



Comptroller of the Currency
Administrator of National Banks

US Department of the Treasury

OCC Fair Lending Conference 2008

Statistical Analysis and Modeling for Risk Assessment

September 10, 2008

The opinions expressed in this paper reflect those of the author only and do not necessarily reflect those of the Office of the Comptroller of the Currency or the Treasury Department.

ENSURING A SAFE AND SOUND
NATIONAL BANKING SYSTEM
FOR ALL AMERICANS

Credit Scoring Modeling from a Fair Lending Perspective

Credit Scoring Systems and Fair Lending

Marilyn Jacob
Financial Economist
Risk Analysis Division
OCC



Comptroller of the Currency
Administrator of National Banks

US Department of the Treasury

**ENSURING A SAFE AND SOUND
NATIONAL BANKING SYSTEM
FOR ALL AMERICANS**



Regulation B Section 202.2(p):1

A credit scoring system - evaluates an applicant's ***creditworthiness*** mechanically, based on key attributes of the applicant and aspects of the transaction, and that determines, alone or in conjunction with an evaluation of additional information about the applicant, whether an applicant is deemed creditworthy.



Evaluating Creditworthiness for Fair Lending

Equal Credit Opportunity Act (Regulation B)

- A creditor shall not discriminate against an applicant on a prohibited basis* regarding any aspects of a **credit** transaction

* Race, Age, Sex, National Origin, Marital Status, Religion, Color, Receipt of Public Assistance, The exercise in good faith of any right under the Consumer Credit Protection Act

Fair Housing Act

- Prohibits discrimination on a prohibited basis* in **real-estate related credit** transactions

* Race, Sex, National Origin, Religion, Familial Status, Disability, Color



Fair Lending Issues

- Overt Discrimination
- Disparate Treatment
- Disparate Impact



Credit Scoring Exam Process

- Supervisory Risk Assessment + Screen
- Economist participation – Statistical review of models
 - Request Letter
 - Statistical Review



Credit Scoring Exam Process

- Supervisory Risk Assessment + Screen
- Economist participation – Statistical review of models
 - Request Letter
 - Statistical Review



Credit Scoring Exam Process

- Supervisory Risk Assessment + Screen
- Economist participation – Statistical review of models
 - Request Letter
 - Statistical Review



Request Letter

- List of models and their Variable list and definitions
- If model includes Age, request information on
 - Development – Sample, Method, Segmentation, KS statistics, Data audit
 - Validation – Tracking reports, Gains charts, Delinquency and Vintage analyses, Characteristic analyses
 - Implementation – Documentation on underwriting criteria, Overrides assessment and tracking
 - Revalidation – Monitoring reports



Credit Scoring Exam Process

- Supervisory Risk Assessment + Screen
- Economist participation – Statistical review of models
 - Request Letter
 - Statistical Review



Overt Discrimination

Occurs in a scoring system when an institution explicitly considers any prohibited basis, i.e., uses a prohibited basis variable in a scoring system.

Prohibited bases (ECOA) - Race, Age, Sex, National Origin, Marital Status, Religion, Color, Receipt of Public Assistance

Prohibited bases (FHA) - Race, Sex, National Origin, Religion, Familial Status, Handicap, Color



One Exception: Age

The credit scoring system is empirically derived,
demonstrably and statistically sound (EDDSS)

and

Applicants 62 years or older are treated at least as
favorably as applicants who are under age 62

OR

On a case by case basis in a judgmental system



EDDSS

Regulation B: Section 202.2 (p)

- **Development**
 - Development Sample
 - ‘Bad’ Definition
 - Risk Variables + Estimator
- **Initial Validation and Re-validation**
 - Out-of-time validation sample
 - Front-end Metrics: Population Stability Index and Characteristics Analysis reports
 - Back-end Metrics: Kolmogorov-Smirnov (K-S) Statistic, Gini Coefficient
 - Monitoring reports: Vintage analysis, Early-read analysis



One Exception: Age

The credit scoring system is empirically derived,
demonstrably and statistically sound (EDDSS)

and

Applicants 62 years or older are treated at least as
favorably as applicants who are under age 62



