



2019 VantageScore 4.0 Model Performance Assessment



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INTRODUCTION:

A key element of sound model risk management practices is to ensure that models continue to perform as expected over time. To that end, model developers and users perform periodic assessments of models to assess model performance against expectations, using recent observations and objective performance criteria.

VantageScore Solutions annually assesses the performance of VantageScore credit score models at each of the national Credit Reporting Companies (CRCs) - Experian, Equifax and TransUnion. To promote transparency and aid in model governance, VantageScore Solutions publishes the results of these assessments, along with updated odds/performance charts.

This 2019 report represents the second annual model performance assessment of VantageScore 4.0 (launched in April 2017). The model is the first tri-bureau credit scoring model to incorporate trended credit data and leverage machine learning for superior performance.

Trended credit data captures credit usage patterns over a 24-month period. Trended data thus provides additional insights into consumer credit risk because traditional credit scores only use information which reflects a snapshot of the consumer's credit file, while trended data allows examination of the dynamic patterns that have led consumers to their current credit profile.

As part of the annual assessment, VantageScore 4.0 performance results are compared to the performance results of previously developed credit scoring models that contain only static credit attributes.

VantageScore 4.0 also scores approximately 40 million consumers who cannot obtain credit scores when conventional scoring models are used. Machine learning techniques were utilized in the development of scorecards for this "Newly Scored" segment.

During the annual assessment, performance of the model in this segment was compared with that of the earlier VantageScore 3.0 model.

A key benefit of VantageScore models is the high degree of consistency in the level of a consumer's credit scores obtained from each of the three CRCs. That consistency is achieved by using credit attributes that are levelled or measured consistently. Testing and comparisons related to score consistency are also included in the annual performance assessment of the VantageScore models.

Finally, a key requirement of credit scoring is that there is no statistical bias in the calculated scores which would cause a significant difference in the observed default rates for consumers from different segments or groups who are assigned the same or similar credit scores. The results of tests for such bias are also included in this document.

The model performance assessment is based on a sample of 15 million anonymized and randomly selected U.S. consumer credit files from the databases at each CRC, totaling 45 million files. The timeframe used for testing was from 2016 to 2018.

2019 Model Performance Highlights:

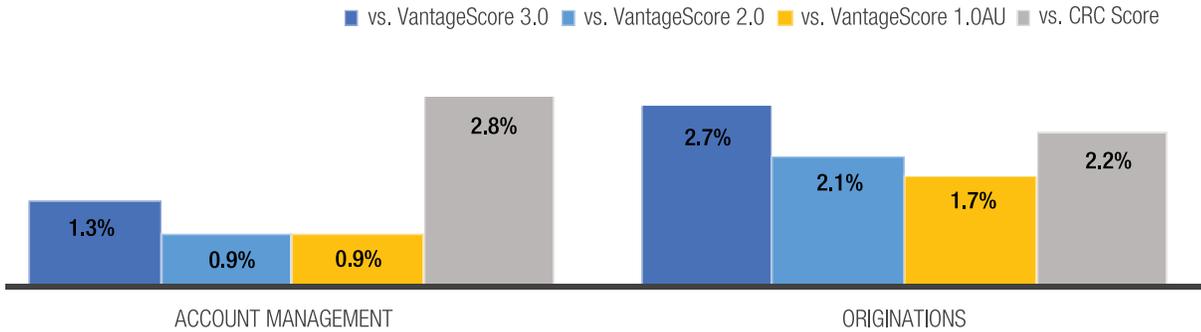
- On a U.S. population representative of mainstream consumers (consumers conventionally scored by generic scoring models):
 - VantageScore 4.0 outperforms prior versions of VantageScore as well as CRC proprietary models across all product types for both new originations and existing accounts.
 - VantageScore 4.0 continues to significantly outperform VantageScore 3.0 in Bankcard, Auto, and Mortgage Originations. The inclusion of trended attributes provides significant improvement in predictive performance, particularly in higher credit score ranges where trended attributes contribute more heavily to the consumers' credit score¹.
- On a U.S. population representative of Newly Scored consumers (consumers who are not scored by conventional scoring models), VantageScore 4.0 maintains its predictive power, which is provided by the machine learning techniques that were used in its development on this population.
- Aided by the use of levelled credit attributes (including trended attributes), a high degree of score consistency across CRCs is maintained, with VantageScore 4.0 providing the most consistent VantageScore model yet.
- There is no statistical bias in credit scores when VantageScore 4.0's performance is compared across ethnic groups nor between mainstream and Newly Scored consumers.

