

# Credit Risk Assessment

The New Lending System  
for Borrowers,  
Lenders, and  
Investors



**CLARK ABRAHAMS    MINGYUAN ZHANG**



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*To Judy, Brad, Candice, and my lifelong mentor, Estella Hunter.*

—CLARK ABRAHAMS

*To Lily, our parents, and Amy, Larry, and Gary.*

—MINGYUAN ZHANG







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# Preface

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**I**n September 2008, the subprime mortgage crisis that began earlier in 2007 evolved into a global financial crisis, and further deepened the economic recession. This is the most serious economic downturn since the Great Depression and there are many opinions and theories concerning its causes and perpetrators. However, the root cause can be traced to incomplete credit risk assessment in lending systems that failed to qualify borrowers for appropriate and affordable loan products. Disconnects between lenders and investors, and lack of transparency in loan underwriting, rating, and securitization processes, only made matters worse. Simply recalibrating existing models and choosing the path of least resistance is a bad strategy that will fail to solve the problem at the root cause and expose us to more of the same. Hence, it is out of necessity that a paradigm shift in the lending system will emerge that benefits both lenders and borrowers, while promoting greater financial market stability and confidence among investors.

There are several factors that have hindered evolutionary improvements in these processes. First, very complicated proprietary processes are involved. There has been an overreliance upon, and lack of understanding of, technically complex credit granting and loan securitization practices and their associated assumptions. Part of the reason is the “secret sauce” nature of credit scoring models and how they are developed. Some solution vendors have steadfastly refused to share the details of their processes with federal regulators. Further complicating matters was the emergence of asset-backed securities, which evolved into very complex packaging of cash flows from the underlying securities. In the case of mortgages, those underlying securities added complexity due to imbedded options and

elaborate pricing features. Furthermore, all parties have so much invested in the status quo, including credit scoring, that their thinking and perceived options seem to have been constrained by the presumption that any improvements in the system would build upon, rather than replace, what currently exists. There is a common mind-set in business, namely “If it isn’t broken, don’t fix it.” This sort of “Do Nothing” rationale, like the argument against preventative medicine, is just plain bad thinking. With any business solution, critical assumptions need to be identified and rechecked periodically. Fixing a system after it breaks is far more costly than if corrections are made in time to avoid failure.

This book describes how a new and comprehensive lending framework can achieve more complete and accurate credit risk assessment, while improving loan transparency, affordability, and performance. We introduce the concept of the underwriting gap, the starting point of the crisis, in order to expose weaknesses, and then offer a new way to evaluate and balance the risk to the lenders and investors, and the affordability for the borrowers. Instead of more narrowly addressing improvement of the lending system from the lender’s perspective, this book describes how a comprehensive credit assessment framework (CCAF, pronounced “See-Caf”) connects lenders, borrowers, and investors, with greater transparency. Existing credit risk assessment approaches put too much emphasis on past loan performance and historical market conditions but not enough on borrower capacity, new mortgage product risk characteristics, and economic cycles. CCAF would have provided early warning of the dangers because it provides forward-looking analyses and does not rely on the premise that the past determines the future. CCAF effectively signals deterioration in underlying instruments and considers a far broader range of possible future outcomes. Further, it identifies growing risk concentration exposures and emerging delinquency and default trends early on in the process to allow the course of events to be altered for the better.

The new lending system we propose represents a departure from the status quo, and may seem a bit unfamiliar and complex. There is a natural tendency for people to confuse lack of familiarity with complexity. In reality, the proposed new lending system will actually simplify today’s current underwriting processes, and make them more consistent, effective, and transparent. As with any solution, the “devil is in the details.” In this book we do more than describe a framework that provides sufficient

context to address the problem. We take it a step further to specify how the framework works, with extensive examples throughout. The new lending system offers an alternative to the current way of doing business that will benefit borrowers, lenders, and investors. It will ensure that the true credit risk is captured and the loan product chosen in order to maximize affordability over the life of the obligation. CCAF can help prevent future financial disruption and can be easily modified for loss mitigation for loans facing foreclosure and for reevaluation of securities backed by those loans. We hope the new credit system described in the book will meet with acceptance and help bring about the changes that are needed to strengthen today's credit system and restore confidence.

## ORGANIZATION OF THE BOOK

**Chapter 1, Unpacking the Financial Crisis.** This chapter provides an overview of the current financial crisis and its implications. We first survey opinions and theories about causes and perpetrators. We trace the root cause to weaknesses in loan underwriting practices and lending systems, and identify the main drivers that undermine borrowers, lenders, and investors. We discuss the fallout from various perspectives including all key participants. Clearly, the current lending system needs a major overhaul.

**Chapter 2, The Case for a Comprehensive Credit Assessment Framework.** In this chapter we explain why a new generation of lending systems is needed. We first provide a historical review of credit market developments and point out areas where a comprehensive risk assessment framework can help. We next provide a system overview and describe the main components and interplay of this new system. Various examples are provided to demonstrate how this framework can improve the current lending system with respect to transparency and accuracy.

**Chapter 3, The Lender and the Underwriting Gap.** This chapter describes the notion of the underwriting gap and how it affects lenders' underwriting practices. We first define and identify the gap components and explain how each of them contributed to the flaws in the current system. In particular, we describe typical issues associated with credit scoring models and how improper use of credit scoring in underwriting leads to underestimation of the borrower's credit risk. We describe how the new system addresses and closes the underwriting gap.

**Chapter 4, The Borrower and Loan Affordability.** This chapter describes how the current lending system fails to address loan affordability. We provide detailed examples of different kinds of loan products and borrowers and how interests are better served by this new system. The added transparency afforded by CCAF will boost borrowers' financial literacy and improve their credit standing and loan performance.

**Chapter 5, The Investor and Financial Innovation.** This chapter addresses how mortgage and capital market financial innovation relates to the crisis. In particular, we examine the connections among borrowers, lenders, and investors, and explain how transparency was lost during the entire process from loan origination through securitization and rating, and finally through sale to investors. CCAF is used to reestablish the connections by bringing greater transparency via effective monitoring of the performance of the underlying assets. As a result, investors are better informed about the risk of securities derived from loans.

**Chapter 6, Crisis Intervention and Prevention.** This chapter discusses how CCAF methodology enables development of an effective loan monitoring system for crisis intervention and prevention. We demonstrate how this monitoring system can benefit investors, borrowers, rating agencies, and lenders. We also discuss how CCAF can help government agencies anticipate lending problems through enhanced risk indicators and reporting systems. We end the book with our vision of a future credit system within a global context.

## AUDIENCE FOR THE BOOK

This book is a valuable reference for borrowers, investors, and lenders who seek a better understanding of the weaknesses in today's loan underwriting and how they are impacted by them. Armed with this information, readers will be able to recognize and better cope with those weaknesses so as to achieve their financial goals. Some ways in which this book can benefit a particular audience include:

- Borrowers, who will better understand the loan underwriting process so they can spot predatory lending tactics and avoid unsuitable or overpriced loan products
- Lenders, who will more deeply understand the consequences of loan underwriting flaws that result in high risk concentrations and losses

- Investors, who will better understand risks associated with the mortgages that back their investment security and how those risks affect the performance and value of their investment
- Regulatory agencies, who will more proactively spot issues using new monitoring methods and technology

This book is also a valuable reference for use in developing countries where credit products are rapidly evolving and the need to avoid financial disruption is pronounced.

CLARK ABRAHAMS  
MINGYUAN ZHANG







# Unpacking the Financial Crisis

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*A problem well-defined is half solved.*

—JOHN DEWEY, EDUCATIONAL PIONEER

In September 2008, the subprime mortgage crisis emerged as a global economic crisis that rocked the world's financial system and triggered responses from governments of many countries. On October 3, 2008, the Emergency Economic Stabilization Act of 2008 was signed into law to provide for a troubled asset relief program (TARP). Under this program a \$700 billion liquidity pool was made available to purchase or insure any troubled assets and to cover any administrative and custodial expenses associated with purchasing, insuring, warehousing, and selling those assets. Government officials felt tremendous pressure to take swift action because they feared that the global financial system might collapse. However, the global financial markets have remained unstable with elevated systematic risk indicators, despite some significant financial market adjustments through a series of interventions carried out by the U.S. Department of the Treasury and the Federal Reserve System. According to the Global Financial Stability Report (GFSR), the International Monetary Fund (IMF) estimates that losses on U.S. subprime assets and securities will total \$1.45 trillion—more than 59% above April 2008 estimates of \$945 billion.<sup>1</sup> The crisis has caused the U.S. economy to continue to shrink. On October 30, 2008, the U.S. government confirmed that the gross domestic product (GDP) declined at an annual rate of 0.3% in the third

quarter, the largest contraction in seven years, while consumer disposable income declined 8.7%, the biggest drop on record.<sup>2</sup>

Based on these and other facts, it is entirely possible that the \$700 billion initial allocation will prove insufficient to accomplish what is needed. The fact is that financial firms face simultaneous pressures posed by a reduction in assets, difficulties in raising capital, and challenges associated with implementing new business models. Hence, it is vital that we first seek to understand what is going on (that is, what caused the crisis, who played an active role in bringing it about, and what processes and controls failed to prevent it from reaching its enormous scope and scale). Failure to define a problem fully before solving it can result in flawed strategies that waste precious time and resources. In the business world, we call these “Ready, Fire, Aim” strategies. Only too often, they occur when there is never sufficient time devoted to fixing things right in the first place, but always enough time to repair them over and over again. It is in this spirit that we devote this first chapter to surveying various opinions concerning the causes of the current financial crisis; its impact, consequences, and implications; and finally the role of loan underwriting, which we see as being at the core of the problem.

It is abundantly clear that restoration of the public’s trust in financial institutions, and in securities that are derived from the loans they make, demands that we fix the flawed processes in loan underwriting and associated securitization process. Fixing the problem will require a new generation of lending systems, not a Band-Aid, if we truly hope to avoid similar future crises. In this book, we share our ideas for a new, comprehensive, and systematic approach to credit granting that combines the best of science, proven credit principles, and common sense. The success of this new approach will hinge partly on the lending industry’s willingness to invest time, effort, and resources to shore up gaps that have crept into our evolving consumer credit system over several decades.

This chapter provides an overview of the current financial crisis, the causes, the impact, consequences, and implications. There are many factors that are attributed as the causes of the crisis. Our focus here is on the major kinds of market participants, and how each of them is perceived to have contributed to, or been victimized by, the crisis. Our goal is to trace back from the events and consequences to identify the root causes, some of which remain obscured by layers of business processes

and by proprietary systems whose accuracy historically has been taken for granted and whose data, assumptions, formulas, and logic were thought to be valid.

## THE FINANCIAL CRISIS

The financial crisis started with a downturn in the housing market of the United States in 2005–2006 after the growth in home prices in 2004 had surpassed any increase in the previous 25 years.<sup>3</sup> Increased foreclosures on subprime mortgages raised concerns about the underwriting standards and the value of a number of mortgage-backed securities (MBS). These realizations became even more pronounced throughout 2007, and by 2008 the pervasiveness of the problems caused more widespread consequences and exposed severe weaknesses in the global financial system.

There have been many different financial crises in the past.<sup>4</sup> All were caused by a variety of factors, and they each had different magnitudes and impacts on the economy. The current financial crisis is of a magnitude not seen since the Great Depression of the 1930s. There are significant differences between today's situation and that of the Great Depression. Although it is still unclear how the current crisis will eventually play out, its breadth of scope and sheer magnitude are astonishing.

- **Scope.** The initial quality deterioration of U.S. subprime mortgages represented a credit event that rapidly transformed into a liquidity and solvency issue. This spilled over into a broader credit crunch and to many other financial products and market areas, further widening the economic crisis. Prime lending markets were affected because homeowners with more conventional loans saw their property values and equity decline. When homes in neighborhoods are left vacant in the aftermath of foreclosure, the impact is felt by all.<sup>5</sup> Around 40 million such homes will suffer price declines averaging almost \$9,000, which translates to a \$350 billion drop in value.<sup>6</sup> Current projections are that there will be nearly 2.2 million subprime foreclosures occurring in 2008 and 2009.<sup>7</sup> Investors, both domestic and foreign, saw the ratings of AAA MBSs severely downgraded, and banks withdrew loan products from the market that featured low down-payment, interest only option pricing loans, and adjustable rate mortgage products with teaser rates. As

a result, speculators who bought homes hoping to flip them for a quick profit found it difficult to find borrowers who would qualify for higher monthly payments. And real estate developers who built spec homes and were in the process of developing entire subdivisions of single-family units also found housing demand slack off, and in many cases evaporate. Banks financing developers with acquisition and development loans found those loans slipping from pass credit grading to special mention or substandard status. This caused loan loss reserves to ramp up significantly. Liquidity shocks contributed to the rapid transmission of turbulence that began in the relatively small U.S. subprime mortgage market and spread to other financial markets in the United States and abroad.<sup>8</sup> According to the IMF, the ongoing deleveraging process has accelerated and threatens to become disorderly, increasing the risk of a severe adverse feedback loop between the financial system and the broader economy.<sup>9</sup>

- **Magnitude.** Losses have been astronomical. On a global scale there were write-downs of \$585 billion by financial institutions, one of the most costly ones ever. There were meltdowns of large financial institutions including Lehman Brothers and Washington Mutual. Since January 1, 2008, owners of stocks in U.S. corporations have suffered about \$8 trillion in losses, as their holdings declined in value from \$20 trillion to \$12 trillion. Losses in other countries have averaged about 40%.<sup>10</sup> Extreme fluctuations in financial markets have caused some investors to panic.<sup>11</sup> Volatility has ruled the markets, reflecting a general lack of investor confidence. Fear eclipsed greed as the primary driver in the equity markets, and it reached historically high levels. Holders of mortgages in the United States, approximately 70% of homeowners, have exhibited historically high delinquency rates.<sup>12</sup> A crisis of this magnitude is particularly troubling partly because it was not spotted in time to take preventative measures, and partly because top officials in the government and financial industry still appeared not to know how large the problem was at the time that the emergency legislation was passed.

In the next section, we explore thinking from a variety of sources who attempt to explain how and why the crisis came about.

## CAUSES OF THE CRISIS

There are many opinions and theories concerning the causes of the financial crisis.<sup>13</sup> In this section, we have attempted to capture as complete a range of opinions as possible. These are not our opinions, and we have taken the liberty to paraphrase what we have heard in order to provide the essence of what has been alleged. The list of suspects is long, and for ease of discussion we classified the causes into four categories: (1) market, economy, and regulations, (2) stakeholders and participants, (3) practices and products, and (4) human behavior and traits, as shown in Exhibit 1.1.

### *Market, Economy, and Regulations*

- **Housing Market Downturn.** Loss of borrower equity and real estate liquidity. The financial crisis's "proximate cause was the end of the U.S. housing boom."<sup>14</sup> This was reflected by a large decline in housing prices, which reduced the incentive of homeowners to repay their mortgages. It was estimated in October 2008 that 23% of mortgage holders owe more than their houses are worth. This was expected to increase to 28% over the next 12 months. The median home prices in the country dropped 9% from September 2007 to September 2008.<sup>15</sup> The wave of foreclosures has had a dramatic effect on house prices, reversing the housing boom of the last few years and causing the first national decline in house prices since the 1930s. At present, there is a glut of four million unsold homes that is depressing prices, as builders have also been forced to lower prices to get rid of unsold properties.
- **Regulatory and Internal Controls.** Concerns of oversight adequacy and safeguard sufficiency. Massive failure in such a highly regulated industry raises questions. For example,
  - Where was risk limitation addressed, and what were the key risk indicators?
  - What were the thresholds, who set them, and how were they determined?
  - How often was risk monitoring performed, at what level, and by whom?
  - What capital is adequate to back loans and asset-backed securities, and what additional capital is required for off-balance assets?

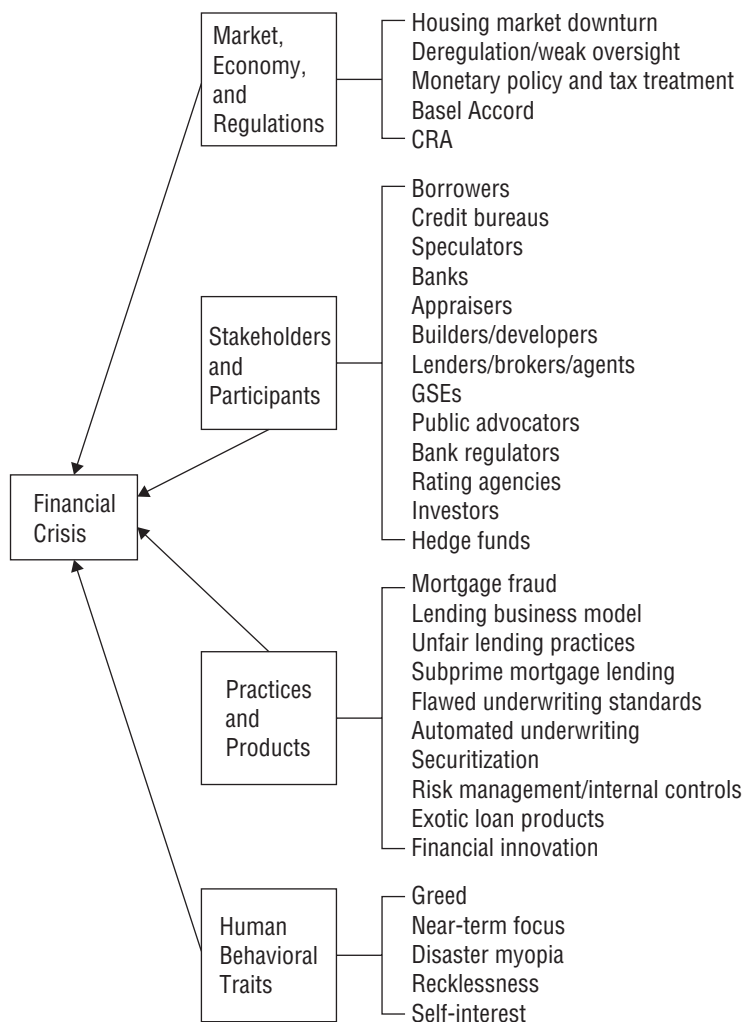


EXHIBIT 1.1

LIST OF CAUSES OF THE FINANCIAL CRISIS

- What stress testing methodology was utilized? Specifically, did stress tests, or performance simulations, include sufficient numbers of scenarios? To what degree did those scenarios capture measures that characterized business, borrower, and market realities, including extreme values of those measures that reflect the full range or risk that could be encountered? Credit risk models, in practice, have tended to underestimate the probability of

extreme outcomes, while overestimating the risk associated with more common outcomes.

- **Tax Treatment.** Income and property tax incentives at federal and state levels. These include tax deductibility for home mortgage interest, no capital gains for home sales of less than \$600,000, property tax relief via state homestead laws, and so on.<sup>16</sup>
- **Basel Accord.** Shifting risky activities off balance sheets. The 1988 Basel Accord encouraged banks to shift risky activities off balance sheets. The growth of structured investment vehicles (SIVs) and conduits were byproducts of regulatory guidelines dealing with capital adequacy. The creation of these off-balance sheet entities allowed banks to reduce the capital associated with a given risk profile. In addition, it reduced the transparency of risky activities and hid them from regulatory scrutiny.<sup>17</sup> The Basel Accord was also criticized for its lack of specific requirements for liquidity, and the accord's approach encouraged regulators to emphasize the importance of liquidity in their supervisory activities, and encourage loan securitization.<sup>18</sup>
- **Community Reinvestment Act (CRA).**<sup>19</sup> Encouragement of lending to unqualified borrowers. While CRA was intended to help improve the welfare of society, banks were criticized for not making enough loans to low- and moderate-income borrowers. Some have blamed banks for making too many subprime loans to those borrowers in response to CRA.<sup>20</sup>

### *Stakeholders and Participants*

- **Borrower.** Financially unsophisticated and irresponsible borrowing. Borrowers knew what they were signing up for and threw caution to the wind. Sometimes they gave misleading information about their income or assets in order to get a loan that they could not afford. Borrowers knew that the rates were going to rise, but bet on the appreciation of their homes. They could get a subprime mortgage at a low rate for two or three years and then refinance before the rates reset at a lower fixed rate. Some used financial leverage to borrow more money for home, stocks, or other assets. It turns out the housing market went the other way, and with lower home values, refinancing was not an option.

- **Credit Bureaus.** Incomplete credit scoring models underestimated the borrower's risk. Traditional credit scoring has been less effective in credit assessment for new and innovative loan products. For example, "the once-vaunted Fair, Isaac and Company (FICO) credit scoring system" is now being blamed for failing to signal risky borrowers in the mortgage market.<sup>21</sup>
- **Speculators.** Evidenced by nonowner-occupied property purchases in real estate market for investment purpose. Speculation in real estate was suggested as a contributing factor to the subprime crisis. During 2006, 22% of homes purchased (1.65 million units) were for investment purposes, with an additional 14% (1.07 million units) purchased as vacation homes; nearly 40% of home purchases (record levels) were not primary residences. Speculators left the market in 2006, which caused investment sales to fall much faster than the primary market.<sup>22</sup>
- **Banks.** "[L]everaged losses" theory—banks have so much leverage, they contract their lending by a multiple of their credit losses in order to restore their balance sheets. The resulting contraction in bank lending then leads to a substantial decline in aggregate spending, because bank loans cannot be replaced by credit from other sources.<sup>23</sup> Many MBSs, which were funded with short-term borrowing, were kept on bank balance sheets.<sup>24</sup>
- **Appraisers.** Inflated valuations fueled a market bubble. Conservative appraisals of home values were abandoned in favor of higher valuation. According to a 2003 study by October Research Corporation, 55% of appraisers reported being pressured by mortgage lenders, brokers, consumers, and real estate agents to inflate home values. A follow-up study released earlier this year shows that 90% of appraisers are reporting pressure to inflate home values. Appraisers depended on mortgage brokers and lenders for new business, and some submitted fake documents, failed to actually inspect the property being appraised, or based the appraisal on outdated comps. Lenders and brokers have been willing to overlook these inflated values, the theory goes, because the loans have been bundled up and resold to unsuspecting investors.<sup>25</sup>
- **Builders.** Created oversupplies of new homes. The building industry makes up 15% of the U.S. economy, and in 2006 home



construction reached its highest level in 30 years. Many assert that housing is overbuilt on the high end and overpriced. According to William Wheaton, an economist with MIT's Center for Real Estate, there was a great deal of overbuilding, driven in part by home speculators, and this resulted in more than 1 million extra homes sitting in the market, even after home building had been cut by 50% and massive layoffs.<sup>26</sup>

- **Developer (house zoning).** Artificially increased housing prices. Zoning restrictions account for a high percentage of the total cost of housing in some of the nation's most expensive real estate markets. Restrictive zoning greatly increases housing prices by reducing the amount of land on which new housing can be built and also by reducing the amount of housing that can be built even in those areas where residential construction is permitted.<sup>27</sup> Higher housing prices helped cause the subprime mortgage crisis by forcing home buyers to borrow more money in order to purchase homes of a given size and location. It was suggested that if prices had been lower, so too would homeowner indebtedness. Fewer buyers would be on the verge of default as a result of a market downturn; their debt burden would likely have been much smaller relative to their income.
- **Lenders, Brokers, and Real Estate Agents.** They displayed commission-driven behavior: (1) practiced predatory lending and took advantage of borrower's financial illiteracy and (2) aggressively made the subprime loans for higher commissions, and offered low teaser interest rate under intensive competition from other lenders. Lenders were able to maximize their revenue by disproportionately marketing and underwriting subprime loans based on introductory interest rates that were, in the long run, much more expensive. They had strong incentives to originate mortgages in large volume and relatively little incentive to scrutinize whether the loans would perform satisfactorily over time. Lenders had little incentive to worry about loan performance, knowing that the loans would be pooled for sale in the secondary market and subsequently held by investors.<sup>28</sup>
- **Government Sponsored Enterprises (GSEs).** Creation of excessive MBS. Huge quantities of loans were bought and packaged into

mortgage-backed securities. These bonds removed hazard from the banks and shifted it to investors and the federal government.

