from Table 5 (results not shown but are available upon request). Results are similar when using state or MSA/MD controls, indicating that it is not geographic sorting across metro areas that explains the higher denial rates for Asian borrowers. The spatial distribution of Asians within a metro area, however, might contribute to denial differences across races/ethnicities, particularly if Asians are more likely to live in areas with lower homeownership rates.¹⁵ Based on 2010 Census, the homeownership rates of principally Asian neighborhoods are lower than those of principally African American or Hispanic neighborhoods.¹⁶

¹⁵ We examined the distribution of Asians across counties within the Houston, Seattle, and Tampa MSAs. In all three areas, Asians were most likely to live in the county with the lowest homeownership rate in the MSA. Homeownership rate came from the 2013 American Community Survey, and data on the Asian distribution by county came from Pew Research (<http://www.pewsocialtrends.org/asianamericans/>).

¹⁶ Based on 2010 Census, tracts with ≥75% Asian residents had homeownership rates of 43%, compared to 47% homeownership in tracts with ≥75% Hispanic residents and 48% homeownership in tracts with ≥75% African American residents. We do not have sufficient volume to use controls in our models below a MSA/MD level.

In Table 6, we provide the marginal effects from the underwriting model, by race and ethnicity at different income levels. The distribution of applicants by income category for each of the minority groups is included in Appendix Table 1. We find that Asians have the highest probability of being denied among racial/ethnic groups at the lowest income level. At the highest income level, this result reverses, with Asians being the least likely to be denied among other minority groups, and a statistically indistinguishable rate from NHWs. We find considerable variance across races within each income category, as well as within races across income levels for Asians and African Americans in particular. At incomes from \$50k to \$100k, Asians have about the same probability of being denied as Hispanics and African Americans. Asians and Hispanics continue to have probability of denial of about 0.015–0.21 (marginal to the omitted NHW group) in the \$100–\$150 k and \$150–\$250 k ranges, but African Americans' marginal probability of denial increases to 0.31 or higher. These trends may reflect discrepancies in credit risk not captured by the credit score or higher downpayments. The differences across income groups, moreover, suggest that Asians, along with other groups, may face distinct challenges depending on their socioeconomic level.

We next include the empirical outcomes from the analysis of APR (Tables 7 and 8). This sample is restricted to borrowers with loan originations, excluding any whose applications were denied. For the pricing results, the marginal effects reflect the difference, on average, in basis points between the loan and borrower characteristic and

Table 6
Analysis of Denial by race/ethnicity for different income levels.

	Marginal effect (1)	p-Value (2)	Lower bound (3)	Upper bound (4)
Asian				
Income ≤ 50,000	0.033	0.000	0.024	0.041
50,000 < Income ≤ 100,000	0.018	0.000	0.013	0.024
100,000 < Income ≤ 150,000	0.018	0.000	0.011	0.025
150,000 < Income ≤ 250,000	0.018	0.000	0.009	0.027
250,000 < Income	−0.002	0.665	−0.013	0.008
Unknown Income	0.024	0.015	0.005	0.043
Hispanic				
Income ≤ 50,000	0.013	0.000	0.009	0.017
50,000 < Income ≤ 100,000	0.018	0.000	0.015	0.021
100,000 < Income ≤ 150,000	0.015	0.000	0.010	0.020
150,000 < Income ≤ 250,000	0.021	0.000	0.014	0.028
250,000 < Income	0.015	0.011	0.004	0.027
Unknown Income	0.007	0.185	−0.003	0.017
African American				
Income ≤ 50,000	0.007	0.000	0.004	0.011
50,000 < Income ≤ 100,000	0.018	0.000	0.015	0.022
100,000 < Income ≤ 150,000	0.031	0.000	0.025	0.038
150,000 < Income ≤ 250,000	0.039	0.000	0.029	0.049
250,000 < Income	0.032	0.000	0.016	0.048
Unknown Income	0.027	0.000	0.013	0.040

Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans. Models used to estimate results include all controls in the underwriting credit model in Table 5.

