

The Merton Default Model: As Good As It Gets?

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MERTON DEFAULT MODELS – AS GOOD AS IT GETS?

The Merton model has a long and celebrated history in the investment industry. It is ensconced in the risk machinery of many major insurance companies, pension funds, hedge funds, and banks. It endures for many reasons, including institutional inertia, apprehension over adopting new technologies, and, in many instances, the notion that however constrained by its reliance on an option pricing framework and its overt neglect of macro factors, the Merton model performs as well as anything else out there.

Risk practitioners and regulators have advanced their thinking on the role of macroeconomic factors in predicting individual company risk. As a recent article in American Banker stated, *“Up until now, virtually all thinking about systemic risk assumes that it’s financial-market instability that causes macroeconomic risk, not the other way around.”*¹

The Kamakura Risk Information Service “KRIS” Jarrow-Chava default model is exceptional in that it incorporates macro-economic factors, as well as market prices and volatilities and company financial data to create a powerful default model that looks across all categories of credit drivers.

Consider Stein Mart (SMRT), which filed for bankruptcy this week. **Figure 1** below shows the company's landing page in our KRIS online service.

Figure 1: Stein Mart Inc KRIS Summary



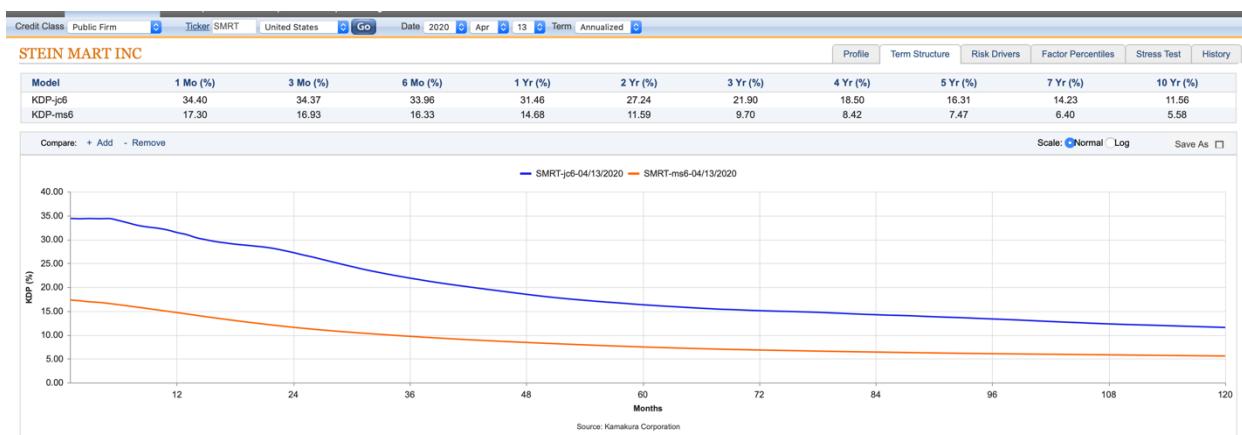
A special feature of reduced form default probability models is its potential to construct full default probability term structures. Their term structures are created much in the same manner as interest rate term structures. Monthly values are smoothed to form a curve so that daily values can be interpolated. These term structures are updated daily in KRIS, and details are available to our clients.

¹ American Banker – What's systemic in the secondary mortgage market? Don't ask the FSOC. July 21, 2020

One of the advantages of default probability term structures-- first noticed by our clients-- is their ability to signal trouble ahead. Term structures of default probabilities are normally positively sloped. However, when the curves invert, it typically indicates a near-term default event, a loan restructuring, or a period of severe credit stress for the bond issuer or credit counterparty.

Stein Mart's default probability term structure appears in **Figure 2** below. Note: it's dated six months ago, when insights about the company's future would have been extremely helpful to a lender, a CLO holder, a swap counterparty, or direct investor.