- **Independent Mortgage Companies.** Less-regulated lenders were responsible for selling high-cost mortgages. About half the high-cost subprime mortgages came from independent mortgage companies, which are not subject to CRA or the same degree of oversight that banks operate under.<sup>29</sup>
- **Public Advocates.** They overpromoted financial innovation. The National Homeownership Strategy promoted the availability of affordable housing through the use of creative financing techniques.<sup>30</sup>
- **Securities and Exchange Commission and Federal Bank Regulators.** Regulations were insufficient. They encouraged the rapid growth of over-the-counter (OTC) derivatives and securities of all types of financial institutions.<sup>31</sup> There was failure to put in place sufficient regulations.<sup>32</sup>
- **Rating Agencies.** Inaccurate ratings. Recently, rating agencies have taken a lot of heat regarding their responsibility in the subprime crisis.<sup>33</sup> They underestimated the risk of structured financial products because rating agencies are paid by bond sellers, not buyers, and their revenue mainly comes from the investment banks that created the collateralized debt obligations (CDOs) and related structured products. The role of the rating agencies in the subprime crisis will be covered in detail in Chapters 5 and 6.
- **Investment Banks/Securitizers.** Creation of exotic financial products with opacity. These participants have been alleged to have been motivated more by issuance and arrangement fees and less by concern for the longer-run performance of these securities. They created exotic and innovative structured financial products backed by subprime loans, which stimulated subprime lending and also investor demand for securities derived from risky loans. Investment banks securitized assets and created the structured financial products that were not transparent and were well beyond the understanding of the average investor.<sup>34</sup>
- **Investors.** Overreliance on rating agencies and failure to perform due diligence. In the past, rating agencies have done a reasonably good job of helping investors determine the riskiness of a particular investment security. Investors needed transparent ratings for all

securities they are considering for investment, and their confidence has been shaken by massive downgrades of MBSs, some of which were rated as highest quality (AAA).

- **Hedge Funds.** They took large long and short positions in subprime MBSs. Their assets, liabilities, and trading activities are not transparent entities and not disclosed publicly. They are often highly leveraged, using derivatives or borrowing large amounts to invest. So other investors and regulators knew little of hedge funds' activities. Because of their leverage, their "impact in the global credit markets is greater than their assets under management would indicate."<sup>35</sup> Their activities at times were thought to exacerbate market volatility and security price declines.

### *Practices and Products*

- **Mortgage Fraud.** Inflated prices. This was identified as one of the main drivers for subprime mortgage defaults. Typical fraud included misrepresentation of occupancy, suspicious items on the borrower's credit report, miscalculation of debt-to-income (DTI) ratio, and falsely stated income.<sup>36</sup> It was also suggested that some borrowers and intermediaries in the housing market inflated appraisals and overstated transaction prices, which increased foreclosure rates.<sup>37</sup>
- **Lending Business Model.** This provided little incentive to maintain loan quality. "A significant and distinctive contributing factor to the outbreak of the current turmoil was the proliferation of the originate-to-distribute model (OTD model) based on the financial technology of securitization."<sup>38</sup> Traditionally, banks have financed their mortgage lending through the deposits they receive from their customers. This has limited the amount of mortgage lending they could do. Over the past 20 years, banks have moved to a new model where they originate loans or purchase them from brokers and then transfer them to a third party who packages the loans into a CDO for sale to investors. This so-called originate-to-distribute model has made it much easier to fund additional borrowing but has also caused moral hazard, as Chairman Bernanke pointed out. This is because the model created some severe incentive problems. Commonly referred to as principal-agent problems, or more simply as

agency problems, these situations arise when an agent (the originator of the loans) does not have an incentive to act fully in the interest of the principal (the ultimate holder of the loan). Originators had every incentive to maintain origination volume, because that allowed them to earn substantial fees. However, originators had weak incentives to maintain loan quality.<sup>39</sup>

- **Unfair Lending Practices.** Predatory lending or steering. These include the practices that target minority or unsophisticated borrowers who are qualified for prime loans and then steer them into higher-priced subprime mortgages.<sup>40</sup> In some instances originators and borrowers collaborated to overstate income, misrepresent occupancy, and hide other details in order to get a loan.<sup>41</sup>
- **Subprime Mortgage Lending.** Excessive subprime lending. Subprime mortgages are based on lenders taking big risks on loans to people who could be considered less than qualified. Mortgage companies require little money down on many of these loans and offer “introductory” rates that were below the prime rate—yet subprime. Subprime mortgage originations grew from \$173 billion in 2001 to a record level of \$665 billion in 2005.<sup>42</sup> This caused a tremendous oversupply of homes, which, in turn resulted in the housing market bubble. Recent research has asserted that subprime lending drove house price increases in some areas. Mortgage credit underwriting standards were relaxed from 2001 to 2005 in zip codes with large numbers of high-risk borrowers and negative relative income and employment growth. Relaxed standards were associated with increased mortgage lending, rising house prices, and a subsequent increase in defaults, which caused the housing bubble to burst.<sup>43</sup>
- **Flawed Underwriting Practices and Standards.** Failure to gauge borrower ability to repay. Many subprime loans were awarded to borrowers without traditional screening processes, including checking the borrowers’ income figures to make sure they could pay back the loans.<sup>44</sup> Models used to assess borrower risk in mortgage lending almost exclusively restricted their input to historical data. The driving analogy is that a rearview mirror is helpful, but not for seeing what is coming at you, such as the driver who crossed the center median and hit you head on, an event that is not supposed

to happen. Underwriting standards were too busy looking back at past loan performance to pay attention to their exposure to changes in future market states and borrower conditions. Furthermore, loans having teaser rates became accidents waiting to happen when their rates, and monthly payments, escalated due to rising interest rates.

- **Automated Underwriting.** Efficient but not effective. It has been recognized that development in automated underwriting technology has played a significant role in encouraging lenders to penetrate deeper into the subprime loan pool. Subprime lenders like automated underwriting because it is cheap and fast. A 2001 Fannie Mae survey found that automated underwriting reduced the average cost to lenders of closing a loan by \$916. The software aims to quickly weed out the very riskiest of applicants and automatically approve the rest.<sup>45</sup> Obviously, automation breeds efficiency, but it must be designed in such a fashion as to also be effective. Otherwise, you have only succeeded in creating a faster way to lose money and put borrowers at risk!
- **Risk Management.** Separation of science and business. “All the drama and chaos of recent months obscures the most fundamental cause of the entire financial crisis: a basic misunderstanding of risk (abetted by heavy borrowing).”<sup>46</sup> We can put this observation in the broader category of ineffective risk management.<sup>47</sup> Because risk management techniques have become so complex and require a high proficiency of sophistication and quantitative expertise, we tend to see highly educated technicians creating the models that business people use. Unfortunately, as Stanford University Professor Sam Savage has noted, an “algebraic curtain” separates business people from the underlying science. Conversely, the scientists rarely possess sufficient knowledge of the business and market realities to ensure that their models are truly reflections of the real world. This observation extends from the use of credit scoring methodologies to the types of models used to develop mortgage-backed securities (MBSs), such as collateralized debt obligations.
- **Exotic Loan Products.** Some bank regulators have called these financial time bombs. These exotic products include (1) no down payment requirement; (2) no documented or verified income requirement; (3) an adjustable interest rate, coupled with a low

introductory teaser rate; (4) prolonged deferred principal repayment in the case of interest only option mortgages, which have a very low monthly payment for the first several years. An analogy to auto manufacturing has become common in subprime lending, where it appears one out of five subprime loans will end in foreclosure. The analogy poses the question “If one out of five cars of a specific make and model coming off the assembly line ended up in a serious accident, would people consider it a problem with the car or operator error?”<sup>48</sup> “Risky mortgage products, not risky borrowers, are at the root of the growing foreclosure epidemic.”<sup>49</sup>

- **Financial Innovations.** These have spread confusion and trapped investors. Financial innovation fueled economic growth. However, over the last several years, many innovative financial products were sold on false pretenses. This led to “the creation of complex and opaque financial instruments that proved fragile under stress.”<sup>50</sup> They were promoted as ways to spread risk and make investment safer. In fact, their creators made a huge profit and did not have to repay when it all went bust. Instead of diversifying risk, investors were lured to take on more risk than they realized.<sup>51</sup>

We also see human behavioral traits as playing a major role and it is doubtful that anyone can effectively change them.

### *Human Behavioral Traits*

- **Greed.** Chasing excessive profits. Greed is a natural tendency, and it is ever-present; it overwhelms better judgment when not kept in check. We see this as one of the core drivers of the financial crisis, and it cropped up among borrowers, lenders, investors, and many other participants who had something to gain by perpetuating what became a spiraling catastrophe.
- **Near-Term Focus.** Neglect of future consequences. It is the tendency to act to reap immediate benefits and let tomorrow take care of itself. The consequences of loose underwriting standards are years away for a hybrid adjustable rate mortgage (ARM) product, and it is not surprising that a quota-driven sales force would not trouble themselves with concern about what might happen in the future when they have to meet more immediate expectations.

- **Disaster Myopia.** Tendency to forget bad events by investors. As time passes after a shock such as house price declines, interest rate shocks, or widespread credit defaults, lenders and investors discount the likelihood of its recurrence, and then underprice risk. This is particularly the case for subprime lending in which the aggressive investor bids for above-market security yields, plus an absence of investor vetting of the collateral behind the securities.<sup>52</sup>
- **Recklessness.** Especially in light of lack of accountability. This applies to executives who chased volume for volume's sake and ignored the latent risk in their business goals. It also applies to the secondary market players who packaged future problem loans for sale to investors with insufficient diligence and care and little regard for the consequences. It also applies to rating agency analysts who certified MBSs were of their high quality without performing sufficient stress testing and performance simulations under broad sets of assumptions that would have identified the true asset value exposures to a housing market downturn or hybrid ARM loan default exposures to rising interest rates.
- **Self-Interest.** The first priority is, as a rule, always to ensure that one's own interests are met. Self-interest is a healthy and basic motivational driver. It does not imply unreasonable or disproportionate expectations, and it must not be confused with greed. This applies to all players in the financial crisis at both individual and institutional levels. Borrowers pursued their priority interest to qualify for a loan for a home that they wanted to own. Lenders competed to gain market share, satisfy their regulatory and business goals, and to move risky assets off the balance sheet to adequately maintain and balance their multitiered capital position. Investors sought investment vehicles that would secure their desired return on investment.

The mess resulting from subprime mortgage defaults can be attributed to many more factors. It arguably is a collective creation of some combination of all of the stakeholders and their practices previously shown in Exhibit 1.1. "Complexity, transparency, liquidity and leverage have all played a huge role in this crisis. . . . And these are things that are not generally modeled as a quantifiable risk."<sup>53</sup> It is easy to fall into a loop

of blame and to focus on penalizing suspected offenders. Our purpose here is more constructive. While we cannot change human traits, we can change the control structure within which the players must operate. Weakened performance and deterioration in quality of subprime loans are the key outcroppings of the underlying causes. The root cause traces back to the current lending system that approved the subprime mortgages based on an incomplete credit risk assessment.

## ROLES OF BORROWERS, LENDERS, AND INVESTORS

As we showed in the previous section, there are various market stakeholders involved in this mess. However, the borrowers, lenders, and investors are the key players who contributed most to the crisis and also suffered most from it. As shown in Exhibit 1.2, the underwriting gap is the root cause of the problem. It relates to unaffordability of loans, opacity of securities, and deterioration of loan performance, which, in turn, caused market illiquidity and bank losses. Now let us describe in detail what happened to the three market players respectively.

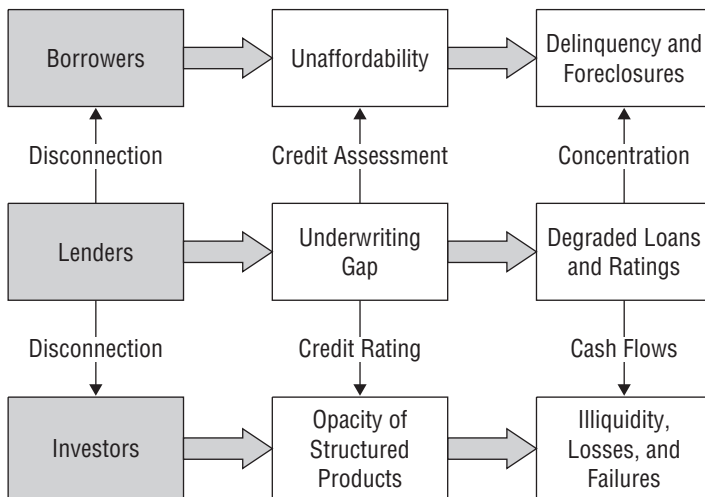


EXHIBIT 1.2

**BORROWERS, LENDERS, AND INVESTORS**



*Borrowers*

- **Situation.** The housing market was booming, house prices were increasing, and the interest rate was low.
- **Expectation.** Borrowers assumed home prices would continue to appreciate and refinancing at a lower rate would be available. They also assumed that home price appreciation and refinancing could generate equity to supplement income to support a higher standard of living.
- **Action.** The borrower obtains a nontraditional high risk mortgage that offered low introductory interest rates from a lender in order to purchase a home. Some borrowed to improve and flip properties in the hopes of turning a quick profit.
- **Reality.** The steady appreciation of U.S. home values started to slow early in 2006. The rate of home price increase fell sharply in the second quarter of 2006. With the interest rate and unemployment rate increase and the home value decrease, refinancing became more difficult. Some of the ARMs started resetting and resulted in much higher interest rates or payment shock. The borrowers were unable to refinance or make payments, which eventually led to foreclosures. These low rates did not last for long, though. After the fixed introductory period of two to three years, the rates often reset three percentage points higher. Rates then readjusted every sixth month thereafter, usually getting higher. These higher rates can drastically increase borrowers' monthly mortgage payment, often-times putting them in a situation where they could not make the payments and then ultimately defaulted. In the case of interest-only ARMs, the situation is even more pronounced because at some point the deferred principal repayment kicks in and the payment amount escalation is more dramatic, as the fully amortized principal and interest are included in the monthly payment.

*Lenders (Brokers, Banks, Originators, GSEs)*

- **Situation.** Increased housing prices and low rates boosted demand for mortgages, and ample funding was available for lending.

- **Expectation.** Lenders assumed a healthy economy would last and that they could sell the loans to the issuers and transfer most, if not all, risk to the investors.
- **Action.** Lowered underwriting standards and increased subprime lending to the borrowers with weak credit combined with intensive competition among mortgage banks. Lenders increased use of the secondary market in order to sell off mortgages to free up capital for more lending. They used inappropriate mortgage incentives such as buy-downs and short fixed term ARMs, coupled with rapidly rising adjustable mortgage rates.
- **Reality.** Decreased loan affordability and degraded loan quality resulted. Loan performance deteriorated.

*Investors (Banks, Financial Institutions, and Anyone Else)*

- **Situation.** Strong demand for complex structured financial products backed by subprime mortgage loans.
- **Expectation.** By securitizing mortgage loans they could reduce the market risk by diversification. Indications are that actual performance of the subprime mortgages in those securities were highly correlated with each other.
- **Action.** They invested in structured financial products without sufficient information to monitor or evaluate the performance of the underlying assets. Instead, they overly relied on credit ratings and did not perform due diligence.
- **Reality.** The performance of the subprime mortgage loans deteriorated, cash flow declined, value was lost, and capital levels were depleted.

## ROOT CAUSES

The downturn of the U.S. housing market revealed serious problems with the current underwriting practices.<sup>54</sup> Although many other economic factors contributed to the near failure of the financial markets, the subprime mortgage crisis was the single largest factor, which was due to irresponsible lending practices. Exhibit 1.3 shows a chain of losses and how the financial crisis began with the failures to qualify borrowers for the appropriate loan products.

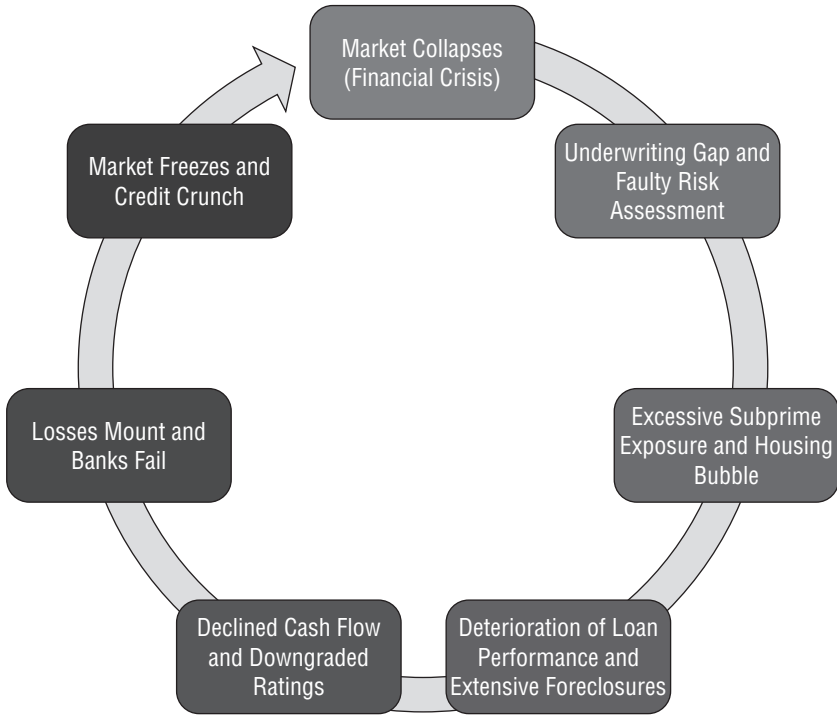


EXHIBIT 1.3

## ROOT CAUSE OF THE CRISIS

The formation of the financial crisis consists of six milestones:

1. **Exposed Underwriting Gap.** This is the starting point representing the underwriting practices that deviated from the lending business reality and borrowers' loan affordability. This resulted in faulty credit assessment of borrowers and products.
2. **Excessive Subprime Mortgage.** Exposures were created with subpar loan quality and affordability. At the same time, this inflated a housing market bubble with housing oversupplies.
3. **Deteriorating Loan Performance and Excessive Foreclosures.** Loan pricing resets further undermined loan performance and affordability, and increased loan delinquency and foreclosures.
4. **Cash Flow Shortage and Downgraded Credit Ratings.** Deteriorating loan performance constricted loan pool cash flows to investors. Subsequent rating downgrades further shattered investors'

confidence. This caused investors to pull back from structured products in general.

5. **Losses Mount and Banks Fail.** The values of the securitized mortgages and structured securities on the balance sheets of financial institutions declined, resulting in extensive write-downs. Bondholders, such as pension funds, who bought subprime mortgage bonds, suffered huge losses. Those securities fell sharply in value. It is estimated that their residual worth is only 20 to 40% of their original value for most asset classes, even those considered safe by the ratings agencies.
6. **Market Freezes and Credit Crunch.** Banks and other lenders cut back on how much credit they were making available. They began rejecting more people who applied for credit cards, insisting on bigger down payments for home purchases, and looking more closely at applications for personal loans. The adverse effects on the mortgage market have been pronounced, with individuals finding it very difficult to get nontraditional mortgages, both subprime and “jumbo” (over the limit guaranteed by government-sponsored agencies). The banks were compelled to restrict lending in this way since the wholesale bond markets dried up and also because of the effect the crisis was having on their own balance sheets.

## KEY DRIVERS OF THE CRISIS

The key drivers surrounding the chain of events explained in the previous section are shown in Exhibit 1.4.

Now we examine each of the drivers in turn.

### Inadequate Risk Assessment System

The current risk assessment is plagued by the following flaws:

- *Fragmentation:* Those primary factors that were considered were evaluated serially, not in parallel.
- *Incompleteness:* Misuse of credit scores, past credit performance, and historical market conditions and not enough future-looking criteria.
- *Overlooking the obvious:* Five Cs of credit, namely borrower character, capacity, capital, collateral, and conditions.

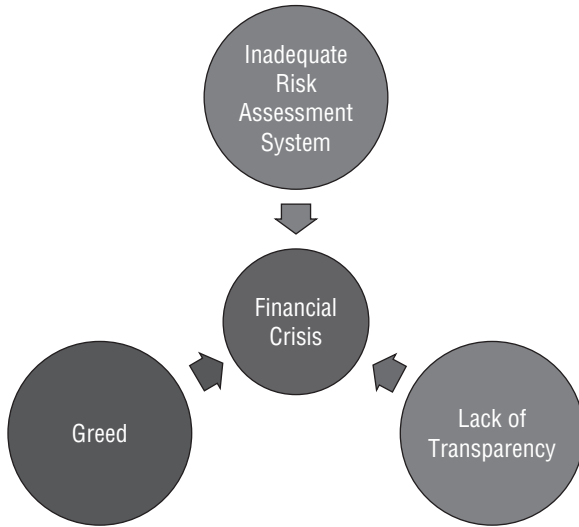


EXHIBIT 1.4

**KEY DRIVERS OF THE CRISIS**

- *Overreliance on risk quantification models* that, despite correct mathematics, are flawed due to bad assumptions and overly complex formulas that fail to reflect the true business, market, and borrower realities.

The impact felt by borrowers, lenders, and investors due to this driver is explored in depth in Chapters 3, 4, and 5.

### **Lack of Transparency**

The borrowers, lenders, and investors all suffered from lack of transparency:

- Relative to borrowers, transparency issues include the following:
  - The risks associated with loan products are not transparent to the borrower.
  - Borrower qualification criteria are not transparent to borrowers themselves, which hinders financial literacy initiatives, and confuses borrowers when they attempt to make sound financial decisions.
  - Some borrowers did not provide adequate transparency relative to their income, employment, and cash reserves. There were so-called Ninja Loans made.<sup>55</sup>

- Credit scores, which factor prominently in the credit granting process and also loan securitization process, are cloaked in secrecy, and scorecard developers have refused to divulge to federal regulatory agencies the details of their methodology. Borrowers are disadvantaged because scores may not accurately reflect their true risk, and they also do not know how to improve their score.
- Relative to borrowers, there is lack of transparency in their loan qualifications and inconsistency relative to lending criteria across the spectrum of lenders.
- To lenders, transparency issues are mainly associated with the use of credit scoring. Credit scores play an especially important role in the approval and pricing of mortgage loans, the classification of borrowers into subprime tiers, the choice of products for which consumers can qualify, and so on. In the securitization process, credit bureau score bands are typically used to pool loans into homogeneous risk classifications and over the years the use of the credit score developed by Fair, Isaac and Company became almost as much of an American standard as apple pie. Unfortunately, the credit scoring formula, often referred to as the “secret sauce,” is not at all transparent. Lenders did not foresee the perfect storm brewing that ultimately consumed many of them. The perfect storm consisted of the following main factors:
  - New loan products having risk attributes that were not sufficiently measured and monitored
  - A downturn in the housing market that saw home prices decline
  - Escalating mortgage loan payments for borrowers as their loan teaser rate anniversaries began to arrive
  - Loose standards on income and employment verification
  - Backward and fragmented underwriting system that attempted to risk rate borrowers from a variety of aspects and then classify them instead of first classifying them relative to all relevant factors and then risk rating them
- Lack of transparency was most pronounced for investors in MBSs. They were almost entirely at the mercy of the rating agencies to tell them the investment grade of these securities. There was no window into the risks associated with the underlying securities stemming from the following situations:

- The underlying loans, and their aggregate attributes, for a given security are not transparent to the investor.
- Deterioration in underlying asset quality is not transparent. Additional information needs to be included together with the rating agency supplied risk grade for a loan-backed investment security.
- How the loans were originally pooled, together with any diversification criteria. Investors want to ensure that any cause for a few of the loans in a pool to default does not correlate to the majority of the remaining loans in the pool!
- The ways in which loan concentrations were measured to gauge any skew in risk exposure associated with the security would consider such things as loan maturity, geography, borrower risk segments, types of mortgage products, delinquency, and prepayment rates.

