

Issues in Credit Scoring

OCC Conference on Fair Lending

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Policy Concerns



- Credit scoring may have adverse effects on certain populations, particularly minorities
 - May disadvantage individuals with nontraditional credit experiences
 - Some factors used in credit scoring models may have adverse effects on particular demographic groups
- Inconsistency in how credit scoring models treat “authorized user” accounts—where an individual can use an account but is not legally responsible for the bill
- Both concerns are related to ECOA Compliance

Adverse impact



- Fact Act (2003) mandated a Fed/FTC study of the effects of credit scoring on the availability and affordability of credit and insurance and certain issues of adverse impact
- Study released in August 2007.
 - Address potential adverse effects of scoring itself.
 - Also addresses the extent to which certain factors included in scoring models could adversely effect protected classes
 - Finally examines the extent to which scoring systems could achieve comparable results using factors with less negative impact.

Data Used in Study



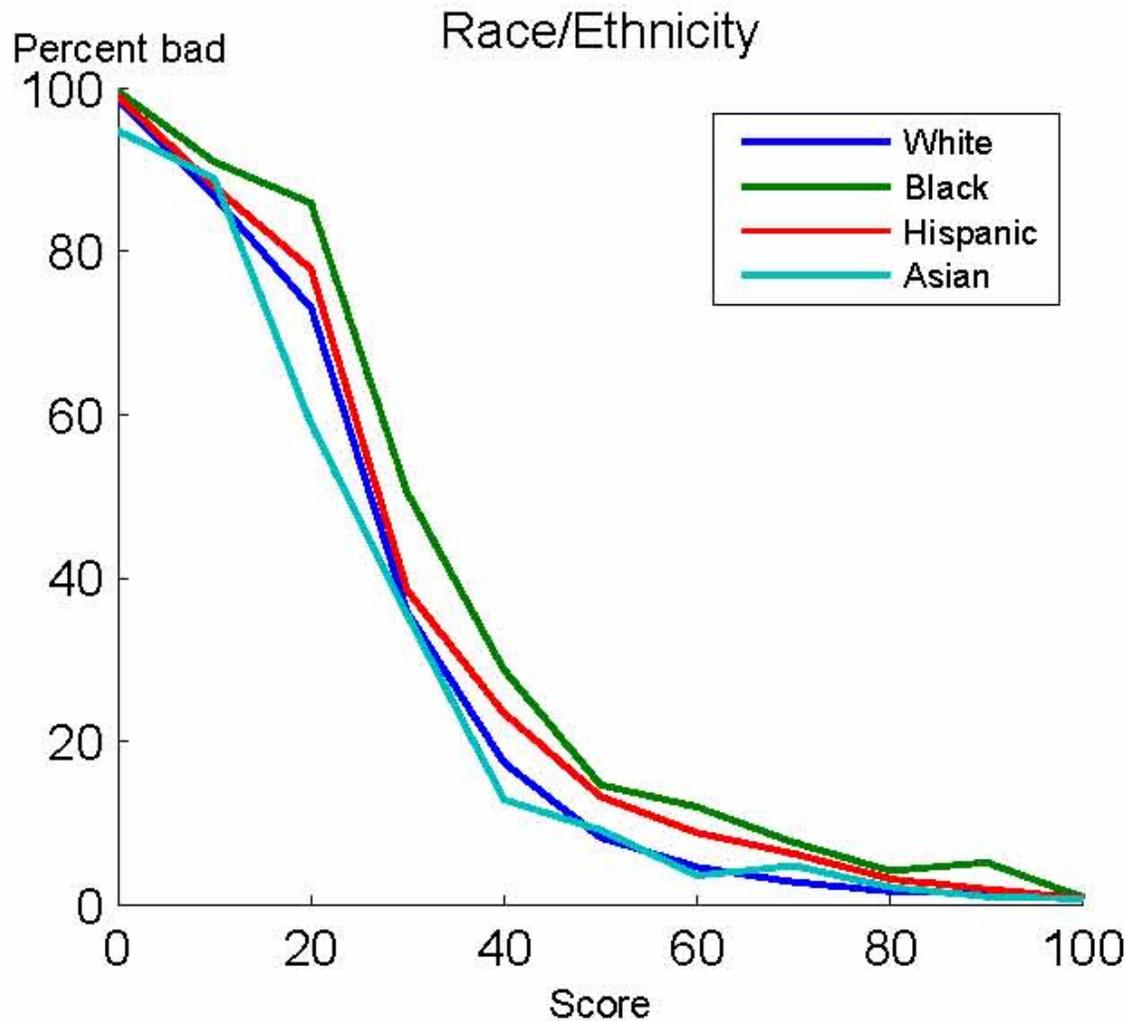
- Full credit records of nationally-representative random sample of 301,000 individual credit records from TransUnion as of June 2003 and December 2004
 - Detailed information on credit accounts, public records, collection agency accounts and inquiries
 - Social Security data on age, race/ethnicity, national origin and gender
 - 312 credit characteristics
 - 2 commercially available credit history scores:
 - TransUnion's TransRisk Account Management® score
 - VantageScoreSM
- Two samples allow credit scores from 2003 to be compared to subsequent performance on new or existing accounts.
- Data allow the estimation of our own credit scoring model comparable to commercial products

