By Russ Labe

25 years of management science at Bank of America

IN NOVEMBER 1986, the Management Science Group was established at Merrill Lynch. The initial group was comprised of six OR/MS practitioners who previously worked together at the RCA Operations Research Group, which was founded by Franz Edelman circa 1950. DuWayne Peterson, head of Operations, Systems and Telecommunications at Merrill Lynch in 1986, was the driving force behind the idea to build an analytics team within the brokerage business. He believed that an internal team of management scientists could identify a host of opportunities to improve business performance. Since RCA had recently been acquired by General Electric, the RCA O.R. group was looking for a new challenge as well as a new home. Over the past 25 years, Peterson's decision paid off with big dividends.

The mission of the group was unique in financial services. There were and still are numerous analysts on Wall Street focused on developing investment strategies, managing risk, supporting trading activity and seeking arbitrage opportunities. Our idea was to focus instead on supporting the general business functions of the organization, to improve efficiency and apply analytics to key business functions such as operations, marketing, pricing and product management.

Much has happened since 1986. Executive leadership changed several times. Financial products and solutions have evolved, grown and declined. Bank of America acquired Merrill Lynch in 2009. The size of the group grew, shrank and grew again. The name of the group changed to Decision Support Modeling. The group migrated to different functional areas of the organization, including technology, marketing, strategic planning and the brokerage line of business. Three different leaders managed the team. H. Newton Garber, the original director, retired in 1990. Garber was followed by Raj Nigam, who led the group until he retired in 2004. Today, the group is managed by Russ Labe, one of the original founding members, and includes 10 professionals with more than 120 years of combined experience at Bank of America and Merrill Lynch. It is part of the marketing organization supporting the client-managed businesses within Bank of America, which includes Merrill Lynch Wealth Management, U.S. Trust and the Bank of America Merrill Lynch institutional businesses.

Throughout all those changes, the group has stayed focused on its mission to improve profitability and assess strategic

A view of the Bank of America Merrill Lynch corporate campus in Hopewell, N.J.

decisions by providing statistical analysis and mathematical modeling.

Application Areas

WHILE THE FOCUS of the team's project work has certainly evolved over time, certain application areas – pricing, client retention, product propensity and revenue forecasting – are consistently important to the business and provide recurring projects.

The group has evaluated numerous pricing situations related to new products and restructuring the pricing of existing products and solutions. Typically these models required gathering huge amounts of transactional data and building historical simulations to evaluate alternate pricing scenarios. The analysis was focused on understanding the detailed impact of price changes on individual clients, financial advisor compensation and firm profitability. In phase one of the analysis, the team assumed client behavior remains the same in order to establish an initial estimate of change impact. In phase two of the analysis the team simulated changes in client behavior based on factors such as client satisfaction, financial advisor loyalty and transactional behavior patterns. Sometimes the resulting analysis led to a decision to not implement any changes. In other cases, the analysis helped launch new products, solutions and services.

Models the team developed to identify clients at risk of leaving Merrill Lynch are used on a regular basis. Alerts are distributed to

The models are customized by client segment, resulting in more than 1,000 separate models that are revised each month.

branch offices each week so they can save some of those relationships. This program has been in place for more than 10 years and is estimated to save $1 billion of client assets annually. The underlying models were developed using a combination of decision trees and logistic regression. A significant refresh and update of the models was recently completed and an enhanced program implementation is in progress. Over the years, the success of this work led to related applications, including development of customized models specifically focused on commercial or small business clients and Merrill Edge clients. Merrill Edge consists of the Merrill Edge Advisory Center (a call center providing investment guidance to clients), as well as self-directed online investing.

The team developed numerous product propensity models to help target the most appropriate financial solutions and services for the most appropriate clients. This has been a highly active area for many years. Originally the team developed customized models for each product and solution of interest. Over the last few years the team developed an automated process, based on collaborative filtering, that allows us to automatically update more than 70 product propensity models and score more than two million clients across all the models on a monthly basis. The models are customized by client segment, resulting in more than 1,000 separate models that are revised each month. These models are used as input to various marketing campaigns and client contact optimization strategies and models.

A related application is referral models, a type of propensity model that addresses a strategic priority for the bank – identify opportunities to support clients across multiple lines of business. Examples include identifying consumer banking clients with a need to manage their investment accounts and finding small business owners with a need to manage their personal investments. The team developed a series of these referral models, which are used to help customer service representatives provide better service to clients and to inform marketing campaigns by selecting the most appropriate messages for each client. Results from these models are embedded in the bank's Web sites to determine messaging strategies.

Another application area is revenue forecasting models. Recently, this has become an area of heightened interest to meet new regulatory requirements imposed by the Federal Reserve. The models estimate the impact of economic stress scenarios, defined quarterly by regulators, on the bank's financial performance. The team developed a series of econometric regression models that predict monthly revenue over a two-year horizon based on a combination of macro-economic factors, internal business drivers and seasonality. The models are used each quarter to support the required stress test analysis. In addition, Finance uses the models as input to their ongoing planning process. These models were classified as trade secrets by the bank.

Other examples of the team's work include financial advisor segmentation, client profitability models, advertising impact modeling

Members of the Decision Support Modeling team (l-r): Lihua Yang, Mark Goldstein, Fang Liu, Je Oh, Zhaoping Wang, Yanni Papadakis, Vera Helman, Russ Labe and Brian Jiang.

and measurement, financial advisor compensation analysis, business strategy impact evaluations, reserve requirement models for debit card reward points and deferred compensation programs, and portfolio optimization. Benefits from these projects through the years have impacted strategic business decisions and contributed hundreds of millions of dollars in bottom line benefits through increased revenue, cost reduction and efficiency improvements.

Professional Recognition

IN ADDITION to internal contributions, the team has received external recognition from INFORMS for the quality and business value of its work. In 1997, the team helped Merrill Lynch win the INFORMS Prize for the effective and widespread use of analytics throughout the organization sustained over 10 years.

In 2001, the team helped Merrill Lynch win the Franz Edelman Prize for the pricing analysis it conducted to help launch Merrill Lynch Unlimited Advantage (MLUA), as well as the legacy ML Direct business, now called Merrill Edge. MLUA was the first financial solution in the brokerage marketplace with true client relation-

ship pricing and attracted $22 billion of incremental assets to the firm during its first two years. ML Direct was the firm's first effort in Web-based online trading accounts.

In 2004, the team won the Wagner Prize for modeling the liquidity risk of revolving credit lines provided to other companies through Merrill Lynch's legacy Bank and Trust business. This analysis allowed ML Bank and Trust to free up $4 billion of capital. In 2005, the team helped the ML Treasury group win the Alexander Hamilton Prize associated with the same work around liquidity risk. These awards from objective, professional peers helped raise the profile of the group internally and increased management confidence in the quality and value of the team's work.

Summary

LOOKING BACK over the last 25 years, the Decision Support Modeling team at Bank of America has much to celebrate. The team survived many market cycles and reorganizations. The team has a strong history of business impact on the organization, using advanced analytics to support good management practices and business transformation. The group provided contributions on a wide range of business issues, including pricing, client attrition, product propensity, financial advisor segmentation, revenue forecasting, financial advisor compensation, business strategy impact evaluations and portfolio optimization. The team employed a wide range of modeling techniques across different types of projects, including data mining, design of experiments, multi-variate statistics, simulation, and optimization. Looking to the future, the team sees many opportunities to continue applying analytics and modeling at Bank of America and to continue providing added value to the business. **IORMS**

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