## Greed

The subprime crisis was preventable. Some would assert that the financial crisis resulted from the forces of greed among Wall Street participants, lenders, and speculative borrowers (property flippers) who hoped to make a quick and easy profit in a booming real estate market. A general definition of greed can be based on the notion that greed is present when a borrower, or a lender, or an investor attempts to extract a greater return than would be reasonable and customary for a given financial transaction, given the basic laws of economics, market conditions, and their particular circumstances. But the challenge lies in specifying what is a “reasonable return” for any financial transaction. In our capitalistic society, the answer back is only too often “Whatever the market will bear.”

- For borrowers, that might translate to purchase of the most expensive home they can afford by choosing a loan product that affords the minimum monthly payment without proper regard for the risk embedded in the pricing and repayment terms and conditions.
- For a lender, the tone is set from the top of the organization, and chief executive officers (CEOs) and executive management are responsible for setting overall business goals and for painting the vision for success. In theory, since CEO compensation is significantly tied to the financial performance of the enterprise, CEOs are supposed to know what achievable results are. That said, CEOs

are faced with a dilemma. If they do not set stretching goals, staff may not try their hardest to achieve results. Still, there must be a bright line between what is achievable and goals that are unreasonable. In reality, personal greed can creep into the equation, and as a result those charged with executing the CEO's vision may attempt to meet their targets, whatever it takes. Every corporation has corporate policies, rules of the road, so to speak. But just as drivers who are in a hurry tend to speed, managers pressed to make their targets begin to apply undue pressure, and inevitably staff starts cutting corners. Some individual loan officers and brokers were overcharging the borrowers in order to maximize their commissions. In the case of loan officers, their institutions often have a policy that provides for splitting of the excess fees.

- For an investor, the usual framework is one of risk versus return. The higher the investor's risk appetite, the greater the potential return. Informed investors should be able to assess what is a reasonable and customary return under normal market conditions for rated securities falling into broad asset classes. Greedy and aggressive investors, looking for excess return, adopted a bull market attitude. It was suggested that a key contributing factor of the subprime crisis was the irrational belief of the lenders and investors that it is possible to generate above-average returns with little risk indefinitely.<sup>56</sup>

Greed is an ever-present emotion and not a special circumstance relative to this crisis. Greed is an emotion that must be kept in check in all areas of commercial and financial dealings in our capitalist economic system. We already have laws and controls in place to combat financial crimes and fraud. To counteract greedy tendencies, new controls need to be put into place that effectively remove inappropriate choices from the menu of options for borrowers, lenders, and investors. This will be discussed in subsequent chapters.

## THE IMPACT

The impact of the crisis is felt everywhere. The financial crisis will have a profound impact on the U.S. and world economy. Recent data shows that the U.S. household wealth has declined in the fourth quarter of 2007, the first time since 2002. This decline, together with rising



foreclosures and unemployment, may further lead the economy into a deep recession.<sup>57</sup> As mortgage defaults and foreclosures continue to rise and housing prices continue to fall, and resets for ARMs mortgage loans in the pipeline continue to occur, more write-downs are expected.<sup>58</sup> It is estimated that over 100 banks in the United States will close their business because of the financial crisis. It is expected that it will take years for the United States to recover from such a mess.<sup>59</sup>

## Effects on the Markets

The effects on the markets are profound at many levels. We have seen that the forced liquidation of some \$3 trillion in private label structured assets is depriving the financial markets, and capital market liquidity has suffered, ranging from commercial paper to longer-term securities backed by loans. Credit markets have tightened, especially relative to consumer, construction, and commercial real estate lending. Concerning the secondary markets, there will be far greater care taken in constructing securitized loan portfolios. Reliance on credit bureau scores for default risk assessment will give way to more holistic methodologies that consider the full range of risk factors. In addition, there will likely be additional information required and reported to investors.

The wind of change is forcefully blowing through the financial services industry. The era of the investment bank ended when Lehman Brothers closed its doors, and Goldman Sachs and Morgan Stanley applied for bank charters. There is consolidation in the banking industry, with Wells Fargo's acquisition of Wachovia, Bank of America's purchase of Countrywide, PNC Financial's acquisition of National City Corporation, and many others. The brokerage industry has also been impacted, most notably the acquisition of a severely weakened Merrill Lynch by Bank of America. Bank business models are changing, and those changes will reflect less appetite for risk in the short run and shifts in business emphasis and mix. There will also be changes in their strategic and capital planning, which will impact their operations over the next three to five years, possibly more.

Relative to risk management, banks, secondary market agencies, and rating agencies will come under much greater pressure and scrutiny relative to their ability to identify, measure, manage, and control risk. Loan portfolio credit risk assessment, loss forecasting, balance sheet interest rate

risk, corporate liquidity risk, and various forms of concentration risk will factor prominently in the strengthening of internal control processes, procedures, reporting, and risk governance. Policy adherence and exception reporting and tracking will also represent an area of renewed focus. Furthermore, the subprime crisis has increased lenders' vulnerability to a number of different types of claims, including predatory lending and possibly fair lending. As noted, underwriting standards represent a primary control point for ensuring that risks are adequately identified and taken into account, based not only on what has happened, but also based on what might happen in the future. Predictive analytics will need to be strengthened so that risk measurement models are not reliant solely on historical data. Qualitative risk assessment will also come into play more formally in this process. Hybrid models that incorporate both quantitative and qualitative factors will evolve to become the new standard for underwriting systems.

### **Effects on Mortgage Industry**

This financial crisis has resulted in a new wave of consolidation of lenders. According to the Federal Reserve Board, 169 Home Mortgage Disclosure Act (HMDA) filers have dropped out in 2007.<sup>60</sup> Now the top four mortgage lenders represent 60% of total volume. Despite JPMorgan Chase's acquisition of Washington Mutual and Bank of America's purchase of Countrywide and Merrill Lynch, Wells Fargo is emerging as the top player in the residential mortgage market—and that is not even factoring in Wells Fargo's planned acquisition of Wachovia. Wells Fargo ranked first among top agency mortgage security issuers in the first three quarters of this year with \$164.0 billion in Fannie Mae, Freddie Mac, and Ginnie Mae business. At \$49 billion, Wells Fargo did more agency MBS volume than the combined Countrywide/Bank of America mortgage operation. JPMorgan Chase emerged in second place with \$35 billion.<sup>61</sup> Most recently, PNC acquired National City, the number six mortgage lender in the United States.<sup>62</sup>

### **Effects on Borrowers, Lenders, and Investors**

The subprime crisis is affecting virtually everyone. However, borrowers, lenders, and investors are affected most as follows:

- **Borrowers.** The subprime mortgage crisis has caused significant financial problems for a large number of borrowers. In particular, resets on subprime ARMs are causing higher monthly payments for many subprime borrowers. Negative equity value, tighter credit and underwriting standards, and sluggish U.S. housing have reduced the borrower's ability to refinance. This has resulted in unprecedented defaults and foreclosures.
- **Investors.** Loss of confidence to the market. Some investors of mortgage-backed derivatives have lost confidence and attempted to liquidate and exit the market.
- **Lenders.** Investor reluctance to accept MBSs as collateral for issuing asset-backed commercial paper created a liquidity problem that spilled over to other markets. This reduced lenders' ability and incentive to make loans. At the same time lenders have significantly tightened their underwriting standards. It is out of necessity that lenders design new profit models and fee structures that incorporate more risk factors and economic scenarios.

## THE CONSEQUENCES

### Litigation

Litigation related to the subprime crisis is underway. From the beginning of 2007 through March 2008, 448 subprime-related cases had been filed in the federal courts. An even larger, but undetermined, number of such cases had been launched in state courts. It was estimated that the numbers of subprime cases is on a path that is likely to exceed the 559 legal actions that were commenced during and after the savings and loan crisis of the 1980s and early 1990s.<sup>63</sup> One study found that 43% of the cases were class actions brought by borrowers, such as those who contended they were victims of discriminatory lending practices. Other cases include securities lawsuits filed by investors, commercial contract disputes, employment class actions, and bankruptcy-related cases. Defendants included mortgage bankers, brokers, lenders, appraisers, title companies, home builders, servicers, issuers, underwriters, bond insurers, money managers, public

accounting firms, and company boards and officers. Some actions of note include the following:

- The Office of Thrift Supervision (OTS) executed a Supervisory Agreement with AIG Federal Savings Bank (AIG FSB) for its failure to manage and control in a safe and sound manner the loan origination services outsourced to its affiliate, Wilmington Finance, Inc. (WFI).<sup>64</sup> The agreement provides for a \$128 million reserve to cover costs associated with making affordable loans to borrowers whose creditworthiness was not satisfactorily assessed at underwriting and also to reimburse borrowers who were charged high fees by brokers and lenders at closing.
- The Federal Deposit Insurance Corporation (FDIC) issued a cease and desist order against Fremont Investment & Loan for operating without adequate subprime mortgage loan underwriting criteria, and for marketing and extending subprime mortgage loans in a way that substantially increased the likelihood of borrower default or other loss to the bank.<sup>65</sup> The order compelled the bank to underwrite subprime loans with an analysis of the borrower's ability to repay at the fully indexed rate and provide borrowers with clear information about the benefits and risks of the products.
- In a landmark decision, a Massachusetts superior court judge issued a preliminary injunction preventing California subprime lender Fremont Investment and Loan from foreclosing on mortgages in the state.<sup>66</sup> It was alleged that Fremont violated the Massachusetts deceptive trade practices act when it made adjustable rate mortgage loans to individuals who were unable to afford them after their interest rates reset following an introductory period. Specifically, the following four loan terms were singled out as crossing the line:
  - (1) “[A]djustable rate loans with an introductory period of three years or less, such as the 2/28 or 3/27 ARMs where the interest rate is fixed for two or three years, respectively, and then varies based on an index-plus margin (known as the fully indexed interest rate)”;
  - (2) Loans “with an introductory or ‘teaser’ rate for the initial period that was significantly lower than the ‘fully indexed rate,’ that is, at least 3 percent below the ‘fully indexed rate’”;

- (3) Loans “where the debt-to-income ratio would have exceeded 50 percent had Fremont’s underwriters measured the debt, not by the debt due under the teaser rate, but by the debt that would be due under the ‘fully indexed rate’”;
- (4) Mortgages with “a loan-to-value ratio of 100 percent or a substantial prepayment penalty (that is, a prepayment penalty beyond the ‘conventional prepayment penalty’ defined in the Act, G.L.C. 183C, § 2), or a prepayment penalty that extended beyond the introductory period.”
- An Ohio Court granted a temporary restraining order in response to a complaint filed by Attorney General Marc Dann to bar New Century Financial Corporation from operating in Ohio.<sup>67</sup> Alleged violations included making false and misleading statements, accepting money from consumers to process loans even though the company knew it did not have the money to fund them, failing to promptly deliver promised services, and failing to act in good faith.
- An Illinois attorney sued Countrywide Financial and its chief executive, Angelo R. Mozilo, for allegedly defrauding borrowers in the state by selling them expensive and defective loans that quickly went into foreclosure, relaxing underwriting standards, structuring loans with risky features, misleading consumers with hidden fees and fake marketing claims (such as its heavily advertised “no closing costs loan”), and for creating incentives for its employees and brokers to sell questionable loans by paying them more on such sales.<sup>68</sup> California Attorney General Jerry Brown also sued Countrywide Financial Corporation and two of its top executives, alleging they used misleading advertising and unfair business practices to trick consumers into accepting risky home loans that would ultimately force them into foreclosure by the thousands.<sup>69</sup>

From a fair lending perspective, due to the virtual shutdown of the subprime mortgage lending market, and general tightening of underwriting standards in 2007, the 2007 HMDA data released in September 2008 reflected some increase in denial rates compared with the same data for 2006.<sup>70</sup> This will present lenders with another possible challenge—fair lending regulatory compliance. Relative to the subprime crisis, regulatory scrutiny will likely focus on increases in denials, possible steering

into subprime products, and discretionary loan modification items such as fee waivers, prepayment penalty waivers, capitalization of fees, and the way in which the borrower's ability to repay the loan is measured. Federal banking regulators expect lenders to review their lending practices and exceptions to policies in preparation for more rigorous fair lending scrutiny and enforcement.<sup>71</sup> The rapidly growing volume of litigation launched against lenders, home builders, and other defendants eventually should lead them to be more careful in their underwriting and in their disclosures to home buyers.

## Legislation and Regulations

Regulators and legislators are considering action regarding lending practices, bankruptcy protection, tax policies, affordable housing, credit counseling, education, and the licensing and qualifications of lenders. Regulations or guidelines can also influence the nature, transparency, and regulatory reporting required for the complex legal entities and securities involved in these transactions. Congress also is conducting hearings to sort out what happened and is applying pressure on the various parties involved to help identify solutions. Legislators and agencies at the state and national levels have stepped in, to attempt to soften the economic blow of the credit market crisis and the deteriorating housing sector. A wide variety of proposals have been introduced and/or adopted.

One of the most important developments is the Federal Housing Finance Regulatory Reform Act of 2008.<sup>72</sup> This legislation strengthens and modernizes the regulation of the government-sponsored housing enterprises—Fannie Mae and Freddie Mac (the enterprises) and the Federal Home Loan Banks (FHLBs or banks)—and expands the housing mission of these government sponsored enterprises (GSEs). In addition, it creates a new program at the Federal Housing Administration (FHA) that will help at least 400,000 families save their homes from foreclosure by providing for new FHA loans after lenders take deep discounts.

This government bailout originally involved purchase of the assets that are causing uncertainty and potential risk to the market. This was intended to boost the investors' confidence level by relieving the issuers of credit default swaps (CDSs) from having to make the payouts that would be required under the contracts. Those payouts would essentially have bankrupted those companies as well as many pension funds, retirement

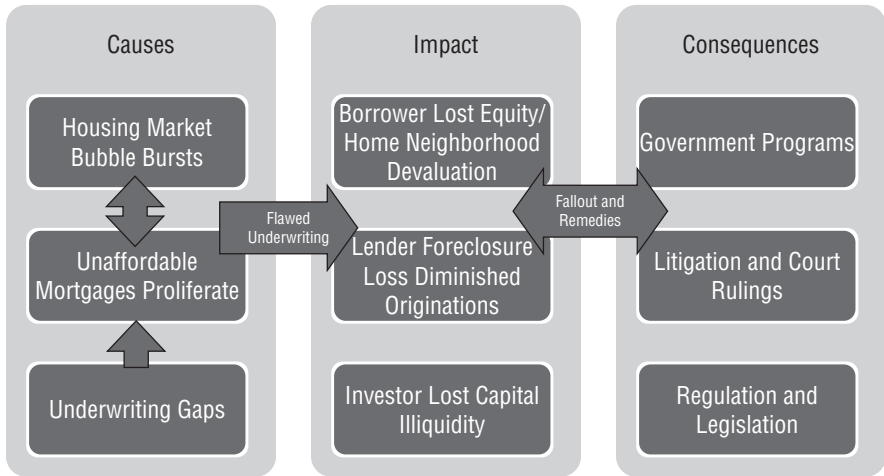


EXHIBIT 1.5

### CAUSES, IMPACT, CONSEQUENCES OF SUBPRIME CRISIS

accounts, and individual investors in those markets. Part of the bailout may be targeted to the derivatives industry that is backed by the mortgage industry. The trillions of dollars of defaults caused by CDSs could have precipitated another economic disaster.

## THE IMPLICATIONS

While the drivers we just discussed (such as inadequate risk assessment, lack of transparency, and greed) were motivating forces in the crisis, we assert that the situation could have been better managed and controlled by means of a more comprehensive and integrated underwriting system. Such a system would not only strengthen the initial loan origination process, but it would also persist through the entire life cycle of the loans, regardless of whether they remain on the balance sheet, are sold to a secondary market maker, such as Fannie Mae, or are placed in a pool of mortgages for sale to investors in one form of security or another.

Exhibit 1.5 frames the major elements of the financial crisis. By considering these elements, and their interrelationships, we can trace back to the gaps in mortgage underwriting systems.

Loan origination is the event during which a host of business, market, and borrower realities collide with (1) limiting assumptions, (2) incomplete data, (3) unverified data, (4) absence of context, (5) inference by proxy,

(6) inflexibility, (7) proprietary aspects, and (8) the balkanized nature of today's loan underwriting systems. We refer to the collision areas as *underwriting gaps*, and we explain their nature and provide examples in Chapter 3, whose focus is on the lender side. Suffice it to say that these gaps allowed loans to be approved with loan amounts, pricing, and payment terms that were inappropriate relative to the current and range of possible future financial conditions of both the borrower and the valuations of the property being financed. These gaps evaded detection, in part, because there was no integrated view of all of the resulting risks and combined exposures of the various elements in play. Put another way, a fragmented view failed to identify the magnitude and nature of exposures resulting from the underwriting gaps. As a result, mortgages that would ultimately prove to be unaffordable proliferated, and the majority of them were sold and then repackaged for sale to investors in the secondary market in the form of MBSs or CDOs. These resulting securities were rated favorably by the rating agencies.

In the meantime, the increased ability of borrowers to qualify as home purchasers helped bolster housing demand, which in turn caused housing prices to appreciate rapidly in many markets. Anticipating that demand would continue unabated, builders pushed ahead with even more new housing development projects. This boom in the housing sector proved not to be sustainable, and by the second quarter of 2006 the market began to cool down. At the same time borrowers who had adjustable rate mortgages began to see their payments increase and as a result the incidence of past due monthly mortgage payments began to climb. After a dozen and a half cuts in interest rates over the past two years, the cost of funds began to rise for borrowers and lenders alike. As home prices continued their fall, foreclosures began to mount. Neighborhoods began to see their values diminish as more homes were vacated after foreclosure. As these events unfolded, lenders had to reserve more for losses due to rising loan defaults, and mortgage-backed securities experienced significant downgrades by the rating agencies, which caused market participants to shun them. At the same time, lenders decided to pull subprime mortgage products, such as 2/28 and 3/27 hybrid ARMs, off the market. With the growing illiquidity in the housing sector, mortgage volume dropped off, and lenders were hampered in efforts to set aside sufficient capital. Borrowing between banks also became more restricted, and this became an issue especially for larger institutions that saw their daily net borrowed

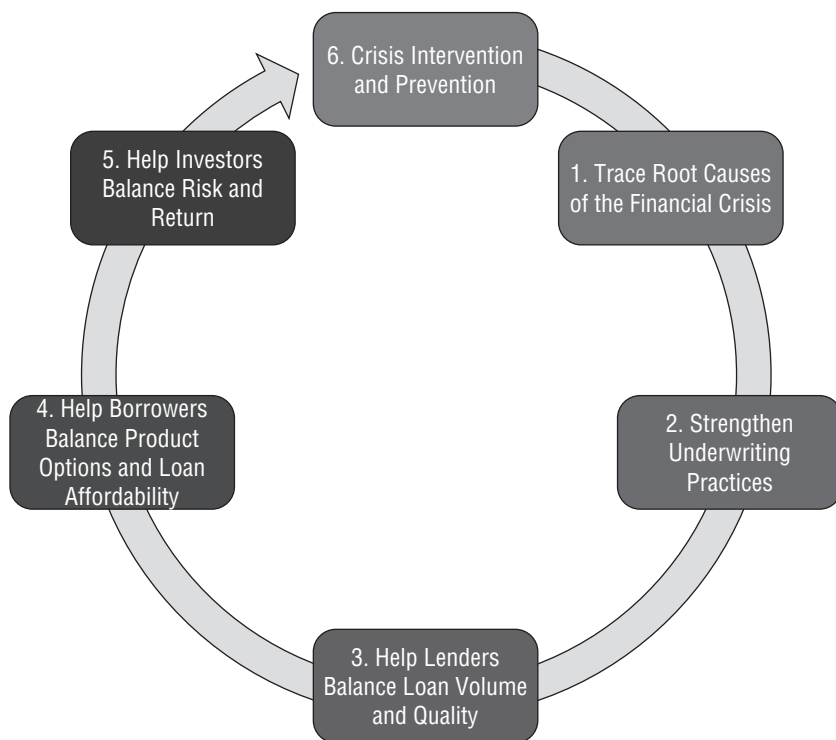


position increase (smaller institutions are generally net sellers of federal funds, but this varies based on balance sheet asset/liability composition and maturity structure). Investor and borrower class action lawsuits began to pile up, some state attorney generals took legal action, and federal regulators issued cease and desist orders and formal agreements with subprime lenders.

A chain reaction of these elements caused a downward spiral in investor and public confidence, and the equity markets reflected growing concern and loss of investor risk appetite. Bank stocks took a big hit, and the Dow Jones Industrial Average (DJIA) and Standard & Poor's (S&P) major indices rapidly declined and then experienced wide swings from day to day. In response to these severe developments, Congress passed the Economic Stabilization Act of 2008 to provide needed liquidity to keep banks functioning, to keep markets open, and to unfreeze the mega-credit crunch that had formed as many lenders drastically cut back their lending operations.

The point we are making is that this type of housing market bubble boom and burst, as well as the subsequent financial crisis, can be prevented provided the gaps in underwriting are properly addressed, so as to significantly narrow, or eliminate, them. The result will be a more safe, sound, transparent, and well-behaved mortgage loan value chain that will benefit borrowers, lenders, and investors alike, and prevent future financial disruptions. The \$700 billion question is "How can this be accomplished?" The remaining chapters of the book provide the answer as we unveil our comprehensive credit assessment framework (CCAF). We show how this new lending system can benefit lenders, borrowers, and investors, and offer effective crisis intervention and prevention. Exhibit 1.6 shows how this can be accomplished.

In Exhibit 1.6, each box corresponds to a chapter in the book. In the next chapter, we introduce a comprehensive credit assessment framework. After describing its form, components, and capabilities, we show in Chapter 3 how it effectively closes the underwriting gaps. In Chapter 4 we describe how it benefits borrowers by improving loan affordability and performance. In Chapter 5 we explain how the CCAF can benefit investors by promoting greater financial transparency. Finally, in Chapter 6 we share insights on the use of CCAF not only to manage loan underwriting better, but also how to anticipate systemic problems better, and to continuously monitor loan concentrations, quality, and exceptions to ensure


**EXHIBIT 1.6 ROAD MAP OF FOLLOWING CHAPTERS**

that we head off large-scale, system-wide problems such as we have recently witnessed.

## SUMMARY

There are many factors that can be attributed to the current financial crisis, and substantial research has been focused on the causes and lessons learned. In this chapter we have provided an overview of the current financial crisis and described the factors that contributed to the crisis from the perspectives of borrowers, lenders, and investors. We also discussed the impact, consequences, and implications of the crisis. We concluded that although many factors have contributed to the crisis, the root cause can be traced to severe flaws in the underwriting practices, which offered an incomplete credit risk assessment with lack of transparency and broken links among borrowers, lenders, and investors. Improving the current

underwriting system requires a fundamental change in the loan underwriting framework that is accomplished through a new lending system.

