

Statistical Fair Lending Analyses

Note: This document was used in support of a live discussion. As such, it does not necessarily express the entirety of that discussion nor the relative emphasis of topics therein.



Consumer Financial
Protection Bureau

Main Concepts

- General Statistical Approach to Fair Lending
- Things you should discuss when working with an Economist
 - Quality and Context of Analysis
 - Statistical Significance
 - Economic Significance

General Statistical Approach to Fair Lending

- Compare average outcomes for two groups
 - Average APR for Hispanics compared to average APR for Non-Hispanics
 - Denial rate for males compared to denial rate for females
 - % of pricing exceptions to Blacks compared to % of pricing exceptions to Whites
- Estimate how much of the disparity is due to legitimate policy factors and how much is due to discrimination
 - Analysis tied to lenders policies

Example: Pricing

- Starting point: Unconditional Disparity
 - Average APR Females = 4.70
 - Average APR Males = 4.50
 - Disparity = 20 bps
- What determines pricing?
 - Lender considers FICO, LTV and product type (Fixed vs. ARM) when pricing mortgages
- To determine whether this is discrimination, we need to first control for the impact of FICO, LTV and product type on APR

“Controlling for” FICO, LTV and Product Type

Control Variables

Avg. APR Females = 4.70
 Avg. APR Males = 4.50
 Disparity = 20 bps

Factor	Weight
Constant	4.50
Gender	
Females	0.20
Males	0.00

Factor	Weight
Constant	3.08
FICO Score	
missing	1.55
300-600	0.95
601-660	0.58
661-720	0.24
721 +	0.00
LTV	
0-79	0.00
80-90	0.28
91-95	0.52
96 +	0.90
Fixed Rate	
No	0.00
Yes	0.21
Gender	
Females	0.04
Males	0.00

Segmentation

Fixed Rate		ARM	
Factor	Weight	Factor	Weight
Constant	3.91	Constant	4.05
FICO Score		FICO Score	
missing	0.97	missing	0.17
300-600	0.95	300-600	0.45
601-660	0.90	601-660	0.31
661-720	0.85	661-720	0.10
721 +	0.00	721 +	0.00
LTV		LTV	
0-79	0.00	0-79	0.00
80-90	0.16	80-90	0.08
91-95	0.19	91-95	0.12
96 +	0.30	96 +	0.23
Gender		Gender	
Females	0.12	Females	0.01
Males	0.00	Males	0.00

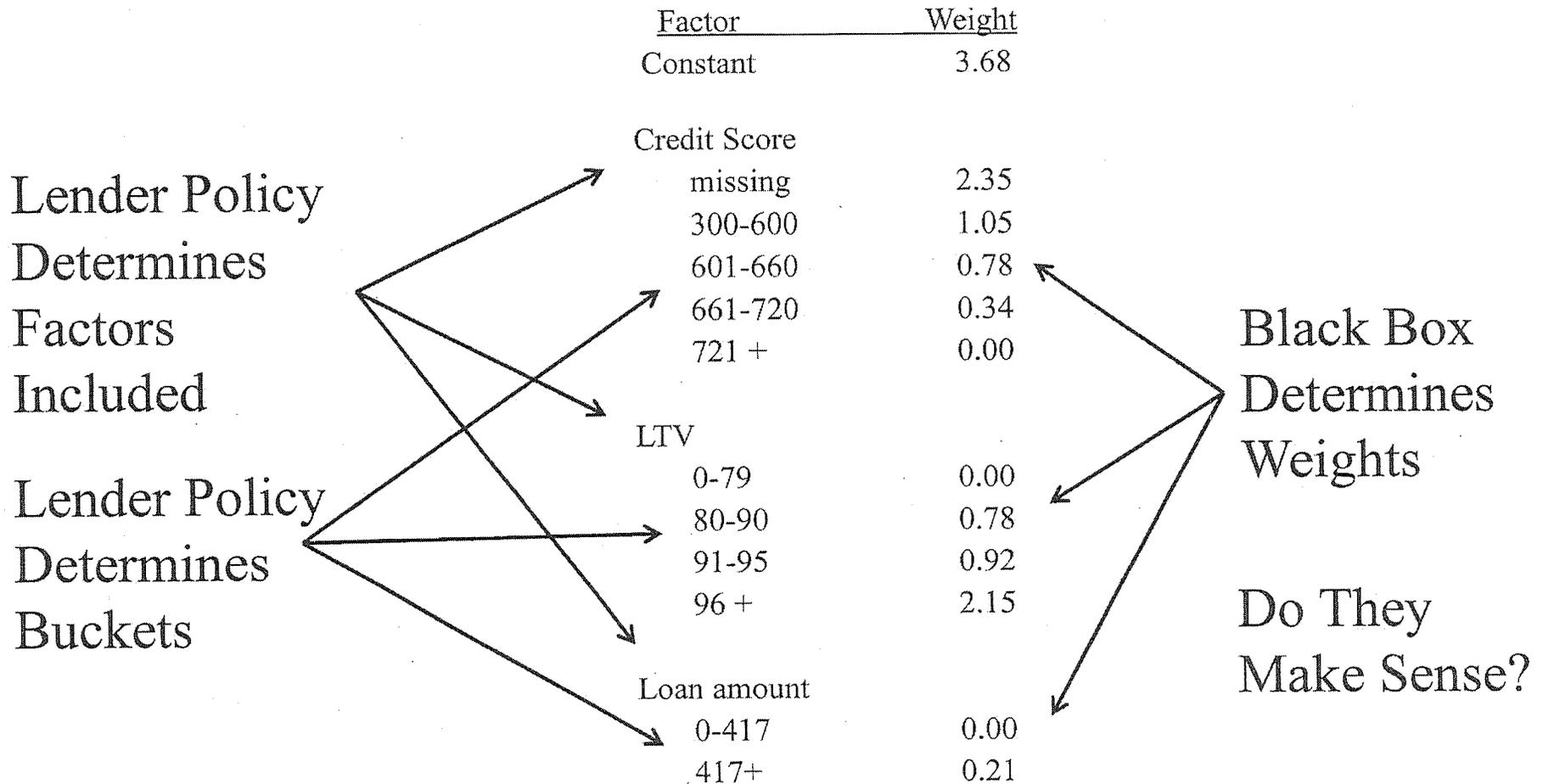
Things You Should Discuss When Working With an Economist