¹ The performance benefits of trended data is discussed in a separate, upcoming VantageScore research paper.

Model Performance – Mainstream Consumers:

VantageScore 4.0, with its trended attributes, has maintained its improvement over the performance of prior VantageScore models. This is true in the Account Management area and especially in Originations, where the incremental improvement is generally significantly higher than that seen on existing accounts. VantageScore 4.0 also continues to outperform the CRCs' proprietary models. The graph below shows the relative lift in Gini values provided by VantageScore 4.0. It should be noted that all four VantageScore models continue to perform well and within expectations.

Figure 1:
VantageScore 4.0: % Lift in Performance Mainstream Consumers - Bankcard



Model Performance – Newly Scored Consumers:

Newly Scored consumers are those who, through their unconventional use of credit, cannot be scored by traditional credit scoring methods. Based on the latest Census information available and credit data, out of the 252 million credit eligible adults, there are approximately 40 million consumers who fall into this category. These consumers can be further classified as:

- Young to Credit / New Entrants – consumers with trades that are six months or younger;
- Dormant / Infrequent Users – consumers who have not used credit within the last six months;
- No Trades – consumers with only public record collections records and inquiries.

VantageScore 4.0 outperforms VantageScore 3.0 by 7.4% for new account originations and 2.3% for existing account management trades, based on a comparison of the Gini values achieved.

Figure 2:
VantageScore 4.0: % Lift in Performance vs. VantageScore 3.0 – Newly Scored Consumers