Table 7
Analysis of pricing by race/ethnicity.

Loan/borrower characteristic	Comparison group	Raw model		Credit model	
		Coeff (1)	p-Value (2)	Coeff (3)	p-Value (4)
Asian	Non-Hispanic white	0.231	0.000	−0.145	0.000
Hispanic		0.908	0.000	0.238	0.000
African American		1.540	0.000	0.287	0.000
LTV ≤ 60	60 < LTV ≤ 80			0.020	0.000
80 < LTV ≤ 85				0.314	0.000
85 < LTV ≤ 90				0.423	0.000
90 < LTV ≤ 95				0.638	0.000
95 < LTV ≤ 100				0.703	0.000
100 < LTV				0.762	0.000
Term ≤ 10	20 < Term ≤ 30			−0.374	0.000
10 < Term ≤ 15				−0.148	0.000
15 < Term ≤ 20				−0.048	0.000
30 < Term				0.257	0.000
Credit score spline to 580	NA			−0.008	0.000
Credit score spline 580–640				−0.027	0.000
Credit score spline 640–700				−0.014	0.000
Credit score spline above 700				−0.001	0.000
38 ≤ DTI < 50	DTI < 38			0.061	0.000
50 ≤ DTI				−0.043	0.000
DTI Missing/unknown				0.300	0.000
Full documentation	Low documentation			−0.013	0.000
Unknown documentation				−0.511	0.000
R-Squared		0.0842		0.721	
# of observations		1,133,478		1,133,328	

Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans. Models used to estimate results in column (3) include amortization type (FRM, ARM, Balloon, unknown), lender, year, and state controls. The number of observations differs as more lenders provided pricing than underwriting data.

the comparison group characteristic. For race/ethnicity, it provides the average difference in APR paid by a minority group compared to that paid by non-Hispanic whites. Omitted, unobserved variables that may impact this

outcome include channel (retail or wholesale), loan type (conventional or government), market segment (prime or subprime) or verifiable employment and assets, among others.

Table 8
Analysis of pricing by race/ethnicity for different income levels.

Loan/borrower characteristic	Coeff (1)	p-Value (2)	Lower bound (3)	Upper bound (4)
Asian				
Income ≤ 50,000	-0.194	0.000	-0.209	-0.179
50,000 < Income ≤ 100,000	-0.162	0.000	-0.172	-0.153
100,000 < Income ≤ 150,000	-0.121	0.000	-0.135	-0.108
150,000 < Income ≤ 250,000	-0.098	0.000	-0.115	-0.081
250,000 < Income	-0.080	0.000	-0.106	-0.054
Unknown Income	-0.116	0.000	-0.155	-0.077
Hispanic				
Income ≤ 50,000	0.138	0.000	0.125	0.150
50,000 < Income ≤ 100,000	0.297	0.000	0.287	0.306
100,000 < Income ≤ 150,000	0.242	0.000	0.229	0.256
150,000 < Income ≤ 250,000	0.104	0.000	0.085	0.122
250,000 < Income	0.041	0.010	0.010	0.071
Unknown Income	0.016	0.275	-0.013	0.044
African American				
Income ≤ 50,000	0.273	0.000	0.258	0.287
50,000 < Income ≤ 100,000	0.303	0.000	0.291	0.315
100,000 < Income ≤ 150,000	0.263	0.000	0.242	0.284
150,000 < Income ≤ 250,000	0.230	0.000	0.197	0.262
250,000 < Income	0.098	0.000	0.046	0.150
Unknown Income	0.070	0.001	0.027	0.113

Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans. Models used to estimate results include all controls in the pricing credit model in Table 7. The number of observations differs as more lenders provided pricing than underwriting data.

