

# Implementing a New Credit Score in Lender Strategies



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# Implementing a New Credit Score in Lender Strategies

In response to industry demands for credit and risk tools that are reflective of changes in the economy, the content of the consumer credit file and consumer attitudes to credit, VantageScore Solutions, LLC developed and released VantageScore 4.0 in April 2017.

The model was developed on 45 million consumer credit files, representative of the 2014-16 timeframe and uses trended credit data and machine learning techniques to improve on the performance of prior VantageScore credit scoring models. In validations, VantageScore 4.0 outperforms all other versions of VantageScore and proprietary credit reporting companies' (CRCs) generic credit scoring models. Unique to VantageScore, the model is identical at each of the three main CRCs – TransUnion, Experian and Equifax. Consequently, consumer scores are more consistent across all three CRCs, with 95% receiving scores within a 40-point range simultaneously across the three CRCs. Additionally, 40 million consumers are now scored who are typically un-scoreable by legacy scoring models.

To take advantage of the strengths of VantageScore 4.0, lenders should conduct a score conversion process to determine how to incorporate the new score into their credit strategies. Such model conversion processes cover all credit scoring models, such as converting VantageScore 3.0 to VantageScore 4.0.

## THE HEART OF THE MATTER....

At first, the process of converting strategies to use new scores can seem overwhelmingly complex. Generic risk scores have become deeply embedded within strategies and often strategy design is contingent upon the score performance.

In reality, there is just one central question that must be answered for successfully converting a strategy to use a new credit score. *What is the value of the new score (NewScore) that represents the same default rate or population volume designated by the previous score (OldScore)?*

All conversion processes revolve around answering this question and essentially follow the same steps. The analytic and resource requirement for each step in the conversion process is determined by the complexity and magnitude of the specific strategy. Furthermore, the process must be followed when converting from one version of a score to a new version or converting from one brand of score to another brand.

## WHY DO DEFAULT RATES AND POPULATION VOLUMES VARY BY CREDIT SCORES?

Models score, and therefore rank order, consumers differently for a number of reasons.

- A more predictive model identifies more defaulting consumers and assigns them to lower credit scores (Figure 1).
- Models assess credit behaviors differently which can result in rank ordering differences, and therefore, score assignment.
- Finally, model developers use different score range design methods to assign the final score to the consumer.

As a result, the final number of consumers assigned to each score varies, resulting in different population distributions for different scoring models (Figure 2).

To successfully use scores from a new scoring model in a strategy, the differences between the OldScore and the NewScore must be analyzed for the following:

- Default rates
- Population volumes
- Secondary consumer behaviors that drive the business P&L, e.g., transact/revolve mix, pre-payment rates
- Changes in the score assigned to a specific consumer that result in a different strategy assignment

Figure 1: Defaults rates for a population scored by OldScore and NewScore. The more predictive NewScore assigns a lower number of defaulting consumers to higher scores