Figure 2: Stein Mart Term Structure



The chart in **Figure 3** below displays the Merton Structural (MS) one-year default probability model (displayed in orange) versus two Jarrow-Chava (JC) models, one for a three-month and one for a one-year default probability (displayed in red and blue, respectively). The JC models, which notably include a selection of macro factors, outperform Merton in two obvious ways: They react farther in advance and they react more dramatically. Notice how the default probabilities jump nearly 100 percent over those of MS in February and March, and pretty much maintain that spread.

In case you are wondering, the KRIS model testing regime applies a special test to identify false positives: the Falkenstein-Boral test. It's described in the KRIS Technical Guide.²

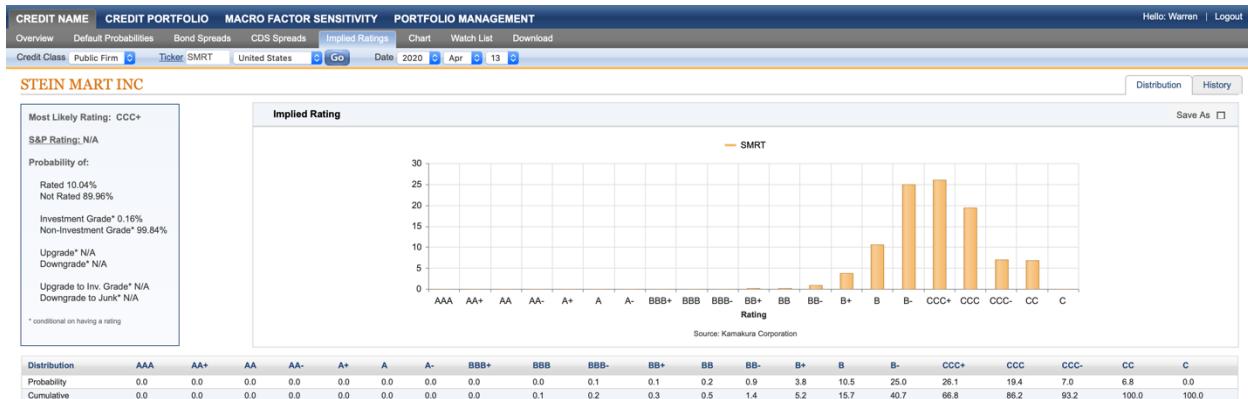
² KRIS Technical Guide, Version 6, page 65.

Figure 3: Stein Mart 1-Year KDP vs. Merton



While Stein Mart (SMRT) is not rated, KRIS can impute its rating equivalent (**Figure 4**). It relies on statistical analysis to impute a distribution of implied ratings based on the rating history and behavior of the S&P ratings universe. Based on that analysis, Stein Mart's likelihood of holding a non-investment grade rating was 99.84% in April of this year. Note also that other measures, which appear on left, include probabilities of a single-notch ratings upgrade or downgrade (for companies that are rated), and the probabilities of moving from investment grade to non-investment grade and vice versa. This is especially relevant for asset managers and investors who are constrained by policy to divest non-investment grade holdings.

Figure 4: Stein Mart Implied Rating



Sector analysis answers another question: How does a given firm compare with its industry peers? Does its trouble reflect the sector as a whole, or is it idiosyncratic?

In **Figure 5** below, SMRT's one-year default probability is represented by the skyline on the chart below (figure 5). The industry median is the dark gray line at the bottom, and the 75th and 90th percentiles are the two lines above the median. As can be seen, the risk of SMRT's defaulting is well outside the range of its peers. In KRIS, the data is updated daily, and the time series can be charted back 10 years or more for long-range comparative analysis.

