Chapter 2

Race and Ethnicity
Classification for Fair Lending Analyses

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I. Introduction

For any fair lending analysis of racial/ethnic disparities, applicants first need to be classified into racial and ethnic groups. For analyses of mortgages, Home Mortgage Disclosure Act (HMDA) data is the primary source of data on race and ethnicity. HMDA contains extensive and granular data on race and ethnicity at the applicant level. The primary applicant and co-applicant can each report up to five races and five ethnicities, and can report either aggregate categories, such as Asian or Hispanic among others, or disaggregate categories, such as Chinese or Mexican, among others. In addition, if the enumerated lists of races and ethnicities in HMDA are not sufficient, applicants can write-in different races and ethnicities. These extensive race and ethnicity data in HMDA allow users significant flexibility in conducting racial and ethnic analyses. However, it also creates significant practical challenges when trying to classify applications into racial or ethnic groups for analysis, especially for applications that report multiple races or ethnicities.

Given the large number of race and ethnicity variables in HMDA, as well as the large number of values that each variable can take on, there are many possible classification strategies Economists can use for fair lending analyses. There is no legal definition of the appropriate classification strategy for fair lending analyses, so the choice of strategy becomes an empirical issue. This report explores some of the issues Economists need to consider when choosing a specific classification strategy, as well as the tradeoffs of these choices. We begin by characterizing the race and ethnicity variables available in the HMDA data, paying particular attention to applications with multiple races or ethnicities reported, since those applications are the most difficult to classify. We then discuss five general issues that need to be considered when using HMDA data to classify applicants into racial and ethnic groups. Finally, we analyze how

volumes, underwriting disparities, and pricing disparities vary across ten specific classification strategies. For all analyses we use 2021 HMDA data and focus on applications for 1st lien, owner-occupied, conventional, 1-4 family, closed-end home purchase loans that were originated, approved but not accepted (NA), or denied. To make the sample more homogenous we also exclude all reverse mortgages and commercial purpose mortgages.[1] These filters resulted in 3,376,935 total applications for the underwriting analysis and 3,052,612 total loans for the pricing analysis. The overall objective of this report is to understand all of the tradeoffs across classification strategies to inform specific choices on strategies for fair lending analyses.

There are four main takeaways from this report,

- Classifying applications into racial and ethnic groups for fair lending analyses of mortgages is very challenging given the extensive race and ethnicity variables in HMDA.
- A legal definition of the appropriate classification strategy to use for fair lending analyses does not exist, so the choice of strategy is an empirical one.
- There are several possible classification strategies that can be used, and the quantitative and qualitative results from fair lending analyses can vary across classification strategies.
- When deciding on which classification strategy to use, it is important to consider how to treat disaggregate races and ethnicities, the race and ethnicity text fields, applications reporting multiple races or ethnicities, and single vs joint applications, as well as whether to treat race and ethnicity as two separate concepts.

II. Characterize Race/Ethnicity Variables in HMDA

As of January 2018, HMDA data contain 16 race variables and 12 ethnicity variables. For race, there are five enumerated-value variables for the primary applicant and five enumerated-value variables for the co-applicant, as well as text fields for American Indian or Alaska Native

[1] The sample also excludes all applications for which Financial Institutions were not required to report demographic data per the Economic Growth, Regulatory Relief, and Consumer Protection Act (EGRRCPA).

Enrolled or Principal Tribe, Other Asian, and Other Pacific Islander for both the primary applicant and co-applicant. For ethnicity, there are five enumerated-value variables for the primary applicant and five enumerated-value variables for the co-applicant, as well as a text field for Other Hispanic or Latino for both the primary applicant and co-applicant. Appendix A provides all possible values for each of these variables except for the text variables.

To develop an initial sense of these data, we start by analyzing just the first race and first ethnicity reported by the primary applicant and co-applicant. Appendix B presents a cross-tabulation of the first race reported for the primary applicant and co-applicant. Appendix C presents the corresponding cross-tabulation of the first ethnicity reported for the primary applicant and co-applicant. Across both sets of results, there are three items of note. First, not surprisingly, single applications from a White applicant (37.05%) and joint applications from two White applicants (30.57%) are the two race combinations with the largest volumes, and single applications from a non-Hispanic applicant (41.31%) and joint applications from two non-Hispanic applicants (32.13%) are the two largest volume ethnicity combinations. Second, using only the first race or ethnicity reported for the primary applicant and co-applicant, there is already a very large number of unique race and ethnicity combinations reported. Of particular interest for this report are applications that reported multiple races or ethnicities, since these applications are more difficult to classify into one racial or ethnic group. Once we incorporate all five races and ethnicities that each applicant could report, the number of unique combinations, as well as the number of applications with multiple races and ethnicities, will increase exponentially. Finally, although there are a large number of unique race and ethnicity combinations, most combinations have very small numbers of applications. This raises questions

about which unique race and ethnicity combinations have sufficient volumes for separate analyses.

III. Classification Strategy Considerations

For fair lending analyses of mortgages, we use the 16 race variables and 12 ethnicity variables in HMDA to classify applicants into racial and ethnic groups. Given the large number of race and ethnicity variables, as well as the large number of values each can take on, there are a large number of possible strategies available. When choosing a specific classification strategy to use, there are five general issues to consider: 1) how should disaggregated races and ethnicities be treated, 2) how should the text fields be used, 3) how should applications where multiple races or ethnicities are reported be classified, 4) should single applications and joint applications be analyzed together or separately, and 5) should race and ethnicity be combined or analyzed separately. We address each of these considerations in turn.

3.1 Disaggregated Races and Ethnicities

As of 2018, in addition to the aggregate races and ethnicities, mortgage applicants can also choose from seven disaggregate Asian categories, four disaggregate Native Hawaiian or Other Pacific Islander categories, and four disaggregate Hispanic categories. Appendix A contains the lists of specific disaggregate categories. Among the 3,376,935 applications in our sample, just under 300,000 (8.79%) reported at least one disaggregate race. Asian Indian and Chinese were the two most commonly reported disaggregate races at 2.99% and 1.97% of applications, respectively. For ethnicity, approximately 244,000 applications (7.24%) reported at

least one disaggregate ethnicity. Mexican was the most commonly reported disaggregate ethnicity at 3.72% of applications.

Although the volumes are somewhat large at the aggregate level, the volumes are generally small for every disaggregate race and ethnicity at the financial institution (FI) level, which is typically the focus of fair lending analyses. As a result, it is common to aggregate up all disaggregate races and ethnicities and use only the aggregate races and ethnicities for fair lending analyses. We adopt that approach here as well and leave analyses of disaggregate races and ethnicities for others. For example, if an application shows Mexican for the ethnicity of the primary applicant, we operate as if the primary applicant reported Hispanic. As a second example, if an application shows Japanese for the race of the co-applicant, we operate as if the co-applicant reported Asian.

3.2 Text Fields

In addition to the formally enumerated aggregate and disaggregate values in HMDA, as of 2018, applicants can also write in values for American Indian or Alaska Native Enrolled or Principal Tribe, Other Asian, Other Native Hawaiian or Other Pacific Islander, and Other Hispanic or Latino. Among the 3,376,935 applications in our sample, just over 80,000 (2.38%) of applications reported a write-in value for Other Hispanic. The volumes of applications with a write-in value for the three races were all less than 50,000 and all less than 1.5% of applications.

Not surprisingly, there are no specific values in any of the text fields with sufficient volume at the FI level to conduct a reasonable statistical analysis of applicants with that race or ethnicity. Therefore, similar to the disaggregate races and ethnicities, we aggregate up the text fields for all analyses and leave analyses of text fields for others. For example, if the text field for

American Indian or Alaska Native Enrolled or Principal Tribe for either the primary applicant or co-applicant is filled out, regardless of the value that was reported, we operate as if that application reported American Indian or Alaska Native. As a second example, if the text field for Other Hispanic for either the primary applicant or co-applicant is filled out, regardless of the value that was reported, we operate as if that application reported Hispanic.

3.3 Multiple Races or Ethnicities

HMDA allows the primary applicant and co-applicant to each report up to five races and five ethnicities. In our sample of 3,376,935 applications, just over 83% of applications reported only one race, and 84.48% of applications reported only one ethnicity.[2] Classifying these applications into racial and ethnic groups is straightforward. Also, 444,486 applications (13.16%) had no racial information for any applicant, and 427,454 applications (12.66%) had no ethnicity information for any applicant. These applications are also easy to address since they are typically be excluded from the analysis. The applications that are difficult to classify are those where multiple races or ethnicities were reported. In our sample, a total of 124,391 applications (3.68%) reported multiple races, and 96,573 applications (2.86%) reported multiple ethnicities. Almost 92% of applications that reported multiple races reported just two races. The remaining 8% reported between three and five races.

In subsequent sections below we focus on how different strategies for classifying applications with multiple races and ethnicities impact underwriting and pricing disparities. Here, we develop the foundation for that analysis by characterizing applications with multiple

[2] For all results in this section, disaggregated races and ethnicities are aggregated up into the aggregate races and ethnicities prior to generating the summary percentages.

races and ethnicities. Table la characterizes, for each race, the types and combinations of races reported.[3] Table 1b provides the corresponding results for ethnicity. For example, looking at the second column of Table la, there were 34,126 total applications where American Indian was reported at least once in the 16 race variables. For 22.68% of these applications, American Indian was the only race reported, and it was reported by only one applicant (either the single applicant for single applications or one of the two applicants for joint applications). For 4.36% of these applications, American Indian was the only race reported, and it was reported for both the primary applicant and co-applicant on joint applications. For 2.71% of these applications, American Indian and Asian were the only two races reported anywhere in the application.[4] Similarly, for 3.40% of these applications, American Indian and Black were the only two races reported anywhere in the application. The remainder of the rows are interpreted similarly. Overall, there is significant variation in the combinations of races reported across racial groups. As one of many examples, 17.87% of the 17,904 applications where Pacific Islanders was reported in at least one of the race variables also reported two other minorities and White, which compares to only 0.10% for this combination of races for the 207,316 applications where Black was reported in at least one of the race variables. As a second example, 45.91% of the 34,126 applications where American Indian was reported also reported White, but no other races. This

[3] Note that some cells contain the same set of applications. For example, the "+ Asian" cell in the Black column contain the same applications as the "+ Black" cell in the Asian column, i.e., all applications where Asian and Black were the only two races reported. The percentages in the two cells differ, because the denominators differ, equal to all applications that reported Black for the first, and all applications that reported Asian for the second. Since some applications are included in multiple columns, the counts in the Totals row together with the counts of applications with no race or ethnicity (mentioned in the text above) will sum to slightly more than the sample total of 3,376,935 applications.

[4] As discussed in more detail below in section 3.4, for all analyses of applications with multiple races or ethnicities reported we ignore whether the information was reported for the primary applicant or co-applicant. For example, for the "American Indian, Asian" cell, these two races could have been reported only for the primary applicant, only for the co-applicant, or in some combination for both the primary applicant and co-applicant.

percentage is significantly higher than for any of the other four races. The results in Table 1b show significant variation for ethnicity as well. Overall, the wide variety of results across racial and ethnic groups in the two tables suggests that there are systematic differences across applications that reported multiple races and ethnicities. These differences could result in different outcomes or treatment that would need to be explored during fair lending analyses.

Table 1a: Composition of Applications by Race

	American Indian	Asian	Black	Pacific Islander	White
Total	34,126	371,231	207,316	17,904	2,439,089
Single Race	22.68%	52.22%	66.10%	17.47%	53.18%
Joint Same Race	4.36%	27.31%	18.26%	4.85%	42.08%
2 Races					
+ American Indian	NA	0.25%	0.56%	0.61%	0.64%
+ Asian	2.71%	NA	1.19%	10.18%	2.54%
+ Black	3.40%	0.66%	NA	3.34%	1.03%
+ Pacific Islander	0.32%	0.49%	0.29%	NA	0.18%
+ White	45.91%	16.70%	12.08%	24.94%	NA
3 Races					
+ 2 Minorities	4.37%	0.41%	0.09%	8.09%	0.20%
+ White and Minority	5.53%	0.96%	1.15%	10.48%	NA
4 Races					
+ 3 Minorities	0.87%	0.08%	0.14%	1.66%	0.14%
+ 2 Minorities and White	9.57%	0.89%	0.10%	17.87%	NA
5 Races					
+ 4 Races	0.26%	0.02%	0.04%	0.50%	0.00%

Table 1b: Composition of Applications by Ethnicity

	Hispanic	non-Hispanic
Total	430,854	2,614,095
Single Ethnicity	53.86%	55.04%
Joint Same Ethnicity	23.73%	41.27%
+ Hispanic	NA	3.69%
+ non-Hispanic	22.41%	NA

To further understand applications with multiple races and ethnicities we now analyze the characteristics of these applications. Tables 2a-2d present, for each minority race, summary statistics of key lending variables available in HMDA data (denial rate, rate spread, FICO score, combined loan-to-value (CLTV), debt-to-income (DTI), and loan amount) for different race combinations that include the specific race for the given table. Table 2e presents the corresponding results for ethnicity. Means are presented for denial rate, and medians are presented for all other variables. The first two rows of results for each table present summary statistics for applications that reported only the race or ethnicity for the specific table. All other rows in each table present summary statistics for a variety of combinations of reported races or ethnicities, all of which contain the race or ethnicity for the specific table. Since each race or ethnicity combination includes the minority race or ethnicity for that table, all applications in each race or ethnicity combination subset could theoretically be classified into that minority race or ethnicity for analysis. If the summary statistics for applications with a specific combination of races or ethnicities reported differ from the summary statistics for applications where only the given race or ethnicity was reported, this suggests that applications with that specific race or ethnicity combination are systematically different. In these instances, the fair lending analysis should assess whether the FI treated these applications differently, and also whether they should be combined into the given minority race or ethnicity or analyzed separately.