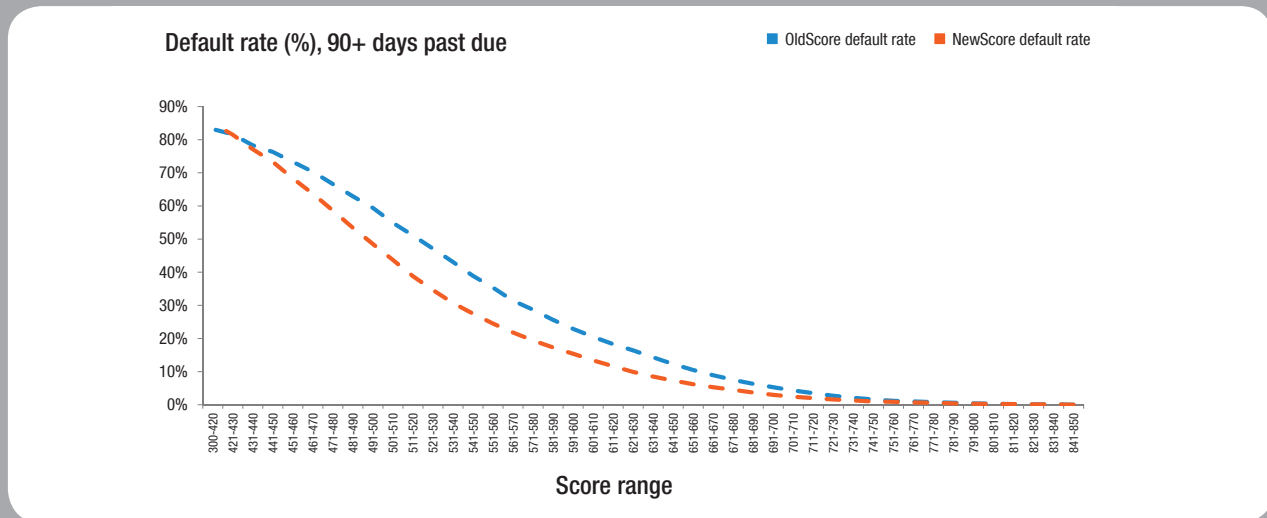
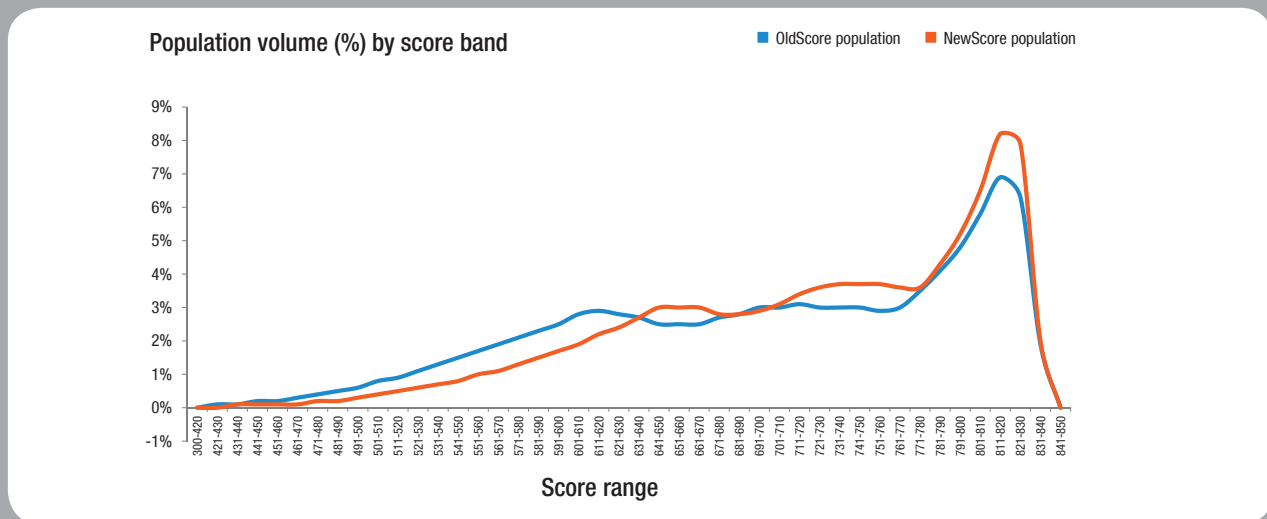


Figure 2: Population distributions using OldScore and NewScore



## THE PROCESS

The conversion process can be generally categorized into three levels, ranging from “Plug & Play”(i.e., simply replace the OldScores with the NewScores) to the most complex process, requiring a full re-design and re-optimization of the strategy (Figure 3). Selecting the right process is determined by the degree of similarity in default rate and population distributions when the population is scored by both OldScore and NewScore.

For any of the three conversion processes, four component steps must be considered (Figure 4):

- **Analysis** to determine the NewScore cut-off that meets the desired default rate or population volume
- **Design** revisions to the strategy based on the NewScore information
- **Testing** the strategy using the new scores
- **Reporting** to monitor the strategy performance under the NewScore

As the conversion process becomes more complex, each of the four steps requires more intense focus.