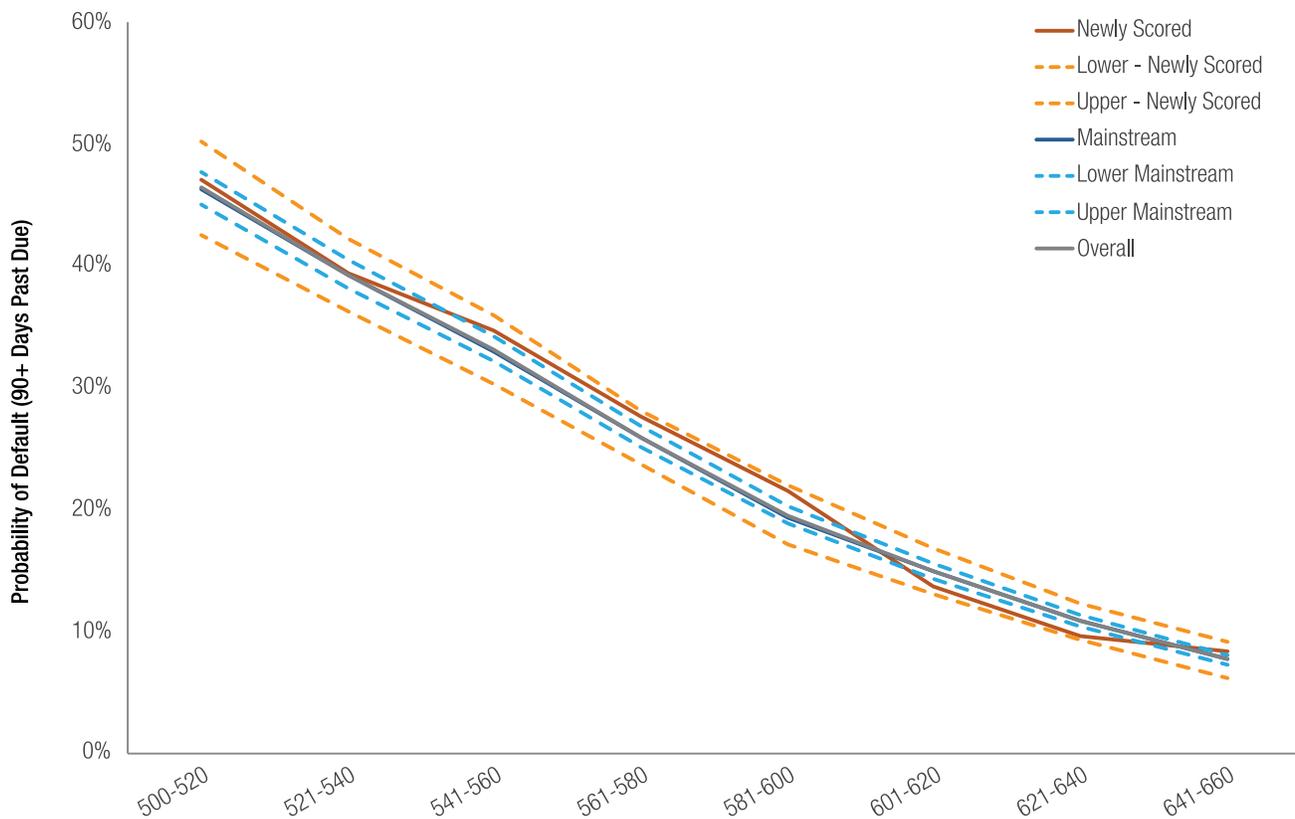


The results indicate that there is no statistically significant difference in default rates observed within each VantageScore 4.0 score band between Mainstream consumers and Newly Scored consumers.

Model Performance – Consistency between Newly Scored vs Mainstream Consumers:

As part of the annual performance assessment process, the consistency of the credit score between the Newly Scored and Mainstream consumer segments is assessed by comparing the observed default rates after controlling for credit score. To perform this assessment, VantageScore 4.0 score bands are created and a Chi-Square based test is applied.² The results indicate that there is no statistically significant difference in default rates observed within each VantageScore 4.0 score band between Mainstream consumers and Newly Scored consumers.³

Figure 3:
Comparison of Default Rates between Newly Scored vs. Mainstream Consumers with confidence intervals



² Chi-Square is a standard test used to compare proportions across different populations.

³ For further details of the testing methodology, please refer to the VantageScore Research Study titled "Testing Credit Scoring Models for Statistical Bias: Ushering in a New Era of Transparency," available at <https://www.vantagescore.com/statbias18>

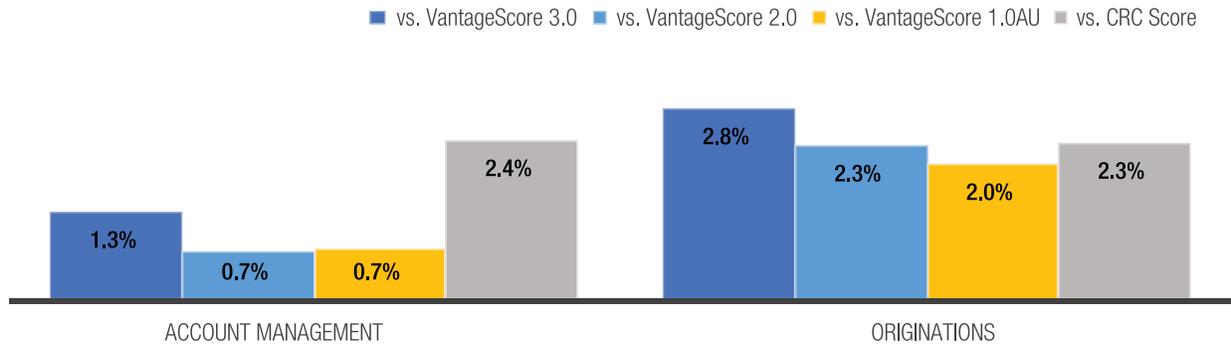
INDUSTRY RESULTS:

Bankcard

- While all four VantageScore models continue to perform well, VantageScore 4.0 shows improved predictive performance compared with all previous versions of VantageScore, especially in the Originations space (average of 2.4% lift in Gini value), as well as in the Account Management space (with an average of .9% lift in Gini values).
- VantageScore 4.0 achieved a predictive performance lift over VantageScore 3.0 of 2.8% for Originations.
- VantageScore 4.0 achieved an average predictive performance lift over CRC proprietary models of 2.3% for Originations and 2.4% for Account Management.

