

# The Origins and Evolution of Credit Risk Management

Credit risk can be traced back thousands of years. But where exactly did it come from and what are its basic tenets? What events changed the course of credit risk history? And who were the true innovators of credit risk management? **Aaron Brown** takes us on an interesting journey, from the ancient origins of credit to the birth of ratings agencies, all the way through modern-day deficiencies in understanding probability of default.

**C**redit is much older than writing. Hammurabi's Code, which codified legal thinking from 4,000 years ago in Mesopotamia, didn't outline the basic rules of borrowing and didn't address concepts such as interest, collateral and default. These concepts appear to have been too well known to have required explanation. However, the Code did emphasize that failure to pay a debt is a crime that should be treated identically to theft and fraud.

The Code also set some limits to penalties. For example, a defaulter could be seized by his creditors and sold into slavery, but his wife and children could only be sold for a three-year term. Similarly, the Bible records enslavement for debt without disapproval; for example, the story of Eli'sha and the widow's oil concerns the threatened

enslavement of two children because their father died without paying his debts. But the Bible also goes further than Hammurabi in limiting the collection rights of creditors — purely as a matter of mercy.

The modern bankruptcy concepts of protection from creditors and extinguishment of debt are entirely absent from both Hammurabi and the Bible. For most of history, credit default was a crime. At various places and times, it was punishable by death, mutilation, torture, imprisonment or enslavement — punishments that could be visited upon debtors and their dependents.

Unpaid debts could sometimes be transferred to relatives or political entities. But that does not mean the law was creditor friendly. The Bible prohibits charging interest (usury), which removes any incentive to lend. It also specified general releases from debt. Aristocrats, especially sovereigns, would frequently repudiate their debts and sometimes debts in general.

Considering the potential consequences, one has to wonder why anyone borrowed or lent money in ancient times. Borrowers risked horrendous consequences from default, while lenders faced legal obstacles to collecting money owed — and to making a profit. Both sides also risked strong social disapproval if money was not repaid.

Moreover, moralists and lawmakers favored equity financing over credit. Under an equity financing arrangement, both successful and unsuccessful outcomes could be resolved without expensive legal proceedings. Documentation and oversight was also much simpler. Even the equity financing language was — and remains — biased with words like “equity” (which means “fair”) as opposed to negative words like “debt” and “liability.”

To answer the question about why people engaged in credit agreements, we must go even farther back in history and replace written sources with guesswork. Credit risk arose before financing of business ventures. There is credit risk, for example, when a farmer says to a stranger, “Help me harvest my crop, and I'll give you two baskets of grain.”



The Bible is hostile even to this form of credit, saying you should not let the sun go down on an unpaid wage. Surprisingly, this belief even has support today, as some fundamentalists insist on paying all employees in cash every day before sundown.

The trouble with this approach, of course, is that it requires the farmer to have cash or goods to spare before the harvest is in. More generally, in any economy, you need a money supply at least equal to the total value of all goods and services in the process of production.

### The Role of Credit

Credit risk is a necessary consequence of a vibrant economy. Everyone involved in complex production processes must wait for payment until the goods or services are delivered to the final consumer — or even later if credit is extended to the consumer as well. When there is a failure in the process, the loss must be allocated among the producers. Intermediaries, like banks or mints, can transfer the payment delays and the credit risk among producers, or between producers and outside investors. These intermediaries can also reduce the amount of delay through fractional reserves and the amount of risk through diversification. But payment delays and credit risk cannot be eliminated entirely without stifling the economy.

The “normal course of business” credit risk is essentially local. A feed and grain supplier will make credit decisions based on reputation and direct observation of local farmers. There is no sharp distinction between credit judgments and general business judgments; and there is no demand for credit ratings, because credit suppliers know more about their customers than outside agencies. Moreover, credit analysis depends on detailed knowledge of the specific business and local conditions. Borrowers do not have generic financial statements or other data suitable for analysis by faraway professional credit raters. Larger scale institutions, like banks, gather their own private credit information or rely on correspondents.

This began to change in the United States in the mid-19th century. Railroads required huge capital investments thousands of miles distant from providers of capital. The corporate organization meant creditors had to depend on the assets and earnings of the business, rather than a government or bank guarantee. Railroad creditworthiness cannot be determined by local observation, but requires knowledge of overall transportation infrastructure and the economics of all goods that are shipped by rail. Generic information about freight tonnage, rates and costs is more important than specific knowledge of things like track quality or personal honesty of managers. Potential creditors could not get this information from companies directly, because consistent and reliable financial statements were a century in the future.

### The Rise of Ratings Agencies

Encouraged by the aforementioned conditions, Lewis Tappan founded the Mercantile Agency — which became Dun & Bradstreet — in 1841. This company provided commercial information on businesses throughout the United States to subscribers. About the same time, a specialized financial press emerged. When Henry Varnum Poor became editor of *The American Railroad Journal* in 1849, he began publishing financial and operating data of US railroads. It later merged with a competitor, Standard Statistics, which became Standard & Poor's.