Figure 3: Conversion processes

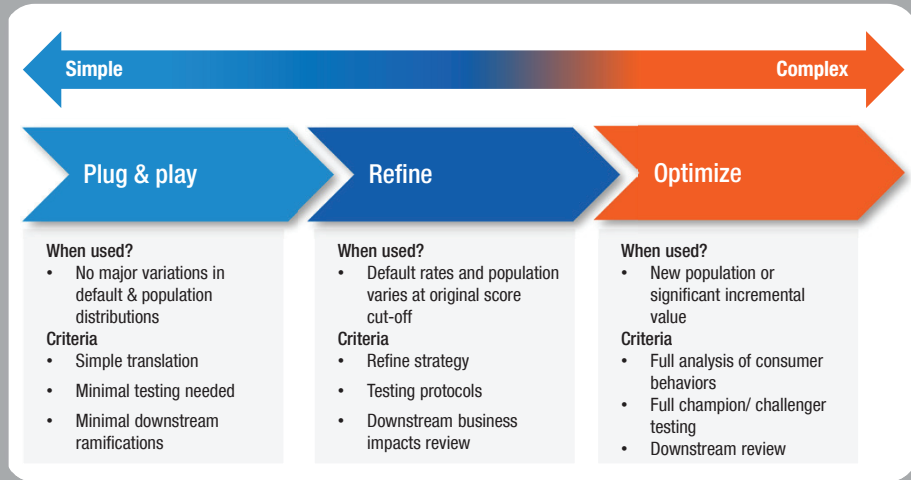
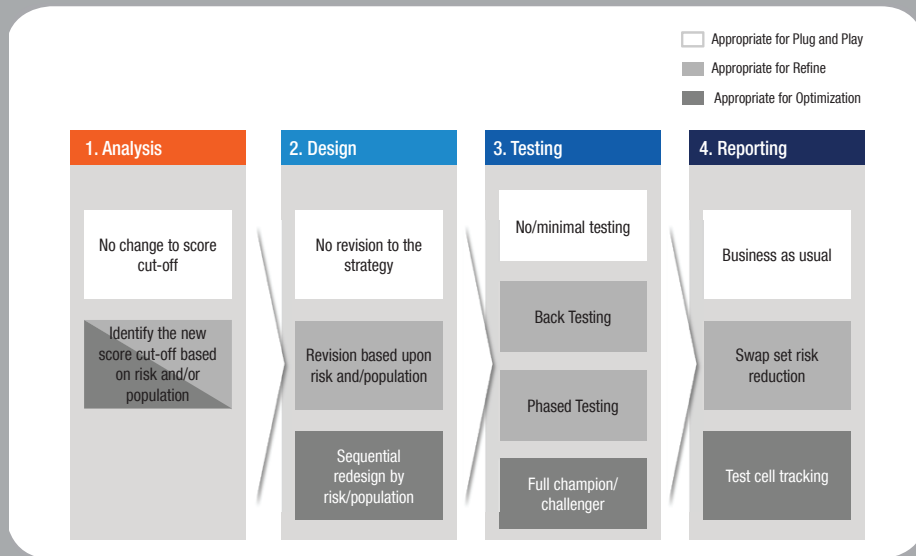


Figure 4: Component steps within the conversion process

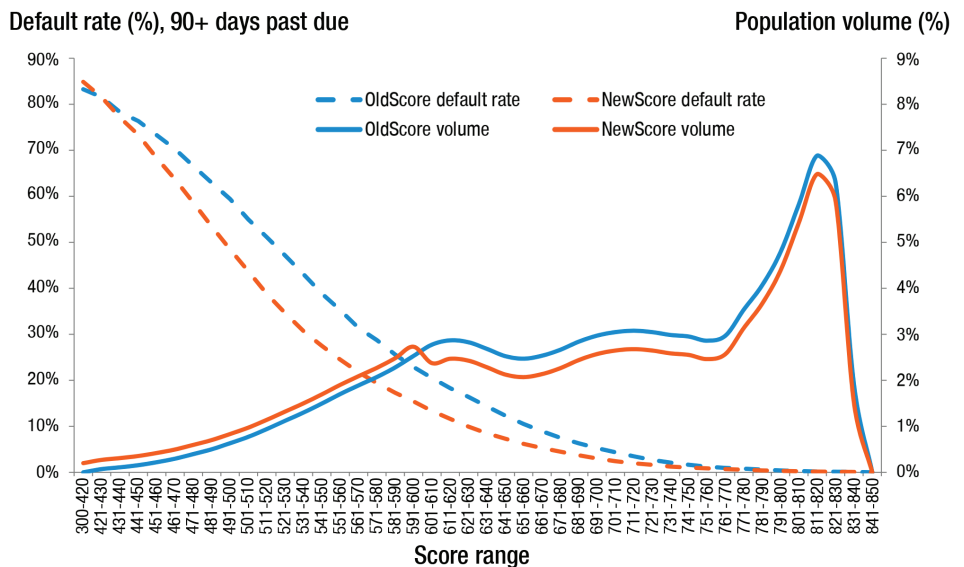


## PLUG & PLAY CONVERSION

### When & where applicable

The Plug & Play approach is most applicable where there is a minimal difference in the population distributions between the old and new scores (Figure 5). Strategies that might be candidates for this approach include applications where the score is used as a cut-off with no additional criteria or for classifying consumers into risk tiers.

Figure 5: Nearly parallel population distributions under OldScore and NewScore



## Process

### Analysis

- Arrangement by Default Rate**  
 Identify the default rate that represents the OldScore cut-off value in the specific strategy. Using industry performance charts, find the NewScore value that represents the equivalent default rate (Figure 6).  
 Alternatively, developing performance charts built specifically on a lender's portfolio would provide more bespoke results. Lenders can assess their portfolio Default Rate by obtaining retro-active scores for a sufficient sample set of the portfolio and assessing the rate at which Charge-offs and bankruptcies arise within a 24-month performance window.
- Arrangement by Population Volume**  
 Identify the population volume that is in line with the OldScore cut-off value from FACT Act Risk-Based Pricing Tables built using OldScore. The population should represent the same population that the score will be applied to in the future. Find the NewScore value that represents the equivalent population volume using the Risk-Based Pricing Tables built using NewScore. Note that while volumes will be consistent, the specific consumers may be different (Figure 7).