Figure 4:

VantageScore 4.0: % Lift Performance over CRC Proprietary Models for Mainstream Consumers - Bankcard

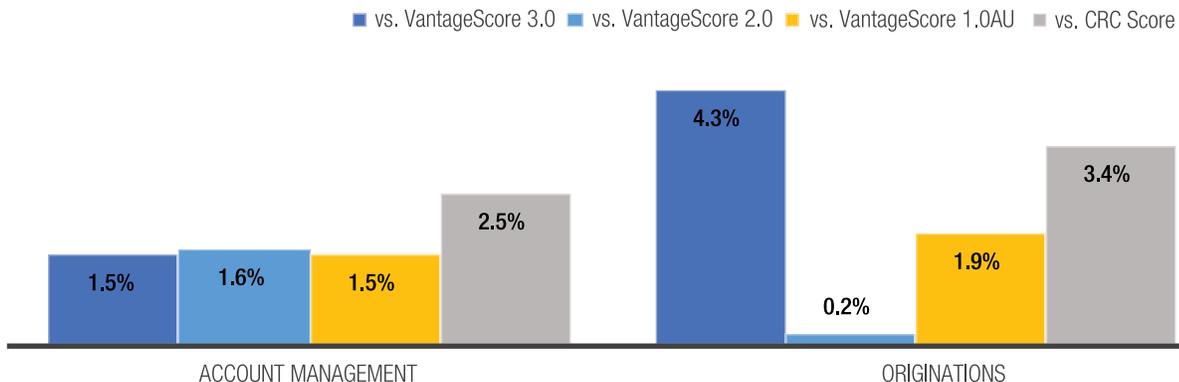


Mortgage

- While all four VantageScore models continue to perform well, VantageScore 4.0's predictive performance lift over all previous versions of VantageScore averaged 1.5% and 2.1% in the Account Management and Originations spaces, respectively.
- VantageScore 4.0 achieved predictive performance lift over VantageScore 3.0 of 4.3% for Originations.
- VantageScore 4.0 achieved an average predictive performance lift over CRC proprietary models of 3.4% for Originations and 2.5% for Account Management.
- The gap between VantageScore 4.0 and VantageScore 2.0 in Originations seems to have narrowed, a result driven almost entirely by an increase in VantageScore 2.0 Gini values, and not a decrease in VantageScore 4.0 Gini values.

Figure 5:

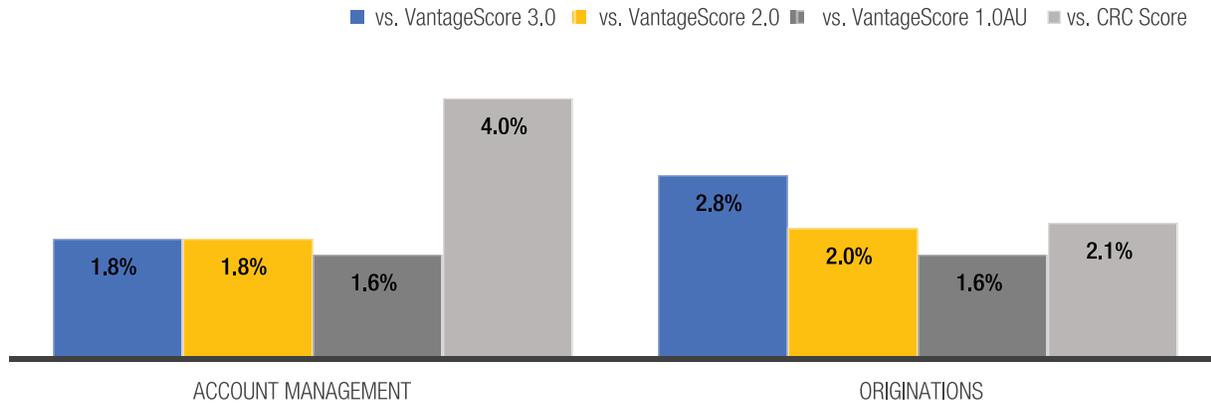
VantageScore 4.0: % Lift Performance over CRC Proprietary Models for Mainstream Consumers - Mortgage