CCAF enables lenders to improve their lending practices by effectively reducing and closing the underwriting gap. An improved lending system will better qualify borrowers for loans, and homes, they can afford, and as a result they will exhibit improvement in loan repayment performance and will experience less financial strain and worry about future unknowns. Investors will benefit not only from improved loan performance and cash flows, but also from the additional transparency, information, and more accurate ratings afforded by CCAF relative to both traditional and innovative mortgage-based investment securities. This will enable investors to perform a better initial investment assessment and also to track and measure structural changes in the risk profile of their investment, which is a leading indicator for its performance. With regard to intervention in the current crisis, and prevention of future crises, establishing an integrated loan performance monitoring and early warning system is the key. To that end, CCAF affords regulators with the information and necessary tools to enforce such a system and ensure lending safety and soundness. All those capabilities will transcend individual borrowers, lenders, and investors to encompass industry sectors, geographic regions, regulatory jurisdictions, and ultimately the credit side of the entire financial system.

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# The Case for a Comprehensive Credit Assessment Framework

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*There is no substitute for Common Sense.*

—BENJAMIN FRANKLIN

In Chapter 1, we discussed causes, impact, and implications concerning the financial crisis. We showed that the root cause of the current financial crisis is the underwriting system and practices that provided inadequate credit assessment of subprime mortgage loans and borrowers. Flawed underwriting also creates disconnects between borrowers and lenders, and between lenders and investors. It also adversely impacts loan quality and hinders early warning on substandard loan performance. Moreover, today's loan underwriting systems often miss the mark by failing to properly consider the complete context of the borrower when gauging the affordability of their chosen loan product, when qualifying their credit application and pricing their loan.

The financial crisis has revealed flaws in lending systems and makes clear that there is significant room, and need, for improvement. This chapter introduces a comprehensive credit assessment framework (CCAF) that combines the best that technology can offer, coupled with expert human judgment. Such an approach represents a significant improvement over the existing lending systems with greater accuracy, transparency, and simplicity. It can help reestablish the connections between lenders, borrowers,

and investors to ensure long-term loan performance. It can be used to deal with the current crisis and may lessen the extent of, or even prevent, the next one.

## THE NEED FOR A NEW LENDING SYSTEM

The root cause of the financial crisis was the failure of the underwriting systems. They failed to take into account all relevant risk factors that would have effectively signaled borrower vulnerability to the payment shock associated with adjustable rate or option-priced mortgage loans. In other words, a loan that may look good today may turn out to be a credit time bomb. Although these innovative loan products create some additional risks, they are not the cause of the problem, and they may represent the best alternative for certain segments of qualified borrowers. For example, in the case of a borrower who is able to find a home selling at a 20% discount to appraised value, and who has a superior capital position and high capacity due to strong earning and little debt, an interest only option mortgage may be the ideal loan product. The point we are making is that a loan product that is suitable, or affordable, for one borrower may not be right for the next one. It is not the loan products that are to blame. Some assert that it is the primary responsibility of the person selling the product to explain the benefits and risks to consumers, who only too often do not understand what they are buying. Others say it is the responsibility of the consumer to make informed choices. We believe that while there is responsibility falling on both sides, the underwriting system should simply not allow bad choices to be on the table in the first place. A new lending system is needed that will prevent the sort of obvious bad choices that sailed through the loan approval process of today's lending systems.

At a housing symposium,<sup>1</sup> a panel made up of regulators representing the Federal Housing Finance Agency (FHFA), the Federal Housing Finance Board (FHFB), the Federal Deposit Insurance Corporation (FDIC), the Office of Thrift Supervision (OTS), the Office of Comptroller of the Currency (OCC), and the North Carolina Banking Commission discussed responses to both housing-finance problems<sup>2</sup> and housing problems.<sup>3</sup> Some of the comments and advice that surfaced during the panel and the follow-up question and answer session included: "we need to think out of the box, we need to look at things we didn't two years ago, greater

transparency is needed, sunshine is the best disinfectant, a national lending standard is needed, and there should be a level playing field where banks, mortgage companies, and other mortgage originators follow the same rules.”<sup>4</sup>

A re-engineering of the credit evaluation process is needed that will eliminate the possibility of future crises and also speed assessment and provide relief to those who are experiencing, or will experience, significant hardship. We say “will” because, as noted in Chapter 1, there are large numbers of mortgage loans that are due for their first rate resets between the second quarter of 2008 through the summer of 2012.

Various proposals have been made to deal with the financial crisis, and among them a common theme has been the need for more flexible, adaptable, effective, and systematic approaches. As previously asserted, simply recalibrating the existing models and throwing technology at the problem will not fix it. It is essential to correct the problem of underwriting standards as early in the loan origination process as possible to avoid fallout that can mushroom and cascade over time. By putting in place controls that remove some broker and lender discretion, and also some borrower choices, the creation of debt traps and credit time bombs can be avoided. This points to the need for a framework that can afford the kind of comprehensive and realistic view that is needed to render sound lending decisions.

## HISTORICAL REVIEW

Major developments in several areas have played significant roles in the evolution of the credit market in the United States, and abroad, over the course of the past 50 years. Predominant factors impacting the credit markets have been as follows:

- Advances in computer technology, especially data warehousing, analysis, and reporting and automation of the underwriting process itself.
- Emergence of new credit products with a broad array of features and terms, such as variable rate pricing, interest only and option-priced mortgages, piggyback loans, reverse mortgages, and so on.
- Application of scientific methods in credit underwriting, as well as in loan portfolio analysis relative to risk, cash flow, and other characteristics to construct pools of loans that are similar and to tailor cash

flows due to investors in tranches associated with the particular investment vehicle.

- Creation and design of credit-backed securities that meet the needs of a broad range of investor groups who have different risk, return, and time horizon preferences.
- Making of secondary markets, and establishment of standards of uniformity, where those securities are sold.
- Credit-supporting roles of government-sponsored agencies, such as Fannie Mae and Freddie Mac, in the mortgage market.
- Passage of new regulations<sup>5</sup> designed to protect consumers and ensure they are given fair consideration in the granting of credit and also to encourage lenders to provide access to credit for qualified low- and moderate-income borrowers and to invest and lend to help improve more economically challenged and depressed communities where they do business.
- Deregulation of the banking industry, which has fueled enormous growth in lending activities and spurred consolidation within the industry that has spawned financial services institutions having enormous scope (banking, insurance, brokerage businesses) and scale (interstate branch networks in the thousands and global market presence).
- Development of emerging markets. The past two decades have witnessed a growing number of consumers who are outside of the mainstream financial system who seek greater access to traditional credit products. This has been fueled by dramatic growth of immigration<sup>6</sup> and an emerging echo boomer generation that is 80 million strong. Tens of millions of “thin-file” consumers make up this group.<sup>7</sup>

Before we proceed to point out areas where improvement is needed and illustrate what kind of new approach is required, we first briefly discuss some important basic concepts that will promote a better understanding of our recommendations. In the beginning, we had guiding principles in lending that related creditworthiness directly to the borrower’s ability to repay the loan. Over the course of time the art of credit granting has evolved to embrace the use of scientific methods, large amounts of data compiled from historical loans of known performance, and computer-based analysis and processing of many different kinds of loan applications,

including mortgages. As science began to play an increasingly central role in the credit-granting process, major scorecard developers determined that their models could find suitable substitutes for common sense. Although the introduction of scientific methods and the ability to leverage greater volumes of data have been largely positive developments, the recent turmoil in the financial markets points up the fact that there is certainly room for some improvement in today's mortgage underwriting systems.

"Credit markets are influenced by what information is made available and also by tools that are used to manage and analyze that set of available information."<sup>8</sup> Models for decision making have advantages, and indeed have been winners in many real-world applications compared with individual decision making. The effectiveness of individual decision making may be diminished by such factors as limited experience, faulty reasoning, poor perception, biased opinions, and limited capacity to consider many combinations of factors at the same time. Perhaps chief among the advantages of a model is that it can provide a frame of reference that conveys the essence of the problem for consideration. This is important especially when models that are assumed to be valid at one point in time subsequently fail to predict outcomes accurately. Provided the model is transparent, the failure may be traced to possible causes, such as gaps in information, invalid assumptions about model factors or the strength of their relationship to predicted outcomes, failure to address new conditions not present or considered at the time the model was developed, and so on. Models can be data-driven, rules-based, or some combination of the two. Modelers must decide what needs to be included in a model, and oftentimes they opt to include some factors because they are readily accessible. Despite the fact that common sense would dictate that certain factors are important, they may be excluded because they pose operational difficulties, or they are more difficult or costly to obtain and verify, or they are more complicated to calculate, or the pattern of their values usually appears counterintuitive.<sup>9</sup> In the case where a model is going to be deployed as a one-size-fits-all solution, then certain rules may be excluded because they do not apply to every case. Hence, it can be important to identify homogenous subsets of cases where certain rules apply, and other rules either do not apply, or have a different weight on the final outcome.

While models have the outward appearance of pure science, they actually contain many judgmental elements that are hidden to the ultimate user and to the individuals who may be affected by the model's predictions. It is important to avoid these, and other situations, where a modeler may make arbitrary decisions or where the modeler does not possess the business domain expertise to make calls on what factors need to be included, how many values are required to fully represent a specific factor, and what is an aberration caused by faulty data versus a genuine relationship associated with a special case that needs to be considered. This issue is addressed head on through a key element of the new loan underwriting approach described in this chapter—namely a model consensus session (MCS), which we will describe later. In general, other advantages of models are that they can make decisions quickly, consistently, and efficiently, and they make it much easier to communicate the reasons for any particular decision.

A statistical prediction model is simply a model, as previously described, that has the added property that associates a probability, or alternatively an odds quote, with every outcome. The advantage of this type of model is that the decision maker can base her decision in any particular case on the likelihood of the outcome she desires. In the case of lending, two outcomes are typically considered, namely *bad* payment performance or *good* payment performance. Bad payment performance usually encompasses loan default, severe delinquency, or chronic past due, history of bankruptcy, repossession of property, liens, and judgments. We cannot overemphasize the importance that defining the outcome can have on the effectiveness of the model. We explore this in our discussion of loan performance definitions in Chapter 3 where we define the notion of an underwriting gap. A statistical prediction model for credit granting would thus be able to calculate the probability that a loan will go bad for every loan application that is evaluated. The most common and widely used statistical prediction model used for credit granting is credit scoring. CCAF is a new challenger in this field, and it also is a statistical prediction model, with some additional distinguishing features that are highlighted in a detailed example that we present.

## NEW LENDING SYSTEM

The subprime mortgage crisis has brought into focus the need for loan underwriting systems that foster understanding and affordability for the consumer while effectively measuring credit risk for the lender and investor.

The system needs to achieve this balance for several reasons. First, borrowers must understand their contractual obligations sufficiently to ensure there are no surprises that may undermine their ability to pay back the money they owe as agreed. They must also consider the impact of the loan collateral (that is, the property they are purchasing in the case of a real estate secured loan, together with the market value of the property and their down payment). Borrowers may choose loan features that reduce their required cash at closing, or their monthly payments for an initial set period of time. While appealing, these borrower elections may put them at greater risk of default in the long run. Hence, the conditions and terms of their loan represent another consideration in the underwriting process that directly impacts credit risk and the financing cost for the borrower.

Second, as the accuracy and power of the current credit scoring methods continue to be debated, new and improved ways that address limitations of credit scoring systems to better evaluate credit risk will be in demand. Only by adopting a holistic view will lenders be able to accurately estimate borrower and loan risk. This will then afford a complete context that first classifies borrowers relative to primary qualification factors that make sense, supported by necessary secondary factors that carry the appropriate weight and conditions to accurately evaluate borrower and transaction risk and determine the appropriate product terms and conditions under the circumstances. Lenders must determine whether a borrower is creditworthy, what products are reasonable to offer for the intended loan purpose and borrower qualifications, and how to price the loan. To accomplish these objectives in the most effective manner, lenders need to do several things: (1) they must collect sufficient information to afford a complete picture of the borrower's current financial condition and past payment performance on all significant contractual obligations; (2) they must assemble the information and put it in a form that is amenable to credit analysis and that will allow them to make the series of lending decisions just described; (3) lenders must measure risk accurately, and this requires taking into consideration the qualifications of the borrower and the particulars of the loan within a holistic context; and (4) lenders need a system that they can validate from both a quantitative and qualitative standpoint in order to spot adverse trends and problems early on, before they mushroom. The need for integration of judgmental components and common sense into the credit assessment process in order to better capture the business reality has undeniably been overlooked.

Third, as previously mentioned, the “originate to distribute” model for the current lending system distanced borrowers from lenders, a significant departure from the traditionally close relationship that had existed. When lenders hold loans on their balance sheets, they have greater incentive to scrutinize and evaluate loan product affordability and the prospects for satisfactory repayment of the obligation. It is critical to have a transparent and simplified framework in place to reestablish the connection between the lenders and the borrowers, to ease measurement of loan affordability and to incentivize loan originators to maintain credit quality.<sup>10</sup> Banks regularly monitor their subprime exposure, and regulators require that when their total exposure exceeds 25% of Tier 1 capital that they perform more extensive reporting and analysis of their subprime business. A heavy concentration in subprime loans on a bank’s balance sheet sets off warning bells normally. Because banks were able to sell the subprime loans that they were originating, they were able to maintain their exposure below levels that would have otherwise triggered far greater self-monitoring and scrutiny by the regulators. The Office of Federal Housing Enterprise Oversight (OFHEO), the regulator for Fannie Mae and Freddie Mac, was responsible for monitoring risk exposures at those institutions, and it is not clear how they failed to see the large concentration of risks associated with subprime loans in the purchased portfolios and in the pools of mortgages that were packaged for sale to investors. One factor was probably the heavy reliance placed on Fannie Mae’s *Desktop Underwriter*, or Freddie Mac’s *Loan Prospector* loan underwriting systems, which were used to process and approve those loans. These flawed underwriting systems no doubt provided a false sense of security to the banks that originated the loans, as well.

Finally, the secondary market must set new standards in order for securities backed by mortgage loans to be acceptable for sale to investors. Those new standards can leverage on the holistic view that is recommended for adoption by lenders for evaluation of individual loans. This will enable rating agencies to base their risk rating of these securities on more complete and accurate information, which will foster greater confidence on the part of investors. Unfortunately, the majority of the subprime mortgage underwriting systems did not capture the full range of risk factors in the market, particularly when their conventional risk models were applied to nonconventional loan products having different payment terms and behavior.



## OVERVIEW OF THE FRAMEWORK

The CCAF naturally affords a sustainable and sensible segmentation based on all primary credit factors. It offers a systematic means for taking appropriate actions relative to those identified segments, and for ongoing monitoring of the impact of those actions in a comprehensive and efficient manner. CCAF accomplishes this by expanding the boundaries of information associated with existing variable rate mortgage holders,<sup>11</sup> appropriately segmenting them based on primary factors, layering in needed secondary risk mitigation factors,<sup>12</sup> assigning actions for each identified segment, and putting in place an adaptable policy mechanism that is responsive to the evolving economic climate.

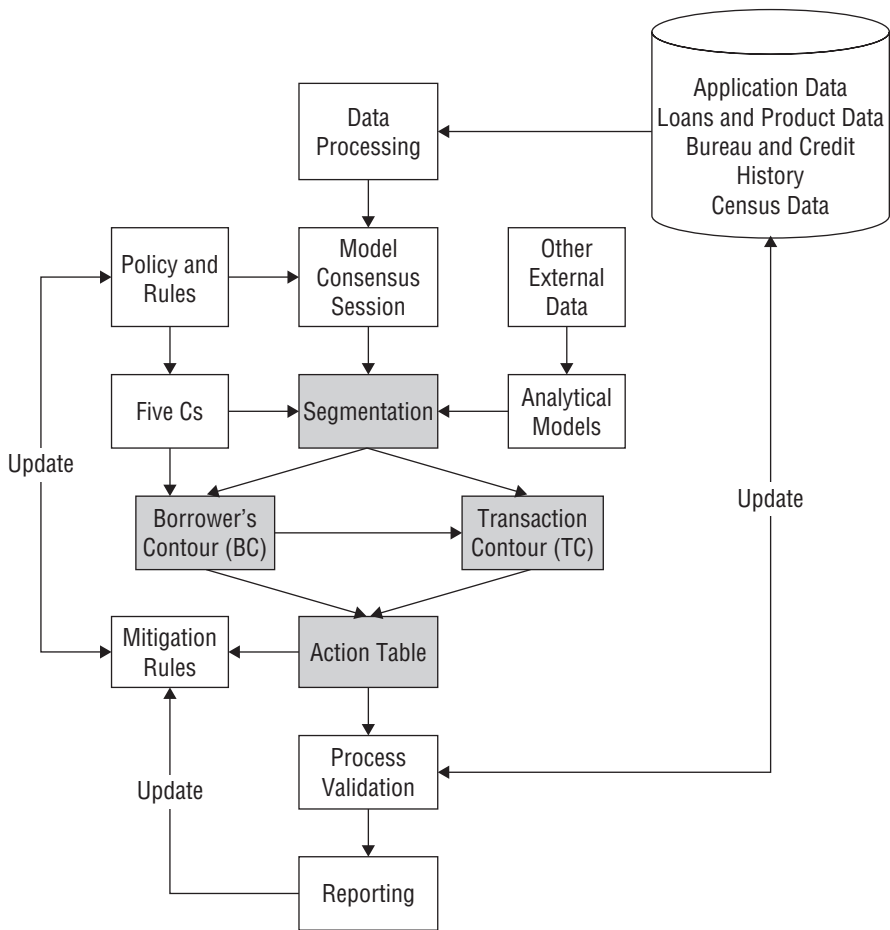
The development and implementation of CCAF entail four milestones: (1) data sourcing and processing, (2) sampling and segmentation, (3) scenario integration, and (4) process validation and updating. At a high level, Exhibit 2.1 describes the overall CCAF process.

As is the case with typical loan approval system development using the standard credit scoring approach, requisite loan data, product data, policies, and business requirements must be sourced and preprocessed so as to create a base of information that is sufficient for system construction.

The model consensus session (MCS)<sup>13</sup> is the core mechanism whereby CCAF ensures that classification of credit transactions is performed sensibly and comprehensively. Expert judgment, proven credit principles, and product and loan policy information are used, in addition to the available historical loan application and performance data. We call the resulting categorization a Transaction Contour (TC), which will be described in detail in a later section. There, we also define a Borrower Contour (BC), which encompasses all financial transactions for a particular borrower.

Next, external factors relating to the economy, market states, and underlying asset valuation, are combined, using a variety of modeling methods to arrive at a loan decision model in the form of an action table, which specifies an approve/decline decision for all borrowers relative to the credit transaction contour.<sup>14</sup> In addition to the action table, a series of additional tables are generated that allow for the maintenance and monitoring of the action table.<sup>15</sup>

A comprehensive and transparent validation process is the next-to-last step in the CCAF process. It is essential in order to foster trust and confidence



**EXHIBIT 2.1      OVERALL PROCESS OF CCAF**

that come from knowing exactly how loans are evaluated and how credit quality and credit access will be maintained and improved. This step involves an examination and interpretation of underwriting model inputs, processing, and outputs.<sup>16</sup>

The final step in the process is to produce various loan underwriting operational reports, such as multidimensional acceptee population mix reports and multidimensional acceptance rates tables associated with the current action table.<sup>17</sup> In addition, alternative action tables associated with

specific credit policy and marketing strategies can be produced, along with their system maintenance and operational reports. Since these reports can be regenerated and compared at two points in time, multidimensional variance reports can be produced that help spot issues early on in great detail using the TC as a basic frame of reference, and several such reports may be generated and visualized graphically to easily identify trends.

The end result of CCAF is a more flexible and adaptable lending system that can accurately evaluate credits, quantify transaction risk, maintain appropriate risk levels based on policy-dictated risk tolerances, and more effectively provide information to monitor and manage loan portfolios. CCAF provides fair access to credit and ensures suitable loan products for consumers, and a more profitable, safe, and sound loan portfolio for lenders.

Relative to borrowers who are at risk of foreclosure, the framework can be applied to (1) identify borrowers who need assistance and loans that can be salvaged to avoid foreclosure, (2) measure the impact of strategies on foreclosure and loss exposures, and (3) continuously update required actions to achieve the best possible outcomes in these difficult circumstances. This type of risk mitigation effort entails the following steps:

- Step 1.* Apply CCAF to current population of mortgage holders “at risk” now, or in the next “n” months.
- Step 2.* Identify primary factors that will define the *transaction contour*. For low/no documentation loans, consider augmenting with alternative data and source actual capacity and capital measures in order to perform a more accurate classification relative to the *borrower contour*.
- Step 3.* Assign actions for each identified segment.
- Step 4.* Determine mitigation rules as secondary (stage 2) factors.
- Step 5.* Put in place an adaptable policy mechanism that is responsive to the evolving economic climate.
- Step 6.* Update the system continuously using the system maintenance techniques described at the end of this chapter to ensure data is timely and complete.
- Step 7.* Monitor results regularly for accuracy and measure success using a combination of system validation techniques and simple trend analysis (that is, increasing, stable, or decreasing risk).

A key aspect of the new credit system is the manner in which it classifies borrowers for the purposes of credit applicant qualification and also for the critical performance definition used to characterize loan performance. We approach this task keeping the advice of John Dewey in mind, because an effective classification in these two areas hugely impacts the effectiveness of the system. And, of course, we draw on proven credit granting principles and common sense.

## HOW CCAF CLASSIFIES BORROWERS

Classification of all credit transactions at their inception may be performed sensibly and comprehensively using CCAF and the Five Cs of Credit. The power of the CCAF is in its ability to look at the Five Cs of credit in context with one another, a method that is not currently used with credit scoring-based systems or other underwriting systems, which usually rely, at least in part, on the credit bureau score. In many instances in today's credit system, consumers are rewarded for being more highly leveraged (that is, having more debt), and penalized for paying with cash. For example, if a consumer having no installment debt has \$15,000 of capital and uses most of it to purchase a car and a major appliance, her capital position is lowered, but her capacity is unchanged, and her credit bureau score is unaffected. Consider Case 2, where the consumer finances the car and major appliance with installment contracts, his capital position is unaffected, capacity is lowered due to a higher debt ratio, and his credit bureau score will improve, all else being equal. Clearly there is more credit risk and cost to the consumer in the second case, but the credit score is focused on credit usage, and mix of credit, and it sees a lower credit default risk.

The next five sections examine how the new credit system classifies borrowers relative to each of the Five Cs of Credit, beginning with character and ending with conditions.

### Character

Borrower character is determined in several ways, including payment history, and measures of job stability, employability (such as years of education, certifications, time in profession). We now examine these components in turn.

Past performance in meeting financial obligations is an important component of character. Credit bureau scores are used by lenders for both the initial granting of credit and also for determining which loans to include in loan sales and securitizations. Unfortunately, credit scoring has historically placed entirely too much emphasis on choices consumers make relative to their prudent use of credit, to the manner in which they shop for credit, or to their payment habits. Relative to their payment habits, historical borrower payment patterns may reflect reasons that have more to do with convenience, or unexpected events that trigger a temporary focus away from timely bill paying, as opposed to actual shortfalls in funds or an inability to pay what is owed, plus any penalties for tardiness. Credit scoring models typically lump chronic late payers who pay late fees (and who are actually the most profitable customers) together with actual defaulters on obligations, which overstates the risk and results in the consumer being overcharged for credit. In short, credit scoring fails to put information into the proper context.

