

## ARTICLE

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### Moody's Analytics

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## Funding Optimization Re-defined

### Highlights

Determining the right approach for asset selection is one of the most important decisions for treasury managers. There is often an overwhelming decision of which methodology and solution is the optimal one. Faced with compliance criteria to meet pledging requirements and frequent fluctuations in the portfolio, the solution needs to have the ability to adapt to these variables.

Managing these risks and uncertainty requires the solution to provide the ability to adjust and respond to ever-changing conditions. Ki Asset Selection bridges these gaps for managing portfolios in the real world..

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## Traditional Solutions Lost in Statistical Methods

Pool selection, as handled by traditional solutions, is a dated strategy. These solutions use a set of statistical solutions that are too simplistic for the challenges of today's market and present the following obstacles:

- » Do not handle outliers efficiently
  - If the data is scattered and heterogeneous, the statistical methods perform poorly in the ability to find an optimal solution. The outliers will skew the solution, which leads to inefficiencies.
- » Performance and Optimality
  - Intuitively, it seems as though the more information we have about a system, the easier it is to make predictions about it. However, this is not the case for many, if not most, commonly used algorithms. Having too many features (for example, independent variables) can cause considerable difficulties. In practice, as we add a larger number of independent variables to the least squares model, a solution that minimizes the sum of the squares of the residuals made in the results of every single equation, the performance of the method typically erodes before the "critical point" (when the number of features begins to exceed the number of training points) is reached.
- » Dependence among variables
  - These statistical methods can lead to poor predictions of an optimal solution when a subset of the independent variables fed to it are significantly correlated to each other.
- » Bottom-of-the-Barrel" Assets
  - Using statistical methods that select better quality assets earlier in the selection process, leads to poorer quality assets remaining in the source portfolio. As more and more selections are done, the residual portfolio quality diminishes, and the "bottom-of-the-barrel" situation occurs.

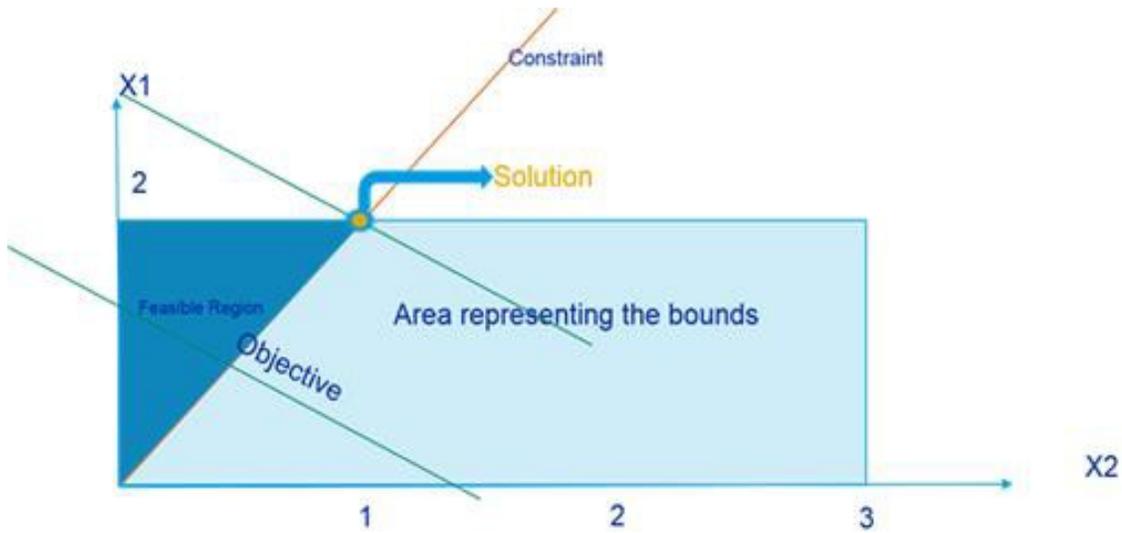
## Pool Selection Using Modern-Day Solvers

Ki asset selection uses a power mixed-integer solver engine under the hood. It uses a linear programming approach, which counters various issues faced by dated statistical solutions.