- Quality and Context of Analysis
- Statistical Significance
- Economic Significance

Quality and Context of Analysis

- Have we controlled for all of the policy factors that affect the outcome being analyzed?
- Have we controlled for all factors in the same way the lender considers each factor?
- Do the signs and magnitudes of the estimated coefficients make sense?
- Do the goodness-of-fit statistics look good?
- Are results robust?

Does Model Make Sense?



The Same Disparity is not Always the Same Disparity

Bank 1: APR R ² = .05		Bank 2: APR R ² = .55		Bank 3: APR R ² = .18		Bank 4: Overage R ² = .04	
Factor	Weight	Factor	Weight	Factor	Weight	Factor	Weight
Constant	4.50	Constant	3.08	Constant	3.91	Constant	0.05
		Credit Score		Credit Score		Credit Score	
		missing	1.55	missing	0.97	missing	0.17
		300-600	0.95	300-600	0.95	300-600	0.02
		601-660	0.58	601-660	0.90	601-660	0.10
		661-720	0.24	661-720	0.85	661-720	0.05
		721 +	0.00	721 +	0.00	721 +	0.00
		LTV		LTV		LTV	
		0-79	0.00	0-79	0.00	0-79	0.00
		80-90	0.28	80-90	0.68	80-90	0.08
		91-95	0.52	91-95	0.12	91-95	0.12
		96 +	0.90	96 +	0.30	96 +	0.03
		Loan amount		Loan amount		Loan amount	
		0-417	0.00	0-417	0.00	0-417	0.00
Gender		417+	0.21	417+	0.51	417+	0.11
Females	0.20	Gender		Gender		Gender	
Males	0.00	Females	0.20	Females	0.20	Females	0.20
		Males	0.00	Males	0.00	Males	0.00