Furthermore, credit scoring can become a data mining exercise where the object is to find “what is predictive” versus what is truly relevant and fair in considering borrower qualifications. Case in point—historically credit scorecards examined the particular type of trade lines that a consumer accessed and used that information as indicative of credit risk. Oftentimes, the only financing available to segments of borrowers were lenders of last resort, either because they did not have established credit, or they had some blemish on their credit history, or perhaps because they lived in a neighborhood where high cost lenders had sales offices and traditional banking services were absent. At that time, the presence of high-rate finance company obligations was interpreted as an indicator of the level of financial sophistication, and credit risk, of the borrower and finance company references on credit applications and credit bureau reports resulted in significant penalties for consumers applying for the full range of financial products. If it were a statistical fact that people who purchase after-market goods from discount stores, or purchase at retread tires outlets, or charge a lot at bars had higher risk, would it make sense to include those factors in a credit model? Similarly, should the brand of automobile, style, or price be considered indicative of a borrower’s riskiness? A recent *BusinessWeek* article<sup>18</sup> explored this area, and it is clear that we are headed for a public policy debate around what is fair game

for inclusion as a factor in a credit granting model. In that article, Fair Isaac CEO Mark Greene asserts that “bad people are bad people are bad people.” “In other words,” the article goes on to state, “their behavior in one domain predicts what they might do in another.” Are we to conclude that people who get in traffic accidents are more likely to be bad credit risks? In the same article, we cautioned that the nature of the information that is used to make lending decisions can have huge social and economic consequences and that society must determine what makes sense and what should be off limits.

In contrast, CCAF takes into consideration (1) whether borrowers have defaulted on obligations in the past, (2) how established they are relative to the length and number of obligations they possess, and (3) their recent payment behavior. A key point is that a borrower’s classification relative to the financial obligation component of character is the result of considering all combinations of these three components, which affords greater context to the interpretation of payment behavior. Just as some people have demonstrated a track record of successfully carrying a high debt burden (for instance, a debt ratio of 50% or more), chronic late payers who pay the late penalties and who possess the capacity and/or capital to ultimately pay all of their obligations should have a different risk rating than would otherwise be the case.

A credit report is available from each of the three major credit bureaus,<sup>19</sup> and typically the three reports are merged by lenders, and the three different credit scores associated with these reports are combined. This is done in order to assess a credit applicant’s payment history, depth, breadth, and usage of credit, and also their credit-seeking activities. The report also includes public records for the borrower that indicate court judgments, tax or other liens, repossessions, foreclosures, and bankruptcies. This data is reviewed to determine how the borrower has handled his previous credit obligations, and the type, amount, and status of the items reported are considered. Viewed in proper context, past credit history can provide valuable insight into the likelihood that the borrower will pay future obligations. Because a credit scoring model based on credit bureau data recognizes that loan default is preceded by delinquent behavior, it considers slow payment to be a risk factor for default without any consideration of borrower capital or capacity! Borrowers with a history of slow payments may, or may not, be likely to continue their payment

pattern based on factors not covered by credit bureau data. Conversely, borrowers who pay their past and current credit obligations in a timely manner will not necessarily continue this practice if their financial condition deteriorates. Credit scoring system development encounters a problem relative to performance classification of borrowers whose payment behavior is not good enough to be classified as good and not bad enough to be classified as bad. These are termed *indeterminates* and they are routinely excluded from the development sample.<sup>20</sup> As a result, the severity of even mild delinquency is magnified because the scoring system point values for delinquent payment characteristics are determined by their presence, or absence, in the good and bad samples. Consider the following simple example in Exhibit 2.2, where we have a hundred credit

EXHIBIT 2.2

**CLASSIFICATION BY PAYMENT PERFORMANCE  
AND MODEL PERFORMANCE GROUP**

	Good Performance	Bad Performance	Indeterminate Performance	Strong Capacity	Strong/ Superior Capital
1. Never late	50	0	0	14	16
2. Only one time 30 days late	22	0	0	6	7
3. Only two times 30 days late	0	0	6	2	3
4. Only three times 30 days late	0	0	5	2	2
5. Four or more times 30 days late but never 60 days	0	0	3	1	2
6. Only one time 60 days late	0	0	4	1	1
7. Only two times 60 days late	0	0	2	0	1
8. Three or more times 60 days late but never 90 days	0	2	0	0	1
9. Over 90 or more days late	0	2	0	0	0
10. Charge-off	0	4	0	0	0
Total	72	8	20	26	33

applicants with the following payment characteristics and payment classifications across all of their trade lines tracked at the credit bureau.

In this example, the most severe payment performance associated with 100 loan applicants is observed over a 24-month time period and they are classified in 1 of 10 payment performance categories and 1 of 3 model performance groups. We have appended two additional columns to capture the ratings relative to capacity and capital of these applicants. Clearly, if indeterminates are excluded from the scorecard development sample, we will experience fallout of high capacity applicants and also those possessing substantial capital reserves. If we then build a credit scoring system on the remaining applicant population of 72 goods and 8 bads and if we examine the predictive strength of delinquent payment characteristics, we will overestimate the seriousness of missing one or two payments relative to eventual loan default because we are ignoring the indeterminate population and many of those applicants have sufficient financial resources to preclude loan default, despite having a record of delinquency, as shown in Exhibit 2.3.

While it may simplify the world for the credit scoring modeler to drop observations, or assume away details and messy difficulties, it adds to the gap between the underwriting system and reality.

In commercial lending there is a clear distinction made between the performing/nonperforming status of a loan and the credit risk rating

EXHIBIT 2.3		SCORECARD FACTORS AND BORROWER SAMPLE COUNTS			
Scorecard Factors	Good Performance	Bad Performance	Indeterminate Performance	Strong Capacity	Strong/ Superior Capital
2+ times 30 days late	0	8	20	6	10
Over 60 days late	0	8	6	1	3
Over 90 days late	0	8	0	0	0
Total	0	8	20	7	13



of the loan. The performing status of a loan relates simply to whether the borrower is making timely payments. The credit risk rating is based on the financial health of the borrower's business, such as is reflected in key profitability, liquidity, capacity, and capital ratios based on recent financial statements and verification of information via tax returns and audited statements. CCAF's adoption of the Five Cs of Credit reflects this broader interpretation of borrower credit strength. Of course, payment performance is an important consideration, but it should not overwhelm the analysis and put consumers into categories that they must wait years to "live down" before they can obtain needed financing at an affordable price. Past delinquencies should be explored to determine the reasons for the delinquency. Suppose, for example, that someone experienced hardship due to illness, injury, or layoffs and as a result had some severe delinquency on one or more loans. If that individual eventually brought his credit current, why should he be penalized at all for the severe delinquencies? In fact, if he had the ability and resolve to make good, is he actually not a better risk potentially than some of his untested but nondelinquent counterparts who have not been confronted with a financial crisis or adverse economic conditions that temporarily might hinder their ability to make timely payments? Hence there needs to be a more complete context built around the borrower's ability and willingness to repay debts, so we are led to examine additional components of borrower character, namely earning potential and stability. While it could be argued that earning potential belongs in the capacity factor, we choose to put it in character because it is more of a borrower attribute than a quantifiable measure.

So-called stability factors are commonly taken into account in lending, such as the length of time on the job (or a related position in the same field of work, which translates to time in profession) and the length of time at residence. Time in profession is a better indicator than time on job, because there are many reasons for changes in employment, and some of them are positive and indicative of less, not more, credit risk. Length of time at residence is another factor that requires more context. Many lenders consider level of education as important, especially relative to employability in general. In addition, attainment of a college degree signals an individual's ability to commit to and successfully complete a program of study. Similarly, completion of honorable service to

the country (for instance, armed forces, Peace Corps ) may constitute a component of stability and often the accompanying training and experience bolster career choices.

For simplicity, suppose the payment history dimension of CCAF consists of three ratings, Good, Fair, and Poor. Further suppose that this rating is based on three factors, namely whether the consumer has defaulted on an obligation in the past five years, whether she is new (that is, her credit file is less than two years old) or established, and her delinquency record, characterized as mild, moderate, and severe.<sup>21</sup> With this information, one can rate borrower payment history based on the scheme shown in Exhibit 2.4.

The point here is that even delinquent patterns need to be put within the context of whether consumers are defaulters and how long they have been paying their bills. The identical definitions can be used to characterize alternative payment data if we simply modify the definition of *defaulter* to be service discontinued with a balance, apartment vacated with rent due, and so forth. In this case a lender using CCAF would require simply the segment number (from 1 to 12) for the consumer. It is possible that the typical credit score would be retained for comparative purposes.

EXHIBIT 2.4      CCAF BORROWER RATING FOR  
PAYMENT HISTORY

Case	Nonpayment	History	Late Payment	Payment Rating
1	Defaulter	New	Mild	Poor
2	Defaulter	New	Moderate	Poor
3	Defaulter	New	Severe	Poor
4	Defaulter	Established	Mild	Fair
5	Defaulter	Established	Moderate	Poor
6	Defaulter	Established	Severe	Poor
7	Nondefaulter	New	Mild	Good
8	Nondefaulter	New	Moderate	Fair
9	Nondefaulter	New	Severe	Poor
10	Nondefaulter	Established	Mild	Good
11	Nondefaulter	Established	Moderate	Good
12	Nondefaulter	Established	Severe	Poor

The information value contained in alternative data and community data<sup>22</sup> has made it increasingly apparent that significant ground can, and must, be gained in enhancing the state-of-the-art in consumer and small business lending relative to those segments in particular, and perhaps for all borrowers in general.<sup>23</sup> A study by the Brookings Institution Urban Markets Initiative and the Political and Economic Research Council (PERC)<sup>24</sup> found that those outside the credit mainstream have similar risk profiles as those in the mainstream when including nontraditional data in credit assessments. The report also found that using nontraditional data decreases credit risk and increases access to credit for those who are creditworthy.

With greater information, lending decisions become better, with lower rates of delinquencies, less overextension, and an increase in the number of performing loans. This will shore up data gaps in the credit evaluation process, especially relative to payment history for noncredit obligations and borrower capacity. Alternative data can be readily fed into CCAF's handle structure for the purpose of segmentation and modeling. Without changing any model factors for payment history, one can incorporate noncredit trade lines, as shown in the previous example. We explore the use of alternative data further in our discussion of the data component of the underwriting gap in Chapter 3.

## Capacity

The overall capacity of the borrower is measured to determine if the customer has the income resources to repay the debt. Important aspects of the income stream include its stability, composition (wages, commission, bonus, rental, investment, disability), size, and verification. Any nontaxable income must be grossed up. Debt ratios exceeding certain thresholds, which vary by loan product, by a specific conventional or government program, by geographic location, and by other criteria are usually reviewed more closely. In addition to ratios, the amount of disposable income, net of obligations, is an important factor and in CCAF this is captured by both a savings rate and also within the capital primary factor, which we will discuss in the next section. Clearly, a 45% debt-to-income ratio for a person making \$20,000 per year does not have the same interpretation as the identical 45% debt ratio for someone making \$200,000 a year.

Other ratios, such as payment to income are sometimes used to determine how much the payment on the obligation reviewed will impact the borrower's total financial picture. Again, payments equal or greater than a given threshold (such as 20% of the borrower's income) may be consequential. Also, previous payment amounts may be compared with regard to new payment amounts. In mortgage lending, this is referred to as payment shock, and an industry rule of thumb is to view increases of more than 25% in housing expenses as a red flag. For revolving credit accounts, previous and existing credit line amounts are usually evaluated with regard to new credit line amounts. Another common ratio is the housing expense ratio, defined as monthly housing expense divided by monthly income. Housing expense components include principal, interest, property insurance, mortgage insurance, homeowners association dues, taxes, and payments on second mortgages. For home equity loans a monthly statement may be required in order to obtain the loan principal balance and then a percentage, say 1 to 3%, is applied to estimate the monthly payment portion. A borrower's debt ratio may be defined as the sum of monthly housing expense plus monthly repayment of all other debt divided by monthly income. Usually the calculation excludes debts less than some minimum amount, any installment debt with few remaining payments, and any revolving debts where the minimum payments or pattern of recent payments will result in total repayment of the debt in a few months. Thresholds for exclusion amounts and number of months remaining vary by lender and are easily specified within CCAF. Furthermore, CCAF can house business rules that provide additional context that is critical, such as avoiding situations where the ratio is inflated due to the inclusion of temporary obligations, such as in the case of bridge loans, or leases on apartments that will soon expire. If the borrower is relocating to San Francisco from Omaha, then the higher cost of living should be factored into the lending context.

One must understand a borrower's current financial position and, especially for mortgages, future market conditions to understand her comprehensive risk profile. We discuss the need for a future debt ratio measure, in addition to a current debt ratio in the section that discusses the fifth C of Credit, namely conditions. CCAF can be configured to consider all borrower capacity, both current and future, in the capacity primary factor. We have chosen, for this example, to put only known values in the

first four primary factors of the Five Cs of Credit and designate measures that depend on uncertain conditions as being associated with conditions. We now consider the simple case where we define strong, moderate, and low capacity based on a rating associated with a financial obligation ratio and borrower savings ratio, defined as borrowers' monthly savings amount divided by their monthly income. The savings ratio categories in this hypothetical example are none, low (less than 3%), moderate (3 to 7%), and high (8% or more). Suppose we are dealing only with credit payments so we use a debt ratio that we categorize as low (for values 30% and under), moderate (for values 31 to 45%), and high (for values greater than 46%).

If a consumer had a debt ratio of 34% and had a savings rate of 6%, she would be classified in Case 7 and would be rated as a moderate capacity risk, as shown in Exhibit 2.5. From a consumer literacy standpoint, this type of model would not only encourage savings, but would provide useful information to consumers on how the rate of savings can impact their classification.

## Capital

All else being equal, the greater the tangible net worth of the borrower, the lower the degree of credit risk. Liquidity is also an important consideration. If a borrower has substantial equity in his home, options to tap

**EXHIBIT 2.5 CCAF CAPACITY RATING**

Case	Debt Ratio	Savings Rate	Capacity Rating
1	L	None	Moderate
2	L	Low	Strong
3	L	Mod	Strong
4	L	High	Strong
5	M	None	Low
6	M	Low	Moderate
7	M	Mod	Moderate
8	M	High	Strong
9	H	None	Low
10	H	Low	Low
11	H	Mod	Low
12	H	High	Moderate

that equity may entail significant expense, may depend on market conditions, and may require time to obtain access to it. In contrast, cash-equivalent sources, such as savings accounts, money-market funds, and other investment securities are preferable. It is important to define what asset categories qualify as liquid.

For simplicity, we adopt as a measure of capital strength the ratio of liquid assets divided by after-tax monthly income, ignoring savings. Suppose we define the rating categories for capital as follows: Low (less than 3 months), Moderate (4 to 6 months), Strong (7 to 23 months), and Superior (24 months or more), as shown in Exhibit 2.6. If a consumer had \$15,000 in liquid assets and an after-tax monthly income of \$3,000, then the months of reserves would be 5 and she would fall into the moderate capital category.

**Collateral**

Collateral offered to secure a loan represents the fourth primary factor in CCAF, and collateral value is an important factor in determining how much the lender is willing to lend. Certified appraisals and real estate property evaluations are used for home mortgages. For automobiles, collateral values are determined and checked using the Black Book and National Automobile Dealer Association (NADA) books. Other methods are utilized based on the collateral type. Advances of more than 115% to collateral value for automobiles are normally considered exceptions (this can occur based on borrower elections, such as opting for dealer extended warranty programs and other add-ons). The amount of borrower equity is considered. Borrowers with at least 10% equity interest in the collateral

EXHIBIT 2.6		CAPITAL RATING
Case	Months of Reserves	Capital Rating
1	Less than 3	Low
2	4–6	Moderate
3	7–23	Strong
4	24 or more	Superior

normally are more likely to repay the loan, as some of their own money is at stake. Rebates are not considered in determining borrower equity—only cash and net trade-in value.

For loans secured by real property or financial assets (such as a mortgage, where the house is the collateral), CCAF factors in the fourth C of Credit. For purposes of simple illustration, we can adopt loan-to-value as a measure for collateral (in practice physical properties, the method and date and outcome of an appraisal, and other information come into play). Here, we assign a rating of high equity (less than 70% loan-to-value ratio), moderate (70 to 89% loan-to-value ratio), and low borrower equity position (90% or greater loan-to-value ratio) for purchase of owner-occupied properties as shown in Exhibit 2.7.

In this example, a borrower who makes a down payment of \$40,000 on a home that is valued at its purchase price of \$200,000 would be rated as moderate relative to his equity position in the property. Rating thresholds may vary by loan product, such as loans for rental properties or jumbo mortgages.

## Conditions

Last, but not least, the conditions of the loan, the borrower, and the current economy must be taken into account. Conditions alone can precipitate credit losses. Borrowers who are good credit risks when the loan is made can and will experience changes in their lives that may trigger financial hardship from time to time. Choice of a loan product that minimizes the monthly payment, but exposes the borrower to future payment increases of loan principal and interest, must be considered. The impact of a depressed market for the loan collateral can also adversely impact the

EXHIBIT 2.7		CCAF COLLATERAL RATING
Case	Loan-to-Value Ratio	Collateral Rating
1	90% or greater	Low
2	70% up to 90%	Moderate
3	Less than 70%	High

borrower, by raising the loan-to-value ratio. In mortgage lending, borrowers who view the equity in their homes as a source of capital in the event of unforeseen circumstances, or as a means of supporting their lifestyle, are vulnerable to falling real estate prices. Anything from a slow economy, a significant rise in the cost of living, or a plant closing can dramatically impact a borrower's ability to repay a loan. Hence, loan terms and known conditions of the borrower are considered along with possible future economic conditions.

For our example, we rate conditions as a measure of borrower vulnerability to changes in economic conditions and the loan product features that they have elected. CCAF takes into account future possible scenarios that impact capacity relative to changes in payment amount due to rising interest rates, capital relative to principal paydown of the loan that increases equity position in the property, and collateral relative to prevailing housing market conditions. Two candidate metrics combine to capture this risk in two rating categories: high and low.

First is future loan-to-value (LTV), defined as the ratio of the remaining principal amount to the quantity equal to the current market value of the property minus two standard deviations of the value of the property over the past five years. Consider the case where a home initially valued at \$100,000 five years ago has appreciated 50% over five years, with an average price of \$120,000 and standard deviation of \$14,000. The home currently sells for \$140,000, but the CCAF adjusted value would be \$150,000 minus two standard deviations (\$28,000) for a value of \$122,000. The borrower's typical 20% down payment (\$28,000) left a loan amount at origination of \$112,000. Exhibit 2.8 shows the results of

EXHIBIT 2.8    LTV AND LOAN TERM

Loan Product Choice	Remaining Principal Loan Amount	Remaining Loan to Future Home Value Ratio
30-year fixed rate	\$103,000	92%
15-year fixed rate	\$98,000	88%
5-year reset interest-only option	\$112,000	100%



different loan product choices for the future loan-to-value calculation at the five-year point into the loan term.

CCAF is product agnostic (that is, it will work with specialized loan products that may be a good choice for some consumers, but a bad choice for others). Product choice depends on other primary givens, such as properties priced significantly below market value (as in the case of bank OREO portfolios or corporate relocation program home sales), the intended purpose of the loan, and the intended holding period of the asset. For example, financing the purchase of a home priced 15% below current appraised value, with a planned four-year horizon, with an interest only 5/1 ARM, may make sense for a medical student in an area where rents are high and where roommates can contribute to help spread the cost of the loan.

The second metric for rating conditions in our example is a future-to-current payment ratio. The numerator is equal to a probability-weighted payment amount based on the current payment amount at loan origination, the maximum possible payment amount five years into the contract, and the simple average of the two payment amounts; the denominator is the loan payment amount at origination.

Alternatively, and more simply, an assumed increment in interest rates, say 3 percent, can be used to calculate the future loan payment, and that can be used to calculate the debt ratio, assuming no increase in income for a more conservative approach.

A CCAF business rule rates vulnerability as high or low, based on whether the new payment will exceed the policy debt ratio and whether the future LTV exceeds a threshold (for instance, equal to or greater than 100%), as shown in Exhibit 2.9.

**EXHIBIT 2.9****CONDITIONS (VULNERABILITY) RATING**

Case	Future Debt-to-Income (DTI) Ratio	Future Loan-to-Value (LTV) Ratio	Vulnerability Rating
1	Does Not Exceed Threshold (at 5 years with maximum repricing and constant income)	Less than 100% (at 5 years)	Low
2	Does Not Exceed Threshold	100% or More	High
3	Exceeds Threshold	Less than 100% (at 5 years)	High
4	Exceeds Threshold	100% or More	High

This takes into account both (1) the impact of a housing bubble, which can lower the value of the home and curtail access to capital via cash-out refinancing, and (2) the risk of rising interest rates, which can dramatically increase loan payments. Borrower vulnerability will alert the lender immediately if the consumer is applying for a type of loan product that is not suitable due to future affordability risk, even if that product provides a smaller payment amount in the short run, which in turn improves borrower capacity. Current credit scoring models could possibly incorporate this type of factor, presenting this as an opportunity to use scoring technology to quantify borrower vulnerability based upon a host of different factors. The downside to utilizing scoring models is some loss of transparency and less adaptability.

## Secondary Factors

Situations where credit applications have a weakness in one or more primary factors are a very common occurrence. In these cases, it may become necessary to gather additional data in order to qualify the borrower for a loan. This capability is built into the new system's framework as the sixth primary factor, following the Five Cs of Credit. We named this primary element *secondary factors*. Some examples of traditional secondary factors are similar housing expense, strong reserves, demonstrated ability to carry high debt, bank relationship, stable years in profession, stable years in residence, discretionary income, low credit usage, strong credit score, explanation of derogatory items, years of education, and cash flow analysis.

Each secondary factor is categorized and risk rated for inclusion in the sixth primary element of CCAF. Examples of more traditional secondary factors, and their rating categories, appear in Exhibit 2.10.

Some examples of alternative secondary factors, and possible rating categories, appear in Exhibit 2.11.

The secondary factors that come into play can vary depending on the combination of the first five primary factor ratings. Exhibit 2.12 enumerates all possible combinations for three primary factors. In every case it specifies secondary factors that may make the loan possible in the event that the initial decision would be to deny the loan, or may reduce the rate on loans that would be approved.

## EXHIBIT 2.10

**TRADITIONAL SECONDARY FACTOR  
DEFINITIONS AND RISK RATINGS**

Secondary Factor	Poor	Fair	Good
Months of reserves <sup>a</sup>	2 months or less	3 to 5 months	6 months +
Similar housing expense <sup>b</sup>	>135% of previous payment	>120 to 135% of previous payment	120% or less of previous payment
Time in profession	<3 years	3 to 4 years	5 years +
Time on current job	<2 years	2 to 4 years	4 years +
Time at residence <sup>c</sup>	<1 year	1 to 2 years	2 years +
Strong liquid assets	4% or less Loan Amt.	5 to 9% Loan Amt.	>10% Loan Amt.
Credit bureau score <sup>d</sup>	<620	620 to 699	700+
History of handling higher debt	<1 year	1–3 years	3+ years
Discretionary income <sup>e</sup>	<\$1M/month	\$1M to \$3M/month	>\$3M/month
Relationship	None	1 loan, deposit, or investment account	2+ loan, deposit, or investment accounts

<sup>a</sup>Typical values sought in the industry are six to 12 months, with two months considered a minimum guideline. The loan amount is also considered (e.g., a \$250,000 loan might require \$20,000 in reserves).

<sup>b</sup>A typical threshold in the industry for conventional mortgages and low/mod loans is 125%, with lesser or equal values considered to be good.

<sup>c</sup>More of a consideration for refinancing, not home purchase mortgages.

<sup>d</sup>A credit bureau score threshold for subprime loans has historically been 660. The name of the score varies by major credit bureau, and includes FICO (for Fair Isaac & Co.), Beacon, and Equifax.