In Table 7, we find that loans with higher LTV values, longer terms, and lower credit scores result in higher APRs. DTI ratios from 38%–50% also lead to increased pricing on the loan, relative to loans with DTI ratios less than 38%. We find, as expected, that African American and Hispanic borrowers paid more, on average, than non-Hispanic whites after controlling for all available factors (displayed in column 3). African Americans had the highest APRs, on average, with a 29 basis point differential when compared to non-Hispanic whites, while Hispanics paid 24 basis points more on average. Asians paid less, on average than non-Hispanic whites, after controlling for factors such as credit score and LTV. This means that either the interaction of factors, or unobservable factors, influence the APR for Asians. Unlike the underwriting results, Asians continue to have relatively favorable pricing compared to the other minority groups after including available loan and borrower characteristics. Therefore, we find evidence that

though some Asian applicants may face challenges obtaining mortgages, they are able to obtain relatively low prices for credit after they have been approved.

As in Table 6, we provide the distribution of pricing outcomes, by race and ethnicity for disaggregated categories of income in Table 8. This table presents effects after controlling for same credit variables included in the model displayed in the third column of Table 7. As in the denial analysis, we find substantial variation across race/ethnicity within each income category and across income categories within race/ethnicity. Asians have lower APRs than either of the other minority groups and lower than NHWs for each income category, ranging from 8 to 19 basis points. As Asian income increases, their relatively advantageous pricing becomes closer to the level of NHWs. On the other hand, Hispanics and African Americans have higher APRs than NHWs at all income levels, after controlling for available borrower and loan characteristics, with substantial

Table 9
Analysis of denial and pricing by tract race/ethnicity composition.

Minority %	Marginal effect	p-Value	Lower bound	Upper bound
<i>Panel A: denial marginal effect (N = 659,643)</i>				
Asian	0.022	0.002	0.008	0.036
Hispanic	0.038	0.000	0.034	0.043
African American	0.031	0.000	0.028	0.035
<i>Panel D: APR marginal effect (N = 1,250,410)</i>				
Asian	-0.756	0.000	-0.789	-0.724
Hispanic	0.508	0.000	0.493	0.522
African American	0.555	0.000	0.540	0.569

Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans and 2000 Census. Models include credit model controls used in Tables 5 and 7.

within race/ethnicity variation (a range of about 28 basis points for Hispanics and about 23 basis points for African Americans).

In Table 9, we present results from the analysis of outcomes based on the racial/ethnic composition of borrower neighborhood. This analysis has similarities to redlining analyses common in mortgage regulatory proceedings, where outcomes are estimated as a function of neighborhood racial composition and observable economic factors. Panel A displays marginal effects of the estimates of denial.

We observe that all of the minority groups have an increasing probability of denial as their share of the residents increasing, with Asians having a lower marginal effect (2.2%) than Hispanics (3.8%) or African Americans (3.1%). With respect to pricing, we see that an increasing Asian resident share is associated with a lower APR, while the converse is true for increasing Hispanic and African American resident shares.

We next test whether aggregating many different subgroups into a single “Asian” category obscures the effects

Table 10
Analysis of underwriting by country of origin, among Asian applicants.

Country of origin	Average % among Asians	Marginal effect (1)	p-Value (2)	Lower bound (3)	Upper bound (4)
Taiwanese	1.07	0.054	0.327	−0.054	0.161
Korean	12.12	0.037	0.000	0.017	0.058
Indian	20.05	0.036	0.000	0.022	0.051
Hmong	1.32	0.035	0.045	0.001	0.070
Bangladeshi	0.27	0.035	0.714	−0.151	0.220
Cambodian	1.28	0.029	0.326	−0.029	0.088
Vietnamese	10.87	0.028	0.001	0.011	0.044
Other Asian	2.26	0.020	0.514	−0.041	0.082
Pakistani	1.70	0.019	0.627	−0.058	0.097
African American		0.017	0.000	0.015	0.019
Hispanic		0.016	0.000	0.014	0.018
Chinese (excl Taiwanese)	20.22	0.013	0.100	−0.002	0.028
Filipino	17.66	0.011	0.095	−0.002	0.024
Thai	1.60	0.004	0.918	−0.081	0.089
Laotian	1.70	−0.018	0.427	−0.063	0.026
Japanese	7.14	−0.048	0.002	−0.079	−0.017
Indonesian	0.38	−0.088	0.472	−0.329	0.153
Malaysian	0.12	−0.101	0.570	−0.452	0.249
Sri Lankan	0.22	−0.123	0.458	−0.447	0.201

Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans and 2000 Census. Models used to estimate results include all controls in the underwriting model in Table 5. African American and Hispanic coefficients are presented for comparison purposes. All comparisons are to non-Hispanic white applicants.

Table 11
Analysis of pricing by country of origin among Asian applicants.

Country of origin	Average % among Asians	Coeff (1)	p-Value (2)	Lower bound (3)	Upper bound (4)
Bangladeshi	0.26	0.960	0.000	0.476	1.445
Indonesian	0.39	0.647	0.012	0.142	1.152
African American		0.288	0.000	0.280	0.297
Cambodian	1.48	0.287	0.000	0.157	0.418
Hispanic		0.240	0.000	0.233	0.246
Thai	1.35	0.111	0.318	−0.107	0.330
Laotian	1.63	0.108	0.094	−0.019	0.234
Filipino	18.61	0.103	0.000	0.072	0.135
Other Asian	1.95	0.012	0.878	−0.146	0.171
Hmong	1.22	−0.001	0.992	−0.105	0.104
Japanese	7.97	−0.005	0.865	−0.062	0.052
Sri Lankan	0.20	−0.015	0.971	−0.832	0.802
Vietnamese	12.10	−0.125	0.000	−0.161	−0.090
Indian	18.21	−0.232	0.000	−0.267	−0.196
Chinese (excl Taiwanese)	19.23	−0.331	0.000	−0.366	−0.296
Korean	12.55	−0.346	0.000	−0.390	−0.302
Pakistani	1.70	−0.430	0.000	−0.610	−0.250
Malaysian	0.10	−0.442	0.427	−1.533	0.649
Taiwanese	1.05	−0.478	0.001	−0.765	−0.191

Source: Proprietary lender data, 1–4 family, purchase money, conventional loans and 2000 Census. Models used to estimate results include all controls in the pricing model in Table 7. African American and Hispanic coefficients are presented for comparison purposes. All comparisons are to non-Hispanic white borrowers.

felt by those from different cultures and different countries of origin. Similar complaints have been made by other racial and ethnic groups. For example, Hispanics have often expressed the differences between those of Hispanic origin compared to those of Latino backgrounds (from Latin American countries of origin) (e.g., Gimenez, 1989).

As previously described, these models follow estimates in Table 9, but we refine the proportion of Asian residents in the tract to reflect reported Asian countries of origin. From this, we estimate variation in outcomes across Asian subgroups. We can clearly see the differences in underwriting and pricing among different groups of Asians in Tables 10 and 11. The underwriting results indicate that the Taiwanese, Indian, Hmong and Korean groups face the highest marginal denial rate, after controlling for other relevant factors (the credit model used in Table 6). Nine of the Asian groups have higher estimates of denial rates than African American or Hispanic borrowers, though not all of these results are precisely estimated. Indonesian, Japanese, Laotian, Malaysian, and Sri Lankan, borrowers are less likely to be denied than non-Hispanic whites.

Table 11 highlights the differences in pricing among the groups. We find that Bangladeshi, Indonesian, and Cambodians face considerable higher pricing differentials ranging from 96 basis points (Bangladeshi) to 29 basis points (Cambodian). These groups pay, on average, not only more than non-Hispanic whites, but more than or comparable levels to African American and Hispanic borrowers. In contrast, many groups pay less, on average, with the lowest pricing differentials experienced by those who originate from Malaysia, Taiwan and Pakistan, after controlling for other factors.