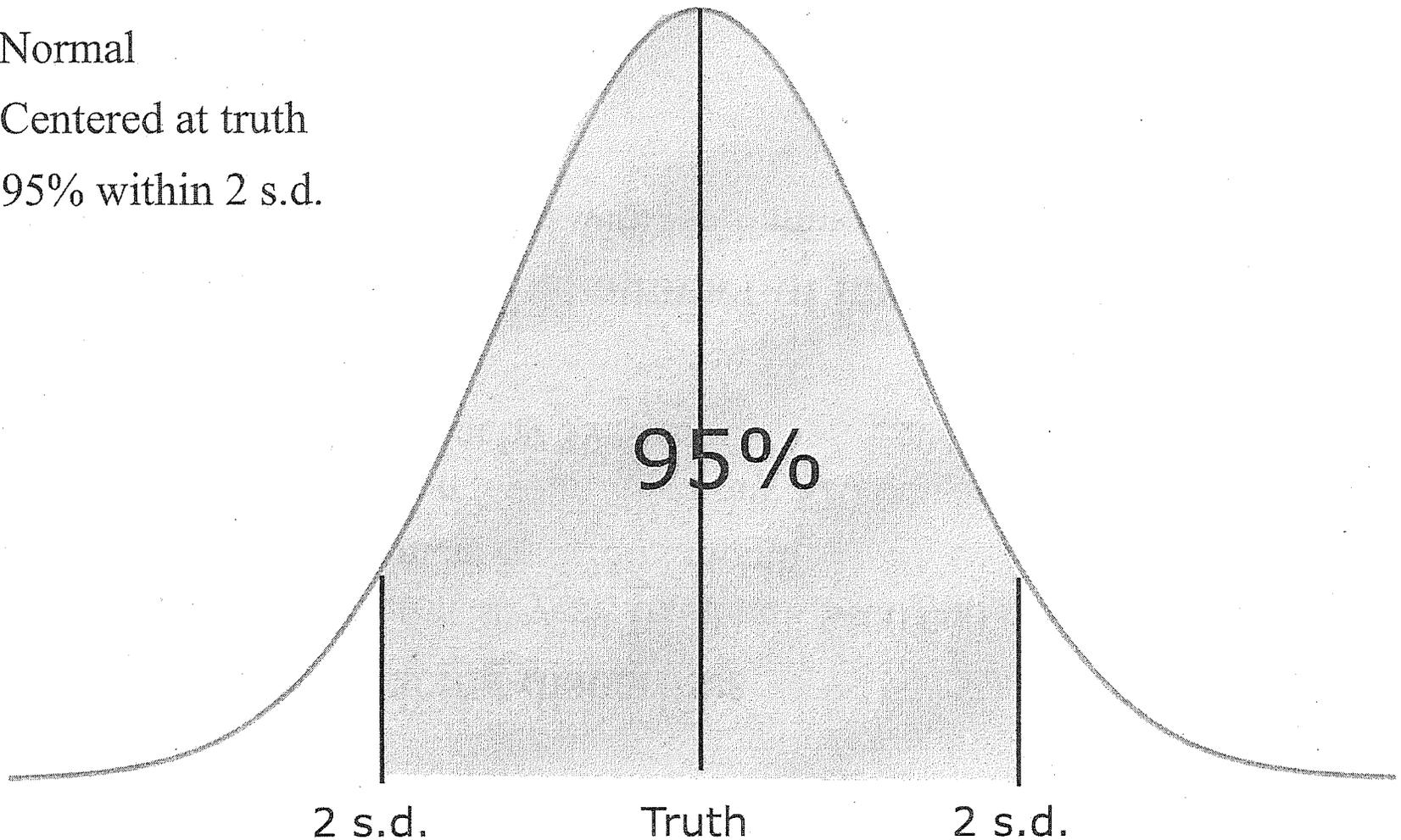
Statistical Significance

- Two main drivers of statistical significance
 1. Larger disparities are more likely to be statistically significant
 2. More reliable disparity estimates do not need to be as large to be deemed statistically significant
 - Larger sample sizes increase reliability
- Statistical significance is often conveyed using a p-value
 - P-value $\leq .05$ is statistically significant at 5% level
 - IF no discrimination, THEN $\leq 5\%$ chance of estimated disparity
- Need to consider more than just statistical significance
 - Quality and context of analysis
 - Economic significance

One Reason Why Statistics is so Great!

3 Things that will always occur ($n \geq 30$)

1. Normal
2. Centered at truth
3. 95% within 2 s.d.



Assume = 0

Economic Significance

- Good to monetize pricing disparities
 - 100 bp increase in rate on 30 year, fixed rate \$400,000 mortgage at 5% increases monthly payment by \$250 / month
 - 100 bp increase in rate on 5 year, fixed rate \$20,000 auto loan at 5% increases monthly payment by \$9 / month

- Good to think about possible number of inappropriate denials
 - During recent exam, we started with ~200 minority denials
 - ~140 (65%) were denied
 - ~30 were marginal applicants
 - ~10 of the marginal applicants were inappropriately denied

Questions

