Credit Modeling: Structural Model of Default

Motivation:
The purpose of the project is to establish a robust but simple framework linking the credit and equity markets. The Project quantifies the implied credit risk of a bond based on equity market parameters and investors can potentially spot emerging credit problems and identify either technical or fundamental factors that may be driving bond spreads. For trading-oriented investors, this may give rise to interesting relative value and cross market trading opportunities. However, the project doesn't intended to be a credit pricing model per se but it identifies firms where the credit and equity markets may be developing divergent views of the credit risk outlook. Such situations may indicate emerging risks or opportunities, or else a need to adjust or update one of the inputs.

Model Description:
The relationship between corporate debt and equity was first formally proposed by Black and Scholes (1973) and Merton (1974). These authors observed that equity may be modeled as an option on a firm's assets, and that the value of a firm's debt is simply the value of its assets in excess of the equity value. The approach was further developed by Black and Cox (1976) and later by Leland (1994). According to their approach (which we will refer to as the structural model), an event of default occurs when the asset value of a firm crosses a predetermined default barrier or threshold. We use the structural model framework to develop a link between credit and equity derivatives. In this framework, we value credit as an exotic equity derivative whose pricing formula can be expressed in closed form. For detailed technical descriptions, please find attached the project submission document.

Implementation:

In the project, this tool quantifies the equity market implied credit spread based on the firm's capital structure, stock price and volatility (model spread) of S&P500 entities. These spreads are then compared with CDS spread (market spread) of these names trading in the credit markets. Any divergence between these two spreads are highlighted as potential changes in risk of the entity or a trading opportunity to be further analyzed. The tool allows us to easily scan the world of S&P500 names and highlight the stocks for which there is such a divergence. In such cases, we further analyze the factors behind the divergence in the spreads and take a market view to gain from these divergences.

We have used the Industry Classification Benchmark (ICB) to classify the S&P500 names among different sector and industries. The Equity implied CDS has been calculated over 2005-2013 and then a time slicer has been provided to easily focus on the period of particular interest such as various market crashes. One can observe the relative movement between model implied spread and market CDS for the stock and time of choice.

There are two possible cases:

1. Market CDS spread is wider than model CDS spread:
   This implies that the perceived credit risk of the firm is higher in the market than that implied by the equity data. In such a case, we propose to short the stock and short the single name CDS. The rationale being that either the market spreads will improve or the equity quality will decline bringing the model and market CDS spreads in line with each other.
2. Model CDS spread is wider than market CDS spread:
   This implies that the risk implied by the equity data is higher than that perceived by the market. In such a case we go long the CDS and long the stock. Effectively betting that either the market spreads will widen or model spread will tighten thus bringing them in line with each other.

Obviously, these trades are merely suggestions and further analysis will give us better insights about the fundamental factors driving the changes in the view. One can then take a more researched view on the firm and put up a hedge trade in equity and/or credit market. Also, there might be a relatively constant spread between

the model CDS spread and market CDS spread which might be due to modeling inaccuracies. However, we are primarily interested in the diverging behavior of the model spread with respect to market CDS spread.

Given below, I have provided an example on **BestBuy Co. Inc.** of how the model can be used to analyze potential transactional opportunities or to monitor changes in the credit riskiness.
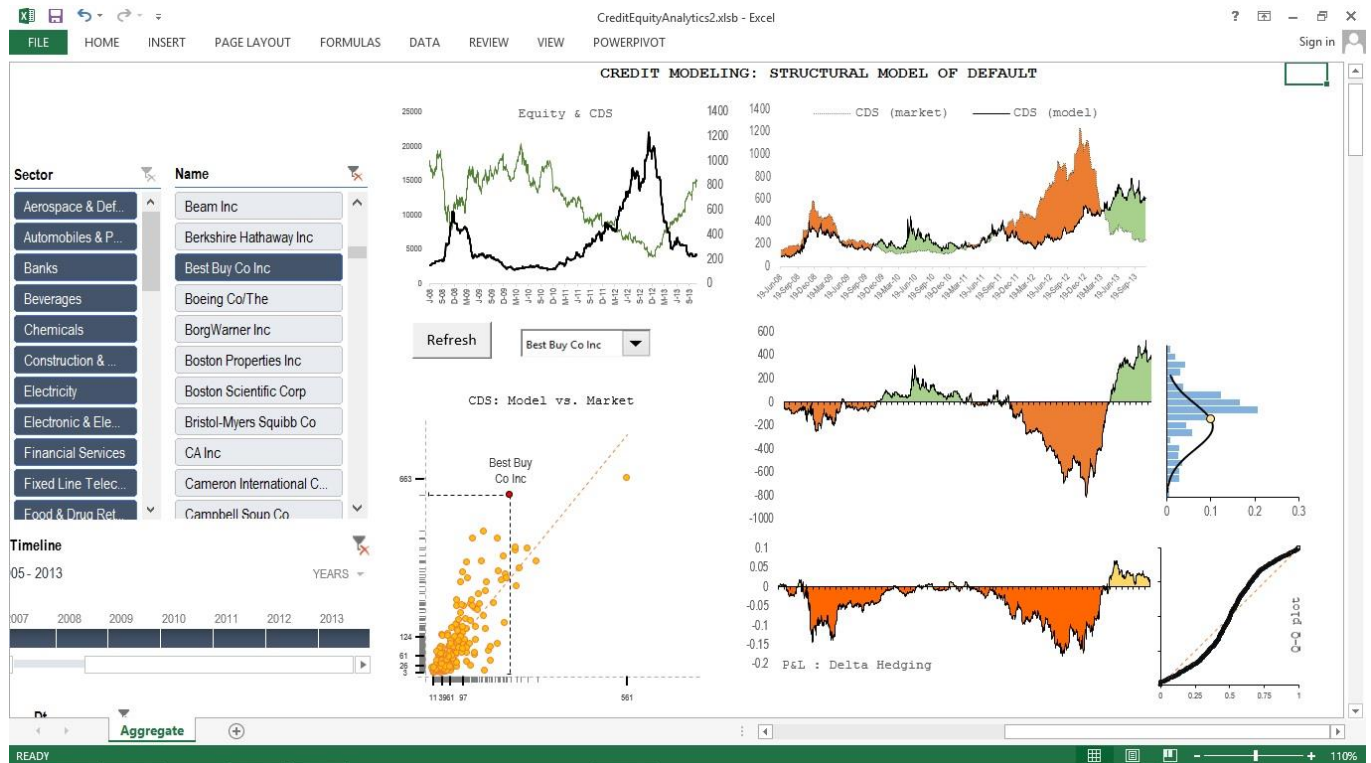
In the above tool snapshot for Best Buy Co Inc for 2008-2013, we see a mean reverting behavior for the spread between CDS (market) and CDS (model). This mean-reverting behavior might not be observed in all the stocks in the given time period, but the tool enables us to filter these stocks first and then further analyze them. In the particular case at hand, we have 4 entry/exit points when the market v/s model spread moved from orange to green in the diagrams above. We can further analyze the historical market news and firm specific factors to firmly establish the model findings.