### Design

Accept NewScore cut-off value in order to maintain the strategy performance levels or adjust the score cut-off to capture improvements in default rate or population opportunity.

### Testing

Given the distributions that are in line, major disruptions in expected default rate performance and population volumes are not expected. Testing may be useful to understand how secondary behavioral metrics, that drive the P&L, may vary.

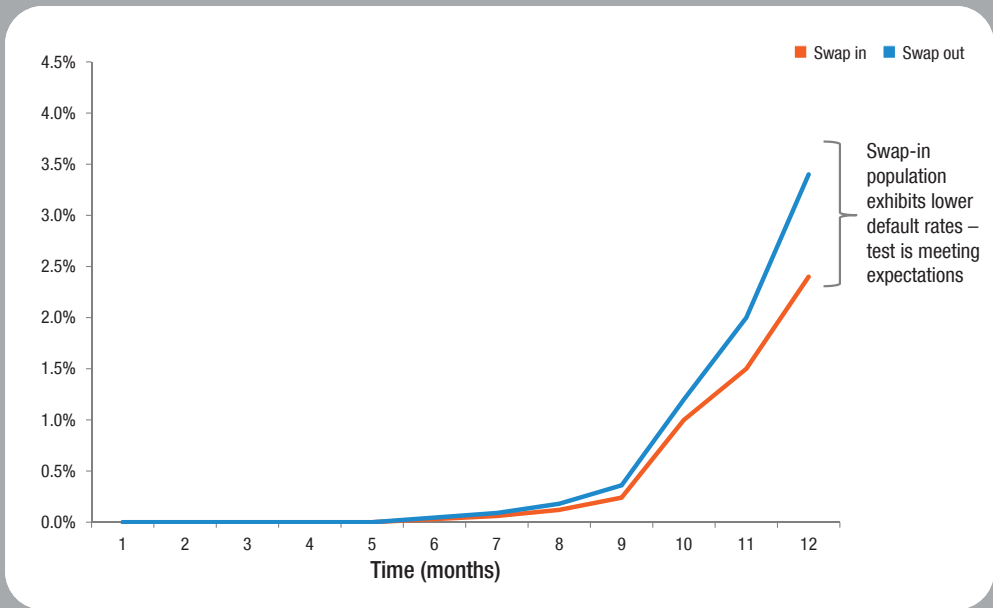
Figure 6: Parallel Default Rates

OldScore	OldScore PD	NewScore PD	NewScore
811-850	0.1%	0.1%	811-850
791-810	0.3%	0.2%	791-810
771-790	0.5%	0.4%	771-790
751-770	0.8%	0.7%	751-770
731-750	1.5%	1.1%	731-750
711-730	2.7%	2.0%	711-730
691-710	3.5%	2.7%	691-710
671-690	4.8%	4.2%	671-690
651-670	6.0%	5.7%	651-670

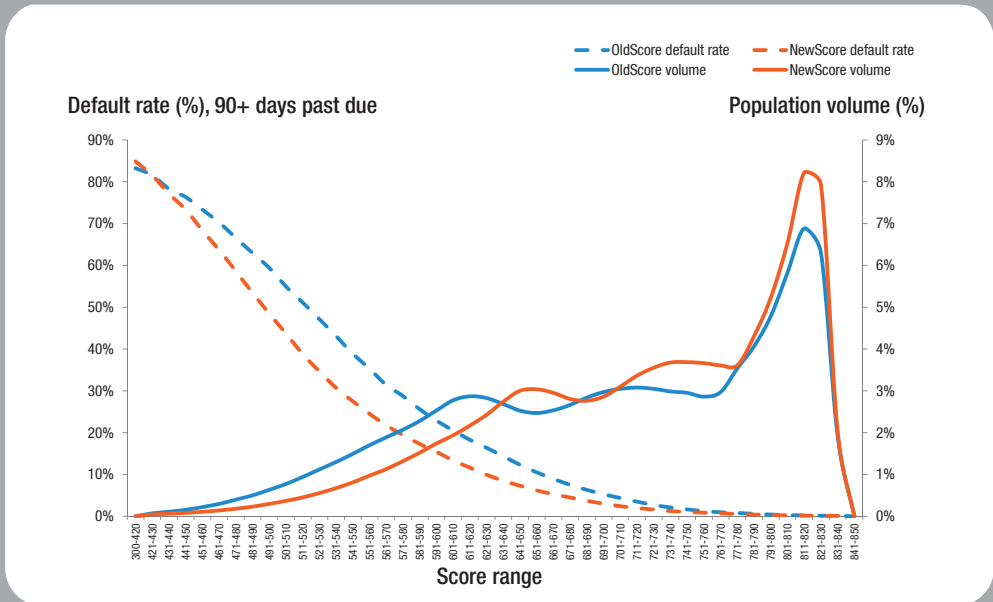
Figure 7: Parallel Population Volume

OldScore min	OldScore max	Ranks higher than x% cumulative	Ranks higher than x% cumulative	NewScore min	NewScore max
710	714	45%	45%	716	720
705	709	46%	46%	711	715
700	704	47%	47%	706	710
695	699	48%	48%	701	705
690	694	49%	49%	696	700