Adverse effect of Score itself



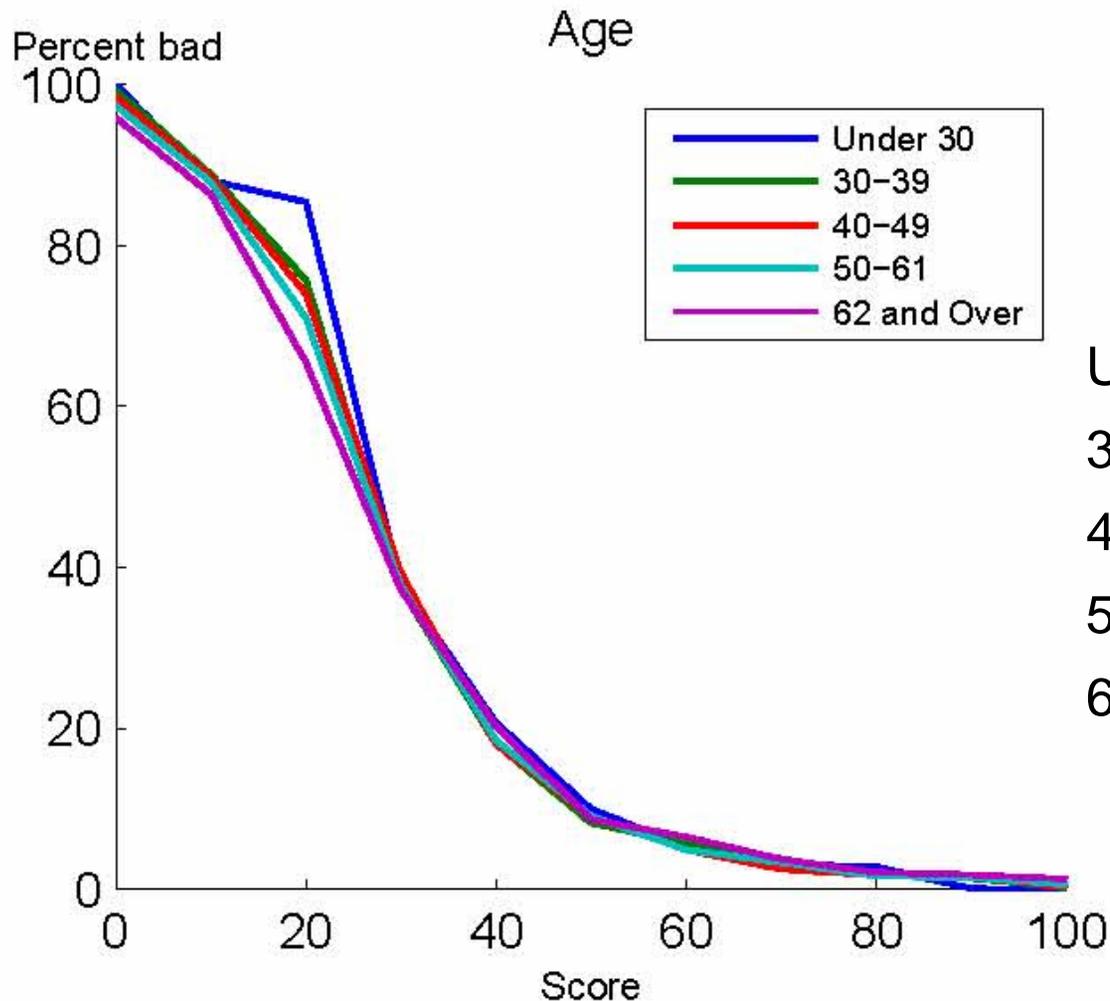
- Use a statistical definition of adverse effect—in part the score serves as a surrogate for a demographic characteristic.
- Implies members of some demographic groups will perform better than would be predicted by the score and others will perform worse.
- Those that perform better could be said to be adversely effected by the use of the score.
- Use normalized versions of Transrisk and VantageScore credit history scores to examine the potential for scores as a whole to embody some demographic adverse effects.
- Performance is measured in a variety of ways common to industry practice (generally 90+ days delinquent)