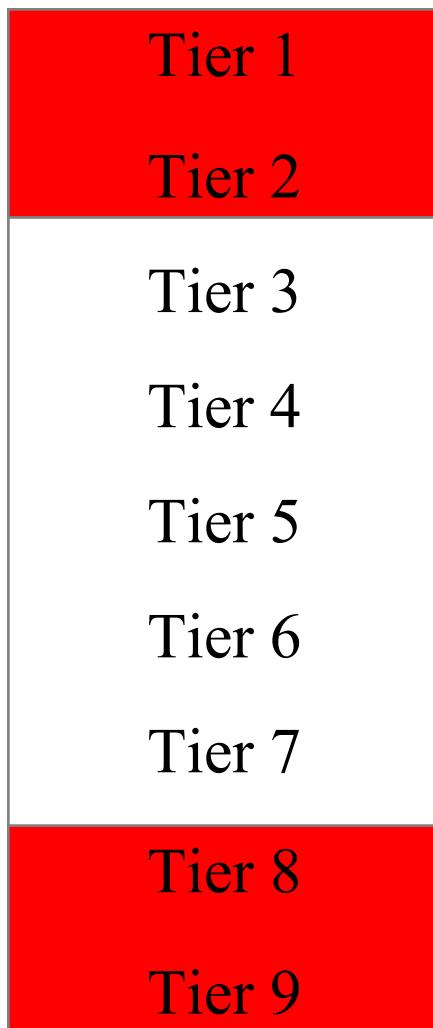
Including Age in a credit scoring model

Example – Net Response Model

- Predict net response rates
- Use to send Pre-approved credit card offers
- Model rank orders applicants into multiple tiers, higher tiers imply higher net response rates
- Cut-off strategy: Exclude non-profitable tiers from solicitation



Net Response Model – Cutoff Strategy



First Payment Default Criteria



Cost Per Account Criteria



Impact of Including Age

Weight on age = 0.14

Tier 1 (80-89)

Tier 2 (70-79)

Tier 3 (60-69)

Tier 4 (50-59)

Tier 5 (40-49)

Tier 6 (30-39)

Tier 7 (20-29)

Tier 8 (10-19)

Tier 9 (0-9)

$$\text{Final Score} = 63 + (62 \times 0.14) \\ = 72$$

$$\text{Final Score} = 63 + (42 \times 0.14) \\ = 69$$

Applicant 1: Age 42
Score = 63

Applicant 2: Age 62
Score = 63



Disparate Treatment

May occur if

- Credit information is characterized subjectively before being entered for credit scoring
- Applicants are given varying degrees of assistance on a prohibited basis
- Overrides of the system are permitted
 - High Side/Low Side Overrides
 - Track by prohibited basis
 - Track by override reason