Auto

- While all four VantageScore models continue to perform well, VantageScore 4.0's predictive performance lift over all previous versions of VantageScore averaged 1.8% and 2.1% in the Account Management and Originations spaces, respectively.
- VantageScore 4.0 achieved predictive performance lift over VantageScore 3.0 of 2.8% for Originations.
- VantageScore 4.0 achieved an average predictive performance lift over CRC proprietary models of 2.1% for Originations and 4% for Account Management.

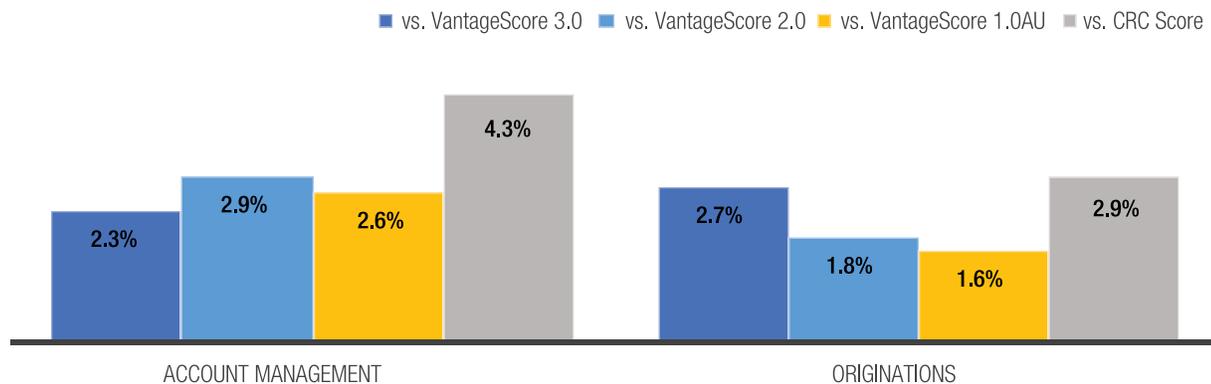
Figure 6:
VantageScore 4.0: % Lift Performance over CRC Proprietary Models for Mainstream Consumers - Auto



Installment

- While all four VantageScore models continue to perform well, VantageScore 4.0's predictive performance lift over all previous versions of VantageScore averaged 2.6% and 2.1% in the Account Management and Originations spaces respectively.
- VantageScore 4.0 achieved predictive performance lift over VantageScore 3.0 of 2.7% within Originations.
- VantageScore 4.0 achieved an average predictive performance lift over CRC proprietary models of 2.9% for Originations and 4.3% for Account Management.

Figure 7:
VantageScore 4.0: % Lift Performance over CRC Proprietary Models for Mainstream Consumers - Installment

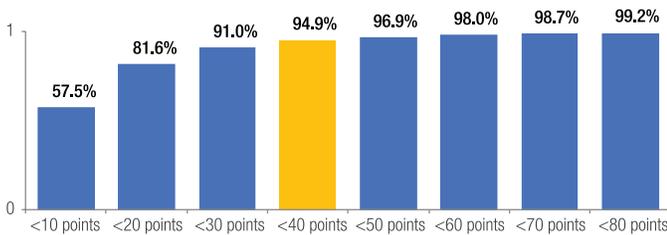


SCORE CONSISTENCY

VantageScore 4.0 and the earlier VantageScore models are the only credit score models to employ consistently calculated credit attributes and the same model specification at each of the three CRC national databases. Consequently, differences in credit scores are solely attributable to variances in the consumer’s credit file data as between the CRCs rather than differences in how the attributes or the score are specified.