Any Account Performance and TransRisk Scores by Race



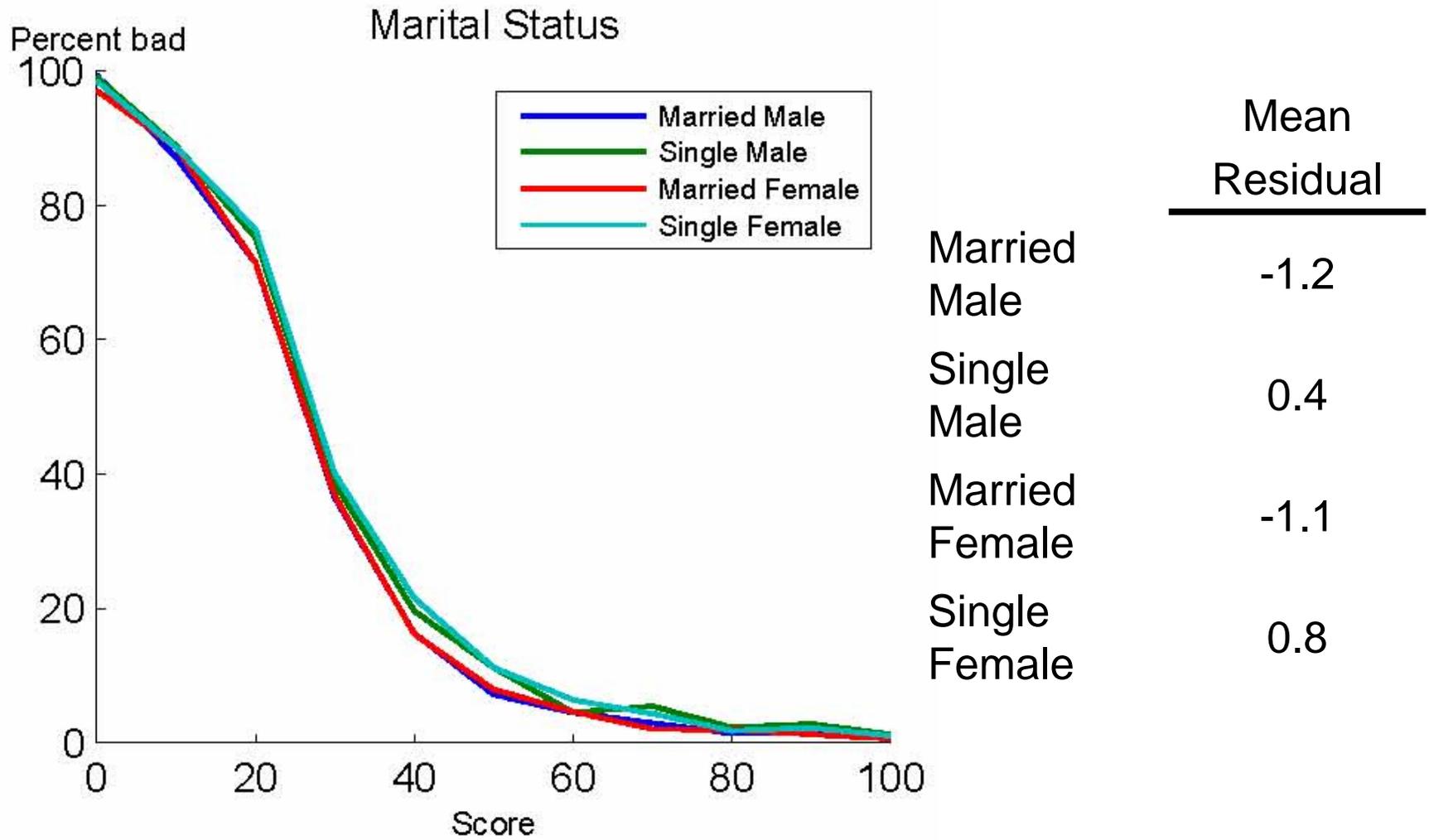
	Mean Residual
White	-1.0
Black	5.6
Hispanic	1.7
Asian	-2.1