Overall, there are many examples in Tables 2a-2e indicating differences in characteristics, and possibly treatment, across applications where multiple races or ethnicities were reported. For example, looking at Table 2a, which presents the results for American Indians, the denial rate for applications that reported only American Indian and Black is 23.34%, which is almost double the denial rates for applications where American Indian was the only race

Table 2a: Summary Statistics of Key Lending Variables for American Indian Applications by Races Reported							
Race Combination	# Applications[5]	Denial Rate	Rate Spread	FICO	CLTV	DTI	Loan Amount
Single Race	7,742	13.38	0.34	744	90.00	38.04	251,100
Joint Same Race	1,490	10.94	0.32	731	90.00	38.54	315,878
2 Races							
+ Black	1,161	23.34	0.48	718	95.00	39.34	256,941
+ Asian	925	11.14	0.16	755	80.00	37.72	375,000
+ Pacific Islander	110	18.18	0.39	729	90.00	38.09	297,000
+ White	15,674	8.44	0.29	750	89.90	36.25	287,200
3 Races							
+ 2 Minorities	1,492	6.43	0.35	754	88.24	37.79	322,134
+ White and Minority	1,888	10.86	0.28	749	90.00	36.88	324,000
4 Races							
+ 3 Minorities	298	8.39	0.55	731	95.00	40.46	285,000
+ 2 Minorities and White	3,267	4.62	0.39	734	90.00	36.71	275,000
5 Races							
+ 4 Races	90	16.67	0.31	746	90.00	37.82	312,915

Table 2b: Summary Statistics of Key Lending Variables for Asian Applications by Races Reported							
Race Combination	# Applications	Denial Rate	Rate Spread	FICO	CLTV	DTI	Loan Amount
Single Race	193,866	7.43	0.08	770	80.00	36.88	400,000
Joint Same Race	101,386	7.58	0.04	765	80.00	37.42	498,750
2 Races							
+ Black	2,461	9.26	0.28	746	90.00	37.65	381,900
+ American Indian	925	11.14	0.16	755	80.00	37.72	375,000
+ Pacific Islander	1,823	8.67	0.22	757	86.63	38.90	399,000
+ White	62,010	5.05	0.14	770	80.00	34.59	420,000
3 Races							
+ 2 Minorities	1,527	6.42	0.35	754	88.32	37.62	323,000
+ White and Minority	3,568	7.85	0.24	756	89.94	36.96	380,450
4 Races							
+ 3 Minorities	298	8.39	0.55	731	95.00	40.46	285,000
+ 2 Minorities and White	3,309	4.68	0.39	754	90.00	36.75	275,500
5 Races							
+ 4 Races	90	16.67	0.31	746	90.00	37.82	312,915

[5] For Tables 2a-2e, the number of applications reflects the number of applications for action taken, which is never missing. The number of applications used to construct the summary statistics for each of the variables might be lower due to non-applicable scenarios and outlier values that were changed to missing. As one example, the sample sizes for rate spread medians is lower, since rate spread is not reported for denied applications.

Table 2c: Summary Statistics of Key Lending Variables for Black Applications by Races Reported							
Race Combination	# Applications	Denial Rate	Rate Spread	FICO	CLTV	DTI	Loan Amount
Single Race	137,054	16.07	0.42	731	95.00	38.99	251,500
Joint Same Race	37,859	14.01	0.45	716	95.00	38.72	332,500
2 Races							
+ American Indian	1,161	23.34	0.48	718	95.00	39.34	256,941
+ Asian	2,461	9.26	0.28	746	90.00	37.65	381,900
+ Pacific Islander	598	12.21	0.44	727	95.00	39.51	300,000
+ White	25,061	8.52	0.32	742	91.26	36.09	320,800
3 Races							
+ 2 Minorities	189	13.23	0.43	729	94.16	39.77	312,000
+ White and Minority	2,383	9.57	0.29	748	90.00	36.26	339,500
4 Races							
+ 3 Minorities	298	8.39	0.55	731	95.00	40.46	285,000
+ 2 Minorities and White	208	15.87	0.26	755	90.00	38.31	357,440
5 Races							
+ 4 Races	90	16.67	0.31	746	90.00	37.82	312,915

Table 2d: Summary Statistics of Key Lending Variables for Pacific Islander Applications by Races Reported							
Race Combination	# Applications	Denial Rate	Rate Spread	FICO	CLTV	DTI	Loan Amount
Single Race	3,129	13.36	0.31	746	90.00	39.31	308,750
Joint Same Race	868	12.33	0.35	730	90.00	40.77	399,480
2 Races							
+ Black	598	12.21	0.44	727	95.00	39.51	300,000
+ Asian	1,823	8.67	0.22	757	86.63	38.90	399,000
+ American Indian	110	18.18	0.39	729	90.00	38.09	297,000
+ White	4,488	6.05	0.26	756	86.41	36.65	346,750
3 Races							
+ 2 Minorities	1,448	6.01	0.35	755	87.07	37.60	323,005
+ White and Minority	1,877	8.15	0.26	755	89.99	37.89	384,000
4 Races							
+ 3 Minorities	298	8.39	0.55	731	95.00	40.46	285,000
+ 2 Minorities and White	3,200	4.31	0.39	754	90.00	36.75	273,165
5 Races							
+ 4 Races	90	16.67	0.31	746	90.00	37.82	312,915

Table 2e: Summary Statistics of Key Lending Variables for Hispanic Applications by Ethnicities Reported							
Ethnicity Combination	# Applications	Denial Rate	Rate Spread	FICO	CLTV	DTI	Loan Amount
Hispanic Only	232,143	10.75	0.37	747	90.48	39.53	264,000
Hispanic, Hispanic	102,301	9.39	0.41	734	91.80	39.71	325,000
Hispanic, non-Hispanic	96,586	6.25	0.24	755	85.00	35.87	356,250

reported. In addition, on average, rate spread, CLTV, and DTI are all higher, and FICO score is lower for these applications. These results suggest that applications reporting American Indian and Black are systematically different, and possibly treated differently, than the overall set of American Indian applications. As a second example, looking at Table 2c, which presents the results for Blacks, the denial rate for applications that reported Black, White, and one other minority is 4-6 percentage points lower than for applications that only reported Black. In addition, on average, rate spread, CLTV, and DTI are lower, and FICO score and loan amount are higher for these applications. Again, these results suggest that applications that reported Black, White, and one other minority are systematically different, and possibly treated differently, than the overall set of Black applications.

The overall takeaway from these summary statistics is that in many instances applications with multiple races or ethnicities appear to be different in some way, and might have been treated differently, as compared to applications with only one reported race or ethnicity. When such differences arise, appropriate steps are needed to understand these differences during fair lending analyses. In subsequent sections we explore these issues further by analyzing how different strategies for classifying applications with multiple races or ethnicities affect volumes, underwriting disparities, and pricing disparities during fair lending analyses.

3.4 Single vs Joint Applications

Differences between single and joint applications, specifically related to reporting of multiple races or ethnicities, need to be considered when classifying applications into racial and ethnic groups for fair lending analyses.[6] Single applications are straightforward as the lone applicant may report multiple races or ethnicities. Joint applications, however, are more complicated since each applicant may report multiple races or ethnicities. With two applicants, there are two main reporting scenarios that result in multiple races or ethnicities. First, each applicant reports multiple races or ethnicities, but the races or ethnicities reported are exactly the same for both applicants. This scenario is similar to single applications where applications have multiple races or ethnicities because an individual applicant reported multiple races or ethnicities. Second, each applicant reports at least one race or ethnicity, and the race(s) or ethnicity(ies) reported are not exactly the same for both applicants.[7] For this scenario, applications have multiple races or ethnicities because of differences across applicants. These differences create challenges for fair lending analyses since FIs may treat different subsets of applications with multiple races or ethnicities differently. For example, there may be systematic differences in treatment of single applications that report both Black and White as compared to joint applications where one applicant reports Black and the other applicant reports White.

In our sample, just over 55% of applications are single applications. Among these applications, 1.69% reported multiple races and 0.65% reported multiple ethnicities.[8] For joint

[6] Single applications and joint applications often have systematically different financial and credit characteristics, and FIs often use different underwriting and pricing criteria for each group. These differences are completely independent of the impacts that differences between single and joint applications have for classifying applications into racial and ethnic groups, but fair lending analyses need to address these differences as well.

[7] A third reporting scenario resulting with multiple races or ethnicities for joint applications is if one applicant reports multiple races or ethnicities and the other applicant reports no race or ethnicity (Information not provided by applicant in mail, internet, or telephone application, for example).

[8] For all results in this section, disaggregated races and ethnicities are aggregated up into the aggregate races and ethnicities prior to generating the summary percentages.

applications, the first reporting scenario discussed above was less likely than the second scenario. For 0.33% of joint applications, the primary applicant and co-applicant both reported multiple races, and they were the exact same races, and for 0.17% of joint applications, the primary applicant and co-applicant both reported multiple ethnicities, and they were the exact same ethnicities. For 5.69% of joint applications, each applicant reported at least one race, and the race(s) or ethnicity(ies) reported were not exactly the same for both applicants, and for 5.39% of joint applications, each applicant reported at least one ethnicity, and the ethnicity(ies) reported were not exactly the same for both applicants.

It is important to address these differences between single and joint applications during fair lending analyses. However, that analysis is complicated and beyond the scope of this report. Therefore, for most classification strategies in this report, we combine primary applicants and co-applicants on joint applications and treat them as a set of 10 races and 10 ethnicities instead of two distinct sets of five races and five ethnicities.

3.5 Race and Ethnicity

Race refers to the concept of dividing people into groups on the basis of various sets of physical characteristics and the process of ascribing social meaning to those groups, while ethnicity describes the culture of people in a given geographic region, including their language, heritage, religion and customs. Since race and ethnicity are separate concepts, a decision is needed on whether to analyze them separately or to combine them. Prior to 2004, HMDA combined race and ethnicity into one variable, so conducting separate analyses was not possible. Post-2004, however, race and ethnicity were separated into different variables, allowing more analytical flexibility.

To further understand the relationships between race and ethnicity we present summary statistics for key lending variables in HMDA for each combination of race and ethnicity. Table 3 presents the results. Means are presented for denial rate, and medians are presented for all other variables. For this analysis, we exclude applications with multiple races and ethnicities reported and focus on applications with exactly one race and one ethnicity. The table contains several items of note. First, not surprisingly, the largest volumes of applications occur for non-Hispanic Whites. Second, on average, non-Hispanic Whites, which are often used as the control group for fair lending analyses, have the lowest denial rate, CLTV, and DTI, as well as one of the lowest rate spreads and one of the highest FICOs. Third, there are clear differences across ethnicity for each race. For example, for each race, the denial rate is higher for Hispanics than non-Hispanics. However, these ethnicity differences are much larger for Asians, Pacific Islanders, and Whites. As a second example, median DTIs are higher for Hispanics than non-Hispanics for Whites and American Indians, but similar for the other three races. Finally, there are also clear differences across race for each ethnicity. For example, for Hispanics, the denial rate ranges from 16.89% for Blacks to 9.69% for Whites. As a second example, for non-Hispanics, median loan amount ranges from 247,350 for American Indians to 430,662 for Asians. The overall takeaway from this analysis is that applications with different combinations of race and ethnicity appear to be different in some way and might have been treated differently.

In subsequent sections we explore how different strategies for classifying applications affect volumes, underwriting disparities, and pricing disparities. Given that race and ethnicity are different concepts, there is a strong theoretical argument for analyzing race and ethnicity separately, i.e., not combining them as in Table 3. However, it is not clear whether people, specifically decision-makers at FIs, view race and ethnicity differently. Given this uncertainty,

and the results from Table 3, we take an empirical approach and assess how different approaches to analyzing race and ethnicity affect underwriting and pricing disparities. Specifically, we consider three general treatments of race and ethnicity: 1) completely separating them, 2) completely combining them, and 3) a hybrid. The next section provides details of these three approaches.