To summarize, the analysis by country of origin in Tables 10 and 11 indicates that mortgage applicants from diverse Asian countries of origin experience diverse outcomes that are not likely to be well-captured in analyses that aggregate Asians. Further research is needed to fully understand the mechanisms that generate such differentials.

5. Discussion

Asians are the fastest growing racial or ethnic group in the U.S., and although some research indicates relative conservatism when purchasing homes (Freddie Mac, 2005), this group has relatively high homeownership rates. While Asians comprise the largest minority group in mortgage markets in recent years, research on housing and housing finance outcomes for these borrowers has lagged behind that focused on the challenges facing African Americans and Hispanics. Using a large sample of proprietary lender data from 2004 to 2012, we provide in this study a comprehensive examination of U.S. mortgage market underwriting and pricing outcomes for Asians.

Asians in the U.S. have relatively high average household incomes and credit scores, which would be expected to contribute to relatively favorable outcomes in mortgage markets. When examining the average price (APR) Asians pay for mortgages, we find evidence that supports this expectation. Asians not only receive lower annual percent-

age rates than African American and Hispanic borrowers in our sample, but also have advantageous pricing (of over 16 basis points) relative to non-Hispanic white borrowers. This result is robust to the inclusion of a number of loan and borrower characteristics expected to affect the pricing of the loan.

Examination of denial outcomes provides a contrary story. Comparing unadjusted group averages indicates that Asians are more likely to be denied than non-Hispanic white borrowers, but less likely to be denied than African American or Hispanic borrowers. Adding loan and borrower characteristics explains a portion of the denial differential for all minority groups, but relatively less for Asians than for the other two groups. In fact, controlling for other factors, our results suggest that Asians are as likely to be denied as often as minority groups who typically command more research attention. Therefore, consistent with findings in other contexts such as labor markets, while Asians may have more favorable observable average economic characteristics, they do not appear to have more favorable outcomes than similarly situated applicants of other minority groups or non-Hispanic whites.

Researchers of Asian American studies often highlight the heterogeneous nature of Asian socioeconomic characteristics to emphasize the need to produced nuanced analyses beyond aggregate outcomes. Part of this concern is that the success of a small number of elite Asians biases averages upwards, masking the challenges faced by those at the bottom of the economic distribution. Our data sample and corresponding analyses provide mixed evidence of this phenomenon for Asian borrowers. For example, while Asians have the most dispersion of income among the racial/ethnic groups we include in our analyses, Asian incomes were also the highest throughout the distribution. As a result, although we find that Asians in our sample may be quite diverse economically, they also were relatively better off, on average and at different points in the income distribution, according to available measures.

To analyze the outcomes of Asians at different income levels more formally, we examine mortgage market outcomes of borrowers in five categories across the income distribution. Analysis of pricing indicates that Asians at different income levels may have faced distinct experiences in mortgage markets, but nonetheless obtained favorable pricing at all income levels. On the other hand, we find evidence that Asians with relatively low incomes had comparable or worse underwriting outcomes than did non-Hispanic whites, African Americans, and Hispanics. Asian denial rates relative to other groups improve as incomes increase.

Finally, we examined differences in denial and pricing across communities with varying levels of residents from different Asian countries of origin. There are some stark differences across Asian groups. For example, borrowers from areas with relatively high Taiwanese, Korean, or Indian communities were more likely to be denied than were borrowers from Japanese or Filipino communities. Alternatively, borrowers from relatively high Bangladeshi or Cambodian geographies had higher average prices than residents of relatively high Chinese or Vietnamese areas. In many cases, those from areas with relatively advantageous

pricing outcomes had relatively disadvantageous underwriting outcomes and vice versa. These differences support concerns about the diversity of experiences faced by Asians originating from different countries of origin.