- » Compliance criteria are converted to linear equations
  - This leads to converting various criteria, which may possibly be independent when viewed as criteria to separate linear equations, thus eliminating the issues with dependent variables, as well as outliers. This reduces the problem to a linear problem from a combinatorial problem. Traditional solutions approach this as a combinatorial problem and try to find the best combination. When criteria are converted to linear equations, they cut through the infeasible combinations and only leave a subset of combinations that need be looked at.
- » Objective Function
  - The linear programming approach uses a customizable objective function, which can be used to maximize the balanced of selected assets and/or include the cost variables for funding to various warehouse facilities. This gives the flexibility to the user to optimize on various aspects of the loan portfolio as the business need may be. For example, in certain cases there may be a business need to minimize the weighted average interest rate of a selected portfolio, where as in other cases there might be a need to minimize the cost of funding.
- » Optimized Solution
  - The optimized solution is reached by creating a convex polyhedron space, as defined by the constraint matrix, and then uses a "cutting plane" method to receive the optimal result, as defined by the objective function. This results in faster performance and getting a truly optimized solution, as opposed to finding a best fit using iterative methods to go through various combinations

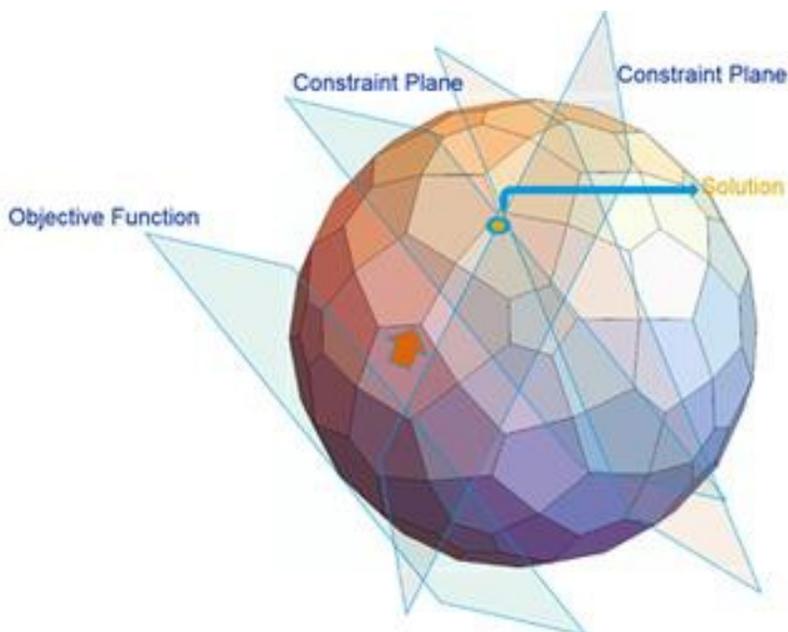
### Simplified Representation of the Solution

- » The solution area is first bounded by how many loans can be selected based on the scenario.
- » It is then further reduced by lines representing constraints giving a feasible region.
- » The optimal solution is found by getting the maxima of the objective function.



### Actual Representation of the Solution

- » The solution space is represented by the convex polyhedron where each vertex represents various combinations of assets.
- » The space is then reduced to a feasible region by constraint planes.
- » The optimal solution is found by getting the maxima of objective function plane.



## Our Solution - Ki™

The evolving financial environment and explosion of data will continue to place significant pressures on financial firms and create myriad challenges for managing collateral. It is essential that modern world solutions are employed to leverage the best-in-class technology and expertise to address the issue in a more holistic manner. To that end, Ki provides business users with a tool that is tailored to the market.

- » Ki uses a powerful mixed integer solver to provide a true optimal solution, while using a linear programming approach to eliminate the inefficiencies produced by using traditional statistical solutions.
- » Ki combines powerful data exploration and visualizations with a mixed integer solver providing one-stop analytics.
- » Ki handles large volumes very efficiently. Ki provides results in minutes.
- » Ki is embedded with business concepts and out-of-the-box monitoring tools. No need for lengthy implementation projects!

Our team continues to collaborate with industry partners to further evolve Ki to address operation efficiencies and risks associated with managing your portfolio.

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