Table 3: Summary Statistics of Key HMDA Variables for Race and Ethnicity Combinations

Race/Ethnicity Combination	# Applications[9]	Denial Rate	Rate Spread	FICO	CLTV	DTI	Loan Amount
non-Hispanic American Indian	4,263	12.13	0.33	743	90.00	36.72	247,350
Hispanic American Indian	3,919	14.09	0.35	740	93.75	39.61	265,600
non-Hispanic Asian	273,124	7.32	0.06	769	80.00	37.03	430,662
Hispanic Asian	4,961	13.26	0.19	759	85.00	37.98	351,000
non-Hispanic Black	158,525	15.45	0.43	728	95.00	38.94	267,319
Hispanic Black	6,844	16.89	0.41	736	95.00	39.18	260,000
non-Hispanic Pacific Islander	2,534	11.88	0.30	746	90.00	39.68	355,000
Hispanic Pacific Islander	1,054	16.60	0.38	738	93.33	39.82	260,500
non-Hispanic White	1,937,622	5.47	0.23	765	80.00	35.29	290,000
Hispanic White	262,896	9.69	0.39	743	90.28	39.70	280,800

[9] The number of applications reflects the number of applications for action taken, which is never missing. The number of applications used to construct the summary statistics for each of the other variables might be lower due to non-applicable scenarios and outlier values that were changed to missing. As one example, the sample sizes for rate spread medians is lower, since rate spread is not reported for denied applications.

IV. Classification Strategies

This section outlines the classification strategies we analyze in this report. Following discussions from above, for every strategy, we aggregate up all disaggregate races and ethnicities (issue 3.1 above), aggregate up all race and ethnicity text fields (issue 3.2 above), and ignore differences between single and joint applications (issue 3.4 above). We then empirically test the impact of three different choices on how to classify applications with multiple races and ethnicities (issue 3.3 above), and three different choices for how to treat race and ethnicity (issue 3.5 above). All combinations of these choices result in nine different classification strategies for the analysis.

For applications with multiple races and ethnicities we explore three general strategies for classifying these applications for analysis: 1) classify an application into a racial/ethnic group only if that race/ethnicity is the only race/ethnicity reported on the application, 2) apply a hierarchy (Cook's Waterfall)[10] to order races/ethnicities for classification, and 3) classify an application into every minority race/ethnicity that is reported on the application. These three strategies range from most conservative (1) to least conservative (3). Tables D1-D3 in Appendix D show how each race combination from Table la above would be classified using each of these strategies. Tables D4- D6 in Appendix D present the corresponding ethnicity mappings.

For how to treat race and ethnicity, we also explore three general strategies. First, we completely separate race and ethnicity, comparing all minority races to Whites and Hispanics to non-Hispanics. Second, we completely combine race and ethnicity, comparing non-Hispanic Blacks, non-Hispanic Asians, non-Hispanic Pacific Islanders, and non-Hispanic American Indians to non-Hispanic Whites, and Hispanic Blacks, Hispanic Asians, Hispanic Pacific

[10] See Appendix E for details on Cook's Waterfall.

Islanders, and Hispanic American Indians to Hispanic Whites. For ethnicity, there would be five different disparities for this strategy, one for each race. Finally, we consider a hybrid approach where we compare Hispanics, regardless of race, as well as Blacks, Asians, Pacific Islanders, and American Indians, regardless of ethnicity, to non-Hispanic Whites. Here, non-Hispanic Whites include applications that only reported non-Hispanic and White.

Table 4 summarizes the nine classification strategies based on how we treat applications with multiple races and ethnicities and how we treat race and ethnicity. Appendix E provides details of each of these strategies.

V. Analysis and Results

This section analyzes how the nine classification strategies presented in the last section and in Appendix E impact results from fair lending analyses of underwriting (denial rates) and pricing (rate spread) disparities for the largest HMDA reporters in 2021. For the underwriting analysis we use the 200 HMDA reporters with the largest volumes of applications and for the pricing analysis we use the 200 HMDA reporters with the largest volume of originations, so the list of FIs for the two analyses is slightly different. Consistent with standard practice, all analyses are at the institution level. We begin by comparing volumes of applications and loans available for analysis across the different classification strategies. We define sufficient volume for the underwriting (pricing) analysis as at least 50 applications (loans) from the treatment group and at least 50 applications (loans) from the control group for the given institution. Overall, a classification strategy is less useful if it is more likely to yield insufficient volumes of applications or loans for meaningful statistical analyses. We then analyze underwriting and pricing disparities by race and ethnicity across classification strategies. To keep the analyses

Table 4: Classification Strategies

	3 Strategies for Multiple Races and Ethnicities		
3 Strategies for Race / Ethnicity	Classify applications into a racial/ethnic group only if that race/ethnicity is the only race/ethnicity reported	Classify applications using a racial/ethnic hierarchy (Cook's Waterfall)	Classify applications into every minority race/ethnicity reported
Completely separate race and ethnicity: Black, Asian, Am Indian, and Pacific Islander compared to White Hispanic compared to non-Hispanic	Strategy 1	Strategy 2	Strategy 3
Hybrid: Black, Hispanic, Asian, Am Indian, and Pacific Islander compared to White	Strategy 4	Strategy 5	Strategy 6
Completely combine race and ethnicity: non-Hispanic Black, non-Hispanic Asian, non-Hispanic Am Indian, and non-Hispanic Pacific Islander compared to non-Hispanic White Hispanic Black, Hispanic Asian, Hispanic Am Indian, and Hispanic Pacific Islander compared to Hispanic White	Strategy 7	Strategy 8	Strategy 9

focused we filter the data to just applications for 1st lien, owner-occupied, conventional, 1-4 family, closed-end home purchase loans, excluding reverse mortgages and commercial purpose mortgages. For underwriting analyses, we further subset the data to applications that were originated, approved but NA, or denied, and for pricing analyses we further subset the data to applications that were originated.

Appendix F presents all results. The first set of results (Tables F1-F10) present volume comparisons and include two tables for each minority race and ethnicity, one for underwriting and one for pricing. In these volume tables, each row represents a classification strategy. For the eight race tables, strategies 7, 8, and 9 each have two rows, since these three strategies break down each race into Hispanic and non-Hispanic for analysis. Strategy 7 for non-Hispanics (NH), which is a conservative strategy resulting in more homogenous race and ethnicity groups, is used as a benchmark of comparison for all other strategies. Presenting results relative to a benchmark provides a direct comparison of the impacts of classification strategies for the same set of FIs and eliminates differences in the set of FIs as an explanation for differences in summary statistics. The tradeoff is that all results are benchmark-specific and will differ for other benchmarks. For the two ethnicity tables, strategies 7, 8, and 9 each have four rows, since these three strategies break down ethnicity into each of the four racial minorities for analysis. For these two tables, Strategy 6, which is a classification strategy that regulatory agencies commonly use for supervisory exams, is used as the benchmark of comparison for all other strategies. Given that the results will be benchmark-specific, we use a different strategy as the benchmark here to provide a second set of results to consider. For each table, the first column shows the classification strategy, treatment group, and control group corresponding to Table 4 above. Column 2 shows the number of FIs with sufficient volumes using both the strategy for that row

and the benchmark strategy. Column 3 shows the number of FIs with sufficient volume for only the strategy for that row, and column 4 shows the number of FIs with sufficient volume for only the benchmark strategy. The remaining columns in these tables present average, minimum, and maximum sample sizes for both the treatment group and the control group. Only FIs with sufficient volumes for both the strategy for the given row and the benchmark strategy are used to generate these summary statistics.

As an example for how to read these volume tables, for Table F3, which contains volumes for underwriting analyses of Asians, the first row shows results for the analysis of classification strategy 1 where the treatment group is Asians and the control group is Whites. A total of 190 of the 200 FIs we analyzed had sufficient volumes for analysis for both classification strategy 1 and strategy 7: NH Asian vs NH White (the benchmark strategy). One FI had sufficient volume for only strategy 1 and no FIs had sufficient volume for only the benchmark strategy. These counts do not sum to 200, because 9 FIs did not have sufficient volumes for either classification strategy. For the 190 FIs with sufficient volumes for both strategy 1 and the benchmark strategy, the average sample size for Asians based on classification strategy 1 was 1,179; the minimum sample size for Asians was 56; the maximum sample size for Asians was 20,606; the average sample size for Whites was 8,161; the minimum sample size for Whites was 874; and the maximum sample size for Whites was 110,172. We discuss the main findings from these tables below.

The second set of results (Tables F11-F20) presents disparity results and includes two tables for each minority race and ethnicity, one for underwriting and one for pricing. All disparities in these tables are conditional disparities estimated using regression techniques that control for key factors that typically impact underwriting and pricing decisions, and are available

in HMDA data. For analyses of approval/denial decisions, we control for FICO score, CLTV, DTI, and loan amount, and for analyses of rate spread, we control for FICO score, CLTV, and loan amount. Each row in the tables represents a classification strategy. For the eight race tables, strategies 7, 8, and 9 each have two rows, since these three strategies break down each race into Hispanic and non-Hispanic for analysis. Strategy 7 for non-Hispanics is again used as the benchmark of comparison for all other strategies. For the two ethnicity tables, strategies 7, 8, and 9 each have four rows, since these three strategies break down ethnicity into each of the four racial minorities for analysis. For these two tables, Strategy 6 is again used as the benchmark of comparison for all other strategies. For each table, the first column shows the classification strategy, treatment group, and control group corresponding to Table 4 above. Column 2 shows the number of FIs with sufficient volumes using both the strategy for that row and the benchmark strategy, which is the same information provided in column 2 of Tables F1-F10. Columns 3-5 show the average, minimum, and maximum disparity estimates using the classification strategy of the given row. Only FIs with sufficient volumes for both the strategy for the given row and the benchmark strategy are used to generate these summary statistics. Column 6 shows the number of FIs where the estimated disparity using the strategy of the given row is larger than the estimated disparity using the benchmark strategy. Columns 7 and 8 show the number of these FIs where only the estimated disparity using the classification strategy of the given row was statistically significant and the number of FIs where estimated disparities using both strategies were statistically significant. The results in column 7 are particularly interesting, because they show the number of FIs where different conclusions would potentially be made and actions taken. The final three columns show similar results, but for FIs where the estimated disparity using the classification strategy of the given row is smaller than the estimated disparity using the

benchmark strategy. Again, the results in the second to last column are particularly interesting, because they show the number of FIs where different conclusions would potentially be made and actions taken.

As an example for how to read these tables, for Table F15, which contains conditional disparity estimates from underwriting analyses of Blacks, the first row shows results for the analysis of classification strategy 1 where the treatment group is Blacks and the control group is Whites. A total of 189 of the 200 FIs we analyzed had sufficient volumes for analysis for both classification strategy 1 and strategy 7: NH Black vs NH White (the benchmark strategy). The average, minimum, and maximum conditional denial rate disparity estimates across these 189 FIs were 2.76, -1.79, and 13.31 percentage points (pps). For 73 of these FIs, the estimated denial rate disparity was larger for the strategy of the given row than for the benchmark strategy. For nine of these 73 FIs, only the estimated disparity for the strategy of the given row was statistically significant, and for 39 of these FIs both estimated disparities were statistically significant. Therefore, for nine FIs, the results based on classification strategy 1 would indicate potential fair lending risk, while the results based on the benchmark strategy would not. Similarly, for 116 of the 189 FIs with sufficient volumes using strategies 1 and the benchmark strategy, the conditional denial rate disparity estimate was smaller for the strategy of the given row than for the benchmark strategy. For 10 of these 116 FIs, only the estimated disparity for the benchmark strategy was statistically significant, and for 77 of these FIs both estimated disparities were statistically significant. Therefore, for 10 FIs, the results based on the benchmark classification strategy would indicate potential fair lending risk, while the results based on strategy 1 would not.

With the large volume of results in Appendix F it is not possible to discuss every interesting finding. Instead, we highlight just a few of the most interesting themes. First, the clear, overriding takeaway from these results is the variation in potential conclusions and actions across classification strategies and FIs. Across all racial and ethnic groups, credit decisions (underwriting and pricing), and classification strategies there were some FIs where the disparity for a given classification strategy was higher and more likely to be statistically significant than for the benchmark strategy and some FIs where the disparity for a given classification strategy was lower and less likely to be statistically significant than for the benchmark strategy. Different analytical conclusions for a given fair lending analysis depending on which classification strategy is used highlights the importance of considering other information and perspectives, such as legal interpretations, as well as policy goals, such as consistency of approach across analyses, when choosing a specific strategy for fair lending analyses.