<sup>e</sup>Defined as total monthly income less total monthly debt.

## EXHIBIT 2.11

**ALTERNATIVE SECONDARY FACTOR  
DEFINITIONS AND RISK RATINGS**

Secondary Factor	Poor	Fair	Good
Utility payment history	3+ times late	1 to 2 late	0 times late
Non-credit payment score	<660	660 to 720	>720
Phone payment history	<1 year	1 to 2 years	2 years +
Non-credit payment-to-income ratio	60% +	41 to 59%	<40%
Months since most recent late non-credit payment	<1 year	7 to 12 months	12 months +

## EXHIBIT 2.12

SECONDARY FACTORS MAY ADDRESS  
WEAKNESSES IN PRIMARY FACTORS

Pay History	Capacity	Collateral		
		Low	Moderate	High
Poor	Low	Just won the \$million lottery!!	Superior capital Alternative payment history	Explanation of derogatory items Good history of handling higher debt Superior capital
Poor	Moderate	Strong capital Pay shock (<115%) Explanation of derogatory items	Strong capital Explanation of derogatory items Alternative payment history	Strong capital Explanation of derogatory items Established savings pattern
Poor	High	Pay shock (<120%) Moderate capital Explanation of derogatory items	Pay shock (<130%) Explanation of derogatory items Alternative payment history	Alternative payment history Explanation of derogatory items Good history of handling higher debt
Fair	Low	Pay shock (<110%) Cash flow analysis Superior capital Explanation of credit history	History of handling higher payments Moderate capital Similar housing payment	Pay shock (<125%) Good history of handling higher debt Moderate capital
Fair	Moderate	Pay shock (<120%) Cash flow analysis Strong capital Alternative payment history	Pay shock (<125%) Moderate capital Alternative payment history	Moderate capital Alternative payment history
Fair	High	Alternative payment history Moderate capital	Alternative payment history Education/years in profession	Alternative payment history Education/years in profession
Good	Low	Similar housing payment Strong liquid assets Education/years in profession Cash flow analysis	Pay shock (<115%) Moderate capital Education/years in profession Fair liquid assets	Fair history of handling higher debt Pay shock (<125%) Education/years in profession
Good	Moderate	Cash flow analysis Pay shock (<125%) Moderate capital	Cash flow analysis Pay shock (<125%) Moderate capital	None required
Good	High	Moderate capital	None required	None required

Suppose an applicant possessed a fair credit history and a low capacity and a low down payment. This corresponds to the fourth row and third column from the left in Exhibit 2.12. In order to obtain approval for the loan, the borrower in this case would need to have a new housing payment that is no more than 10% greater than what she is currently paying. She would also need to have superior cash reserves, and an explanation of her credit history. She would also have to submit to a cash flow analysis of her known obligations and income sources to ensure that there are no shortfalls.

It should be noted that CCAF affords flexibility, because secondary factors can be added, modified, or deleted without any structural change to the system. Unlike a scorecard, it allows credit policy to live and breathe in order to respond to market conditions and management risk tolerances. At the same time, CCAF provides a risk score that is based on all relevant factors.

## CCAF AND EXISTING UNDERWRITING MODELS

Exhibit 2.13 provides a comparison of the new underwriting system with typical underwriting models. While this summary is a generalization and simplification, it does convey some critical differences, which we view as needed improvements in the way underwriting systems should work.

There are obvious crossover effects between the Five Cs, such as the notion that the risk associated with a loan having undocumented income (Capacity) can adequately be quantified and priced for a subprime option-type mortgage (Conditions), or that there are reserves (Capital) that can be tapped if necessary in the future due to rising property valuations (Collateral). The subprime mortgage crisis, and spill-over effect to prime mortgage loans, can be traced to many of the shortcomings summarized here and to combined assumptions across key underwriting factors.

CCAF can be developed to reflect the loan applicant population that is specific to any given lending institution, and it can also be fashioned more broadly to handle the type of market model that would be used to qualify loans for sale to investors in the capital markets, or for whole loan bulk purchase offerings to other lenders. In Chapter 5, we explore the importance of a market model as we consider how CCAF can help

## EXHIBIT 2.13

**CCAF VERSUS STATUS QUO UNDERWRITING (U/W) MODEL<sup>a</sup>**

Key U/W Factors	Typical U/W System	CCAF
Character (Payment History)	Credit History Dominant, Age of Trades, Types of Credit, Credit Inquiries, Stability Factors	Credit + Cash Payments, Default/Non-Default, New/Established, Stability Factors
Capacity (Income, Debt)	Verified Income, Number of Dependents, Regional Location (Cost of Living), Stated/Undocumented Income (Now Discontinued!), Credit Obligations	Verified Income, Number of Dependents, Region, Credit + Non-Credit Obligations, Future Income Stream
Capital (Liquidity, <sup>b</sup> Net Worth)	Checking, Savings Accounts, Investments	Bank Accounts, Investment Accounts, Insurance Products w/Cash Values, Insurance Protection
Collateral (Current/Future Value)	Current Appraisal	Current Appraisal, Future Valuation
Conditions (Vulnerability—includes economic effects, borrower circumstances, and product terms)	“Prime” Borrowers can be sold “Subprime” Loans, Risk-Based Mispricing, Payment-Minimization Focus, Channel Cost Structure	Match Borrowers to Right Loan Product, Default Odds Geared to Homogeneous Handle Groups, Affordability/Suitability Focus, Future Payment Stream

<sup>a</sup>Small business lending presents additional considerations that are covered by additional business-related key factors, such as industry, location, target market, external economic conditions, management strength, financial strength, and relationship with lender. For an example, see Clark Abrahams and Mingyan Zhang, *Fair Lending Compliance: Intelligence and Implications for Credit Risk Management* (John Wiley & Sons, 2008), pp. 225–234.

<sup>b</sup>Liquidity is now seen as the most severe risk facing the banking industry, according to this year's Banking Banana Skins survey. *Banking Banana Skins 2008: An industry in turmoil*.

purchasers of loans originated using CCAF, and also investors in loan-backed securities, better assess the likely default and prepayment experience of the portfolio of loans in question. Indeed, it was suggested in early 2008, as we briefed representatives from three primary financial services industry associations,<sup>25</sup> that standardization of the credit assessment framework would pay huge dividends, as opposed to the case where each lending institution invents its own version of the primary factors and their associated thresholds. We see great value in such a framework from several directions. It would bring needed conformity, and

cohesiveness, to what is currently a sizable collection of different underwriting standards that are nuanced for specific loan products, lending programs, and for loans that are destined to ultimately reside in targeted loan securitization pools. The scope we are envisioning in this area would include not only conventional loans that are sold to Fannie Mae and Freddie Mac, but also government-guaranteed loans that are underwritten to Federal Housing Administration (FHA) and Department of Veterans Affairs (VA) standards.

EXAMPLE

This section provides an in-depth example of CCAF based on the rating methodology described in the previous section. We have selected a generic example of a mortgage loan that is used to purchase a home. This example provides the reader with an important foundation and reference case for concepts introduced in later chapters. We draw from it repeatedly in order to illustrate CCAF’s ability to make the entire lending value chain more cohesive. We will also use this example in many ways to show how CCAF will benefit borrowers, lenders, and investors.

Basic Elements

We begin by identifying CCAF primary factors, and we adopt a general rating scheme for capturing borrower qualifications. Exhibit 2.14 provides the required structure. The reader will note that for each factor, the worst rating appears to the left and the rating improves as you move

EXHIBIT 2.14		CCAF GENERAL STRUCTURE: RISK RATINGS FOR PRIMARY/SECONDARY FACTORS			
		Risk Ratings (Worst[1] to Best[4])			
Factors	1	2	3	4	
Payment History	Poor	Fair	Good	n/a	
Capacity	Low	Moderate	High	n/a	
Capital	Low	Moderate	Strong	Superior	
Collateral	Low	Moderate	High	n/a	
Vulnerability	High	Low	n/a	n/a	
Secondary Factors	No	Yes	n/a	n/a	

to the right. For example, the ratings for the third primary factor, capital, range from low to superior.

In addition to identifying primary factors for our lending framework, and category ratings, we must select quantitative or qualitative measures that can effectively be used to rate borrowers for each of the primary factors. For this example, we have already completed this work in our discussion of each of the Five Cs of credit and secondary factors. When the primary factors are combined, the result is a table that enumerates all possibilities. Exhibit 2.15 illustrates just such an enumeration for this example.

EXHIBIT 2.15

CCAF BORROWER SEGMENTS: PROVIDES A HANDLE ON RISK ASSESSMENT

				Vulnerability			
				High	High	Low	Low
				Secondary Factors			
Pymthist	Capacity	Capital	Collateral	No	Yes	No	Yes
Poor	Low	Low	Low	1	2	3	4
Poor	Low	Low	Moderate	5	6	7	8
Poor	Low	Low	High	9	10	11	12
Poor	Low	Moderate	Low	13	14	15	16
Poor	Low	Moderate	Moderate	17	18	19	20
Poor	Low	Moderate	High	21	22	23	24
Poor	Low	Strong	Low	25	26	27	28
Poor	Low	Strong	Moderate	29	30	31	32
Poor	Low	Strong	High	33	34	35	36
Poor	Low	Superior	Low	37	38	39	40
Poor	Low	Superior	Moderate	41	42	43	44
Poor	Low	Superior	High	45	46	47	48
Poor	Moderate	Low	Low	49	50	51	52
Poor	Moderate	Low	Moderate	53	54	55	56
Poor	Moderate	Low	High	57	58	59	60
Poor	Moderate	Moderate	Low	61	62	63	64
Poor	Moderate	Moderate	Moderate	65	66	67	68
Poor	Moderate	Moderate	High	69	70	71	72
Poor	Moderate	Strong	Low	73	74	75	76
Poor	Moderate	Strong	Moderate	77	78	79	80
Poor	Moderate	Strong	High	81	82	83	84
Poor	Moderate	Superior	Low	85	86	87	88
Poor	Moderate	Superior	Moderate	89	90	91	92
Poor	Moderate	Superior	High	93	94	95	96



EXHIBIT 2.15 (CONTINUED)

				Vulnerability			
				High	High	Low	Low
				Secondary Factors			
Pymthist	Capacity	Capital	Collateral	No	Yes	No	Yes
Poor	High	Low	Low	97	98	99	100
Poor	High	Low	Moderate	101	102	103	104
Poor	High	Low	High	105	106	107	108
Poor	High	Moderate	Low	109	110	111	112
Poor	High	Moderate	Moderate	113	114	115	116
Poor	High	Moderate	High	117	118	119	120
Poor	High	Strong	Low	121	122	123	124
Poor	High	Strong	Moderate	125	126	127	128
Poor	High	Strong	High	129	130	131	132
Poor	High	Superior	Low	133	134	135	136
Poor	High	Superior	Moderate	137	138	139	140
Poor	High	Superior	High	141	142	143	144
Fair	Low	Low	Low	145	146	147	148
Fair	Low	Low	Moderate	149	150	151	152
Fair	Low	Low	High	153	154	155	156
Fair	Low	Moderate	Low	157	158	159	160
Fair	Low	Moderate	Moderate	161	162	163	164
Fair	Low	Moderate	High	165	166	167	168
Fair	Low	Strong	Low	169	170	171	172
Fair	Low	Strong	Moderate	173	174	175	176
Fair	Low	Strong	High	177	178	179	180
Fair	Low	Superior	Low	181	182	183	184
Fair	Low	Superior	Moderate	185	186	187	188
Fair	Low	Superior	High	189	190	191	192
Fair	Moderate	Low	Low	193	194	195	196
Fair	Moderate	Low	Moderate	197	198	199	200
Fair	Moderate	Low	High	201	202	203	204
Fair	Moderate	Moderate	Low	205	206	207	208
Fair	Moderate	Moderate	Moderate	209	210	211	212
Fair	Moderate	Moderate	High	213	214	215	216
Fair	Moderate	Strong	Low	217	218	219	220
Fair	Moderate	Strong	Moderate	221	222	223	224
Fair	Moderate	Strong	High	225	226	227	228
Fair	Moderate	Superior	Low	229	230	231	232
Fair	Moderate	Superior	Moderate	233	234	235	236
Fair	Moderate	Superior	High	237	238	239	240
Fair	High	Low	Low	241	242	243	244
Fair	High	Low	Moderate	245	246	247	248
Fair	High	Low	High	249	250	251	252
Fair	High	Moderate	Low	253	254	255	256

(Continued)

EXHIBIT 2.15 (CONTINUED)

Pymthist	Capacity	Capital	Collateral	Vulnerability			
				High	High	Low	Low
				Secondary Factors			
				No	Yes	No	Yes
Fair	High	Moderate	Moderate	257	258	259	260
Fair	High	Moderate	High	261	262	263	264
Fair	High	Strong	Low	265	266	267	268
Fair	High	Strong	Moderate	269	270	271	272
Fair	High	Strong	High	273	274	275	276
Fair	High	Superior	Low	277	278	279	280
Fair	High	Superior	Moderate	281	282	283	284
Fair	High	Superior	High	285	286	287	288
Good	Low	Low	Low	289	290	291	292
Good	Low	Low	Moderate	293	294	295	296
Good	Low	Low	High	297	298	299	300
Good	Low	Moderate	Low	301	302	303	304
Good	Low	Moderate	Moderate	305	306	307	308
Good	Low	Moderate	High	309	310	311	312
Good	Low	Strong	Low	313	314	315	316
Good	Low	Strong	Moderate	317	318	319	320
Good	Low	Strong	High	321	322	323	324
Good	Low	Superior	Low	325	326	327	328
Good	Low	Superior	Moderate	329	330	331	332
Good	Low	Superior	High	333	334	335	336
Good	Moderate	Low	Low	337	338	339	340
Good	Moderate	Low	Moderate	341	342	343	344
Good	Moderate	Low	High	345	346	347	348
Good	Moderate	Moderate	Low	349	350	351	352
Good	Moderate	Moderate	Moderate	353	354	355	356
Good	Moderate	Moderate	High	357	358	359	360
Good	Moderate	Strong	Low	361	362	363	364
Good	Moderate	Strong	Moderate	365	366	367	368
Good	Moderate	Strong	High	369	370	371	372
Good	Moderate	Superior	Low	373	374	375	376
Good	Moderate	Superior	Moderate	377	378	379	380
Good	Moderate	Superior	High	381	382	383	384
Good	High	Low	Low	385	386	387	388
Good	High	Low	Moderate	389	390	391	392
Good	High	Low	High	393	394	395	396
Good	High	Moderate	Low	397	398	399	400
Good	High	Moderate	Moderate	401	402	403	404
Good	High	Moderate	High	405	406	407	408
Good	High	Strong	Low	409	410	411	412
Good	High	Strong	Moderate	413	414	415	416
Good	High	Strong	High	417	418	419	420
Good	High	Superior	Low	421	422	423	424
Good	High	Superior	Moderate	425	426	427	428
Good	High	Superior	High	429	430	431	432

Each of the resulting 432 combinations is identified by a unique number. We refer to this number as a *CCAF handle*.<sup>26</sup> For example, referring to the last row in Exhibit 2.15, handle 432 corresponds to a borrower that has a good credit history, high capacity, superior capital position, high collateral equity position, low vulnerability to higher loan payments or home price depreciation, and acceptable secondary factors that further strengthen the loan application. In other words, the handle is a unique identifier that classifies all consumers into one of 432 unique segments in this example. If consumers know their handles, they immediately know their ratings relative to all primary factors in the lending decision (provided that this information is shared—which we strongly endorse).

In the absence of data, a team of seasoned mortgage underwriters and credit managers could go through each combination of factors and determine whether to grant a loan, decline a loan, or seek further information prior to making a final decision. For example, a mortgage loan underwriter might consider an applicant, whom we refer to as Jim the Landscaper, who has *poor* credit history, *low* capacity, and *low* capital as a marginally acceptable credit risk. How so, you might ask? Well, our underwriter sees that Jim has a down payment of 40% and that nets him a *high* collateral rating. Jim has opted for a 30-year, fixed-rate loan product and the price of the home he is purchasing has not moved more than 15% in base valuation over the past five years and that means that Jim has a *low* vulnerability to home value fluctuations and no possibility of increasing monthly principal and interest mortgage payments. Finally, Jim's new proposed housing payment is only 10% higher than his current one, which means he has no significant payment shock. Jim also has a history of being able to carry higher-than-normal debt, and so he is actually overpenalized by being rated low on capacity. Furthermore, Jim's explanation for his poor credit history is that it was largely due to hardship caused by loss of income as a consequence of a serious auto accident over a year ago and subsequent medical bills, which are now all paid in full. Jim has brought all of his accounts current and there is no record of delinquency during the past four months. Prior to the accident, Jim's payment history was rated as good. These circumstances are very

material to the lending decision and they qualify Jim to achieve a *yes* rating for his acceptable secondary factors. At this point we can classify Jim using CCAF and, referring to Exhibit 2.15, Jim is associated with handle number 10. Exhibit 2.16 shows how Jim, and the full spectrum of mortgage loan applicants, fare relative to one possible outcome of a *purely judgmental* lending exercise.

EXHIBIT 2.16      CCAF JUDGMENTAL RISK ASSESSMENT

				Decision			
				Vulnerability			
				Low	Low	High	High
				Secondary Factor			
Pymthist	Capacity	Capital	Collateral	No	Yes	No	Yes
Poor	Low	Low	Low	Fail	Fail	Fail	Fail
Poor	Low	Low	Moderate	Fail	Fail	Fail	Fail
Poor	Low	Low	High	Fail	Marginal	Fail	Fail
Poor	Low	Moderate	Low	Fail	Fail	Fail	Fail
Poor	Low	Moderate	Moderate	Fail	Fail	Fail	Fail
Poor	Low	Moderate	High	Fail	Marginal	Fail	Fail
Poor	Low	Strong	Low	Fail	Fail	Fail	Fail
Poor	Low	Strong	Moderate	Fail	Marginal	Fail	Fail
Poor	Low	Strong	High	Fail	Marginal	Fail	Fail
Poor	Low	Superior	Low	Fail	Fail	Fail	Fail
Poor	Low	Superior	Moderate	Fail	Marginal	Fail	Fail
Poor	Low	Superior	High	Marginal	Marginal	Fail	Fail
Poor	Moderate	Low	Low	Fail	Fail	Fail	Fail
Poor	Moderate	Low	Moderate	Fail	Fail	Fail	Fail
Poor	Moderate	Low	High	Marginal	Marginal	Fail	Fail
Poor	Moderate	Moderate	Low	Fail	Fail	Fail	Fail
Poor	Moderate	Moderate	Moderate	Fail	Marginal	Fail	Fail
Poor	Moderate	Moderate	High	Marginal	Marginal	Fail	Marginal
Poor	Moderate	Strong	Low	Fail	Marginal	Fail	Fail
Poor	Moderate	Strong	Moderate	Marginal	Marginal	Fail	Fail
Poor	Moderate	Strong	High	Marginal	Pass	Fail	Marginal
Poor	Moderate	Superior	Low	Fail	Marginal	Fail	Fail
Poor	Moderate	Superior	Moderate	Marginal	Marginal	Fail	Marginal
Poor	Moderate	Superior	High	Pass	Pass	Marginal	Pass
Poor	High	Low	Low	Fail	Marginal	Fail	Fail
Poor	High	Low	Moderate	Fail	Marginal	Fail	Fail
Poor	High	Low	High	Marginal	Pass	Marginal	Pass
Poor	High	Moderate	Low	Fail	Marginal	Fail	Fail
Poor	High	Moderate	Moderate	Marginal	Marginal	Fail	Marginal

EXHIBIT 2.16 (CONTINUED)

Pymthist	Capacity	Capital	Collateral	Decision			
				Vulnerability			
				Low	Low	High	High
				Secondary Factor			
				No	Yes	No	Yes
Poor	High	Moderate	High	Marginal	Pass	Marginal	Pass
Poor	High	Strong	Low	Marginal	Marginal	Fail	Fail
Poor	High	Strong	Moderate	Marginal	Pass	Marginal	Marginal
Poor	High	Strong	High	Pass	Pass	Marginal	Pass
Poor	High	Superior	Low	Fail	Pass	Fail	Fail
Poor	High	Superior	Moderate	Marginal	Pass	Marginal	Marginal
Poor	High	Superior	High	Pass	Pass	Marginal	Pass
Fair	Low	Low	Low	Fail	Fail	Fail	Fail
Fair	Low	Low	Moderate	Fail	Fail	Fail	Fail
Fair	Low	Low	High	Fail	Marginal	Fail	Fail
Fair	Low	Moderate	Low	Fail	Fail	Fail	Fail
Fair	Low	Moderate	Moderate	Fail	Marginal	Fail	Fail
Fair	Low	Moderate	High	Marginal	Marginal	Fail	Fail
Fair	Low	Strong	Low	Fail	Fail	Fail	Fail
Fair	Low	Strong	Moderate	Marginal	Marginal	Fail	Fail
Fair	Low	Strong	High	Marginal	Marginal	Fail	Marginal
Fair	Low	Superior	Low	Fail	Marginal	Fail	Fail
Fair	Low	Superior	Moderate	Marginal	Pass	Fail	Fail
Fair	Low	Superior	High	Marginal	Pass	Fail	Marginal
Fair	Moderate	Low	Low	Fail	Fail	Fail	Fail
Fair	Moderate	Low	Moderate	Fail	Marginal	Fail	Fail
Fair	Moderate	Low	High	Marginal	Pass	Marginal	Marginal
Fair	Moderate	Moderate	Low	Fail	Marginal	Fail	Fail
Fair	Moderate	Moderate	Moderate	Marginal	Marginal	Fail	Fail
Fair	Moderate	Moderate	High	Marginal	Pass	Marginal	Marginal
Fair	Moderate	Strong	Low	Fail	Pass	Fail	Fail
Fair	Moderate	Strong	Moderate	Marginal	Pass	Fail	Fail
Fair	Moderate	Strong	High	Pass	Pass	Marginal	Pass
Fair	Moderate	Superior	Low	Marginal	Marginal	Fail	Fail
Fair	Moderate	Superior	Moderate	Marginal	Pass	Fail	Pass
Fair	Moderate	Superior	High	Pass	Pass	Marginal	Pass
Fair	High	Low	Low	Marginal	Marginal	Fail	Fail
Fair	High	Low	Moderate	Marginal	Pass	Fail	Marginal
Fair	High	Low	High	Pass	Pass	Marginal	Pass
Fair	High	Moderate	Low	Marginal	Marginal	Fail	Fail
Fair	High	Moderate	Moderate	Pass	Pass	Marginal	Marginal
Fair	High	Moderate	High	Pass	Pass	Marginal	Pass
Fair	High	Strong	Low	Marginal	Pass	Marginal	Fail
Fair	High	Strong	Moderate	Pass	Pass	Marginal	Marginal
Fair	High	Strong	High	Pass	Pass	Marginal	Pass

(Continued)

EXHIBIT 2.16 (CONTINUED)

Pymthist	Capacity	Capital	Collatrl	Decision			
				Vulnerability			
				Low	Low	High	High
				Secondary Factor			
				No	Yes	No	Yes
Fair	High	Superior	Low	Pass	Pass	Marginal	Fail
Fair	High	Superior	Moderate	Pass	Pass	Marginal	Marginal
Fair	High	Superior	High	Pass	Pass	Pass	Pass
Good	Low	Low	Low	Fail	Fail	Fail	Fail
Good	Low	Low	Moderate	Fail	Marginal	Fail	Fail
Good	Low	Low	High	Marginal	Marginal	Fail	Fail
Good	Low	Moderate	Low	Fail	Fail	Fail	Fail
Good	Low	Moderate	Moderate	Marginal	Marginal	Fail	Fail
Good	Low	Moderate	High	Marginal	Marginal	Fail	Fail
Good	Low	Strong	Low	Marginal	Marginal	Fail	Fail
Good	Low	Strong	Moderate	Marginal	Pass	Fail	Marginal
Good	Low	Strong	High	Pass	Pass	Fail	Marginal
Good	Low	Superior	Low	Fail	Marginal	Fail	Fail
Good	Low	Superior	Moderate	Marginal	Pass	Fail	Marginal
Good	Low	Superior	High	Pass	Pass	Fail	Marginal
Good	Moderate	Low	Low	Fail	Fail	Fail	Fail
Good	Moderate	Low	Moderate	Marginal	Marginal	Fail	Marginal
Good	Moderate	Low	High	Pass	Pass	Marginal	Pass
Good	Moderate	Moderate	Low	Marginal	Marginal	Fail	Fail
Good	Moderate	Moderate	Moderate	Pass	Pass	Fail	Marginal
Good	Moderate	Moderate	High	Pass	Pass	Marginal	Marginal
Good	Moderate	Strong	Low	Marginal	Pass	Fail	Fail
Good	Moderate	Strong	Moderate	Pass	Pass	Marginal	Marginal
Good	Moderate	Strong	High	Pass	Pass	Marginal	Pass
Good	Moderate	Superior	Low	Pass	Pass	Fail	Marginal
Good	Moderate	Superior	Moderate	Pass	Pass	Marginal	Pass
Good	Moderate	Superior	High	Pass	Pass	Marginal	Pass
Good	High	Low	Low	Marginal	Pass	Fail	Fail
Good	High	Low	Moderate	Pass	Pass	Fail	Marginal
Good	High	Low	High	Pass	Pass	Marginal	Pass
Good	High	Moderate	Low	Marginal	Pass	Fail	Marginal
Good	High	Moderate	Moderate	Pass	Pass	Fail	Pass
Good	High	Moderate	High	Pass	Pass	Marginal	Pass
Good	High	Strong	Low	Marginal	Pass	Fail	Marginal
Good	High	Strong	Moderate	Pass	Pass	Marginal	Pass
Good	High	Strong	High	Pass	Pass	Pass	Pass
Good	High	Superior	Low	Pass	Pass	Marginal	Pass
Good	High	Superior	Moderate	Pass	Pass	Marginal	Pass
Good	High	Superior	High	Pass	Pass	Pass	Pass

The initial reaction may be that this would represent a lot of work and also some compromise around the risk classification of borrowers relative to their primary factor combinations. Certainly, it would strengthen credit policy by affording more guidance to loan officers and underwriters who typically must attempt to apply more general guidelines to specific cases they encounter. Each and every loan application has its own twists, and only too often loan underwriting systems fail to capture the proper context. That context does not reside in the raw borrower data itself. Even when used in the pure judgmental mode described, CCAF brings enormous lift to the credit evaluation process. This is due not only to additional factors and rules that can be brought to bear on the lending decision, but also to CCAF's ability to first build a complete context that can be used to view the borrower comprehensively at a single processing point and, when necessary, weigh any required additional factors within that comprehensive context. In other words, CCAF enables the loan underwriter to avoid rules of thumb that may apply in a majority of cases but can be useless, or even harmful, in a minority of cases.