On a sample of bankcard consumers with credit files at all three CRCs, 80.9% had three VantageScore credit scores within a 20-point range and 94.7% of the consumers had three scores within a 40-point range. Likewise, comparing mortgage consumers across the 3 CRCs, 81.6% had the VantageScore credit scores within 20 points and 94.9% had 3 scores within 40 points. The percentage of consumers who received scores within 40 points across the 3 CRCs is higher by 1.3% both in bankcard and mortgage using VantageScore 4.0 compared with using VantageScore 3.0.

Figure 8:
VantageScore 4.0 Score Consistency – MORTGAGE (16-18)



VantageScore 3.0 Score Consistency – MORTGAGE (16-18)

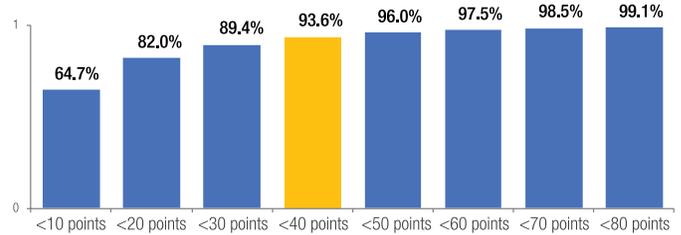
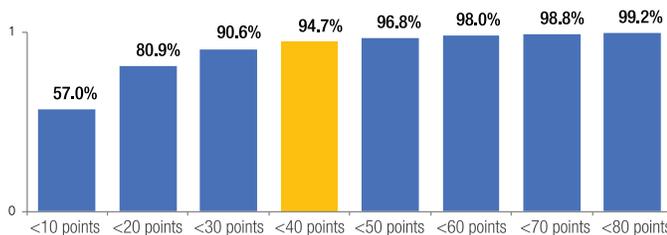
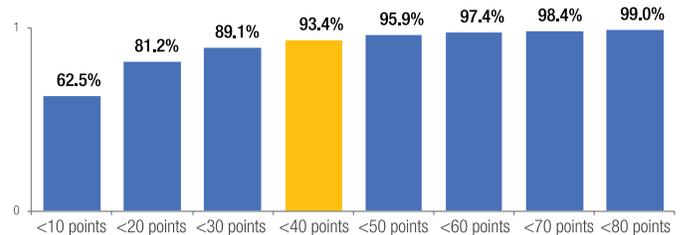


Figure 9:
VantageScore 4.0 Score Consistency – BANKCARD (16-18)

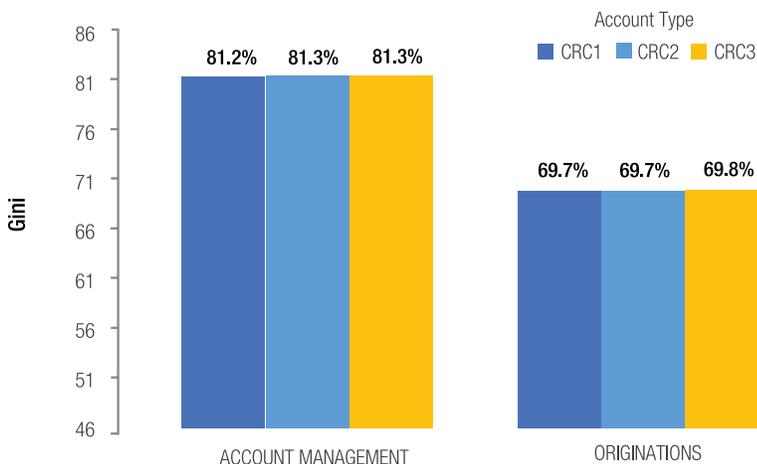


VantageScore 3.0 Score Consistency – BANKCARD (16-18)



In terms of predictive consistency, as the graph below suggests, VantageScore 4.0’s Gini results among the CRCs remains strongly consistent for both Originations (0.1 Gini difference) and Account Management (0.1 Gini difference).

Figure 10:
VantageScore 4.0: Performance Consistency OVERALL (16-18)



In terms of score risk alignment, the score-to-risk relationship (90+ days past due) for VantageScore 4.0 is consistent across all CRCs for both account management and originations.