Our research provides evidence that Asians face distinct challenges in mortgage markets and that these borrowers warrant consideration in consumer protection and in the receipt of housing and financial support services. In particular, we find that Asians may face impediments when trying to obtain a mortgage, with denial rates at worse or comparable levels than relatively oft-studied African Americans and Hispanics. These difficulties appear exacerbated for Asians with low incomes, while we find less evidence of disadvantageous conditional outcomes for Asians with high incomes. Therefore, support for Asian borrowers would appear to be well-targeted if it started with those with relatively poor socioeconomic backgrounds.

Mortgage market outcomes across Asian countries of origin based on the geographic proxy are also starkly dissimilar. This is consistent with other research that indicates that aggregation of Asian preferences and socioeconomic characteristics is problematic when trying to understand challenges to prudent decisions. This challenge, however, is not necessarily unique to Asians. Other minority racial and ethnic groups can make similar claims about heterogeneity of experiences and communities. The lack of conformity among members of many races and ethnicities presents challenges to policymakers and researchers, where broad rules and groupings are attractive. Nevertheless, nuanced analysis and detailed understanding are needed to appropriately characterize experiences, recognize causal mechanisms, and promote an efficient mortgage market.

Appendix 1

Appendix Table 1

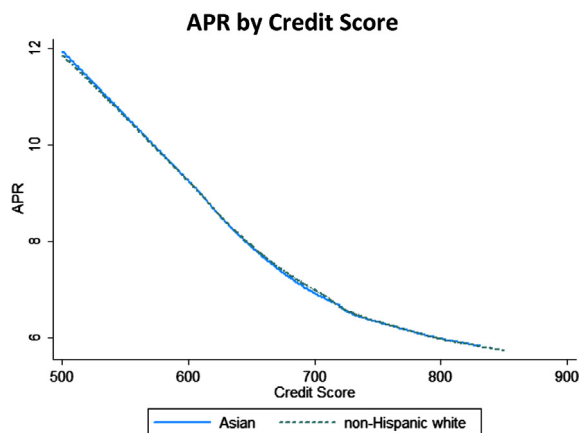
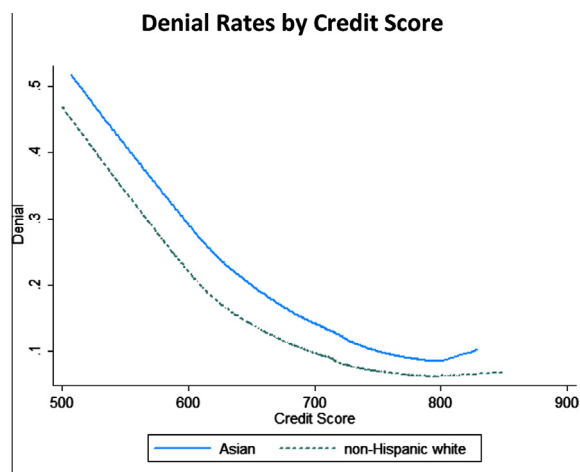
Observations by income category, within race/ethnicity.

	Borrowers (%)	Applicants (%)
Asian		
Income ≤ 50,000	15	18
50,000 < Income ≤ 100,000	41	38
100,000 < Income ≤ 150,000	23	21
150,000 < Income ≤ 250,000	15	15
250,000 < Income	6	8
Hispanic		
Income ≤ 50,000	25	30
50,000 < Income ≤ 100,000	44	42
100,000 < Income ≤ 150,000	19	17
150,000 < Income ≤ 250,000	8	8
250,000 < Income	3	3
African American		
Income ≤ 50,000	37	40
50,000 < Income ≤ 100,000	43	41
100,000 < Income ≤ 150,000	13	12
150,000 < Income ≤ 250,000	5	5
250,000 < Income	2	2

Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans with non-missing income. The percentage of borrowers and applicants are the proportion of borrowers or applicants with incomes in each category within each race/ethnicity group.

Appendix 2: Denial rates and APR by credit score

These figures include locally weighted (lowess) curves of the relationship between credit score (on the x-axis) and denial rate or APR (on the y-axis) respectively. Source: Proprietary lender data, 1–4 family, purchase money, first lien, conventional loans.