Second, based on volumes, strategy 4, as well as strategies 7, 8, and 9 for Hispanic minorities may not be broadly viable, because sufficient volumes for analysis are available for only small numbers of the 200 FIs we analyzed. It is not surprising that volume is an issue for strategy 4 given the strict requirement that only one race or ethnicity is reported. Similarly, it is not surprising that strategies 7, 8, and 9 for Hispanic minorities have small volumes for many FIs as well, since each of these strategies generates the most disaggregate race and ethnicity groupings. Although analyses using these strategies are possible for some FIs, and possibly optimal for some FIs, it might be difficult to use any of these strategies as a general approach to fair lending analyses due to these volume constraints.

Third, in general, average denial rate and rate spread disparities tend to be larger for strategy 1, as well as for strategy 7 for non-Hispanics. We focus here on results for the strategies

with the largest volumes of FIs with sufficient volumes for statistical analyses (column 2 in Tables F11-F20), since these results are based on the most similar sets of FIs and therefore are the most comparable. Some examples of higher average disparities for strategies 1 and 7 include,

- Denial rate disparity for Asians vs Whites for strategy 1 (1.46 pps, second highest, Table F13)
- Denial rate disparity for NH Asians vs NH Whites for strategy 7 (1.47 pps, highest, Table F13)
- Denial rate disparity for Blacks vs Whites for strategy 1 (2.76 pps, second highest, Table F15)
- Denial rate disparity for NH Blacks vs NH Whites for strategy 7 (2.89 pps, highest, Table F15)
- Rate spread disparity for NH Blacks vs NH Whites for strategy 7 (6.95 bps, highest, Table F16)
- Denial rate disparity for Hispanics vs non-Hispanics for strategy 1 (1.46 pps, highest, Table F19)
- Rate spread disparity for Hispanics vs non-Hispanics for strategy 1 (5.10 bps, highest, Table F20)

In addition to having higher average disparities in general, the volumes for these two strategies are generally sufficient for analysis for most FIs as well, especially for Asians, Blacks, and Hispanics, as shown in Tables F1-F10. Both of these strategies exclude applications with multiple races and ethnicities, so these results suggest that a cleaner definition of race and ethnicity for fair lending analyses may be more effective at identifying higher fair lending risk. This evidence also suggests that applications with multiple races and ethnicities might need to be analyzed separately during fair lending analyses when volumes allow.

Finally, the results show clear differences for race across ethnicities, and for ethnicity across races. For example, looking at Table F15, for strategy 7, the average conditional denial rate disparity for non-Hispanic Blacks relative to non-Hispanic Whites is 2.89 pps, while the disparity for Hispanic Blacks relative to Hispanic Whites is 2.28 pps. Similarly, looking at Table F16, for strategy 7, the average conditional rate spread disparity for non-Hispanic Blacks relative to non-Hispanic Whites is 6.95 basis points (bps), while the average conditional rate spread disparity for Hispanic Blacks relative to Hispanic Whites is 2.50 bps. Another important difference here is that behind these results, the number of FIs with sufficient volumes for

analysis is much higher for non-Hispanics (just under 190) than for Hispanics (just under 20). As a second example, looking at Table F19, for strategy 8, the average conditional denial rate disparity for Hispanic Asians relative to non-Hispanic Asians is 0.74 pps, while the disparity for Hispanic Blacks relative to non-Hispanic Blacks is -1.28 pps. Similarly, looking at Table F20, for strategy 8, the average conditional rate spread disparity for Hispanic Asians relative to non-Hispanic Asians is 3.92 bps, while the average conditional rate spread disparity for Hispanic Blacks relative to non-Hispanic Blacks is 0.14 bps. Results such as these are consistent with the analyses above showing differences in characteristics and outcomes for applications by race and ethnicity, and suggest that race and ethnicity may need to be combined for analysis to estimate differences for race across ethnicities and differences for ethnicity across races.

VI. Conclusions

This report explores the extensive set of race and ethnicity variables available in HMDA data. While such data provide considerable flexibility and opportunities to conduct a wide variety of analyses of race and ethnicity, it also creates significant challenges when choosing an approach to classifying applications into racial and ethnic groups for fair lending analyses. Five specifically challenging issues, which we discuss in this report, are the disaggregate race and ethnicity variables, the race and ethnicity text fields, differences between single and joint applications, applications reporting multiple races or ethnicities, and whether to treat race and ethnicity as two separate concepts. In addition to the analytical and coding complexities that these issues create, different approaches to addressing these issues can lead to different results and conclusions from fair lending disparity analyses.

Focusing on just the last two of the five issues, we provided empirical evidence using 2021 HMDA data showing how different choices about how to address these two issues generated subsets of applications with different underlying characteristics, and potentially different treatment. We then developed nine classification strategies that address these two issues in different ways, and showed how volumes of applications and loans, as well as estimated underwriting and pricing disparities, varied across these classification strategies. There were several items of note from these analyses. First, there did not appear to be any clear, analytical justification for any one specific classification strategy for every fair lending analysis. Instead, an argument could probably be made for each strategy depending on the specifics of the analysis. Second, some evidence indicated that applications with multiple races or ethnicities reported are systematically different from applications reporting only one race or ethnicity. This suggests that these applications might need to be analyzed separately. Third, some evidence indicated that racial effects differed by ethnicity and that ethnic effects differed by race.

Overall, given the complexity of the race and ethnicity data in HMDA, the lack of a clear legal definition of the appropriate classification strategy, and the empirical evidence in this report, it is important to consider each of the five specific issues discussed in this report, as well as any other issues or information that may be relevant, when choosing an approach to classifying applications into race and ethnicity groups for fair lending analyses. Most importantly, it is vital to document the choices made and the rationale for those choices, as well as any supporting analyses showing how different strategies may impact the results from fair lending analyses.

Appendix A: Possible Values for Each Race and Ethnicity Variable in HMDA

Race: Primary Applicant

1. American Indian or Alaska Native
2. Asian
21. Asian Indian
22. Chinese
23. Filipino
24. Japanese
25. Korean
26. Vietnamese
27. Other Asian
3. Black or African American
4. Native Hawaiian or Other Pacific Islander
41. Native Hawaiian
42. Guamanian or Chamorro
43. Samoan
44. Other Pacific Islander
5. White
6. Information not provided by applicant in mail, internet, or telephone application
7. Not applicable

Race: Co-Applicant

1. American Indian or Alaska Native
2. Asian
21. Asian Indian
22. Chinese
23. Filipino
24. Japanese
25. Korean
26. Vietnamese
27. Other Asian
3. Black or African American
4. Native Hawaiian or Other Pacific Islander
41. Native Hawaiian
42. Guamanian or Chamorro
43. Samoan
44. Other Pacific Islander

5. White
6. Information not provided by applicant in mail, internet, or telephone application
7. Not applicable
8. No co-applicant

Ethnicity: Primary Applicant

1. Hispanic or Latino
11. Mexican
12. Puerto Rican
13. Cuban
14. Other Hispanic or Latino
2. Not Hispanic or Latino
3. Information not provided by applicant in mail, internet, or telephone application
4. Not applicable

Ethnicity: Co-Applicant

1. Hispanic or Latino
11. Mexican
12. Puerto Rican
13. Cuban
14. Other Hispanic or Latino
2. Not Hispanic or Latino
3. Information not provided by applicant in mail, internet, or telephone application
4. Not applicable
5. No co-applicant

Appendix B: Cross-tabulation of the First Race Reported for the Primary Applicant and Co-Applicant

White, No Co-Applicant	1251107	37.05	Guamanian, No Co-Applicant	65	0.0	Indirect, Guamanian	6	0.0
White, White	1032201	30.57	Korean, Asian	60	0.0	Missing, Asian	6	0.0
Indirect, No Co-Applicant	259582	7.69	Chinese, Korean	57	0.0	American Indian, Korean	5	0.0
Indirect, Indirect	185380	5.49	Pacific Isldr, Black	57	0.0	Filipino, Asian Indian	5	0.0
Asian, No Co-Applicant	172553	5.11	Samoan, No Co-Applicant	52	0.0	Other Asian, Vietnamese	5	0.0
Black, No Co-Applicant	138929	4.11	Chinese, Vietnamese	51	0.0	Other Pacific Isldr, Filipino	5	0.0
Asian, Asian	90793	2.69	Korean, Chinese	49	0.0	Pacific Isldr, Native Hawaiian	5	0.0
Black, Black	39167	1.16	Other Pacific Isldr, Indirect	49	0.0	Indirect, Samoan	5	0.0
White, Indirect	37463	1.11	Vietnamese, Indirect	47	0.0	Missing, Black	5	0.0
White, Asian	20026	0.59	Asian Indian, Black	45	0.0	American Indian, Chinese	4	0.0
Asian, White	16190	0.48	Korean, Indirect	45	0.0	American Indian, Other P. I.	4	0.0
Indirect, White	15997	0.47	Black, Filipino	45	0.0	American Indian, Missing	4	0.0
American Indian, No Co-Appl	13288	0.39	NA, NA	45	0.0	Chinese, Other Pacific Isldr	4	0.0
Asian Indian, No Co-Applicant	12776	0.38	Indirect, Korean	44	0.0	Filipino, Pacific Isldr	4	0.0
Black, White	10031	0.30	Chinese, Filipino	41	0.0	Korean, Black	4	0.0
White, Black	9439	0.28	Asian Indian, Other Asian	40	0.0	Other Asian, Japanese	4	0.0
Asian Indian, Asian Indian	6822	0.20	White, Missing	39	0.0	Other Asian, Missing	4	0.0
American Indian, White	5414	0.16	Asian Indian, Chinese	38	0.0	Asian, Guamanian	4	0.0
White, American Indian	4592	0.14	Black, Other Asian	38	0.0	Guamanian, Indirect	4	0.0
Asian, Indirect	4457	0.13	Black, Asian Indian	37	0.0	Other Pac Isldr, Pac Isldr	4	0.0
Chinese, No Co-Applicant	3962	0.12	White, Native Hawaiian	36	0.0	Pacific Isldr, Chinese	4	0.0
Other Asian, No Co-Applicant	3417	0.10	Other Asian, Asian Indian	33	0.0	Indirect, Native Hawaiian	4	0.0
Pacific Isldr, No Co-Appl	2976	0.09	Asian, Japanese	33	0.0	NA, Black	4	0.0
Black, Indirect	2940	0.09	Native Hawaiian, White	31	0.0	Asian Indian, Other Pac Isldr	3	0.0
Amer Indian, Amer Indian	2297	0.07	Indirect, Japanese	31	0.0	Chinese, American Indian	3	0.0
Indirect, Asian	1935	0.06	American Indian, Pacific Isldr	30	0.0	Japanese, Asian Indian	3	0.0
Filipino, No Co-Applicant	1724	0.05	Filipino, Black	30	0.0	Vietnamese, Japanese	3	0.0
Chinese, Chinese	1687	0.05	Pacific Isldr, American Indian	30	0.0	Guamanian, Asian	3	0.0
Korean, No Co-Applicant	1327	0.04	Filipino, Chinese	29	0.0	Other Pac Isldr, Amer Indian	3	0.0
Indirect, Black	1278	0.04	White, Guamanian	29	0.0	Missing, American Indian	3	0.0
Other Asian, Other Asian	1156	0.03	Chinese, Japanese	28	0.0	Missing, Other Asian	3	0.0
Vietnamese, No Co-Applicant	1136	0.03	Japanese, Indirect	28	0.0	American Indian, Vietnamese	2	0.0
White, Pacific Isldr	1042	0.03	Vietnamese, Chinese	28	0.0	Asian Indian, Pacific Isldr	2	0.0
Pacific Isldr, White	904	0.03	Missing, White	24	0.0	Asian Indian, Guamanian	2	0.0