Disparate Impact

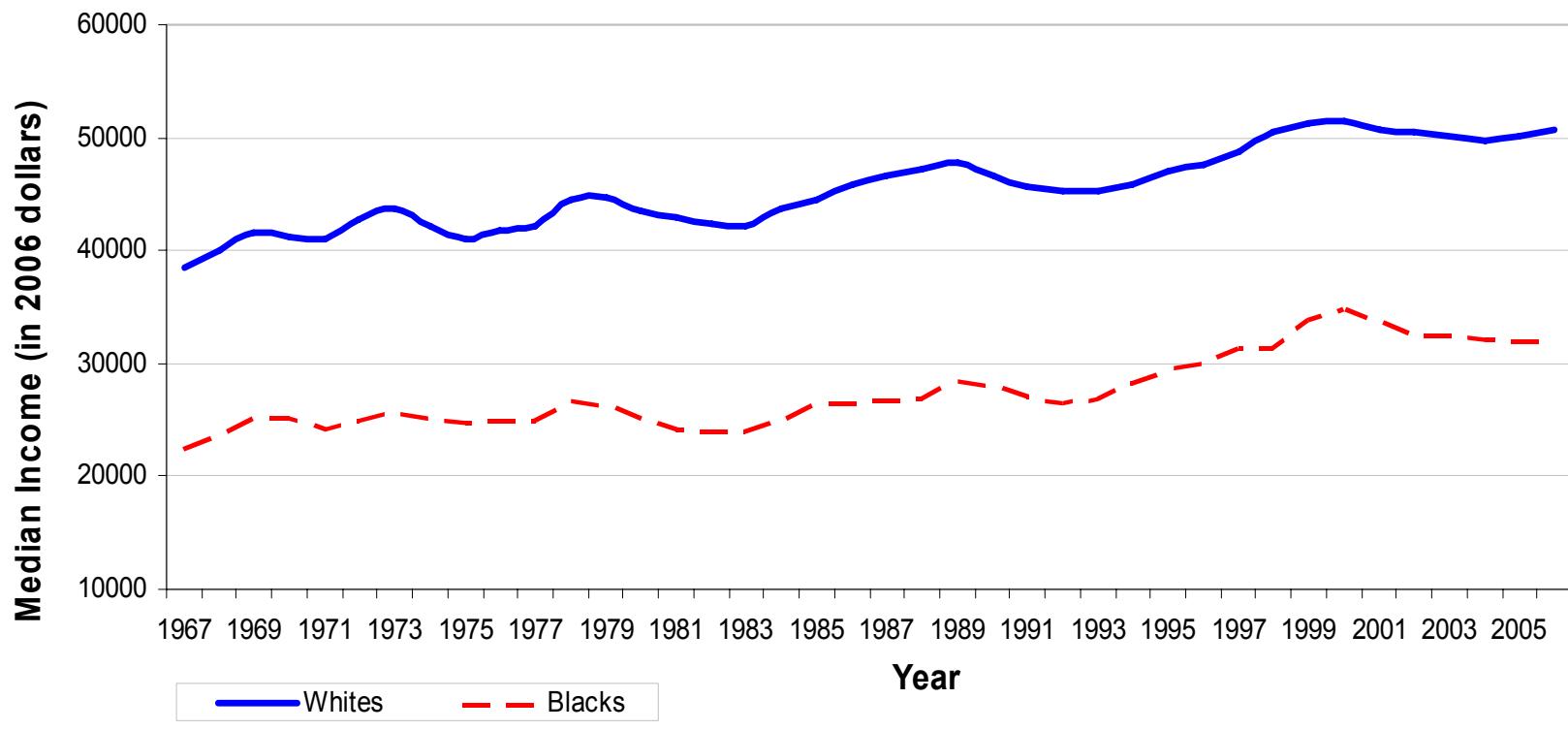
May occur if

- A variable used in the credit scoring system appears to be neutral but is in fact correlated with a prohibited basis factor.
 - Income, rent or own, mortgage payment, geography
- AND the variable cannot be justified by business necessity