**Figure 8: Performance Reporting Cumulative Default Rates**



**Figure 9: Population Distribution Shifts using NewScore**



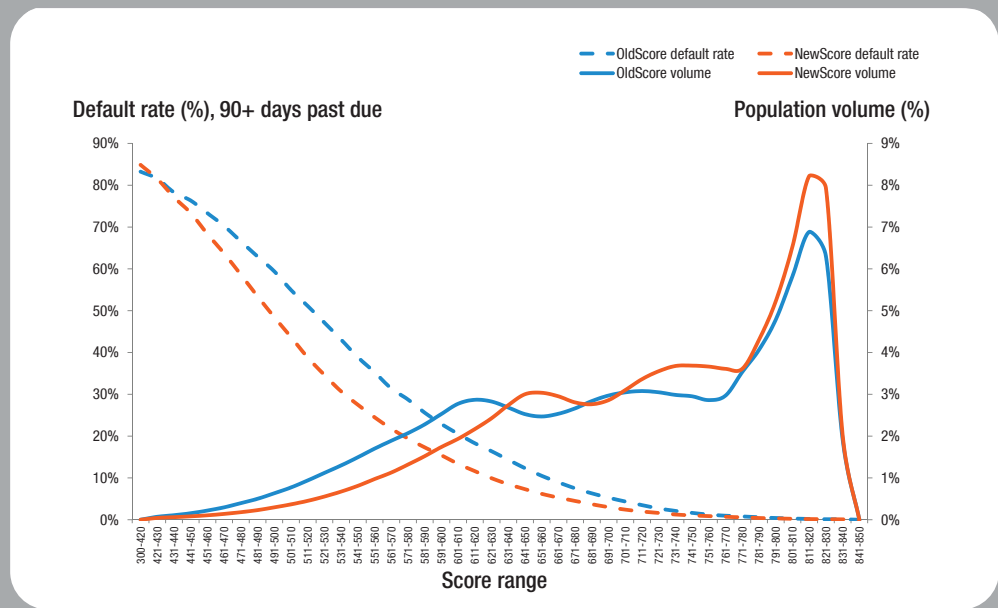
## Reporting

Performance reporting should monitor default rates to ensure that rates using NewScore are at or below acceptable levels (Figure 8).

## Governance, Compliance and Operational Notification

Clearly the implementation of a new generic credit risk model, whether an updated version or a new brand, must be reviewed with a lender’s model governance, compliance and fair lending function. If the use of NewScore is likely to drive changes in population volume or introduce significant shifts in behaviors that drive the organization’s P&L, then downstream business functions such as portfolio management, customer service, collections, finance and accounting should be notified and made aware in order to accommodate the impact in their operations.

**Figure 10: Arrangement by Default Rate on Lender Population (Example: Acquisition Strategy)**



## REFINE

### When and where applicable

More extensive strategy refinement may be necessary to implement NewScore when the shifts in the population distribution may meaningfully impact the business P&L (Figure 9). Under this scenario, further analysis is required to understand the shifts in P&L-related metrics and whether volume and default rate adjustments in the strategy can accommodate these shifts. This “Refine” approach can be applied to convert the majority of lending strategies to using NewScore.

### Process

#### Analysis

To accurately understand how to set the NewScore cut-off, industry-level performance data is insufficient. The lender population should be fully scored using both NewScore and OldScore and arranged by default rates (as described in Plug & Play) to identify the appropriate NewScore cut-off (Figure 10).

Similarly, the population volume is ordered by OldScore and NewScore. The NewScore cut-off that matches the desired population volume under OldScore is identified (Figure 11).

**Figure 11: Arrangement by Population Volume on Lender Population (Example: Acquisition Strategy)**

OldScore	Cumulative percent	NewScore	Cumulative percent
...	...	...	...
660	21.0%	660	23.8%
661	21.2%	661	24.1%
662	21.5%	662	24.5%
663	21.8%	663	24.8%
664	22.1%	664	25.1%
665	22.4%	665	25.5%
666	22.7%	666	25.8%
667	23.0%	667	26.1%
668	23.3%	668	26.4%
669	23.7%	669	26.7%
670	24.0%	670	27.1%
671	24.3%	671	27.4%
672	24.6%	672	27.7%
673	24.9%	673	28.0%
674	25.2%	674	28.3%
675	25.5%	675	28.6%
676	25.8%	676	28.9%
677	26.1%	677	29.3%
678	26.5%	678	29.6%
679	26.8%	679	29.9%
680	27.1%	680	30.2%
...	...	...	...