Asian Indian, White	841	0.02	Indirect, Vietnamese	23	0.0	Filipino, Guamanian	2	0.0
White, Filipino	828	0.02	Indirect, Other Pac Isldr	22	0.0	Japanese, Amer Indian	2	0.0
Black, Asian	805	0.02	Chinese, Other Asian	21	0.0	Korean, Amer Indian	2	0.0
Filipino, Filipino	784	0.02	Missing, Indirect	21	0.0	Korean, Asian Indian	2	0.0
American Indian, Indirect	767	0.02	Filipino, Other Asian	20	0.0	Korean, Other Pac Isl	2	0.0
White, Asian Indian	740	0.02	Other Asian, Black	20	0.0	Other Asian, Pac Isldr	2	0.0
Pacific Isldr, Pacific Isldr	736	0.02	Black, Other Pacific Isldr	20	0.0	Asian, Native Hawaiian	2	0.0
Asian, Asian Indian	686	0.02	White, Samoan	20	0.0	Nat Hawaiian, Asian	2	0.0
Asian, Black	656	0.02	Vietnamese, Filipino	19	0.0	Nat Hawaiian, Chinese	2	0.0
White, Chinese	617	0.02	American Indian, Other Asian	18	0.0	Nat Hawaiian, Japanese	2	0.0
Other Pac Isldr, No Co-Applicant	582	0.02	Guamanian, White	18	0.0	Nat Hawaiian, Black	2	0.0
NA, No Co-Applicant	541	0.02	Vietnamese, Other Asian	17	0.0	Nat Hawaiian, Pac Isl	2	0.0
White, Other Asian	534	0.02	Other Asian, Chines	17	0.0	Samoan, Indirect	2	0.0
Korean, Korean	497	0.01	Filipino, Vietnamese	16	0.0	Other P.I., Vietnamese	2	0.0
Asian, Indian, Asian	483	0.01	Japanese, Asian	16	0.0	Pac Isldr, Japanese	2	0.0
Vietnamese, Vietnamese	481	0.01	Japanese, Chinese	16	0.0	Pac Isldr, Other Asian	2	0.0
Filipino, White	470	0.01	Black, Chinese	16	0.0	NA, American Indian	2	0.0
Japanese, No Co-Applicant	432	0.01	Filipino, Korean	15	0.0	Amer Indian, Samoan	1	0.0
Other Asian, White	407	0.01	Other Asian, Filipino	15	0.0	American Indian, NA	1	0.0
Chinese, White	402	0.01	Black, NA	15	0.0	Asian Ind, Japanese	1	0.0
White, Korean	401	0.01	Guamanian, Guamanian	15	0.0	Asian Indian, NA	1	0.0
Asian, Other Asian	376	0.01	American Indian, Asian Indian	13	0.0	Asian Indian, Missing	1	0.0
Indirect, American Indian	341	0.01	Chinese, Black	13	0.0	Chinese, Pac Isldr	1	0.0
American Indian, Asian	330	0.01	Other Asian, American Indian	13	0.0	Chinese, Guamanian	1	0.0
White, Japanese	323	0.01	Samoan, White	13	0.0	Chinese, Missing	1	0.0
Asian Indian, Indirect	306	0.01	Pac Isldr, Other Pac Isldr	13	0.0	Filipino, Nat Hawaiian	1	0.0
Asian, American Indian	299	0.01	NA, Asian	13	0.0	Filipino, Samoan	1	0.0
NA, White	294	0.01	American Indian, Filipino	12	0.0	Japanese, Pac Isldr	1	0.0
White, Vietnamese	276	0.01	Asian Indian, American Indian	12	0.0	Japanese, Nat Hawaiian	1	0.0
Missing, No Co-Applicant	268	0.01	Chinese, Asian Indian	12	0.0	Japanese, Guamanian	1	0.0
American Indian, Black	260	0.01	Other Pacific Isldr, Black	12	0.0	Vietnamese, Nat Hwaiin	1	0.0
White, NA	259	0.01	Asian Indian, Filipino	11	0.0	Vietnamese, Other P.I.	1	0.0
Asian, Chinese	253	0.01	Asian, Other Pacific Isldr	11	0.0	Black, Nat Hawaiian	1	0.0
Black, American Indian	242	0.01	Other Pacific Isldr, Asian	11	0.0	Black, Guamanian	1	0.0
Other Asian, Asian	238	0.01	Pacific Isldr, Filipino	11	0.0	Black, Samoan	1	0.0
Indirect, NA	225	0.01	Indirect, Missing	11	0.0	Nat Hwaiian, Guamanian	1	0.0
Korean, White	211	0.01	Japanese, Korean	10	0.0	Guamanian, Chinese	1	0.0
Japanese, White	191	0.01	Korean, Filipino	10	0.0	Guamanian, Filipino	1	0.0
Asian, Pacific Isldr	188	0.01	Korean, Japanese	10	0.0	Guamanian, Other Asian	1	0.0
Pacific Isldr, Indirect	180	0.01	Asian, NA	10	0.0	Guamanian, Black	1	0.0
Other Pac Isldr, Other Pac Isldr	178	0.01	Nat Hawaiian, Nat Hawaiian	10	0.0	Guamanian, Pac Isldr	1	0.0
Other Asian, Indirect	175	0.01	Other Pac Isldr, Other Asian	10	0.0	Guamanian, Samoan	1	0.0
Chinese, Asian	172	0.01	Filipino, American Indian	9	0.0	Samoan, Asian	1	0.0
Asian, Filipino	169	0.01	Japanese, Vietnamese	9	0.0	Samoan, Pacific Isldr	1	0.0
Pacific Isldr, Asian	169	0.01	Japanese, Other Asian	9	0.0	Pacific Isldr, Korean	1	0.0
Asian, Vietnamese	160	0.00	Korean, Other Asian	9	0.0	Pacific Isldr, NA	1	0.0
Filipino, Indirect	155	0.00	Other Asian, Other Pac Isldr	9	0.0	NA, Asian Indian	1	0.0
White, Other Pacific Isldr	154	0.00	Black, Korean	9	0.0	Missing, Asian Indian	1	0.0
Vietnamese, White	143	0.00	Filipino, Japanese	8	0.0	Missing, Chinese	1	0.0

Filipino, Asian	127	0.00	Japanese, Black	8	0.00	Missing, Korean	1	0.00
Indirect, Asian Indian	124	0.00	Other Asian, Korean	8	0.00	Missing, Pacific Isldr	1	0.00
NA, Indirect	124	0.00	Asian, Missing	8	0.00			
Indirect, Pacific Isldr	117	0.00	Black, Japanese	8	0.00			
Chinese, Indirect	106	0.00	Black, Vietnamese	8	0.00			
Indirect, Filipino	100	0.00	Samoan, Samoan	8	0.00			
Other Pacific Isldr, White	97	0.00	Korean, Vietnamese	7	0.00			
Asian, Korean	96	0.00	Vietnamese, Korean	7	0.00			
Missing, Missing	93	0.00	Black, Missing	7	0.00			
Vietnamese, Asian	87	0.00	American Indian, Japanese	6	0.00			
Black, Pacific Isldr	84	0.00	Asian Indian, Korean	6	0.00			
Indirect, Chinese	80	0.00	Asian Indian, Vietnamese	6	0.00			
Indirect, Other Asian	79	0.00	Japanese, Filipino	6	0.00			
Japanese, Japanese	76	0.00	Vietnamese, American Indian	6	0.00			
Native Hawaiian, No Co-Applicant	65	0.00	Vietnamese, Black	6	0.00			
			Native Hawaiian, Indirect	6	0.00			

Appendix C: Cross-tabulation of the First Ethnicity Reported for the Primary Applicant and Co-Applicant

non-Hispanic, No Co-Applicant	1395062	41.31	Other Hispanic, Hispanic	388	0.01	Cuban, Indirect	30	0.00
non-Hispanic, non-Hispanic	1084968	32.13	Puerto Rican, non-Hispanic	384	0.01	Other Hisp, P. Rican	28	0.00
Indirect, No Co-Applicant	246172	7.29	Puerto Rican, Puerto Rican	329	0.01	Indirect, Cuban	28	0.00
Hispanic, No Co-Applicant	207624	6.15	non-Hispanic, NA	308	0.01	Cuban, Other Hispanic	27	0.00
Indirect, Indirect	182056	5.39	Unknown, Unknown	293	0.01	Mexican, Puerto Rican	19	0.00
Hispanic, Hispanic	95135	2.82	NA, non-Hispanic	292	0.01	Other Hispanic, Missng	18	0.00
non-Hispanic, Indirect	39628	1.17	non-Hispanic, Cuban	236	0.01	Unknown, Hispanic	17	0.00
non-Hispanic, Hispanic	38057	1.13	Mexican, Indirect	229	0.01	Hispanic, Missing	15	0.00
Hispanic, non-Hispanic	32796	0.97	Indirect, Other Hispanic	195	0.01	NA, Hispanic	14	0.00
Indirect, non-Hispanic	14782	0.44	Cuban, Cuban	175	0.01	Cuban, Puerto Rican	11	0.00
Other Hispanic, No Co-Applicant	7845	0.23	Cuban, bon-Hispanic	168	0.00	Hispanic, NA	11	0.00
Hispanic, Indirect	6211	0.18	Indirect, Mexican	148	0.00	Mexican, Cuban	10	0.00
Mexican, No Co-Applicant	4407	0.13	Hispanic, Puerto Rican	142	0.00	Other Hispanic, Cuban	10	0.00
Indirect, Hispanic	2738	0.08	NA, Indirect	134	0.00	Puerto Rican, Cuban	9	0.00
Other Hispanic, Other Hispanic	1956	0.06	Indirect, NA	122	0.00	Cuban, Mexican	8	0.00
Puerto Rican, No Co-Applicant	1644	0.05	Puerto Rican, Hispanic	112	0.00	Unknown, Other Hispanic	6	0.00
non-Hispanic, Other Hispanic	1531	0.05	Puerto Rican, Indirect	92	0.00	Mexican, NA	5	0.00
Other Hispanic, non-Hispanic	1476	0.04	Hispanic, Cuban	83	0.00	Unknown, Puerto Rican	4	0.00
non-Hispanic, Mexican	1359	0.04	Cuban, Hispanic	75	0.00	Hispanic, Missing	2	0.00
Mexican, Mexican	1350	0.04	non-Hispanic, Missing	69	0.00	Other Hispanic, NA	2	0.00
Unknown, No Co-Applicant	837	0.02	Unknown, non-Hispanic	68	0.00	NA, Other Hispanic	2	0.00
Mexican, non-Hispanic	779	0.02	Other Hispanic, Mexican	63	0.00	Unknown, Mexican	2	0.00
Cuban, No Co-Applicant	771	0.02	Mexican, Other Hispanic	58	0.00	Mexican, Missing	1	0.00
Hispanic, Mexican	678	0.02	Indirect, Puerto Rican	54	0.00	NA, Puerto Rican	1	0.00
non-Hispanic, Puerto Rican	566	0.02	NA, NA	50	0.00	Unknown, Puerto Rican	1	0.00
NA, No Co-Applicant	558	0.02	Unknown, Indirect	47	0.00			
Other Hispanic, Indirect	503	0.01	Indirect, Missing	40	0.00			
Mexican, Hispanic	435	0.01	Puerto Rican, Mexican	39	0.00			
Hispanic, Other Hispanic	391	0.01	Puerto Rican, Other Hispanic	38	0.00			

Appendix D: Strategies for Classifying Applications with Multiple Races and Ethnicities

Table D1: Race Classification Strategy 1 - Classify an application into a racial group only if that race is the only race reported on the application

Key

Green: Application is classified into the race of the given column

Red: Application is not classified into the race of the given column

	American Indian	Asian	Black	Pacific Islander	White
Single Race					
Joint Same Race					
2 Races					
+ American Indian	NA				
+ Asian		NA			
+ Black			NA		
+ Pacific Islander				NA	
+ White					NA
3 Races					
+ 2 Minorities					
+ White and Minority					NA
4 Races					
+ 3 Minorities					
+ 2 Minorities and White					NA
5 Races					
+ 4 Races					

Table D2: Race Classification Strategy 2 - Apply a hierarchy (Cook's Waterfall) to order races for classification

Key

Green: Application is classified into the race of the given column

Yellow: Some applications are classified into the race of the given column, and some are not

Red: Application is not classified into the race of the given column

	American Indian	Asian	Black	Pacific Islander	White
Single Race					
Joint Same Race					
2 Races					
+ American Indian	NA				
+ Asian		NA			
+ Black			NA		
+ Pacific Islander				NA	
+ White					NA
3 Races					
+ 2 Minorities					
+ White and Minority					NA
4 Races					
+ 3 Minorities					
+ 2 Minorities and White					NA
5 Races					
+ 4 Races					

Table D3: Race Classification Strategy 3 - Classify an application into every minority race that is reported on the application

Key

Green: Application is classified into the race of the given column

Red: Application is not classified into the race of the given column

	American Indian	Asian	Black	Pacific Islander	White
Single Race					
Joint Same Race					
2 Races					
+ American Indian	NA				
+ Asian		NA			
+ Black			NA		
+ Pacific Islander				NA	
+ White					NA
3 Races					
+ 2 Minorities					
+ White and Minority					NA
4 Races					
+ 3 Minorities					
+ 2 Minorities and White					NA
5 Races					
+ 4 Races					

Table D4: Ethnicity Classification Strategy 1 - Classify an application into an ethnic group only if that ethnicity is the only ethnicity reported on the application

Key

Green: Application is classified into the ethnicity of the given column

Red: Application is not classified into the ethnicity of the given column

	Hispanic	non-Hispanic
Single Ethnicity		
Joint Same Ethnicity		
+ Hispanic	NA	
+ non-Hispanic		NA

Table D5: Ethnicity Classification Strategy 2 - Apply a hierarchy (Cook's Waterfall) to order ethnicities for classification

Key

Green: Application is classified into the ethnicity of the given column

Red: Application is not classified into the ethnicity of the given column

	Hispanic	non-Hispanic
Single Ethnicity		
Joint Same Ethnicity		
+ Hispanic	NA	
+ non-Hispanic		NA

Table D6: Ethnicity Classification Strategy 3 - Classify an application into every minority ethnicity that is reported on the application

Key

Green: Application is classified into the ethnicity of the given column

Red: Application is not classified into the ethnicity of the given column

	Hispanic	non-Hispanic
Single Ethnicity		
Joint Same Ethnicity		
+ Hispanic	NA	
+ non-Hispanic		NA

Appendix E: Classification Strategies

This appendix details each of the nine classification strategies we analyze in this report. As discussed above, for all strategies, disaggregate groups and text fields are first aggregated up to the aggregate races and ethnicities.