Disparate Impact: Income

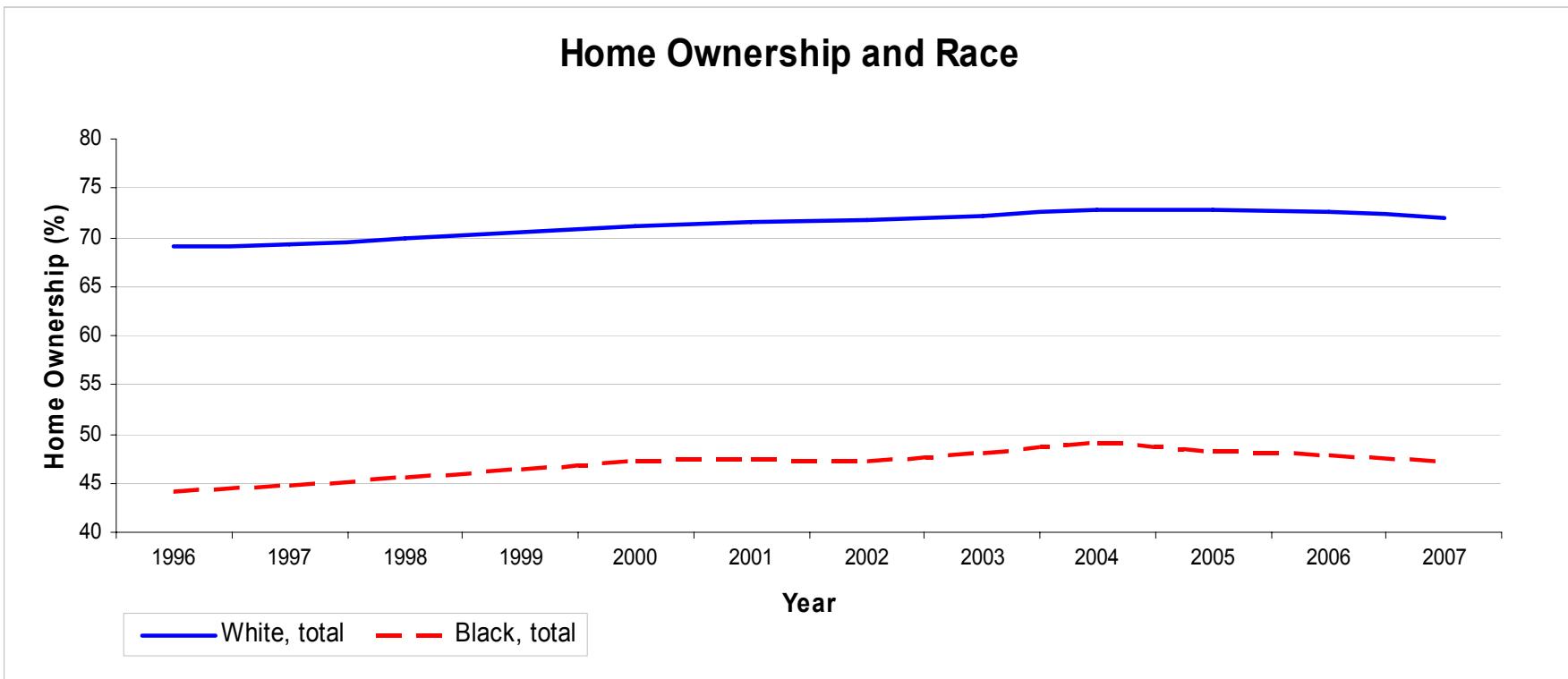
Median Income by Race



Source: US Census



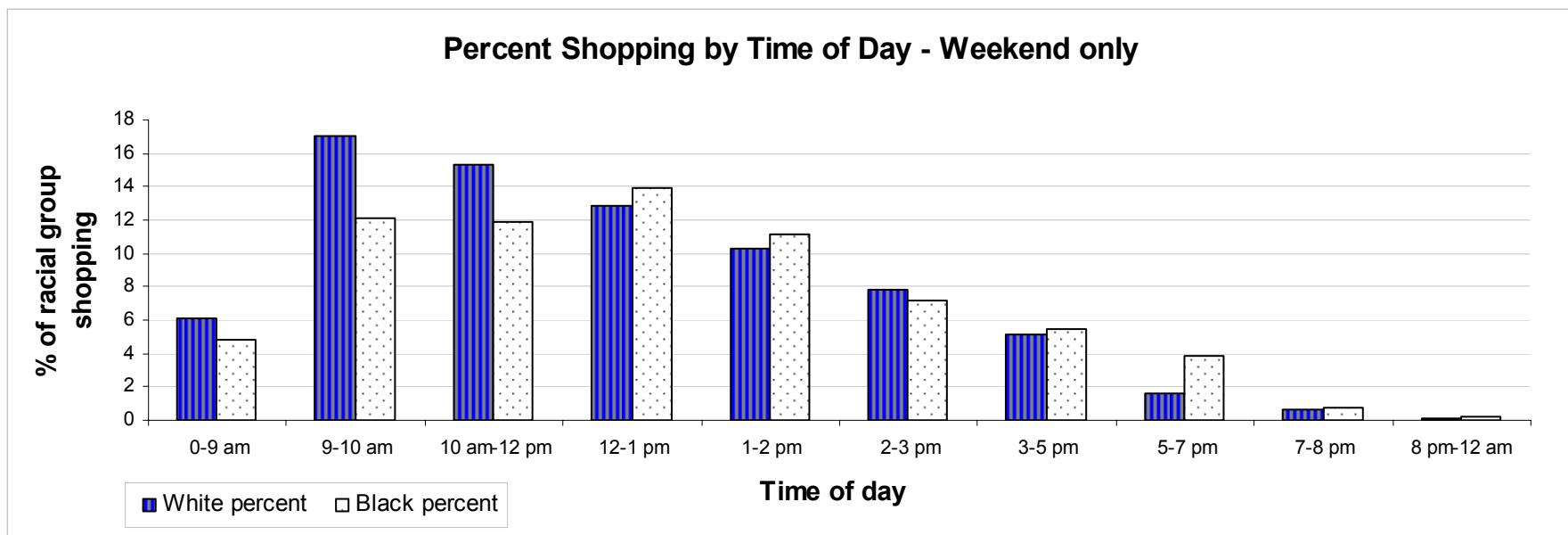
Disparate Impact: Home Ownership



Source: US Census



Disparate Impact: Time of Day



Source: Bureau of Labor Statistics



Take Away Points

- If a credit scoring system uses age as a predictive variable, does it meet the requirements of Regulation B?
- Are there aspects of the bank's credit granting decision process that may lead to disparate treatment of applicants for credit?
- Are there variables in the scorecard that raise disparate impact concerns?