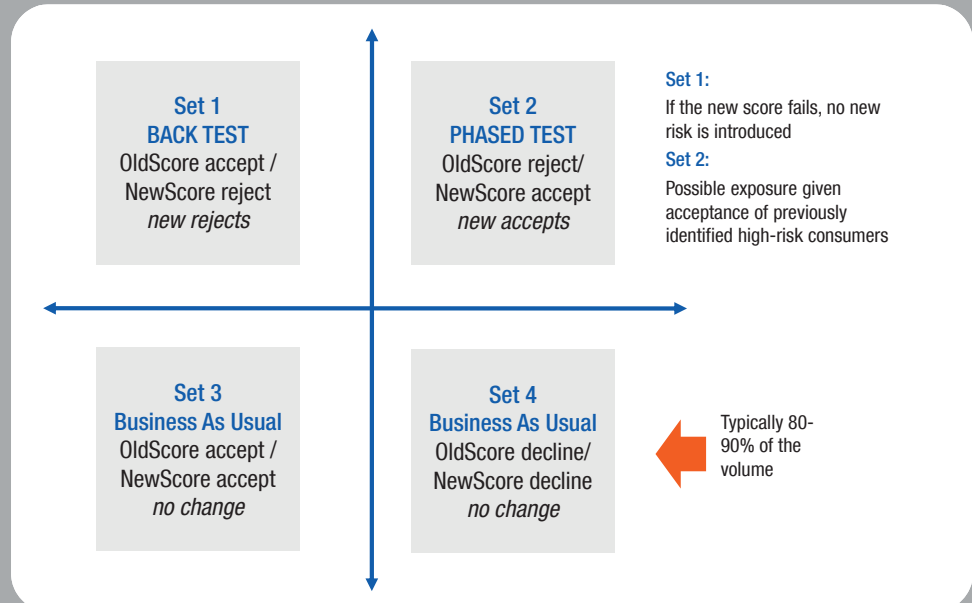
Annotations:

- Old Score cut-off to 675 (indicated by a blue arrow pointing to the 675 row in the OldScore column).
- Maps to New Score cut-off to 665 (indicated by a blue arrow pointing from the 675 row in the OldScore column to the 665 row in the NewScore column).

**Figure 12: Trade-offs in Strategy Design**

	Match marginal default rate	Match population volume
Opportunity	<ul style="list-style-type: none"> <li>Will not take on any additional risk at the margin</li> <li>Given the new score is stronger, <i>overall</i> default rate should be reduced</li> </ul>	<ul style="list-style-type: none"> <li>Minimizes operational impact by maintaining constant volume</li> <li>Straight-forward process to identify score cut-off</li> </ul>
Check for	<ul style="list-style-type: none"> <li>Likely to cause shift in volumes</li> </ul>	<ul style="list-style-type: none"> <li>May not capture entire opportunity from reduced bad rate</li> </ul>
Additional considerations	<p>How do behavioral metrics change after accounting for swap sets? Some examples include:</p> <ul style="list-style-type: none"> <li>Bankcard: Revolve / Transact mix</li> <li>Installment: Prepayment rate</li> <li>HELOC: Draw rate and amount</li> <li>Additionally, consider Fair Lending implications</li> </ul>	

**Figure 13: Test Cell Configuration**



**Design**

Strategy refinement involves an understanding of the trade-offs between default rate, volume and secondary P&L metrics. If the goal is to maintain or reduce the default rate level, then shifts in volume and secondary metrics should be evaluated and considered for business impact. Conversely, if the goal is to maintain population volume, then there will be minimal operational impact, but the opportunity to capture improvements in losses may not be achieved (Figure 12).

**Testing**

With the likelihood that the strategy has undergone some revisions in order to incorporate NewScore, testing the score performance is critical for successful implementation. The population considered by the strategy is scored with both OldScore and NewScore and allocated to one of four sets (Figure 13). For the majority of this population (perhaps as much as 90%), there is no impact from incorporating NewScore. Consumers who were previously accepted under OldScore, continue to be accepted under NewScore (Set 3). Consumers who were previously declined under OldScore are similarly declined using NewScore (Set 4). In other words, Set 3 & 4 represent business as usual.