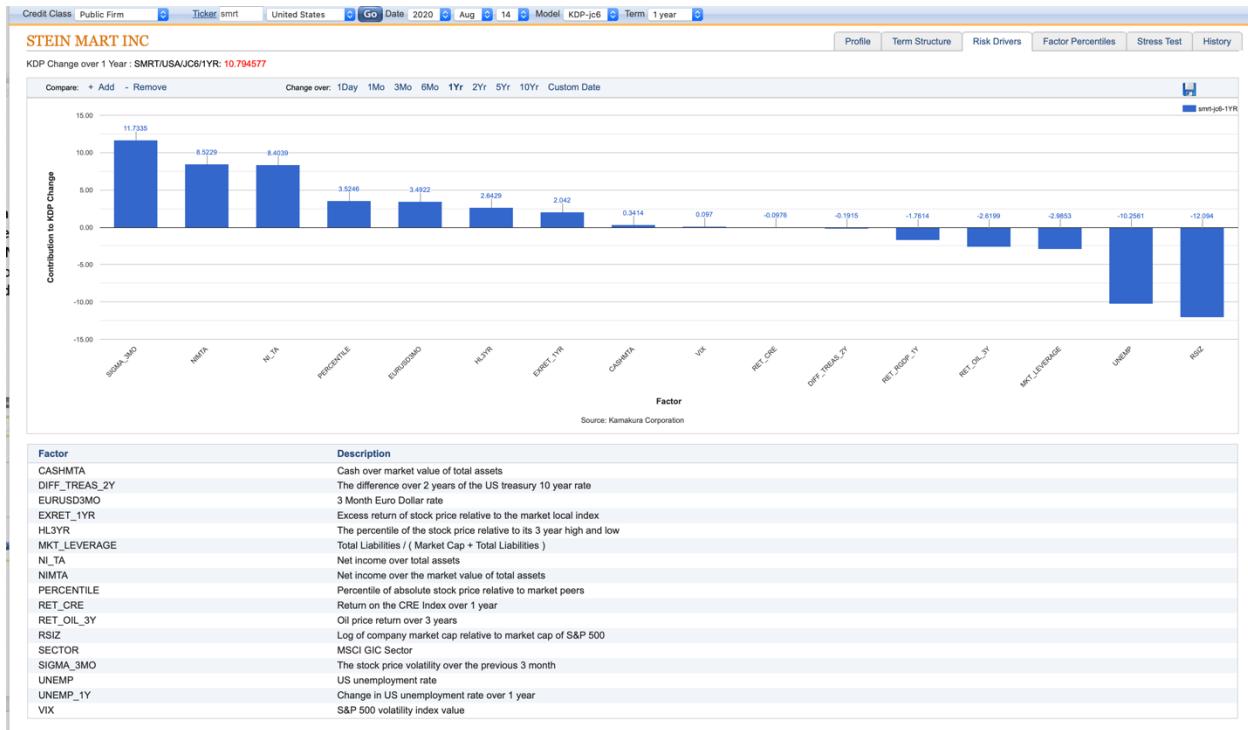
Figure 5: Stein Mart vs. Sector



With KRIS, reduced form models not only identify the relevant risk drivers, they estimate their marginal effects on default probabilities. During the calibration process, each regression run and pass through the data generates a new set of coefficients for each firm and for every month, for 10 years.

The coefficients for SMRT's one-year default probability for its top variables are charted in **Figure 6** below. They impact the one-year default probability both positively and negatively (i.e., negatively-signed values reduce default probabilities). The default probabilities for a given term are computed by formula, which includes the product of the factor coefficients and the factor values for the date specified. Coefficients are effectively risk betas, and can be used to hedge credit exposures, a byproduct of reduced form modeling that is not available in any other models.

Figure 6: Factor Analysis



Every technology has a lifecycle. When it first appeared, Merton Structural default modeling was regarded as break-through. But advances in computing technology and finance theory since then have led to more modern approaches for measuring default risk. As we pointed out in our [April 3 release, The Debate about Reduced Form Credit Models Versus the Merton Model is Over](#), the credit crisis gave us some costly lessons about reliance on ratings and neglecting macroeconomic risks.

A more recent shock occurred earlier this year occurred, when oil prices fell below \$20. Did your stress test modeling allow you to anticipate the effects of the price drop on holdings in the energy sector, including energy loans in CLOs? As the FSOC recognized when it implemented a series of banking stress tests following the credit crisis of 2007-8, managing systemic risk is largely about understanding the impacts of macro factors.

Blog Written by Warren A. Sherman with input from Martin Zorn