Figure 11:
VantageScore 4.0 Odds Alignment OVERALL ACCOUNT MANAGEMENT (16-18)

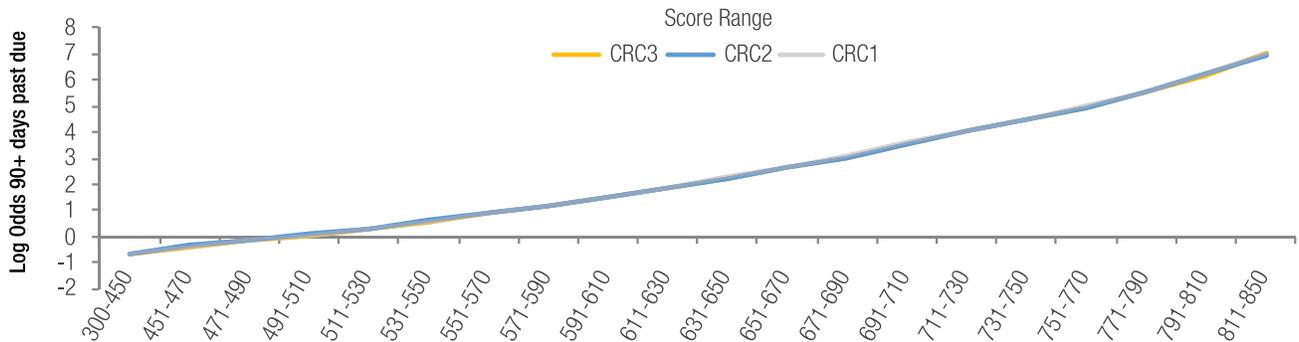
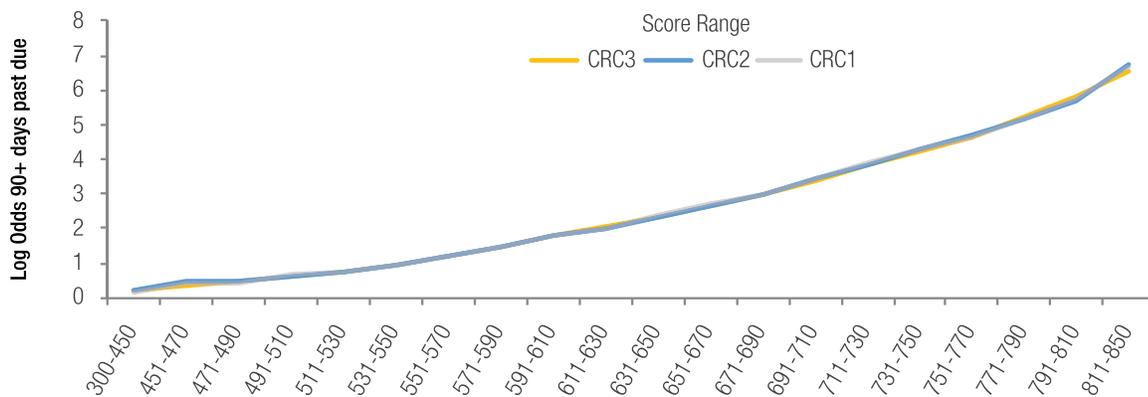


Figure 12:
VantageScore 4.0 Odds Alignment OVERALL ORIGINATIONS (16-18)



STATISTICAL BIAS: ETHNICITY

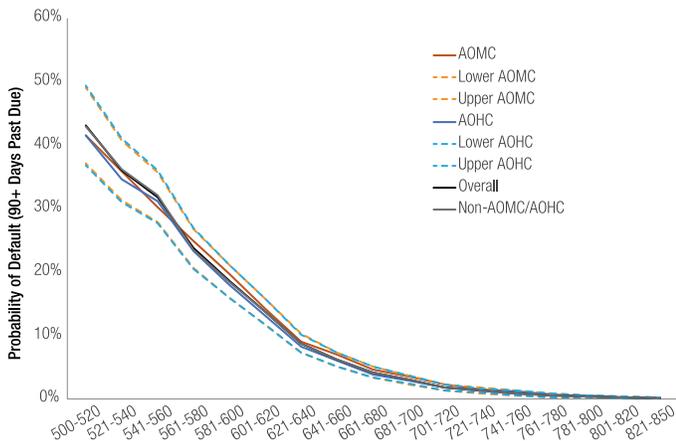
A requirement for any credit scoring model is that there is no statistical bias (either positive or negative) with regards to any specific consumer group. Therefore, a key element of the annual assessment process is to ensure that VantageScore 4.0 continues to be free from any such statistical bias by comparing default rates observed for a given credit score between ethnicity-based consumer groups and other groups of consumers.