Strategy 1: Completely separate race and ethnicity / Classify only applications with only one race or ethnicity reported

For this strategy, race and ethnicity are analyzed separately. For the analysis of race, for a given application, if only one race is reported across all 16 race variables, then the application is classified as that race. Each minority race is compared to Whites. For the analysis of ethnicity, if only one ethnicity is reported across all 12 ethnicity variables, then the application is classified as that ethnicity. Hispanics are compared to non-Hispanics.

Strategy 2: Completely separate race and ethnicity / Apply Cook's Waterfall

For this strategy, race and ethnicity are analyzed separately. For the analysis of race, for a given application, if Black is reported in any of the 16 race variables, then the application is classified as Black. If the application is not classified as Black, but American Indian is reported in any of the 16 race variables, then the application is classified as American Indian. If the application is not classified as Black or American Indian, but Pacific Islander is reported in any of the 16 race variables, then the application is classified as Pacific Islander. If the application is not classified as Black, American Indian, or Pacific Islander, but Asian is reported in any of the 16 race variables, then the application is classified as Asian. Finally, if the application is not classified as any minority race, and White is reported in any of the 16 race variables, then the application is classified as White. Each minority race is compared to Whites.

For the analysis of ethnicity, for a given application, if Hispanic is reported in any of the 12 ethnicity variables, then the application is classified as Hispanic. If the application is not classified as Hispanic, but non-Hispanic is reported in any of the 12 ethnicity variables, then the application is classified as non-Hispanic. Hispanics are compared to non-Hispanics.

Strategy 3: Completely separate race and ethnicity / Classify applications into every race or ethnicity reported

For this strategy, race and ethnicity are analyzed separately. For the analysis of race, a given application is classified into each minority race that is reported in any of the 16 race variables. A given application can therefore be classified into more than one minority racial group. If no minority races are reported in any of the 16 race variables and White is reported in any of the 16 race variables, then the application is classified as White. Each minority race is compared to Whites.

For the analysis of ethnicity, a given application is classified as Hispanic if Hispanic is reported in any of the 12 ethnicity variables. If Hispanic is not reported in any of the 12 ethnicity variables and non-Hispanic is reported in any of the 12 ethnicity variables, then the application is classified as non-Hispanic. Hispanics are compared to non-Hispanics. Note that strategies 2 and 3 are exactly the same for ethnicity.

Strategy 4: Hybrid / Classify only applications with only one race or ethnicity reported

For this strategy, race and ethnicity are treated as the same when classifying applicants, so we refer to the combined set of all races and ethnicities as demographic groups for this discussion. For a given application, if only one demographic group is reported across all 16 race variables and all 12 ethnicity variables, then the application is classified as that demographic

group. For example, if Black is reported in at least one of the 16 race variables, and no other race is reported in any of the 16 race variables and no ethnicity is reported in any of the 12 ethnicity variables, then the application is classified as Black. As a second example, if Hispanic is reported in at least one of the 12 ethnicity variables, and no other ethnicity is reported in any of the 12 ethnicity variables and no race is reported in any of the 16 race variables, then the application is classified as Hispanic. As a third example, if White is reported in at least one of the 16 race variables, and no other race is reported in any of the 16 race variables and no ethnicity is reported in any of the 12 ethnicity variables, then the application is classified as White. Each minority demographic group is compared to Whites.

This is a very strict and conservative classification strategy, since it only includes applications that only report one race or only report one ethnicity, but not both. Therefore, the volumes of applications included in each demographic group will likely be small and the volumes of applications excluded from the analysis will likely be large.

Strategy 5: Hybrid / Apply Cook's Waterfall

For this strategy, race and ethnicity are treated as the same when classifying applicants. For a given application, if Black is reported in any of the 16 race variables, then the application is classified as Black. If the application is not classified as Black, but Hispanic is reported in any of the 12 ethnicity variables, then the application is classified as Hispanic. If the application is not classified as Black or Hispanic, but American Indian is reported in any of the 16 race variables, then the application is classified as American Indian. If the application is not classified as Black, Hispanic, or American Indian, but Pacific Islander is reported in any of the 16 race variables, then the application is classified as Pacific Islander. If the application is not classified

as Black, Hispanic, American Indian, or Pacific Islander, but Asian is reported in any of the 16 race variables, then the application is classified as Asian. Finally, if the application is not classified as any minority race or ethnicity, and White is reported in any of the 16 race variables, then the application is classified as non-Hispanic White. Each minority race and ethnicity is compared to non-Hispanic Whites.[11]

Strategy 6: Hybrid / Classify applications into every race or ethnicity reported

For this strategy, race and ethnicity are treated as the same when classifying applicants. A given application is classified into each minority race that is reported in any of the 16 race variables. Similarly, a given application is classified as Hispanic if Hispanic is reported in any of the 12 ethnicity variables. Therefore, a given application can be classified into multiple minority racial groups and also as Hispanic. If an application does not report any minority races in any of the 16 race variables or Hispanic in any of the 12 ethnicity variables, and White is reported in at least one of the 16 race variables, then the application is classified as non-Hispanic White.[12] Each minority race and ethnicity is compared to non-Hispanic Whites.

Strategy 7: Combine race and ethnicity / Classify only applications with only one race or ethnicity reported

For this strategy, applications where only one race and one ethnicity are reported are classified into that joint racial/ethnic group. All other applications are excluded from the analysis. For example, for a given application, if Black is the only race reported in any of the 16

[11] None of the applications classified as non-Hispanic White also reported Hispanic in any of the 12 ethnicity variables. A very large percentage of these applications explicitly reported "2. Not Hispanic or Latino" in at least one of the 12 ethnicity variables, and the remainder reported "3. Information not provided by applicant in mail, internet, or telephone application."

[12] See footnote 14.

race variables, and Hispanic is the only ethnicity reported in any of the 12 ethnicity variables, then the application is classified as Hispanic Black. As a second example, for a given application, if Asian is the only race reported in any of the 16 race variables, and non-Hispanic is the only ethnicity reported in any of the 12 ethnicity variables, then the application is classified as non-Hispanic Asian. For analyses of race, non-Hispanic White is the comparison group for each non-Hispanic racial minority and Hispanic White is the comparison group for each Hispanic racial minority. For analyses of ethnicity, non-Hispanic Asians are compared to Hispanic Asians, non-Hispanic Blacks are compared to Hispanic Blacks, non-Hispanic American Indians are compared to Hispanic American Indians, and non-Hispanic Pacific Islanders are compared to Hispanic Pacific Islanders.

Strategy 8: Combine race and ethnicity / Apply Cook's Waterfall

For this strategy, for a given application, if Black is reported in any of the 16 race variables and Hispanic is reported in any of the 12 ethnicity variables then the application is classified as Hispanic Black. If the application is not classified as Hispanic Black, Black is reported in any of the 16 race variables, and non-Hispanic is reported in any of the 12 ethnicity variables then the application is classified as non-Hispanic Black. If the application is not classified as Hispanic Black or non-Hispanic Black, Hispanic is reported in at least one of the 12 ethnicity variables, and American Indian is reported in at least one of the 16 race variables, then the application is classified as Hispanic American Indian. The remaining applications where Hispanic is reported in at least one of the 12 ethnicity variables are classified into racial groups in this sequential manner using the order, Pacific Islanders, Asians, and Whites. If the application is not classified into any group yet, non-Hispanic is reported in at least one of the 12 ethnicity

variables, and American Indian is reported in at least one of the 16 race variables, then the application is classified as non-Hispanic American Indian. The remaining applications where non-Hispanic is reported in at least one of the 12 ethnicity variables are classified into racial groups in this sequential manner using the order, Pacific Islanders, Asians, and Whites.

For analyses of race, non-Hispanic White is the comparison group for each non-Hispanic racial minority and Hispanic White is the comparison group for each Hispanic racial minority. For analyses of ethnicity, non-Hispanic Asians are compared to Hispanic Asians, non-Hispanic Blacks are compared to Hispanic Blacks, non-Hispanic American Indians are compared to Hispanic American Indians, and non-Hispanic Pacific Islanders are compared to Hispanic Pacific Islander Hispanics.

Strategy 9: Combine race and ethnicity / Classify applications into every race or ethnicity reported

For this strategy, applications where Hispanic is reported in any of the 12 ethnicity variables and American Indian is reported in any of the 16 race variables are classified as Hispanic American Indian. A similar process is used to classify applications as Hispanic Asian, Hispanic Black, and Hispanic Pacific Islander. Applications are classified as Hispanic White if Hispanic is reported in any of the 12 ethnicity variables, White is reported in any of the 16 race variables, and no minority races are reported in any of the 16 race variables. Applications where Hispanic is not reported in any of the 12 ethnicity variables, non-Hispanic is reported in any of the 12 ethnicity variables, and American Indian is reported in any of the 16 race variables are classified as non-Hispanic American Indian. A similar process is used to classify applications as non-Hispanic Asian, non-Hispanic Black, and non-Hispanic Pacific Islander. Applications are classified as non-Hispanic White if Hispanic is not reported in any of the 12 ethnicity variables,

non-Hispanic is reported in any of the 12 ethnicity variables, White is reported in at least one of the 16 race variables, and no minority races are reported in any of the 16 race variables.

For analyses of race, non-Hispanic White is the comparison group for each non-Hispanic racial minority and Hispanic White is the comparison group for each Hispanic racial minority. For analyses of ethnicity, non-Hispanic Asians are compared to Hispanic Asians, non-Hispanic Blacks are compared to Hispanic Blacks, non-Hispanic American Indians are compared to Hispanic American Indians, and non-Hispanic Pacific Islanders are compared to Hispanic Pacific Islanders.

Appendix F: Underwriting and Pricing Disparity Results

Table F1: Underwriting Counts, American Indians (AI)

Benchmark Strategy – 7: NH AI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Applications	Min # of Treatment Group Applications	Max # of Treatment Group Applications	Avg # of Control Group Applications	Min # of Control Group Applications	Max # of Control Group Applications
1: AI vs White	11	19	0	235	93	594	47,107	8,251	110,172
2: AI vs White	11	60	0	589	157	1,258	47,107	8,251	110,172
3: AI vs White	11	69	0	641	195	1,317	47,107	8,251	110,172
4: AI vs White	2	0	9	100	69	131	2,197	1,955	2,439
5: AI vs NH White	11	42	0	366	126	767	39,704	7,786	86,369
6: AI vs NH White	11	69	0	641	195	1,317	39,704	7,786	86,369
7: NH AI vs NH White	11	0	0	95	50	218	38,613	7,759	83,930
7: H AI vs H White	8	6	3	133	65	241	7,249	2,990	20,420
8: NH AI vs NH White	11	39	0	325	113	616	38,613	7,759	83,930
8: H AI vs H White	10	22	1	242	61	491	8,096	2,907	23,803
9: NH AI vs NH White	11	41	0	355	117	659	38,613	7,759	83,930
9: H AI vs H White	10	24	1	263	65	519	8,096	2,907	23,803

Table F2: Pricing Counts, American Indians (AI)

Benchmark Strategy – 7: NH AI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Loans	Min # of Treatment Group Loans	Max # of Treatment Group Loans	Avg # of Control Group Loans	Min # of Control Group Loans	Max # of Control Group Loans
1: AI vs White	11	14	0	202	78	540	44,015	7,786	102,377
2: AI vs White	11	58	0	532	175	1,144	44,015	7,786	102,377
3: AI vs White	11	61	0	574	183	1,193	44,015	7,786	102,377
4: AI vs White	2	0	9	94	65	123	2,001	1,750	2,252
5: AI vs NH White	11	38	0	342	117	699	37,090	6,355	81,184
6: AI vs NH White	11	61	0	574	183	1,193	37,090	6,355	81,184
7: NH AI vs NH White	11	0	0	85	50	199	36,098	6,244	78,932
7: H AI vs H White	7	6	4	114	53	214	6,732	2,797	18,014
8: NH AI vs NH White	11	35	0	305	107	557	36,098	6,244	78,932
8: H AI vs H White	11	18	0	190	56	445	6,925	1,431	21,193
9: NH AI vs NH White	11	39	0	329	111	582	36,098	6,244	78,932
9: H AI vs H White	11	19	0	205	60	466	6,925	1,431	21,193