John Moody's innovation in 1909 was to combine the credit reporting of Dun & Bradstreet with the investor focus of Standard & Poor's. He was arguably preceded, in 1899, by Alfred Best, who did for the insurance industry what Moody did for railroads. The difference was that Moody's quickly expanded to cover almost all bond

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issuers, while A. M. Best remained an insurance company specialist. John Fitch jumped into the ratings business in 1913 and Standard & Poor's got its official credit ratings start in 1916.

Due to a lack of data for estimating reliable default probabilities, ratings remained qualitative. Historical financial data were sketchy and unreliable for railroads, and almost nonexistent for other types of businesses. Moreover, the rational federal bankruptcy process was new, and defaults in earlier periods were difficult to define and measure. Defaults were concentrated in panics that seemed to occur every 20 or 30 years; so it would have taken hundreds of years of observation to estimate reliably the frequency of such events.

The first major attempt at quantification was W. Braddock Hickman's three-volume study of US corporate bonds, published between 1953 and 1960. Hickman tabulated default rates and investor returns from bonds of different credit ratings and other characteristics. He had all the facts, but his economics training led him to the wrong conclusions and planted seeds that contributed to the junk bond bubble, the S&L and pension fund crises and the evisceration of the ratings agencies.

The silver lining was that, as older practitioners took

Hickman's wrong turn, the field of credit risk management opened up to young innovators. People under 30 did most of the important credit risk work from 1965 to 1975. This led to rapid progress and blessed the field with luminaries like William Beaver, Edward Altman, Robert Merton and others who have contributed at the forefront for their entire adult lives.

Students trained or inspired by this generation led the renewal of the profession — including the revival of ratings agencies — that began in the 1980s. The study of consumer credit risk, which never had the historical baggage that weighed down the corporate credit risk, provided important cross-fertilization.

For the first time, risky-debt investors were able to acquire reliable estimates of default probability. With qualitative ratings, we knew that AAA debt is safer than BB, but we didn't know how much safer. On top of the reliability factor, quantitative estimates also led to tremendous innovation in fixed-income portfolio management, which began a virtuous circle with innovation in fixed-income products.

### Evolution of Lenders

The next quantitative challenge was to estimate exposure at default. Historically lenders fell into one of two groups: (1) managed lenders (such as banks) and sophisticated trade creditors who monitored financial conditions closely and attempted to get all their money secured or out before default; and (2) fixed-amount term lenders and unsophisticated trade creditors who took most of the losses but saved on monitoring expense. The first group had little pure credit risk; the second group knew its exposure.

Over the last 25 years this situation has changed for several reasons, including the explosion of derivative trading and hence derivative counterparty exposure. In the credit scandals of recent years, the surprise is often not that the borrower defaulted but how much money creditors had lent it. A lot of good work has been done in this field — much of it borrowed from market risk — but it is nowhere near finished.

An important credit risk definition is that expected credit loss equals probability of default times expected exposure at default times expected loss given default. The last term is also the last one to receive concentrated quantitative attention.

Until Michael Milken's junk bond revolution of the 1980s, it was hard to define expected loss given default. Newly issued debt was almost always investment grade, meaning that default required drastic changes to the business; and it's hard to forecast recovery rates conditional on drastic future events. Measuring the decline in bond prices as a result of the default was also difficult, because there

was not much liquidity in low-rated and defaulted bonds.

Large bankruptcies often involved complicated exchanges and choices that made it hard to match specific recoveries to specific credit exposures and even harder to estimate present values at time of default. To evade this issue, many institutions combined probability of default and loss given default in a single credit rating.

Fast forwarding to present day, Basel II requires dual ratings for obligor probability of default and facility expected loss given default. Painstaking empirical work is chipping away at this problem, but estimating recovery rates remains more art than science.


### Back to Basics

The work on exposure at default and loss given default has highlighted deficiencies in understanding of probability of default. Early research defined default as missing a payment or filing for bankruptcy. These events are easy to determine and thus convenient for early progress in estimating probabilities. As the marketplace evolved, probability was defined over fixed time intervals.

Lenders sometimes restructure rather than default. Restructurings form a continuum from those that involve no loss of economic value to creditors to those that make creditors claims almost worthless. These clearly contribute to creditor losses and thus should be included in loss given default. If we do this, it's easier to measure the loss given default but harder to define default and hence harder to estimate probability of default.

To estimate exposure at default, we need to know the future time series of probability of default, not just the cumulative probability over specific intervals. Even the probability over every interval is not enough; we need to know the dynamics of the process. There has been quite a bit of work done on this problem for the purpose of pricing credit derivatives, but unfortunately it has proven hard to reconcile with risk management default probability models. This has been a dilemma in the past and will continue to be a major challenge in the future, especially as active credit risk management strategies gain popularity.

Credit risk has been around for millennia. Good qualitative credit ratings have been around for a century. Serious quantitative credit risk estimates have a 40-year history. Quantitative progress was slowed by confusion within the profession, but regulators, ratings agencies, practitioners and academics have been working together for at least the last five years. Consequently, for the first time in history, it seems likely that the problem of credit risk can be solved. ■

 **AARON BROWN** works as a vice president for Morgan Stanley, converting credit risk models and systems to Basel II standards. He is also a member of GRR's editorial board, and has spent the last 17 years working in risk management at Citigroup, Rabobank and JP Morgan.