Any Account Performance and TransRisk Scores by Age



	<u>Mean Residual</u>
Under 30	1.5
30 - 39	-0.2
40 - 49	-0.4
50 - 61	-0.7
62 and over	-0.3

Any Account Performance and Scores by Sex/Marital Status



Summary of Credit Performance Across Populations



- Each credit score evaluated rank orders individuals by risk for the population as a whole and for all demographic groups
- For most groups, actual performance controlling for credit score is virtually the same
 - Blacks, the young and single individuals underperform
 - Married Individuals, Seniors and foreign born individuals (particularly recent immigrants) overperform

Evaluating the Impact of Individual Credit Characteristics



- Congress asked whether the **factors** used in credit scoring have a negative effect on some populations and whether such effects could be mitigated by changes in the models
- We define such negative effects in a statistical sense—that is the factor included in the model serves (at least in part) as a proxy for a demographic characteristic adversely affecting some groups.
- For a factor (credit characteristic) to serve as a proxy for a demographic characteristic
 - it must be correlated with performance and the demographic characteristic
 - Additionally, there must be a correlation between the demographic characteristic and performance

Evaluating the Impact of Individual Credit Characteristics II



- We define a credit characteristic as having a statistical “differential effect” if the weight assigned to the characteristic in a model differs from the weight that would be assigned in a model estimated in a **demographically neutral** environment
- A model embeds differential effects for specific populations if the mean credit scores for such populations change markedly when the model is reestimated in a demographically neutral environment
- Differential effects are both positive and negative and by construction will be zero-sum game

Developing the FRB Base Model



- To examine which factors enter in credit scoring models, Fed staff developed a credit history scoring model using process that mimics to the extent possible industry practice
 - Process entirely rule-based to ensure transparency
 - Considered each of 312 credit characteristics supplied by TransUnion
 - Model predicts future 90+ days delinquent performance on any new account or existing account which was in good standing when the score was computed

The FRB Base Model



- The FRB Base model consists of three scorecards:
 - **Thin file** (2 credit accounts or less) --10 percent of sample
 - **Clean file** (no record of a serious delinquency, public record or collection account) -- 59 percent of sample
 - **Major Derogatory file** (at least one serious delinquency, public record or collection account) -- 31 percent of sample
- FRB model includes 19 credit characteristics some on more than one scorecard
- Model yields similar credit score distributions and performance residuals as other credit scores

Demographically Neutral Analysis: Sex



- Three demographically neutral models were estimated
 - Using only females
 - Using only males
 - Using indicator variables for sex
- Results for sex show no evidence of differential effect
 - Mean scores for males and females are essentially unchanged
 - Model predictiveness essentially unchanged