Table F3: Underwriting Counts, Asians

Benchmark Strategy – 7: NH Asian vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Applications	Min # of Treatment Group Applications	Max # of Treatment Group Applications	Avg # of Control Group Applications	Min # of Control Group Applications	Max # of Control Group Applications
1: Asian vs White	190	1	0	1,179	56	20,606	8,161	874	110,172
2: Asian vs White	190	4	0	1,421	80	23,459	8,161	874	110,172
3: Asian vs White	190	5	0	1,480	82	23,877	8,161	874	110,172
4: Asian vs White	33	0	157	164	51	598	591	58	2,439
5: Asian vs NH White	190	4	0	1,353	74	22,304	6,959	752	86,369
6: Asian vs NH White	190	5	0	1,480	82	23,877	6,959	752	86,369
7: NH Asian vs NH White	190	0	0	1,100	51	19,351	6,773	654	83,930
7: H Asian vs H White	16	0	174	146	55	346	4,949	1,111	20,420
8: NH Asian vs NH White	190	3	0	1,309	72	21,658	6,773	654	83,930
8: H Asian vs H White	47	0	143	219	53	1,155	3,377	406	23,803
9: NH Asian vs NH White	190	3	0	1,339	75	21,965	6,773	654	83,930
9: H Asian vs H White	51	0	139	302	50	3,665	3,214	406	23,803

Table F4: Pricing Counts, Asians

Benchmark Strategy – 7: NH Asian vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Loans	Min # of Treatment Group Loans	Max # of Treatment Group Loans	Avg # of Control Group Loans	Min # of Control Group Loans	Max # of Control Group Loans
1: Asian vs White	195	2	0	1,037	52	18,817	7,376	790	102,377
2: Asian vs White	195	2	0	1,256	73	21,503	7,376	790	102,377
3: Asian vs White	195	3	0	1,306	74	21,877	7,376	790	102,377
4: Asian vs White	28	1	167	164	52	543	591	53	2,252
5: Asian vs NH White	195	2	0	1,198	72	20,441	6,333	629	81,184
6: Asian vs NH White	195	3	0	1,306	74	21,877	6,333	629	81,184
7: NH Asian vs NH White	195	0	0	969	51	17,679	6,170	533	78,932
7: H Asian vs H White	15	0	180	131	53	312	4,640	998	18,014
8: NH Asian vs NH White	195	1	0	1,160	70	19,856	6,170	533	78,932
8: H Asian vs H White	43	1	152	208	51	1,062	3,131	396	21,193
9: NH Asian vs NH White	195	1	0	1,183	71	20,136	6,170	533	78,932
9: H Asian vs H White	48	1	147	286	51	3,551	2,946	394	21,193

Table F5: Underwriting Counts, Blacks

Benchmark Strategy – 7: NH Black vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Applications	Min # of Treatment Group Applications	Max # of Treatment Group Applications	Avg # of Control Group Applications	Min # of Control Group Applications	Max # of Control Group Applications
1: Black vs White	189	2	0	668	53	7,977	8,214	1,478	110,172
2: Black vs White	189	4	0	790	61	9,137	8,214	1,478	110,172
3: Black vs White	189	4	0	790	61	9,137	8,214	1,478	110,172
4: Black vs White	23	0	166	108	53	268	742	150	2,439
5: Black vs NH White	189	4	0	790	61	9,137	7,008	775	86,369
6: Black vs NH White	189	4	0	790	61	9,137	7,008	775	86,369
7: NH Black vs NH White	189	0	0	606	50	7,269	6,820	654	83,930
7: H Black vs H White	20	0	169	147	50	325	4,583	1,009	20,420
8: NH Black vs NH White	189	4	0	700	55	8,094	6,820	654	83,930
8: H Black vs H White	49	0	140	187	50	740	3,228	270	23,803
9: NH Black vs NH White	189	4	0	700	55	8,094	6,820	654	83,930
9: H Black vs H White	49	0	140	187	50	740	3,228	270	23,803

Table F6: Pricing Counts, Blacks

Benchmark Strategy – 7: NH Black vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Loans	Min # of Treatment Group Loans	Max # of Treatment Group Loans	Avg # of Control Group Loans	Min # of Control Group Loans	Max # of Control Group Loans
1: Black vs White	183	2	0	566	52	6,760	7,717	1,092	102,377
2: Black vs White	183	10	0	678	67	7,818	7,717	1,092	102,377
3: Black vs White	183	10	0	678	67	7,818	7,717	1,092	102,377
4: Black vs White	18	0	165	102	50	237	803	180	2,252
5: Black vs NH White	183	10	0	678	67	7,818	6,622	629	81,184
6: Black vs NH White	183	10	0	678	67	7,818	6,622	629	81,184
7: NH Black vs NH White	183	0	0	515	50	6,143	6,450	533	78,932
7: H Black vs H White	16	0	167	135	53	277	4,471	779	18,014
8: NH Black vs NH White	183	7	0	601	63	6,906	6,450	533	78,932
8: H Black vs H White	46	0	137	165	50	646	3,002	241	21,193
9: NH Black vs NH White	183	7	0	601	63	6,906	6,450	533	78,932
9: H Black vs H White	46	0	137	165	50	646	3,002	241	21,193

Table F7: Underwriting Counts, Pacific Islanders (PI)

Benchmark Strategy – 7: NH PI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Applications	Min # of Treatment Group Applications	Max # of Treatment Group Applications	Avg # of Control Group Applications	Min # of Control Group Applications	Max # of Control Group Applications
1: PI vs White	7	9	0	139	67	286	60,237	36,501	110,172
2: PI vs White	7	29	0	352	185	675	60,237	36,501	110,172
3: PI vs White	7	36	0	388	204	739	60,237	36,501	110,172
4: PI vs White	0	0	7	.	.	.	.	.	.
5: PI vs NH White	7	22	0	256	111	511	50,092	28,578	86,369
6: PI vs NH White	7	36	0	388	204	739	50,092	28,578	86,369
7: NH PI vs NH White	7	0	0	91	50	207	48,799	27,790	83,930
7: H PI vs H White	3	0	4	58	50	72	10,233	5,011	20,420
8: NH PI vs NH White	7	22	0	242	110	482	48,799	27,790	83,930
8: H PI vs H White	6	4	1	105	52	164	10,504	6,346	23,803
9: NH PI vs NH White	7	24	0	260	120	512	48,799	27,790	83,930
9: H PI vs H White	7	12	0	113	57	195	10,145	6,346	23,803

Table F8: Pricing Counts, Pacific Islanders (PI)

Benchmark Strategy – 7: NH PI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Loans	Min # of Treatment Group Loans	Max # of Treatment Group Loans	Avg # of Control Group Loans	Min # of Control Group Loans	Max # of Control Group Loans
1: PI vs White	4	10	0	141	78	251	66,112	34,423	102,377
2: PI vs White	4	26	0	402	314	609	66,112	34,423	102,377
3: PI vs White	4	37	0	437	339	665	66,112	34,423	102,377
4: PI vs White	0	0	4	.	.	.	.	.	.
5: PI vs NH White	4	24	0	308	221	466	55,024	27,073	81,184
6: PI vs NH White	4	37	0	437	339	665	55,024	27,073	81,184
7: NH PI vs NH White	4	0	0	101	50	181	53,411	26,333	78,932
7: H PI vs H White	0	1	4	.	.	.	.	.	.
8: NH PI vs NH White	4	21	0	291	201	440	53,411	26,333	78,932
8: H PI vs H White	3	7	1	108	70	143	12,521	7,350	21,193
9: NH PI vs NH White	4	25	0	309	213	467	53,411	26,333	78,932
9: H PI vs H White	4	13	0	108	56	169	11,088	6,788	21,193

Table F9: Underwriting Counts, Hispanics

Benchmark Strategy – 6: H vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Applications	Min # of Treatment Group Applications	Max # of Treatment Group Applications	Avg # of Control Group Applications	Min # of Control Group Applications	Max # of Control Group Applications
1: H vs NH	196	0	3	1,198	52	24,092	8,863	1,055	116,598
2: H vs NH	199	0	0	1,523	63	28,737	8,779	1,055	116,598
3: H vs NH	199	0	0	1,523	63	28,737	8,779	1,055	116,598
4: H vs White	109	0	90	284	50	2,311	284	51	2,439
5: H vs NH White	199	0	0	1,462	63	27,997	6,781	752	86,369
6: H vs NH White	199	0	0	1,523	63	28,737	6,781	752	86,369
7: H AI vs NH AI	8	0	191	133	65	241	107	50	218
7: H Asian vs NH Asian	16	0	183	146	55	346	6,251	726	19,351
7: H Black vs NH Black	20	0	179	147	50	325	2,791	703	7,269
7: H PI vs NH PI	3	0	196	58	50	72	111	61	207
8: H AI vs NH AI	30	0	169	256	50	3,325	218	70	671
8: H Asian vs NH Asian	47	0	152	219	53	1,155	3,947	506	21,658
8: H Black vs NH Black	49	0	150	187	50	740	1,877	265	8,094
8: H PI vs NH PI	10	0	189	89	52	164	205	110	482
9: H AI vs NH AI	32	0	167	264	50	3,572	230	70	716
9: H Asian vs NH Asian	51	0	148	302	50	3,665	3,787	445	21,965
9: H Black vs NH Black	49	0	150	187	50	740	1,877	265	8,094
9: H PI vs NH PI	17	0	182	86	51	195	213	72	692

Table F10: Pricing Counts, Hispanics

Benchmark Strategy – 6: H vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where the given strategy and benchmark strategy both have volume	# FIs where only the given strategy has volume	# FIs where only the benchmark strategy has volume	Avg # of Treatment Group Loans	Min # of Treatment Group Loans	Max # of Treatment Group Loans	Avg # of Control Group Loans	Min # of Control Group Loans	Max # of Control Group Loans
1: H vs NH	194	0	5	1,054	69	21,262	8,152	853	108,367
2: H vs NH	198	0	1	1,347	58	25,596	8,042	853	108,367
3: H vs NH	198	0	1	1,347	58	25,596	8,042	853	108,367
4: H vs White	105	0	94	252	50	2,044	263	53	2,252
5: H vs NH White	199	0	0	1,302	58	24,950	6,245	63	81,184
6: H vs NH White	199	0	0	1,353	58	25,596	6,245	63	81,184
7: H AI vs NH AI	7	0	192	114	53	214	101	55	199
7: H Asian vs NH Asian	15	0	184	131	53	312	6,063	1,008	17,679
7: H Black vs NH Black	16	0	183	135	53	277	2,593	764	6,143
7: H PI vs NH PI	0	0	199	.	.	.	.	.	.
8: H AI vs NH AI	27	0	172	255	52	3,252	193	55	557
8: H Asian vs NH Asian	43	0	156	208	51	1,062	3,836	488	19,856
8: H Black vs NH Black	46	0	153	165	50	646	1,635	143	6,906
8: H PI vs NH PI	10	0	189	77	50	143	211	92	490
9: H AI vs NH AI	27	0	172	276	54	3,479	211	57	582
9: H Asian vs NH Asian	48	0	151	286	51	3,551	3,597	502	20,136
9: H Black vs NH Black	46	0	153	165	50	646	1,635	143	6,906
9: H PI vs NH PI	15	0	184	77	51	169	202	78	537

Table F11: Conditional Denial Rate Disparities, American Indians (AI)

Benchmark Strategy - 7: NH AI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (pps)	Min Disparity (pps)	Max Disparity (pps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.*	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: AI vs White	11	3.75	-2.02	19.13	5	3	1	6	1	4
2: AI vs White	11	2.78	-0.65	12.03	6	3	2	5	1	3
3: AI vs White	11	2.72	-0.72	9.93	5	3	2	6	0	4
4: AI vs White	2	-1.57	-2.04	-1.09	0	0	0	2	2	0
5: AI vs NH White	11	3.09	-0.51	13.61	4	2	2	7	0	4
6: AI vs NH White	11	2.99	-0.31	9.86	7	3	3	4	0	3
7: NH AI vs NH White	11	3.41	-2.00	20.90	0	0	0	0	0	0
7: H AI vs H White	8	2.12	-2.21	8.35	3	1	0	5	4	0
8: NH AI vs NH White	11	2.81	-0.63	13.33	5	2	3	6	0	3
8: H AI vs H White	10	1.26	-4.77	5.57	5	2	1	5	2	2
9: NH AI vs NH White	11	2.66	-0.72	10.89	6	2	3	5	0	3
9: H AI vs H White	10	1.44	-4.96	5.65	5	2	1	5	2	2

* s.s. means statistically significant at the 95 percent confidence level in this table and for all subsequent tables.