References

Joseph, Altonji, Blank, Rebecca., 1999. Gender and race in the labor market. In: Ashenfelter, O., Card, D. (Eds.), *Handbook of Labor Economics*. Elsevier, New York, pp. 3143–4259.

Arrow, Kenneth., 1972. Some mathematical models of race in the labor market. In: Pascal, A.H. (Ed.), *Racial Discrimination in Economic Life*. Lexington Books, Lexington, MA, pp. 187–204.

Asian American/Pacific Islander Policy Research Consortium (AAPIRC), 2012. Letter to Pew Research Center. Available at: <<http://www.aapirc.com/home-1/pressreleases/pewopenletter>> (last accessed 09.10.13).

Becker, Gary S., 1971. *The Economics of Discrimination*. University of Chicago Press, Chicago, IL.

Bhutta, Neil., Canner, Glenn B., 2013. Mortgage market conditions and borrower outcomes: evidence from the 2012 HMDA data and matched HMDA-credit record data. *Fed. Reserve Bull.* 99 (4).

Calem, Paul S., Hershaff, Jonathan E., Wachter, Susan M., 2004. Neighborhood patterns of subprime lending: evidence from disparate cities. *Hous. Policy Debate* 15 (3), 602–622.

Coulson, N. Edward, 1999. Why are Hispanic- and Asian-American homeownership rates so low? Immigration and other factors. *J. Urban Econ.* 45, 209–227.