Specifically, a Chi-Square based formal statistical bias test was run on protected ethnic class population segments, i.e., African-American (AOMC) or Hispanic-American (AOHC) populations, to assess if there are statistically significant differences in the actual default rates between these different ethnic groups and other groups. Census data at the zip code level was appended to the consumer data as a proxy for ethnicity. Bankcard and mortgage products were selected for this test based on their relative size and because they are representative of mainstream lending.⁴

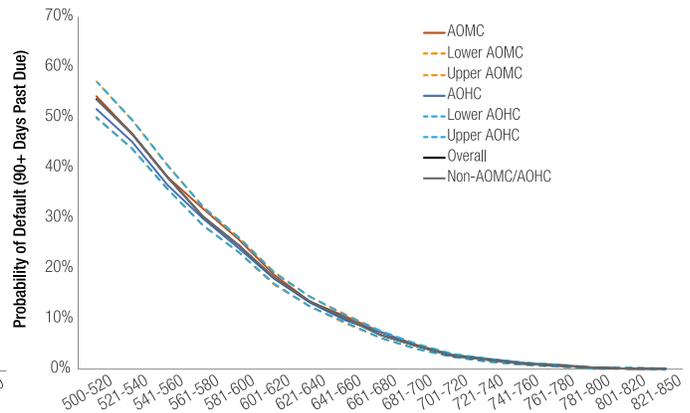
The results indicate that there is no statistically significant difference in default rates between the groups at each credit score band and the overall population default rates for credit cards or first mortgages.

⁴ For further details of the testing methodology, please refer to the VantageScore Research Study titled “Testing Credit Scoring Models for Statistical Bias: Ushering in a New Era of Transparency” available at <https://www.vantagescore.com/statbias18>

Figure 13:
Statistical Bias: First mortgage default profiles by ethnicity
with confidence intervals



Statistical Bias: Bankcard default profiles by ethnicity
with confidence intervals



CONCLUSIONS

The 2019 annual performance assessment of VantageScore 4.0 has shown a continued material performance lift when compared to benchmark models across all product types for new originations as well as for existing accounts. VantageScore 4.0 leverages trended data for mainstream consumers and newly designed machine learning attributes for non-mainstream consumers. In both settings, VantageScore 4.0 continues to outperform all previous versions of VantageScore. VantageScore 4.0-based credit scores are unbiased across different consumer segments and are highly consistent across the three CRCs.

Although lenders should independently validate models, based on their own portfolios and strategies in accordance with the regulatory guidelines, and perform periodic model performance monitoring, those who use the VantageScore 4.0 model in their decision-making processes can have confidence in the model's best-in-class performance and most comprehensive use of data available on the consumers' credit file.⁵

The VantageScore model is licensed to the three major CRCs, Equifax, Experian, and TransUnion, who each in turn compete to market, price, distribute and sell VantageScore credit scores. Lenders and other commercial entities interested in learning more about the VantageScore models may contact one of the CRCs listed to the right for additional assistance.

⁵ Refer to OCC 2011-12 *Sound Practices for Model Risk Management*, Federal Reserve's SR 11-7 *Supervisory Guidance on Model Risk Management* and FHFA's 2013-07 *Model Risk Management Guidance*

The VantageScore credit score models are sold and marketed only through individual licensing arrangements with the three major credit reporting companies (CRCs): Equifax, Experian and TransUnion. Lenders and other commercial entities interested in learning more about the VantageScore credit score models, including the VantageScore 4.0 credit score model, may contact one of the following CRCs listed for additional assistance:

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