Demographically Neutral Analysis: Race



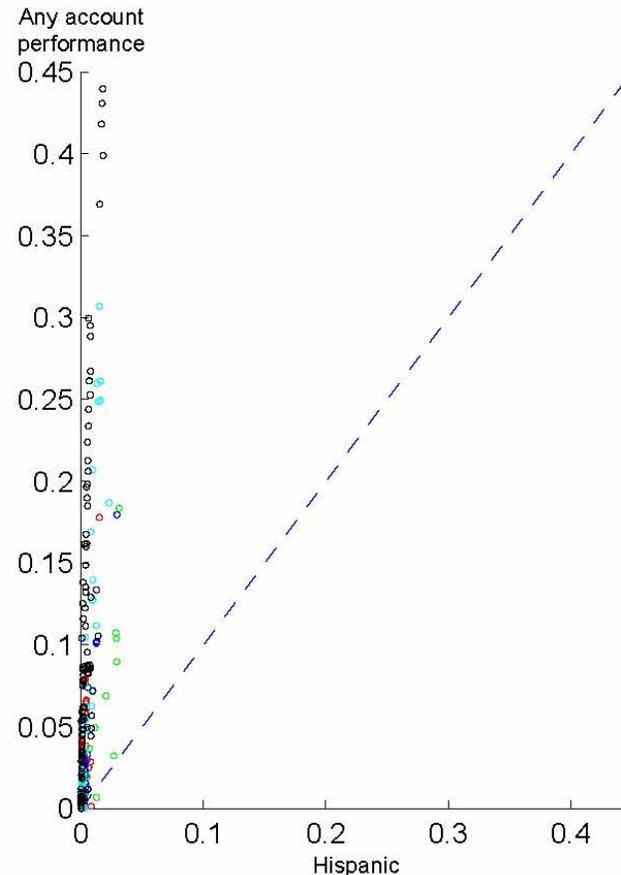
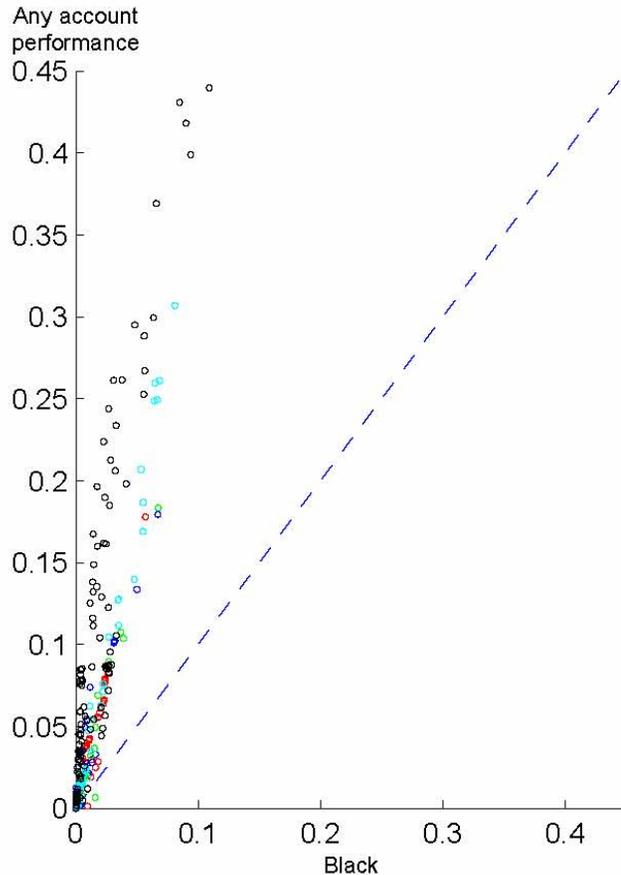
- Two demographically neutral models were estimated for race
 - Non-Hispanic whites only
 - Indicator variables for race
- Results show little evidence of differential effect:
 - Model predictiveness deteriorates slightly
 - Credit score distributions show virtually no change
 - Performance residual rises slightly for blacks
 - Tested specifically for finance company tradelines and no effect

Race Neutral Model Results



	FRB Base		White		Race Indicator	
	Mean	KS	Mean	KS	Mean	KS
White (NH)	54.0	72.8	54.1	72.7	54.2	72.8
Black	25.8	69.4	25.9	69.3	25.9	69.4
Hispanic	38.3	66.2	38.5	66.1	38.5	66.3
Asian	54.8	66.9	54.9	66.4	54.9	66.4

Credit Characteristic Correlations: Race



Legend: Red - Types of Credit in Use; Black - Payment History; Green – Length of Credit History; Light Blue – Amounts Owed; Blue – New Credit

Demographically Neutral Analysis: Age



- Two demographically neutral models were estimated
 - Using only those 40 or older, including age indicator variables
 - Using all ages, with age indicator variables
- Results for age show evidence of differential effect
 - Mean credit scores for the young decrease; increase for older persons
 - Performance residuals are affected, showing slight overperformance by young
 - Model predictiveness shows minor deterioration