- Courchane, Marsha J., Surette, Brian J., Zorn, Peter M., 2004. Subprime borrowers: mortgage transitions and outcomes. *J. Real Estate Finance Econ.* 29 (4), 365–392.
- Dymski, Gary., Mohanty, Lisa., 1999. Credit and banking structure: Asian and African-American experience in Los Angeles. *Am. Econ. Rev.* 89 (2), 362–366.
- Freddie Mac, 2005. Homeward Bound: an in-depth look at Asian homebuyers in the United States. Available at: <http://www.freddiemac.com/news/pdf/Asian_Homebuyers_in_the_US.pdf>, (last accessed 9.10.13).
- Federal Financial Institutions Examination Council, 2013 Home Mortgage Disclosure Act data. Available at: <<http://www.ffiec.gov/hmda/hmdaproducts.htm>> (last accessed 17.10.13).
- Fong, Timothy P., 2008. *The Contemporary Asian American Experience: Beyond the Model Minority*. Prentice Hall, Upper Saddle River, NJ.
- Gimenez, Martha E., 1989. Latino/Hispanic – who needs a name? The case against a standardized terminology. *Int. J. Health Serv.* 19 (3), 557–571.
- Hirschman, Charles., Wong, Morrison., 1984. Socioeconomic gains of Asian Americans, Blacks and Hispanics: 1960–1976. *Am. J. Sociol.* 90, 584–607.
- Ishimatsu, Josh, 2013. In the News: dismantling the Model Minority Myth Should be Everybody's Project. National Coalition for Asian Pacific American Community Development. Available at: <<http://nationalcapacd.org/in-the-news/news-dismantling-model-minority-myth-should-be-everybody%E2%80%99s-project>> (last accessed 9.10.13).
- Kim, Andrew Tae.-Hyun., 2011. Culture matters: cultural differences in the reporting of employment discrimination claims. *William Mary Bill Rights J.* 20 (2), 405–455.
- Lai, James, Tam Cho, Wendy K., Kim, Thomas P., Okiyoshi, Takeda, 2001. Asian Pacific–American Campaigns, elections, and elected officials. *Polit. Sci. Polit.* 3, 611–617.
- National Coalition for Asian Pacific American Community Development, 2013. Spotlight: Asian American and Pacific Islander Poverty Available at: <http://nationalcapacd.org/sites/default/files/u12/aapi_poverty_report-web_compressed.pdf> (last accessed 9.10.13).
- Painter, Gary., Gabriel, Stuart., Myers, Dowell., 2001. Race, immigrant status, and housing tenure choice. *J. Urban Econ.* 49, 150–167.
- Painter, Gary., Yang, Lihong., Zhou, Yu, 2003. Heterogeneity in Asian American home-ownership: the impact of household endowments and immigrant status. *Urban Stud.* 40 (3), 505–530.
- Phelps, Edmund S., 1972. The statistical theory of racism and sexism. *Am. Econ. Rev.* 62 (4), 659–661.
- Pew Research Center, 2012. *The Rise of Asian Americans*. Washington, DC: Pew Research Center, available at: <<http://www.pewsocialtrends.org/files/2012/06/SDT-Rise-of-Asian-Americans.pdf>>, (last accessed 9.10.13).
- Reagan, Ronald, 1984. Remarks at a Meeting with Asian and Pacific-American Leaders. Available at: <<http://www.reagan.utexas.edu/archives/speeches/1984/22384a.htm>> (last accessed 9.10.13).
- SAALT (South Asian Americans Leading Together), 2010. From Macacas to Turban Toppers: the Rise in Xenophobic and Racist Rhetoric in American Political Discourse. Available at: <http://saalt.org/wp-content/uploads/2012/09/From-Macacas-to-Turban-Toppers-Report_small_.pdf> (last accessed 9.10.13).
- Schneider, Anne., Ingram, Helen., 1993. Social construction of target populations: implications for politics and policy. *Am. Polit. Sci. Rev.* 87 (2), 334–347.
- Takaki, Ronald., 1998. *Strangers from a Different Shore: A History of Asian Americans*. Updated and Revised Edition. Little, Brown and Company, New York, NY.
- Turner, Margery A., Ross, Stephen L., 2002. Discrimination in metropolitan housing markets: Phase 2 – Asians and Pacific Islanders. Washington, DC: Urban Institute Available at: <http://digitalcommons.uconn.edu/econ_wpapers/200318> (last accessed 9.10.13).
- Turner Margery A., Rob Santos, Diane K., Levy, Doug Wissoker, Claudia Aranda, Rob Pitingolo, 2013. *Housing Discrimination Against Racial and Ethnic Minorities 2012*. Available at: <http://www.huduser.org/portal/publications/fairhsg/hsg_discrimination_2012.html>.
- U.S. Census Bureau, 2013. Asians Fastest-Growing Race or Ethnic Group in 2012. Census Bureau reports. Available at: <<http://www.census.gov/newsroom/releases/archives/population/cb13-112.html?sf13889727=1>> (last accessed 17.10.13).
- U.S. Commission on Civil Rights, 1992. *Civil Rights Issues Facing Asian Americans in the 1990s*. Available at: <<https://www.ncjrs.gov/pdffiles1/Digitization/135906NCJRS.pdf>>.
- U.S. Equal Employment Opportunity Commission, 2008. *Asian American and Pacific Islander Work Group Report to the Chair of the Equal Employment Opportunity Commission*. Available at: <<http://www.eeoc.gov/federal/reports/aapi.html>>.
- U.S. News & World Report, 1966. December 26. “Success Story of One Group in the US.” Available at: <<http://www.dartmouth.edu/~hist32/Hist33/US%20News%20&%20World%20Report.pdf>> (last accessed 9.10.13).
- Wong, Frieda., Halgin, Richard., 2006. The ‘Model Minority’: bane or blessing for Asian Americans? *J. Multicult. Couns. Dev.* 34, 38–49.
- Wu, Frank H., 2002. June 14. The Invisibility of Asian-American Scholars. *The Chronicle Review*. Available at: <<http://chronicle.com/article/The-Invisibility-of/10314>> (last accessed 10.10.13).
- Yezer, Anthony M., 2010. *A Review of Statistical Problems in the Measurement of Mortgage Market Discrimination and Credit Risk*. Research Institute for Housing America, Washington, DC.