Table F12: Conditional Rate Spread Disparities, American Indians (AI)

Benchmark Strategy - 7: NH AI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (bps)	Min Disparity (bps)	Max Disparity (bps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: AI vs White	11	2.78	-1.12	9.71	5	1	2	6	2	0
2: AI vs White	11	1.59	-0.26	5.11	3	1	0	8	2	2
3: AI vs White	11	1.89	-0.51	5.19	3	1	0	8	2	2
4: AI vs White	2	-8.21	-14.26	-2.16	0	0	0	2	0	1
5: AI vs NH White	11	1.59	-1.75	5.68	2	1	0	9	2	2
6: AI vs NH White	11	2.71	0.51	6.13	4	3	0	7	2	2
7: NH AI vs NH White	11	3.63	-1.76	9.02	0	0	0	0	0	0
7: H AI vs H White	7	0.23	-3.88	4.01	1	0	0	6	3	0
8: NH AI vs NH White	11	1.86	-1.33	4.69	2	0	0	9	2	2
8: H AI vs H White	11	-0.25	-7.09	4.07	2	1	0	9	4	0
9: NH AI vs NH White	11	2.24	-1.51	4.64	3	1	0	8	1	3
9: H AI vs H White	11	0.00	-4.78	4.28	2	0	0	9	4	0

Table F13: Conditional Denial Rate Disparities, Asians

Benchmark Strategy - 7: NH Asian vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (pps)	Min Disparity (pps)	Max Disparity (pps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: Asian vs White	190	1.46	-3.36	22.57	67	8	24	123	6	42
2: Asian vs White	190	1.10	-3.26	20.90	52	12	8	138	16	49
3: Asian vs White	190	1.11	-3.17	20.63	51	12	9	139	15	49
4: Asian vs White	33	2.81	-3.08	19.16	17	1	4	16	9	1
5: Asian vs NH White	190	1.18	-3.30	22.00	56	13	10	134	9	55
6: Asian vs NH White	190	1.25	-2.94	21.22	61	12	13	129	8	55
7: NH Asian vs NH White	190	1.47	-3.25	22.81	0	0	0	0	0	0
7: H Asian vs H White	16	1.73	-1.20	9.58	8	0	2	8	4	1
8: NH Asian vs NH White	190	1.15	-3.56	21.50	45	6	10	145	11	54
8: H Asian vs H White	47	0.80	-6.71	22.20	19	0	4	28	16	2
9: NH Asian vs NH White	190	1.15	-3.56	21.32	47	6	11	143	9	55
9: H Asian vs H White	51	1.01	-6.63	20.65	22	2	4	29	17	1

Table F14: Conditional Rate Spread Disparities, Asians

Benchmark Strategy - 7: NH Asian vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (bps)	Min Disparity (bps)	Max Disparity (bps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: Asian vs White	195	-6.28	-24.74	49.30	68	0	49	127	2	74
2: Asian vs White	195	-5.74	-24.29	40.54	114	2	88	81	3	32
3: Asian vs White	195	-5.61	-24.13	36.09	121	2	92	74	3	28
4: Asian vs White	28	-8.09	-16.78	-1.75	12	0	6	16	3	12
5: Asian vs NH White	195	-5.21	-29.99	48.55	146	3	106	49	2	15
6: Asian vs NH White	195	-4.92	-29.60	44.29	155	2	110	40	2	11
7: NH Asian vs NH White	195	-5.71	-29.77	58.38	0	0	0	0	0	0
7: H Asian vs H White	15	-5.42	-13.24	3.26	10	0	5	5	2	3
8: NH Asian vs NH White	195	-5.17	-29.36	49.40	141	2	105	54	2	17
8: H Asian vs H White	43	-4.53	-14.48	3.40	28	0	8	15	1	11
9: NH Asian vs NH White	195	-5.03	-29.16	49.24	153	2	110	42	2	12
9: H Asian vs H White	48	-4.50	-16.29	3.08	33	0	10	15	3	8

Table F15: Conditional Denial Rate Disparities, Blacks

Benchmark Strategy - 7: NH Black vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (pps)	Min Disparity (pps)	Max Disparity (pps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: Black vs White	189	2.76	-1.79	13.31	73	9	39	116	10	77
2: Black vs White	189	2.28	-1.61	9.50	49	9	19	140	16	91
3: Black vs White	189	2.28	-1.61	9.50	49	9	19	140	16	91
4: Black vs White	23	1.79	-1.85	10.53	4	0	2	19	16	2
5: Black vs NH White	189	2.41	-2.73	9.57	46	8	19	143	11	96
6: Black vs NH White	189	2.41	-2.73	9.57	46	8	19	143	11	96
7: NH Black vs NH White	189	2.89	-2.83	13.45	0	0	0	0	0	0
7: H Black vs H White	20	2.28	-1.62	7.30	6	0	4	14	13	1
8: NH Black vs NH White	189	2.44	-3.11	9.68	42	7	17	147	10	99
8: H Black vs H White	49	0.17	-8.12	6.23	7	0	2	42	37	2
9: NH Black vs NH White	189	2.44	-3.11	9.68	42	7	17	147	10	99
9: H Black vs H White	49	0.17	-8.12	6.23	7	0	2	42	37	2

Table F16: Conditional Rate Spread Disparities, Blacks

Benchmark Strategy - 7: NH Black vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (bps)	Min Disparity (bps)	Max Disparity (bps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: Black vs White	183	6.08	-26.22	50.49	64	3	38	119	9	83
2: Black vs White	183	5.62	-24.28	41.65	52	6	23	131	10	96
3: Black vs White	183	5.62	-24.28	41.65	52	6	23	131	10	96
4: Black vs White	18	7.97	-0.04	18.13	9	0	6	9	5	4
5: Black vs NH White	183	6.54	-25.88	50.18	69	8	35	114	2	92
6: Black vs NH White	183	6.54	-25.88	50.18	69	8	35	114	2	92
7: NH Black vs NH White	183	6.95	-28.66	61.10	0	0	0	0	0	0
7: H Black vs H White	16	2.50	-16.48	21.41	5	1	4	11	9	1
8: NH Black vs NH White	183	6.44	-26.74	53.93	57	6	30	126	2	98
8: H Black vs H White	46	2.19	-14.72	9.97	14	2	5	32	25	5
9: NH Black vs NH White	183	6.44	-26.74	53.93	57	6	30	126	2	98
9: H Black vs H White	46	2.19	-14.72	9.97	14	2	5	32	25	5

Table F17: Conditional Denial Rate Disparities, Pacific Islanders (PI)

Benchmark Strategy - 7: NH PI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (pps)	Min Disparity (pps)	Max Disparity (pps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: PI vs White	7	3.38	-1.24	10.13	3	1	2	4	2	2
2: PI vs White	7	1.58	-0.67	5.30	1	0	1	6	3	2
3: PI vs White	7	1.81	-0.82	6.88	1	0	1	6	2	3
4: PI vs White	0	.	.	.	.	.	.	.	.	.
5: PI vs NH White	7	1.43	-1.08	6.64	1	0	1	6	1	4
6: PI vs NH White	7	2.07	-0.46	6.92	1	0	1	6	1	4
7: NH PI vs NH White	7	4.37	-1.56	10.62	0	0	0	0	0	0
7: H PI vs H White	3	6.07	1.99	10.71	1	0	1	2	2	0
8: NH PI vs NH White	7	1.38	-1.32	6.76	1	0	1	6	1	4
8: H PI vs H White	6	2.01	-1.88	6.51	0	0	0	6	4	1
9: NH PI vs NH White	7	1.42	-1.43	7.39	1	0	1	6	1	4
9: H PI vs H White	7	1.83	-2.12	5.88	1	0	0	6	3	2

Table F18: Conditional Rate Spread Disparities, Pacific Islanders (PI)

Benchmark Strategy - 7: NH PI vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (bps)	Min Disparity (bps)	Max Disparity (bps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: PI vs White	4	1.68	-3.23	9.15	4	0	1	0	0	0
2: PI vs White	4	-0.11	-2.77	2.73	2	0	0	2	1	0
3: PI vs White	4	0.37	-2.76	3.67	3	0	0	1	0	1
4: PI vs White	0	.	.	.	.	.	.	.	.	.
5: PI vs NH White	4	-0.74	-3.13	2.97	2	0	0	2	1	0
6: PI vs NH White	4	1.17	-1.51	4.75	3	1	0	1	0	1
7: NH PI vs NH White	4	0.19	-4.09	7.84	0	0	0	0	0	0
7: H PI vs H White	0	.	.	.	.	.	.	.	.	.
8: NH PI vs NH White	4	-1.02	-3.53	2.84	2	0	0	2	1	0
8: H PI vs H White	3	2.20	-3.82	9.64	2	1	0	1	0	0
9: NH PI vs NH White	4	-0.50	-3.69	3.68	2	0	0	2	0	1
9: H PI vs H White	4	2.05	-3.97	9.42	1	1	0	3	1	0

Table F19: Conditional Denial Rate Disparities, Hispanics

Benchmark Strategy - 6: H vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (pps)	Min Disparity (pps)	Max Disparity (pps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: H vs NH	196	1.46	-2.32	9.71	101	8	53	95	16	33
2: H vs NH	199	1.02	-4.14	7.26	38	5	15	161	21	67
3: H vs NH	199	1.02	-4.14	7.26	38	5	15	161	21	67
4: H vs White	109	0.61	-8.22	11.65	41	2	5	68	41	3
5: H vs NH White	199	1.35	-4.14	7.64	110	4	51	89	3	49
6: H vs NH White	199	1.39	-4.17	7.16	0	0	0	0	0	0
7: H AI vs NH AI	8	1.61	-2.28	10.28	2	0	1	6	6	0
7: H Asian vs NH Asian	16	1.55	-1.57	6.08	7	0	2	9	8	0
7: H Black vs NH Black	20	0.70	-3.85	5.55	5	0	1	15	14	1
7: H PI vs NH PI	3	0.04	-1.33	1.32	0	0	0	3	3	0
8: H AI vs NH AI	30	0.56	-3.36	6.44	12	0	2	18	15	0
8: H Asian vs NH Asian	47	0.74	-6.97	13.39	16	1	7	31	26	0
8: H Black vs NH Black	49	-1.28	-12.41	4.26	6	0	0	43	34	2
8: H PI vs NH PI	10	0.51	-4.00	4.01	4	0	0	6	5	0
9: H AI vs NH AI	32	0.67	-3.27	6.45	13	0	2	19	17	0
9: H Asian vs NH Asian	51	0.91	-5.12	11.93	18	2	8	33	28	0
9: H Black vs NH Black	49	-1.28	-12.41	4.26	6	0	0	43	34	2
9: H PI vs NH PI	17	1.51	-2.80	12.63	7	0	2	10	9	0

Table F20: Conditional Rate Spread Disparities, Hispanics

Benchmark Strategy - 6: H vs NH White

Classification Strategy, Treatment Group, Control Group	# FIs where row strategy and benchmark strategy both have volume	Avg Disparity (bps)	Min Disparity (bps)	Max Disparity (bps)	# FIs where row disparity > benchmark disparity	# FIs where row disparity > benchmark disparity and only row disparity is s.s.	# FIs where row disparity > benchmark disparity and both disparities are s.s.	# FIs where row disparity < benchmark disparity	# FIs where row disparity < benchmark disparity and only benchmark disparity is s.s.	# FIs where row disparity < benchmark disparity and both disparities are s.s.
1: H vs NH	194	5.10	-18.00	157.79	134	15	78	60	9	18
2: H vs NH	198	4.26	-21.05	143.20	91	8	42	107	5	38
3: H vs NH	198	4.26	-21.05	143.20	91	8	42	107	5	38
4: H vs White	105	2.95	-15.60	18.57	45	0	16	60	40	4
5: H vs NH White	199	4.05	-18.24	146.69	65	0	33	134	5	72
6: H vs NH White	199	4.20	-19.11	144.57	0	0	0	0	0	0
7: H AI vs NH AI	7	0.71	-5.38	4.35	2	0	0	5	5	0
7: H Asian vs NH Asian	15	4.84	-1.43	12.24	11	0	6	4	4	0
7: H Black vs NH Black	16	1.83	-3.66	18.65	6	1	1	10	10	0
7: H PI vs NH PI	0	.	.	.	.	.	.	.	.	.
8: H AI vs NH AI	27	0.37	-10.86	10.83	10	0	2	17	14	1
8: H Asian vs NH Asian	43	3.92	-5.85	11.54	24	4	12	19	13	3
8: H Black vs NH Black	46	0.14	-15.15	6.75	14	2	2	32	25	2
8: H PI vs NH PI	10	4.47	-2.88	12.75	6	0	3	4	4	0
9: H AI vs NH AI	27	0.20	-12.09	9.81	9	0	2	18	15	1
9: H Asian vs NH Asian	48	3.30	-28.24	12.19	29	5	12	19	11	5
9: H Black vs NH Black	46	0.14	-15.15	6.75	14	2	2	32	25	2
9: H PI vs NH PI	15	2.92	-6.37	10.39	7	0	1	8	8	0