One area where a purely judgmental lending system cannot provide an adequate answer is the ability to provide an odds quote with the recommended action. In other words, if a loan is approved, or denied, what is its associated default probability? One reason this is important, is that a lender would like to know how much risk the institution is booking in a given reporting period, or even from day to day. To address this, judgmental systems collect performance data on past loans and analyze it to determine if their policy guidelines are being met, and also to validate that they are adequately managing risk. But without a framework, and a means to uniquely identify similarly situated loan applications, the task is nearly impossible—especially if one's goal is to provide actionable and specific feedback to the underwriters on their decisions. Also, CCAF's new information should prove useful to those responsible for setting appropriate loan loss reserve levels. Loan loss reserve is typically viewed as a separate exercise that is based on loan performance in the aggregate (that is, all loans booked in a particular quarter of the year, having similar maturity and terms and loan purpose, and possibly geographic location). We contend that rather than waiting for delinquency trends to surface, it would be far preferable to see the CCAF handle-based risk breakdown that surfaces risky concentrations to better anticipate loan defaults.

CCAF leverages on the best of judgment, but it avoids the limitations just described by tapping loan performance data and broader sets of borrower information to provide quantitative support for CCAF primary risk classifications and also secondary factors, which can come into play conditionally. As a result, every handle, or consumer segment, has a CCAF score associated with it that quantifies how many good loans for every bad loan are expected. It is important for the reader not to confuse this handle risk score with the credit scores today that are in consumer credit files. The credit score that is so commonly used today to assess borrowers for creditworthiness, is based on a much narrower set of information, and it is of no value as an estimator of probability of loan default to CCAF. The only possible use for it would be in the rating definition for credit payment history in the character primary factor.

In addition to the reasons just discussed on the need to quantify risk, the CCAF score is also useful for setting overall risk tolerances, which makes very complicated lending decisions more clear-cut. In order to understand why this is the case, we need to consider some credit granting strategies and how they are represented and carried out using CCAF. If a lender's strategy is to target an 80% approval rate for mortgage loans overall, or if the goal is to take no more than 200 bad loans per 10,000 loan originations, CCAF will identify the handles that should be approved and those that should be declined, to achieve the goal. Case in point, to take only 200 bad loans per 10,000 loan approvals, the CCAF cutoff score would be 722.<sup>27</sup> There are three handle numbers that correspond

**EXHIBIT 2.17    CCAF SCORE QUANTIFIES RISK TO IMPROVE JUDGMENTAL DECISIONS**

Pay History	Capacity	Capital	Collateral	Vulnerability Low		CCAF Score
				Secondary	No	
Fair	Moderate	Strong	Low	Handle #: Decision:	217 Judgmental Fail	722 Approve
Fair	Moderate	Strong	Mod	Handle #: Decision:	221 Judgmental Marginal	722 Approve
Fair	High	Mod	Mod	Handle #: Decision:	257 Judgmental Pass	722 Approve



to a CCAF score of 722: 217, 221, and 257.<sup>28</sup> Exhibit 2.17 shows the judgmental ratings for these handles from Exhibit 2.15, and the value of having a CCAF score to quantify the risk becomes readily apparent. The power of CCAF is its ability to quantify risk, while also providing transparency to ensure that risk scores make sense relative to their linkage through the combination of primary lending factors.

While data is not a requirement for the development of a CCAF-based system, we have just seen how it can be put to good use to create a risk score. In general, a full set of data helps to better control and monitor initial system performance. An initial development sample for CCAF makes it possible to produce a more accurate forecast of handle-based acceptance rates and also handle-based breakdowns of loans that are originated by considering the primary factors that make up the handle. These forecasts are produced for each factor individually, and also for all possible pairwise, three-way, four-way, and five-way combinations to spot hidden trends, explore reasons for higher- or lower-than-expected loan approvals overall, and for isolating counterintuitive patterns. An example of a pattern that would look strange might occur if one of two nearly identical categories was rated higher by a single factor (so it should be less risky), but actually had a lower acceptance rate than its riskier counterpart. We will examine several of these tables toward the end of this section. From the time CCAF is implemented, information will accumulate. Over time, the system's predictive capability will increase, in sharp contrast to credit scoring systems, whose overall predictive ability diminishes from the day they are installed.

For the purposes of our example, we will assume that performance and application data on loans is available and that it has been sourced and validated for accuracy. The data sample used for this specific example consisted of 11,806 credit applications having known performance (6,746 classified as having good performance and 5,060 classified as having bad performance). The breakdown of that sample, relative to our primary factors, is given in Exhibit 2.18.

The data sample also included 5,097 rejected credit applications. The breakdown of the reject sample, relative to our primary factors, is given in Exhibit 2.19.

Space limitations preclude display of all 432 handle sample counts and system development statistics. Exhibit 2.20 provides key statistics and information for two representative handles. We can examine the column for handle 161, which corresponds to borrowers having fair payment

**EXHIBIT 2.18 KNOWN PERFORMANCE SAMPLE COUNTS BY INDIVIDUAL PRIMARY FACTORS**

Payment History		Collateral		Capacity	
Poor	3,152	Low	4,116	Low	3,095
Fair	3,997	Moderate	4,095	Moderate	3,764
Good	4,657	High	3,595	High	4,947
Total	11,806	Total	11,806	Total	11,806
Capital		Vulnerability		Secondary Factors	
Low	2,780	High	5,852	No	5,250
Moderate	3,016	Low	5,954	Yes	6,556
Strong	2,923	Total	11,806	Total	11,806
Superior	3,087				
Total	11,806				

**EXHIBIT 2.19 REJECTED APPLICATION SAMPLE COUNTS BY INDIVIDUAL PRIMARY FACTORS**

Payment History		Collateral		Capacity	
Poor	1,992	Low	1,840	Low	1,671
Fair	2,882	Moderate	1,857	Moderate	2,057
Good	223	High	1,400	High	1,369
Total	5,097	Total	5,097	Total	5,097
Capital		Vulnerability		Secondary Factors	
Low	1,177	High	2,439	No	3,082
Moderate	1,331	Low	2,658	Yes	2,015
Strong	1,391	Total	5,097	Total	5,097
Superior	1,198				
Total	5,097				

history, low capacity, moderate capital, and moderate collateral ratings, high vulnerability, and no supporting secondary factors. Handle 161 had 2 good loans, 10 bad performing loans, and 25 rejected loan applications. CCAF development methodology includes a procedure that can infer the behavior of the declined applicants more effectively than prevailing credit scoring methods could. This is mainly due to (1) the inclusion of all primary lending factors; (2) the simultaneous consideration of those factors;

EXHIBIT 2.20

## HANDLE-BASED STATISTICS

				Vulnerability	High	High
				Secondary	No	Yes
Pymthist	Capacity	Capital	Collateral	Handle	161	162
Fair	Low	Mod	Mod	Knowns	12	18
				(K) Bads	10	15
				(K) Goods	2	3
				(K) G/B Odds	.17	.17
				Unknowns	25	9
				(E) Expected Bads	7.64	2.75
				(E) Expected Goods	17.36	6.25
				All Applicants (Scaled to 10,000)	32	39
				(K + E) Goods	28	36
				(K + E) Bads	4	3
				(K + E) % Applicants	0.13	0.08
				(K + E) CCAF Score	684	684
				Action	Decline	Decline

(3) the use of alternative data; (4) the inclusion of forward-looking measures associated with borrower vulnerability that consider future economic states and their impact on loan payment amount, collateral value, and borrower equity; and (5) CCAF's ability to leverage business rules and proven credit principles, in addition to historical loan performance data, to ensure all qualitative risk concerns are captured and addressed.

For each handle, Exhibit 2.20 shows the primary quantities that are used, some of which are computed, in order to construct an information base that can be used to create strategy-based CCAF loan decision tables. In order to arrive at the singular CCAF score for loan default risk (for instance, 684 for handles 161 and 162 in Exhibit 2.20), the sample of applicants having known loan performance can be used to infer the number of likely good and bad loan applicants in the reject sample of mortgage applications. For the population at large, the known bad rate was 6%. The inferred bad rate for the declined applicant group, or unknowns, was 15%. In other words, the unknown group was found to be 2.5 times more at risk for default than the known group. Once this reject inference process has been completed,

EXHIBIT 2.21

**FINAL CCAF LOAN  
APPLICANT COUNTS**

Known Goods	7,504
Inferred Goods	1,702
Total Goods	9,206
Known Bads	496
Inferred Bads	298
Total Bads	794
Total Applicants	10,000

each handle will have an associated number of good and bad applicants associated with it that correspond to the predicted performance of future loan applications associated with it, together with the forecasted percentage of applications that will end up in the handle and their associated score. For this example, Exhibit 2.21 displays the final counts for the reconstructed applicant population, scaled to 10,000 loan applicants.

An abbreviated example of a CCAF loan decision table is displayed in Exhibit 2.22 that corresponds to a strategy of maintaining an 80% acceptance rate. We suppressed 75% of the handles (that is, primary factor combinations) due to space considerations. We preserved handles corresponding to all specific examples used throughout the book.

This CCAF decision table is identical to our earlier Exhibit 2.15 that specified CCAF borrower segments, except that in addition to the handle identifier, it specifies an action for every combination of primary factors, and secondary factor consideration when indicated. This decision table is one of 87 distinct CCAF decision tables, each of which corresponds to a different CCAF score threshold. In the case of Exhibit 2.22, the threshold was selected so as to maintain a specified acceptance rate (80%) for mortgage applications.

It should be noted that unlike setting a scorecard cutoff, CCAF has the additional advantage that individual handles can be singled out, within the identical risk category, for special treatment. For example, if handles corresponding to borrowers with high vulnerability at a specified CCAF score level were determined to reflect higher than normal risk due to a sudden change in the housing market, or relative to market interest rates, those handles could be assigned a lower CCAF score that more accurately reflects the risk. The result would be that borrowers would likely still qualify if they opted for loan products that have more predictable

Pymthist	Capacity	Capital	Collateral	Vulnerability		High		Low	
				Secondary	No	Yes	No	Yes	Low
Poor	Low	Low	Low	Cell No. 1	Decline	2	3	4	Decline
Poor	Low	Low	Moderate	Action Cell No. 5	Decline	6	7	8	Decline
Fair	Low	Low	Moderate	Action Cell No. 149	Decline	150	151	152	Decline
Fair	Low	Moderate	Moderate	Action Cell No. 161	Decline	162	163	164	Decline
Fair	Low	Moderate	High	Action Cell No. 165	Decline	166	167	168	Approve
Fair	Moderate	Low	Low	Action Cell No. 193	Approve	Approve	Approve	Approve	Approve
Fair	Moderate	Low	Moderate	Action Cell No. 197	Decline	198	199	200	Decline
Fair	Moderate	Low	High	Action Cell No. 201	Decline	Approve	Decline	Approve	Approve
Fair	Moderate	Moderate	Moderate	Action Cell No. 209	Approve	Approve	Approve	Approve	Approve
Fair	Moderate	Moderate	High	Action Cell No. 213	Approve	Approve	Approve	Approve	Approve
Fair	Moderate	Strong	Low	Action Cell No. 217	Approve	Approve	Approve	Approve	Approve

Pymthist	Capacity	Capital	Collateral	Vulnerability				High	High	Low	Low
				Secondary	No	Yes	Yes				
Fair	Moderate	Strong	Moderate	Cell No.	221	Approve	222	Approve	223	224	Approve
Fair	High	Low	Moderate	Cell No.	245	Approve	246	Approve	247	248	Approve
Fair	High	Low	High	Cell No.	249	Approve	250	Approve	251	252	Approve
Fair	High	Moderate	Low	Cell No.	253	Decline	254	Decline	255	256	Approve
Fair	High	Superior	High	Cell No.	285	Approve	286	Approve	287	288	Approve
Good	Low	Low	Low	Cell No.	289	Decline	290	Decline	291	292	Decline
Good	Low	Low	Moderate	Cell No.	293	Decline	294	Decline	295	296	Decline
Good	Low	Low	High	Cell No.	297	Decline	298	Decline	299	300	Approve
Good	Low	Moderate	Low	Cell No.	301	Decline	302	Decline	303	304	Decline
Good	Low	Moderate	Moderate	Cell No.	305	Decline	306	Decline	307	308	Approve
Good	Low	Superior	High	Cell No.	333	Approve	334	Approve	335	336	Approve
Good	Moderate	Low	Low	Cell No.	337	Decline	338	Decline	339	340	Decline
Good	High	Superior	High	Cell No.	429	Approve	430	Approve	431	432	Approve

future payments, or if they sought to purchase a home that has a more stable valuation, or a home that is less expensive, or possibly increase their down payment, and so on. In other words, CCAF affords lenders with a great deal of flexibility in adjusting and enforcing their lending policy relative to their risk tolerance. For borrowers, their lender can help them better understand their options, which will enable them to better anticipate and understand the outcome of the loan decision.

In the event that a loan is declined, it is important for the lender and borrower to know why. CCAF provides a comprehensive report on the reasons, and it can be as specific as the lender and regulations require. At a minimum, such a report should indicate to borrowers where the greatest opportunity lies for improvement in their CCAF score relative to the primary factor categories.

For example, Exhibit 2.23 corresponds to the entry in the table in Exhibit 2.22 that corresponds to handle number 161. It shows that the loan applicant’s CCAF score can be improved the most by a high rating in capacity, which would result in a new CCAF score of 742, well above the approval cutoff of 713 for the 80% acceptance rate strategy.

Capital and collateral also represent areas where improvement can qualify the borrower. In this case, secondary factors cannot successfully play a role for loan qualification, unless there is a strengthening of one or more primary factors at a minimum.

For that purpose, CCAF produces a report (refer to Exhibit 2.24) that rank orders the primary factors for each declined handle, showing the points that would result if the maximum improvement were achieved in that category, and the resulting decision based on that single change. In the interest of preserving space, we have suppressed the majority of

EXHIBIT 2.23		HANDLE 161 PRIMARY FACTOR SENSITIVITY ANALYSIS			
Payment History	Capacity	Capital	Collateral	Vulnerability	Secondary Factors
Fair	Low	Moderate	Moderate	High	No
Handle 161		CCAF Score 684		CCAF Action Decline	
Capacity 58	Capital 53	Collateral 43		Vulnerability 36	
Approve	Approve	Approve		Decline	

PRIMARY FACTOR SENSITIVITY ANALYSIS SPECIFYING  
ASSOCIATED SCORE GAIN AND DECISION

Seg Ref Nbr	Factor 1 Net Gain Result	Factor 2 Net Gain Result	Factor 3 Net Gain Result	Factor 4 Net Gain Result	Seg Ref Nbr	Factor 1 Net Gain Result	Factor 2 Net Gain Result	Factor 3 Net Gain Result	Factor 4 Net Gain Result
1	Collateral	Capital	Payment History	Secondary	172	Capacity	Collateral	Capital	Payment History
2	32 Decline	18 Decline	18 Decline	12 Decline	241	89 Approve	78 Approve	49 Approve	6 Decline
	Collateral	Capital	Capacity	Payment History		Collateral	Capital	Payment History	Vulnerability
3	30 Decline	20 Decline	14 Decline	10 Decline	242	80 Approve	72 Approve	60 Approve	23 Approve
	Collateral	Capital	Payment History	Capacity		Payment History	Collateral	Capital	Vulnerability
4	66 Approve	34 Decline	20 Decline	10 Decline	289	80 Approve	67 Approve	56 Approve	38 Approve
	Collateral	Capital	Payment History	Capacity		Capital	Capacity	Collateral	Vulnerability
19	80 Approve	40 Decline	20 Decline	14 Decline	290	87 Approve	80 Approve	20 Decline	14 Decline
	Collateral	Capacity	Payment History	Secondary		Capacity	Capital	Collateral	Vulnerability
21	52 Approve	52 Approve	32 Approve	20 Approve	291	116 Approve	99 Approve	24 Decline	16 Decline
	Vulnerability	Payment History	Capital	Secondary		Capacity	Collateral	Capital	Secondary
	72 Approve	67 Approve	20 Decline	12 Decline		109 Approve	78 Approve	78 Approve	6 Decline



22	Payment History	Vulnerability	Capital	Capacity	Capital	Capacity	Capital	Vulnerability	Collateral
72	Approve	67	20	20	293	119	52	26	12
25	Collateral	Approve	Decline	Decline		Approve	Approve	Decline	Decline
		Vulnerability	Payment History	Secondary	294	Capacity	Capital	Vulnerability	Collateral
34	Decline	26	20	14		124	82	26	14
100	Payment History	Decline	Decline	Decline		Approve	Approve	Decline	Decline
		Collateral	Capital	Secondary	301	Capacity	Capital	Collateral	Vulnerability
115	Approve	86	58	0		108	83	71	16
101	Payment History	Approve	Approve	Decline		Approve	Approve	Approve	Decline
		Vulnerability	Collateral	Capital	329	Capacity	Vulnerability	Collateral	Secondary
119	Approve	32	32	32		114	67	52	47
125	Payment History	Decline	Decline	Decline		Approve	Approve	Approve	Approve
		Vulnerability	Secondary	Collateral	337	Capital	Capacity	Collateral	Vulnerability
101	Approve	40	20	20		125	83	60	11
133	Payment History	Approve	Approve	Approve		Approve	Approve	Approve	Decline
		Collateral	Vulnerability	Secondary	344	Capacity	Capital	Collateral	Payment History
122	Approve	60	40	20		96	94	60	40
161	Capacity	Approve	Approve	Decline		Approve	Approve	Approve	Approve
58	Approve	Capital	Collateral	Vulnerability	351	Capacity	Collateral	Capital	Vulnerability
162	Capacity	53	43	36		109	87	80	20
		Approve	Approve	Approve		Approve	Approve	Approve	Decline
78	Capacity	Capital	Collateral	Vulnerability	352	Capacity	Collateral	Capital	Vulnerability
		66	61	46		104	92	84	12
171	Approve	Approve	Approve	Approve		Approve	Approve	Approve	Decline
		Collateral	Capital	Secondary	367	Capacity	Capital	Collateral	Vulnerability
69	Approve	67	43	9		103	87	72	48
		Approve	Approve	Decline		Approve	Approve	Approve	Approve

cases. We preserved the decline handle sensitivity analysis for the handles 161 and 162 appearing in Exhibit 2.20 and also for the borrower qualification case examples in Chapter 4.<sup>29</sup> We note that the new system is capable of providing more detailed information relative to specific factors that make up the primary factor ratings, and it can also report on a range of secondary factors that, if certain combinations were satisfactorily met, would be sufficient to approve the loan. This feature of the system is entirely customizable to meet the needs of the lenders, while providing helpful information to borrowers.

### CCAF Score Distributions

It is useful and necessary to produce three different types of CCAF score distributions. *Distribution* is a commonly used statistical term that refers to a breakdown of the values, and relative frequency of those values, that a particular quantity takes on. Our focus here is good, bad, and total loans associated with CCAF scores at or above, or below some particular value. That value might represent a cutoff for credit approval. The first distribution we consider, which appears in Exhibit 2.25, provides the odds, number of handles, and number and percentage of good, bad, and total credit applicants, respectively, for each CCAF score. This exhibit not only specifies the odds at a given score—it also indicates how many applicants are expected to correspond to that score out of a pool of roughly 10,000 mortgage applicants, and how many of those will ultimately turn out to have either good or bad performance. The table in Exhibit 2.26 has been shortened due to space limitations and displays 28 out of the 87 distinct CCAF scores in this example.

The CCAF system in this example was scaled so that every 20 points doubles the odds. This fact is readily verified by examining Exhibit 2.26.