- **Back Testing – Set 1**  
This set represents consumers who were previously accepted under OldScore, i.e., assessed as low risk, but NewScore has re-assessed them as high risk, and therefore, rejects those consumers. NewScore on this set of consumers can be holistically implemented given that even in a worst-case scenario where NewScore ‘fails,’ these consumers represent no *new incremental* risk to the business. Performance monitoring is still recommended, however, to confirm that these consumers do indeed perform at the higher risk levels that NewScore identified.
- **Phased Testing – Set 2**  
A more conservative testing protocol is recommended for this consumer set. These are consumers who were previously rejected by OldScore as high risk, but that NewScore indicates are actually low risk and should be accepted. If NewScore fails here, then higher risk consumers have been accepted which may jeopardize the business P&L. This testing protocol involves introducing the NewScore ‘accepts’ sequentially according to incremental OldScore tiers. For example, the NewScore ‘accepts’ who have OldScore values that fall no more than 10 points under the OldScore cut-off value are initially accepted. These consumers might be thought of as ‘the best of the declines’ from an OldScore perspective. Once sufficient sample size and performance has been observed to confirm that NewScore has accurately identified these consumers as low risk, the next tier can be considered – that is NewScore ‘accepts’ with OldScore values between 10 and 20 points below the OldScore cut-off. And so forth, until performance has fully confirmed that NewScore risk identification is accurate.

## Reporting

Performance reporting focuses on questions across two dimensions. For Sets 1 and 2, do default rate levels meet expectation given NewScore’s predictive insights? Secondly, how have relevant behavioral metrics shifted, and what is their associated impact to the P&L?

## Governance, Compliance and Operational Notification

As with the Plug & Play process, governance and compliance teams should review the new model, the revised strategy and its impact to risk levels. Operations and finance teams must also consider the consequences of any major populations shifts to their resources and forecasts.



Figure 14: Multi-Score Strategy Example

	ProfitScore Low	ProfitScore Medium	ProfitScore High
OldScore 600-660	8%	9%	10%
	\$1	\$10	\$10
OldScore 661-720	7%	7%	6%
	\$10	\$25	\$60
OldScore 721+	4%	3%	2%
	\$10	\$35	\$50

% Probability of default \$ Profit per account

Figure 15: Parallel Population Volume

OldScore cut-offs	Default rates	NewScore cut-offs
600-660	8.1-10%	610-650
661-720	5.1-8%	651-730
721+	0-5%	731+

## OPTIMIZE

### When and where applicable

A full optimization approach is necessary for implementing NewScores in a strategy that uses multiple scores or attribute overlays. Here the second strategy dimension, the overlay or second score, may need to be revised in order to fully optimize strategy performance. As an example, Figure 14 shows a matrix strategy involving OldScore and a ProfitScore. The two scores classify consumers according to high, medium and low risk as well as high, medium and low profitability. Nine strategy segments are therefore identified for various sub-strategies. In this scenario, implementing a new credit score involves not only identifying new values using NewScore, but also identifying the values of ProfitScore given NewScore values in order to maximize overall strategy performance.

Note that while this process is the most resource intensive, it can offer lenders the greatest opportunity to capitalize on the benefits of the NewScore.

### Process

#### Analysis

The analysis process leverages the approach used in Plug & Play to arrange the NewScore cut-offs based on the default rates associated with OldScore (Figure 15).

Additionally, key performance metrics, such as threshold profitability per account levels, are determined as the targets that each cell in the new strategy must achieve.

## Design

Given the number of ‘moving parts’ with more complex strategies, a comprehensive test cell design allows the strategy to be empirically optimized. While the initial default rate arrangement provides the general boundaries for the risk tiers, the test cell design identifies the ‘optimal cut-offs’ for both NewScore and ProfitScore when they are used in conjunction (Figure 16). Within the primary NewScore tiers, sub-tiers are created on the margins of the primary cut-off values. For example, within the high risk tier of NewScore 610-650, a sub-tier at the margin between high and medium risk is created for consumers with NewScores of 640-650, i.e., default rates in the range of 8.1% to 9%. The upper and lower limits of sub-tier test cells are essentially arbitrary and intended to test the costs and benefits of adjusting score cut-offs. Performance in this sub-tier at varying levels of ProfitScore reveals whether the final NewScore cut-off between high and medium risk should remain at 650 or be lowered to 640. A similar sub-tiering approach is applied to the medium and low risk tiers for NewScore and also for ProfitScore. Performance of the key metrics in the central sixteen ‘X’ cells provides insights for determining the optimal cut-offs on both NewScore and ProfitScore. Secondary learning can be generated for additional cells for inclusion in P&L forecasting.