Age Neutral Model Results



	FRB Base		Older Age		Age Indicator	
	Mean	KS	Mean	KS	Mean	KS
Under 30	33.2	69.4	32.6	69.1	32.8	69.3
30 – 39	40.8	74.2	40.0	74.1	40.2	74.1
40 – 49	48.2	74.0	47.7	74.1	47.8	74.1
50 – 61	55.4	72.2	55.5	72.4	55.4	72.2
62 and over	66.0	68.1	68.2	68.1	67.5	68.2

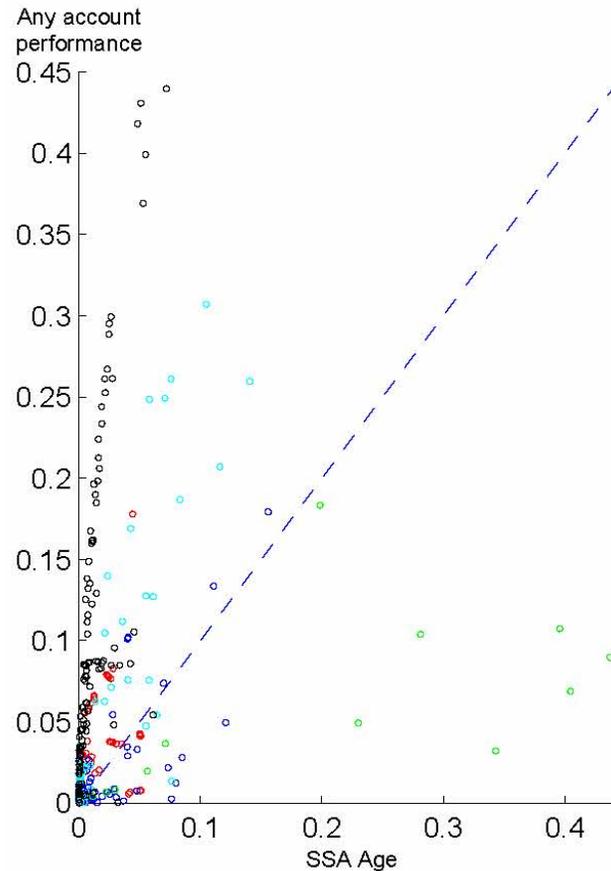
Effects on Recent Immigrants



- Evidence of differential effect is found for recent immigrants
 - Mean scores decrease for recent immigrants
 - Performance residuals are affected: recent immigrants overperform slightly more

	FRB Base		Older Age		Age Indicator	
	Mean	KS	Mean	KS	Mean	KS
Rec. Immigrants	44.3	61.3	43.2	60.9	43.6	61.5

Credit Characteristic Correlations: Age



Legend: Red - Types of Credit in Use; Black - Payment History; Green – Length of Credit History; Light Blue – Amounts Owed; Blue – New Credit

Source of the Age-Related Differential Effect



- Most of the differences in the mean scores by age and for recent immigrants can be traced to a single characteristic appearing on the clean scorecard, “average age of accounts”
 - Change in weights from age-neutral models suggest that differential effect makes the weights on this characteristic’s attributes lower than they should be.
 - Stems from the fact that new older immigrants overperform and also have short histories watering down the credit history effect. The effect is stronger when age is controlled for.
- Mitigating such an effect by omitting the variable results in a loss in model predictiveness
- Alternative is to use age-neutral coefficients

Summary

- Testing for disparate effects is difficult
 - Requires demographic data
 - Need to use sample used to create the scores
 - Factors differ for every estimation and scorecard—likely to be few generalizable results
- Little evidence of effect by race or gender. Although race correlated with performance few factors correlated with race.
- Some effect by age but effect is complex.
- No free lunch—could find no model that did not have effect without loss of predictiveness.

Authorized Users



- Early Interpretation of ECOA said that lenders needed to take the credit experience of spouses into account in underwriting new credit for individuals with no credit history.
 - Many such individuals were married women with credit in husband's name only.
 - Many were authorized users of husband's accounts
 - As a consequence FICO treated (and still does) authorized users accounts like any other account both in model development and in computing scores.
 - VantageScore does not, claiming it is unfair to reward or punish people for performance that they are not legally responsible for.
- Issue is complicated by recent practice of credit doctors improving scores by “selling” authorized user accounts