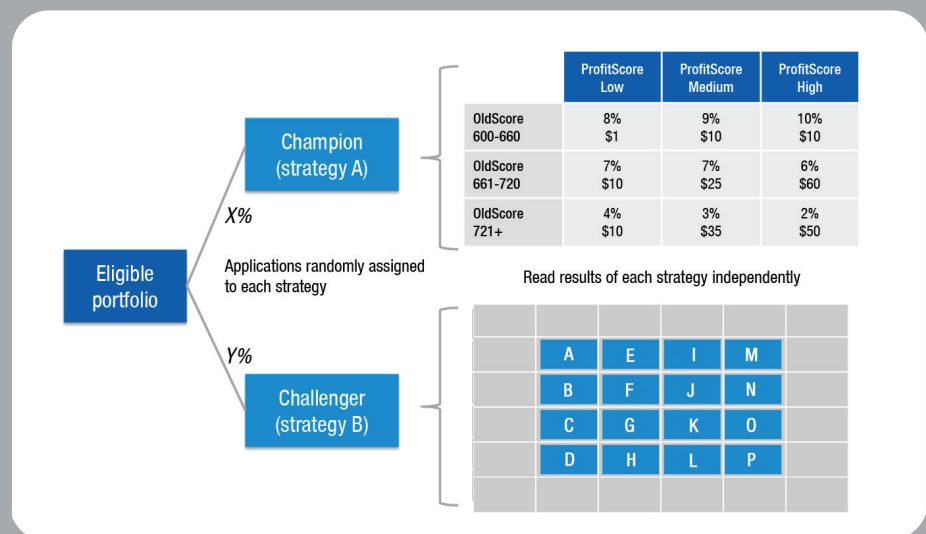
## Testing

A classic Champion/Challenger process should be followed for evaluating NewScore performance in the strategy (Figure 17). Sufficient volume is directed to the Challenger strategy to achieve statistically significant performance.

Figure 16: Test Cell Design

		ProfitScore – Low						ProfitScore – Medium		ProfitScore – High	
		Default rate	Low-Low	Low-Med	Low-Med	Med-High	Med-High	High-High			
High Risk	NewScore 610-650	<640 >9%									
		640-650 8.1%-9%		A	E	I	M				
Medium Risk	NewScore 651-730	651-690 6.5%-8%		B	F	J	N				
		691-730 5.1%-6.4%		C	G	K	O				
Low Risk	NewScore 731+	731-790 4%-5%		D	H	L	P				
		791+ <4%									

Figure 17: Champion/Challenger Design



## Reporting

Performance reporting must simultaneously provide insight into default rate performance and key metrics; in this case, consumer profitability. Performance in each cell is monitored until a sufficient sample size has been assigned to the cell such that the performance metrics are statistically valid (Figure 18). Note, if performance thresholds are not met or insufficient volume has been assigned to the cell, the test cell configuration and directed volume levels should be revised to achieve the necessary sample size targets. Assuming sufficient transparency with regard to performance has been achieved, the final cut-off values for NewScore and ProfitScore can be determined.

### Governance, Compliance and Operational Notification

Not surprisingly, this conversion process requires the most extensive level of due diligence by the governance and compliance teams. Volume and behavioral shifts may require re-configuring downstream operations.

### IN CONCLUSION...

Generic risk scores have been deeply embedded within lending processes for decades. Perhaps to the detriment of the business, this deep entrenchment has hindered the

business' ability to leverage and deploy state of the art risk management tools quickly and flexibly. The clearest example of this has been the impact on mortgage lending due to limitations placed on Government Sponsored Enterprises Freddie Mac and Fannie Mae by the Federal Housing Finance Agency (FHFA). As a result, lending strategies are often using scores that can be more than 15 years old and that are certainly less than optimal for today's business dynamics. This paper intends to provide lenders with the tools and clarity for effectively incorporating new credit scores in their strategies, thereby enabling them to achieve their credit and risk management goals.

### Disclaimer...

With any conversion strategy, it is important to understand the contractual and legal restrictions applicable for using the OldScore and NewScore models. This includes any other terms and requirements that may be imposed by the credit score model providers. Certain score license terms or other restrictions imposed by credit score model providers and CRCs may prohibit use of those scores in connection with the strategies presented in this white paper. Before beginning any conversion process, the lenders should ensure compliance with all applicable contractual and legal terms for each model.

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**Figure 18: Cell-level Performance Monitoring**

Test cell	Metric	Threshold/target	Results by month						
			1	2	3	5	14	18	
L	Default Rate	5%				6%			Default rate fails threshold at month 5. Reconfigure test cell
	Profit	\$45				\$48			
	Cell Size	20,000				20,000			
P	Default Rate	3%					3%		Test cell reaches targets. Increase volume to cell
	Profit	\$55					\$55		
	Cell Size	20,000					22,000		
B	Default Rate	7%						7%	Inconclusive results. Consider test redesign
	Profit	\$30						\$34	
	Cell Size	20,000						18,000	