The remaining two score distributions simply sum the table in Exhibit 2.25, each in a different direction. Summing from the lowest to highest CCAF score results in the ascending distribution in Exhibit 2.27. The basic idea is that the bad risks will score lower and the good risks will score higher. The predictive power of the system is particularly evidenced in this view in terms of CCAF's ability to separate good and bad credit applicants at a statistically significant rate. For example, one can read across the ninth row in the table corresponding to see that scores at

EXHIBIT 2.25

**SCORE/ODDS RELATIONSHIP FOR  
LOAN APPLICANTS**

Score	Odds	Nbr Cells	Good		Bad		Total	
			Nbr	Pcnt	Nbr	Pcnt	Nbr	Pcnt
652	0.7	1	5	0.1	7	0.9	12	0.1
656	0.9	1	5	0.1	6	0.7	11	0.1
670	1.4	11	65	0.7	46	5.8	111	1.1
672	1.5	1	8	0.1	5	0.6	13	0.1
674	1.6	5	29	0.3	18	2.3	47	0.5
690	2.8	25	215	2.3	76	9.6	291	2.9
692	3.0	1	17	0.2	6	0.7	23	0.2
694	3.3	1	5	0.1	2	0.2	7	0.1
713	6.3	1	29	0.3	5	0.6	33	0.3
715	6.8	2	44	0.5	6	0.8	50	0.5
722	8.5	3	77	0.8	9	1.1	86	0.9
730	11.3	23	422	4.6	37	4.7	459	4.6
733	12.2	1	22	0.2	2	0.2	24	0.2
737	14.1	3	83	0.9	6	0.7	89	0.9
750	22.7	19	314	3.4	14	1.7	327	3.3
753	25.6	3	87	0.9	3	0.4	90	0.9
755	26.1	2	63	0.7	2	0.3	65	0.7
772	48.7	1	44	0.5	1	0.1	45	0.5
773	52.3	3	99	1.1	2	0.2	101	1
777	57.2	8	200	2.2	4	0.4	204	2
792	97.7	1	29	0.3	0	0.0	30	0.3
793	103.5	6	207	2.2	2	0.3	209	2.1
795	112.2	2	56	0.6	0	0.1	57	0.6
812	193.1	7	309	3.4	2	0.2	311	3.1
813	201.7	1	60	0.7	0	0.0	61	0.6
815	213.8	3	107	1.2	0	0.1	107	1.1
832	382.0	1	38	0.4	0	0.0	38	0.4
833	397.0	2	159	2	0	0	159	1.6

or below 710 (first column) have a cumulative good/bad odds of 2.7 to 1 (second column), representing 157 distinct handles (third column), representing 21% of the total applicant population (ninth column from the left), but only 16.6% of the good risks (fifth column from the left) while capturing 70.8% of the bad risks (seventh column from the left).

Summing the table in Exhibit 2.25 from the highest to lowest CCAF score results in the table shown in Exhibit 2.28. For example, one can read across the twentieth row in the table corresponding to see that scores

**EXHIBIT 2.26      ODDS SCALE FOR CCAF SCORE**

<b>CCAF Score</b>	<b>652</b>	<b>672</b>	<b>692</b>	<b>713</b>	<b>733</b>	<b>753</b>	<b>773</b>	<b>793</b>	<b>813</b>	<b>833</b>
<b>Odds</b>	<b>0.7</b>	<b>1.5</b>	<b>3.0</b>	<b>6.3</b>	<b>12.2</b>	<b>25.6</b>	<b>52</b>	<b>104</b>	<b>202</b>	<b>397</b>

**EXHIBIT 2.27      ASCENDING CUMULATIVE SCORE  
DISTRIBUTIONS FOR GOOD, BAD,  
AND TOTAL CREDIT APPLICANTS**

Score	Odds	Nbr Cells	Good		Bad		Total	
			Nbr	Pcnt	Nbr	Pcnt	Nbr	Pcnt
652	0.7	1	5	0.1	7	0.9	12	0.1
656	0.8	2	10	0.1	13	1.6	23	0.2
670	1.2	27	149	1.6	123	15.5	272	2.7
672	1.2	28	157	1.7	128	16.1	285	2.8
674	1.3	33	186	2.0	146	18.4	332	3.3
690	1.9	99	744	8.1	388	48.9	1,132	11.4
692	1.9	100	761	8.3	394	49.6	1,155	11.6
694	1.9	101	767	8.3	396	49.8	1,162	11.7
710	2.7	157	1,532	16.6	562	70.8	2,094	21
713	2.8	158	1,561	17.0	566	71.4	2,127	21.3
715	2.8	160	1,605	17.4	573	72.2	2,177	21.8
722	3.1	171	1,838	20.0	602	75.9	2,441	24.4
730	3.7	202	2,406	26.1	655	82.5	3,061	30.6
733	3.7	203	2,428	26.4	657	82.7	3,084	30.8
737	3.8	206	2,511	27.3	662	83.5	3,173	31.7
750	4.9	249	3,501	38.0	715	90.1	4,215	42.1
753	5.0	252	3,588	39.0	718	90.5	4,306	43
755	5.1	254	3,650	39.6	721	90.8	4,371	43.7
772	6.7	317	5,114	55.6	760	95.8	5,875	58.8
773	6.8	320	5,214	56.6	762	96.0	5,976	59.8
777	7.1	328	5,414	58.8	765	96.5	6,180	61.8
792	8.2	364	6,376	69.3	778	98.1	7,155	71.5
793	8.4	370	6,583	71.5	780	98.3	7,364	73.6
795	8.5	372	6,640	72.1	781	98.4	7,420	74.2
812	10.0	409	7,877	85.6	788	99.4	8,666	86.6
813	10.1	410	7,938	86.2	789	99.4	8,727	87.2
815	10.2	413	8,045	87.4	789	99.5	8,834	88.3
832	11.4	430	9,048	98.3	793	99.9	9,841	98.4
833	11.6	432	9,206	100	794	100	10,000	100

## EXHIBIT 2.28

DESCENDING CUMULATIVE SCORE  
DISTRIBUTIONS FOR GOOD, BAD,  
AND TOTAL CREDIT APPLICANTS

Score	Odds	Nbr Cells	Good		Bad		TOTAL	
			Nbr	Pcnt	Nbr	Pcnt	Nbr	Pcnt
833	397	2	159	1.7	0	0.1	159	1.6
832	394	3	197	2.1	0	0.1	198	2
815	276	22	1,269	13.8	5	0.6	1,273	12.7
813	271	23	1,329	14.4	5	0.6	1,334	13.3
812	252	30	1,638	17.8	6	0.8	1,645	16.4
795	197	62	2,623	28.5	13	1.7	2,636	26.3
793	185	68	2,830	30.7	15	1.9	2,845	28.4
792	183	69	2,859	31.1	16	2.0	2,875	28.7
777	127	112	3,993	43.4	31	4.0	4,024	40.2
773	123	115	4,092	44.4	33	4.2	4,125	41.2
772	121	116	4,136	44.9	34	4.3	4,170	41.6
755	75	180	5,619	61.0	75	9.5	5,694	56.9
753	73	183	5,706	62.0	79	9.9	5,784	57.8
750	65	202	6,019	65.4	92	11.6	6,112	61.1
737	50	229	6,779	73.6	137	17.3	6,915	69.1
733	49	230	6,801	73.9	139	17.5	6,939	69.4
730	41	253	7,222	78.4	176	22.2	7,398	73.9
722	37	264	7,446	80.9	200	25.2	7,646	76.4
715	34	274	7,645	83.0	227	28.6	7,872	78.7
713	33	275	7,674	83.4	232	29.2	7,906	79
710	27	301	8,037	87.3	296	37.2	8,332	83.3
694	21	332	8,445	91.7	400	50.4	8,844	88.4
692	21	333	8,462	91.9	405	51.1	8,867	88.6
690	18	358	8,678	94.3	481	60.7	9,159	91.5
674	14	404	9,049	98.3	666	83.9	9,715	97.1
672	14	405	9,057	98.4	671	84.5	9,728	97.2
670	13	416	9,122	99.1	717	90.3	9,839	98.3
656	12	431	9,201	99.9	786	99.1	9,987	99.8
652	12	432	9,206	100	794	100	10,000	100

at or above 713 (first column) have a cumulative good/bad odds of 33 to 1 (second column), representing 275 distinct handles (third column), representing 79% of the total applicant population (ninth column from the left), and 83.4% of the good risks (fifth column from the left) while taking only 29.2% of the bad risks (seventh column from the left).

This table is very useful, because it can be referenced to determine the trade-off between various strategies that weigh the acceptance rate with

the number of bad loans taken. The higher the acceptance rate cutoff is set, the greater is the number of bad loans that are accepted. In this example, if our cutoff was 713, we would have an acceptance rate close to 80% and we would originate 232 bad loans. If the cutoff score was set at 733 we would have an acceptance rate close to 70% and we would originate 139 bad loans.

A unique feature of CCAF, not available with credit scoring systems, is that changes in the policy cutoff can be examined relative to their impact on handles. In other words, with CCAF, lenders will know in advance which borrower segments they are impacting when they adjust the CCAF score cutoff up or down. CCAF produces a special report that can isolate affected handles when the cutoff changes. This capability is explained in the next section.

## Policy Maintenance

CCAF enables management to be more specific during times where credit tightening, or loosening, is needed. Some would assert that this is already handled by adjusting credit score cutoffs, or debt ratio or loan-to-value ceilings. We assert that the approach of trying to control credit access through adjustments in single factors is both fragmented and sub-optimal. When you make an adjustment based on a single factor at a time, you are in essence averaging over the entire applicant population, which is quite diverse, or in statistical terms, heterogeneous. For example, if credit tightening is desired and the debt ratio is lowered from 38% to 34%, borrowers who otherwise might qualify that have compensating strengths in terms of equity or capital are victimized. Similarly, if the minimum LTV is raised from 15% to 20%, borrowers who do not possess the cash to close, but have strong earning capacity and stability will suffer. The current best practice of tightening and loosening credit in this fashion is imprecise. A sharper focus on specific borrower segments, which leverages business context provided by a comprehensive framework, boosts effectiveness.

In contrast to current best practices in the industry, CCAF provides a means to take all relevant information into account when lenders make policy changes, and this avoids situations where borrower segments, which we have termed handles, are inappropriately penalized—or

rewarded. A key feature of CCAF is that in addition to providing more specific information and finer controls, it has a singular score associated with each handle that takes into account all risk factors. That score is associated with one or more CCAF handles (that is, applicant segments) and the table in Exhibit 2.29 lists in the leftmost column selected CCAF scores, from lowest (652) to the highest (833).<sup>30</sup> In the next column, the

EXHIBIT 2.29

SEGMENT IMPACT OF A POLICY CHANGE  
IN CUTOFF

CCAF Score	# Cells	Corresponding Segment Identifiers (Handles)											
652	1	1											
667	3	51	337	338									
670	11	4	6	14	15	17	37	50	53	73	109	289	
672	1	149											
674	5	52	99	121	290	301							
678	15	16	18	21	26	41	54	62	63	65	85	98	
		101	293	302	339								
684	20	7	9	38	69	74	89	100	110	111	148	159	
		161	162	170	196	207	291	294	305	313	162		
690	25	8	22	27	29	42	45	64	66	86	102	112	
		113	117	122	133	153	160	241	292	297	303	306	
		314	340	351									
692	1	70											
710	26	31	34	40	43	56	58	76	78	81	94	103	
		105	118	123	125	134	197	242	254	296	316	329	
		344	349	350	367								
713	1	243											
722	3	217	221	257									
730	23	11	32	35	44	67	79	82	88	91	104	106	
		124	126	129	135	164	201	246	269	307	317	346	
		361											
733	1	185											
737	3	173	202	247									
742	8	136	138	209	213	223	229	266	321				
750	19	12	23	36	47	59	68	80	83	92	115	127	
		141	155	174	200	270	319	355	385				
753	3	178	184	225									

(Continued)

EXHIBIT 2.29 (CONTINUED)

CCAF Score	# Cells	Corresponding Segment Identifiers (Handles)											
759	2	187	211										
762	21	48	60	71	84	95	107	116	131	167	179	190	
		210	234	237	277	299	310	327	333	347	356		
772	1	358											
773	3	132	279	326									
777	8	120	250	260	261	312	323	331	359				
793	6	228	259	263	268	281	387						
795	2	252	418										
812	7	283	284	286	377	404	412	421					
813	1	415											
833	2	431	432										

number of handles is indicated. The remaining columns contain the handle identifiers. This table is used in conjunction with the table previously discussed in Exhibit 2.28, Descending Cumulative Score Distributions, which enables the CCAF system user to set a score cutoff that will maintain a specified acceptance rate, or a specified bad rate, and so on. For example, to maintain an acceptance rate of 70%, we would use Exhibit 2.28 and go to the percentage column for total applicants and find the number closest to 70%. We would then read across the row to the left to obtain the score, which turns out to be 733.

It is important for users of any credit granting system to understand the composition of the loans they originate and also to track, and control, acceptance rates for borrower groups. For this purpose, CCAF provides an extensive set of reports.

CCAF also provides the acceptance rates relative to the primary underwriting factor rating categories, and any and all combinations of them. We show in Exhibits 2.30 and 2.31 the mix relative to each individual primary factor and then all two-way combinations of primary factors.

The reader will note that the acceptance rates increase as the rating improves from lowest to highest. One might question relative to any particular rating that is low why the system would approve an applicant for a loan having that rating. For example, we see that 48% of loan applicants having a poor payment history are approved. We look to the table in Exhibit 2.31 to examine combinations of payment history.



## EXHIBIT 2.30

## ACCEPTANCE RATE FORECAST BY INDIVIDUAL PRIMARY FACTORS

Payment History		Collateral		Capacity	
Poor	48	Low	61	Low	63
Fair	84	Moderate	81	Moderate	77
Good	91	High	92	High	89
Capital		Vulnerability		Secondary Factors	
Low	62	High	68	No	77
Moderate	70	Low	87	Yes	81
Strong	84				
Superior	92				

## EXHIBIT 2.31

### PERCENTAGE ACCEPTANCE RATE FORECAST BY PRIMARY FACTOR PAIRS

[illegible]

EXHIBIT 2.32      **FOUR-WAY ACCEPTANCE RATE FORECAST**

Payment History	Capacity	Capital	Collateral		
			Low	Moderate	High
Poor	Low	Low	0	0	18
Poor	Low	Moderate	0	19	21
Poor	Low	Strong	0	7	23
Poor	Low	Superior	0	10	35
Poor	Moderate	Low	0	0	40
Poor	Moderate	Moderate	0	25	33
Poor	Moderate	Strong	0	38	82
Poor	Moderate	Superior	43	56	70
Poor	High	Low	0	33	49
Poor	High	Moderate	0	38	57
Poor	High	Strong	20	77	100
Poor	High	Superior	63	83	100

We see that for applicants having a poor payment history, the acceptance rate of 48% drops to from 15 to 30% when either capacity, collateral, or capital are in their lowest ratings. If we were to examine the four-way table for payment history, capacity, capital, and collateral, we would find zero acceptance rates for collateral for 11 of the 36 possible combinations as shown in Exhibit 2.32.

As was the case with acceptance rates, the percentage mix increases as the rating improves from lowest to highest as shown in Exhibit 2.33.

EXHIBIT 2.33      **FORECAST ORIGINATION PERCENTAGE MIX BY INDIVIDUAL PRIMARY FACTORS**

Payment History		Collateral		Capacity	
Poor	13	Low	23	Low	18
Fair	41	Moderate	36	Moderate	31
Good	46	High	41	High	51
Capital		Vulnerability		Secondary Factors	
Low	15	High	37	No	46
Moderate	21	Low	63	Yes	54
Strong	28				
Superior	36				



**EXHIBIT 2.35 ORIGINATED LOANS: FOUR-WAY MIX**

Payment History	Capacity	Capital	Collateral		
			Low	Moderate	High
Poor	Low	Low	0.00	0.00	0.13
Poor	Low	Moderate	0.00	0.03	0.14
Poor	Low	Strong	0.00	0.04	0.16
Poor	Low	Superior	0.00	0.08	0.29
Poor	Moderate	Low	0.00	0.00	0.18
Poor	Moderate	Moderate	0.00	0.18	0.22
Poor	Moderate	Strong	0.00	0.33	0.66
Poor	Moderate	Superior	0.57	0.63	0.95
Poor	High	Low	0.00	0.25	0.35
Poor	High	Moderate	0.00	0.44	0.61
Poor	High	Strong	0.15	0.85	1.38
Poor	High	Superior	0.90	1.00	1.42

population. Hence, there may be a low mix for a desirable handle segment because there just are not that many applicants falling into the segment in the first place.

The foregoing example assumed an 80% acceptance rate. If the lender decided to target a 65% acceptance rate instead, which is historically less than the norm in mortgage lending, this would result in 62 fewer handles being approved and Exhibit 2.36 specifies the handle numbers corresponding to borrower segments that would now be declined.

**EXHIBIT 2.36 BORROWER SEGMENT HANDLES CORRESPONDING TO CCAF SCORES 713 THROUGH 742**

11	20	32	35	44	67	79	82
87	88	91	104	126	129	135	136
138	163	164	165	173	175	177	183
185	186	189	198	201	202	209	213
217	218	219	220	221	222	223	229
243	243	245	246	247	255	256	257
258	265	266	269	307	308	317	321
341	342	345	346	362	368		

The change in originated cumulative portfolio odds of default would be a near doubling, from 33-to-1 pooled odds associated with a 713 CCAF score at 70% acceptance versus 64-to-1 pooled odds at a 742 CCAF score.<sup>31</sup>

Comparison with Current Scoring-Based Practices

It has been pointed out that many of the elements of the new lending system we are proposing are present in current underwriting systems. Those systems already combine business rules with credit scoring. A key difference, however, is the fact that current underwriting systems are fragmented relative to primary underwriting factors, whereas CCAF is integrated. At this point we turn to a simple analogy to illustrate why a fragmented approach is not as effective as one that is integrated.

Suppose we surveyed the public across the United States and recorded responses using the scheme in Exhibit 2.37.

Suppose further that we learned that the individual responses, when tallied up, were as follows:

- 50% of Americans live on junk food.
- 50% of Americans do not exercise.
- 50% of Americans are significantly overweight.
- 50% of Americans smoke a pack of cigarettes a day.
- 50% of Americans have bad genes for heart disease.

Based on these results, should an alarm be sounded to deal with a national health crisis in the making? Perhaps not if those factors were totally independent. In that case approximately 3% (or 1 out of 32) of the

EXHIBIT 2.37 HEALTH SURVEY		
Primary Health Factor	No	Yes
Live on junk food	0	1
Don't exercise	0	1
Significantly overweight	0	1
Smoke a pack of cigarettes a day	0	1
Have bad genes for heart disease	0	1

**EXHIBIT 2.38      LIKELIHOOD OF HAVING RISK FACTORS UNDER TWO HYPOTHESES**

Number of Risk Factors Present	Probability (Totally Independent)	Probability (Totally Dependent)
None	1/32	1/2
One	5/32	0
Two	10/32	0
Three	10/32	0
Four	5/32	0
All Five	1/32	1/2

population would fall into all five high risk categories (all 1s). The table in Exhibit 2.38 shows what the likelihood of someone having none, one, two, three, four, or five risk factors would be if we drew anyone living in the United States at random under two hypotheses. The first hypothesis is where we assume total independence of all five factors, and, alternatively, the second hypothesis maintains that they are totally dependent.

In the real world, factors are rarely at these two extremes of collective independence or perfect correlation. Suppose we also had mortality rates based on the number of risk factors present and further suppose that the mortality associated with having any particular risk factor was the same (for instance, chain smokers and junk food addicts have equal chances of premature heart disease and death). Exhibit 2.39 shows mortality rates based on these factors.

**EXHIBIT 2.39      MORTALITY BASED ON PRESENCE OF RISK FACTORS**

Number of Risk Factors Present	Mortality Rate Prior to Age 40
None	2%
One	4%
Two	8%
Three	16%
Four	32%
All Five	64%

With the addition of each additional factor, the odds of premature death double in this example. Suppose we asked you which factors you had, and we put that into our automated diagnosis system. If your answer was four factors and we used a holistic approach we would estimate your risk of death to be 32%. If we used a fragmented approach that may have looked at two factors together and the rest individually we would estimate your chances as 16% (8% for two factors and 4% for each of two remaining factors present). Hence, the holistic approach would estimate twice the risk as compared with the fragmented approach. The conclusion is that only by looking at factors in unison can one capture and effectively measure the true nature of the risk.

And so it is with mortgage underwriting, and lending in general. A system that has separate business rules for borrower indebtedness, employment stability, payment history, savings habits, equity stake in property being financed, loan repayment terms, and so on is not operating effectively. Looking at factors individually, and overreliance on credit scoring, will lead to bad decisions. All relevant primary factors and, when indicated, secondary factors must be taken into account at the same time, and that property lies at the heart of the new credit system. Further, it should be apparent that in addition to the holistic CCAF score that corresponds to the odds of loan default, there is an associated handle number that conveys the borrower's classification relative to the primary underwriting factors and their risk rating relative to each factor. Armed with that information, borrowers would be able to more easily assess their credit standing, validate their ratings, and know how they can improve their score, which not only impacts their ability to obtain credit, but also how much they pay for it. We explore the benefits of CCAF for borrowers in Chapter 4. In Chapter 3, we explain how this new system can help lenders exercise greater control, make better decisions, and more effectively price loans. These improvements benefit both the lender and borrowers, and they accrue to investors when those loans are offered for sale in the secondary markets. All the while, safety and soundness of the underwriting process itself is strengthened.

## SUMMARY

The Comprehensive Credit Assessment Framework (CCAF) offers lending institutions the ability to approve, and better price, credit through the use of more complete information and new and improved models. It

enables the construction of credit profiles across multiple categories and factors, and puts credit profiles in an appropriate context for assessment of borrowers' creditworthiness and also their loan repayment performance. It does so by leveraging a more meaningful segmentation, coupled with expanded source data that has been integrated with judgmental factors and policy thresholds. Furthermore, it is adaptive and takes into account changes relative to borrowers, channels, markets, competition, credit policy, lender business objectives, and economic state. Unlike credit scoring systems, CCAF does not require periodic replacement.

CCAF ensures comprehensive classification of borrowers, and loans, relative to the major categories of factors linked to loan default risk as a prerequisite to risk quantification. It avoids substituting payment habit and loan preference history factors as proxies for debt ratio and income, net worth, liquid reserves, and payment shock since they are clearly out-of-context relative to the broad categories of capacity and capital. The CCAF borrower contour determines what products are available to borrower segments according to their credit qualifications. Even if there are bad actors who want to sell consumers products that will put them into a debt trap, CCAF will not allow them to succeed, nor will it allow consumers to pick financing that will prove too costly for them. Because CCAF is comprehensible, it will be easy for lenders to explain to consumers what is available to them and why. CCAF is validated from both a qualitative and quantitative basis and monitored for any signs of predictive decay or compliance violations. This ensures that it will perform at least as well as expected relative to credit risk measurement, responsible lending, and fair lending. Because of CCAF's adaptive, and forward-looking, nature it will perform acceptably under all economic and sector cycles. CCAF's systematic segmentation approach has implications for both intervention in the mortgage crisis and prevention of future financial disruptions. This will be detailed in Chapter 6.

## ■ NOTES

1. Women in Housing and Finance Symposium: The Landscape of Housing Finance for 2008, February 6, 2008, held at the offices of Skadden, Arps, Slate, Meagher & Flom LLP, Washington, D.C. 20005.
2. Such as foreclosures, tightening credit standards, the impact of mortgage losses on lenders, mortgage modifications, and improving the mortgage origination process.



3. Such as housing affordability, the impact of falling house prices on local communities, the availability of rental housing, and the slowdown in new home construction.
4. See James Lockhart, Director, OFHEO, Geoff Bacino, Board Member, FHFB, Robert Mooney, FDIC, Marc Pearce, NC Deputy Commissioner, AARMR At-Large Director, AG Taskforce Representative, "What's Been Done/What's Next," Panel One: Regulatory Roundtable, Women in Housing and Finance Symposium—2008: A New Landscape for Housing Finance, February 6, 2008, 10–11 A.M., Offices of Skadden Arps 1440 New York Avenue, N.W., Washington, D.C. 20005. Also see Preston DuFauchard, "Commissioner's Memorandum from Department of Corporations," California's Investment and Financing Authority, State of California—Business, Transportation and Housing Agency, December 11, 2007, p. 5: "In his last speech before the U.S. Congress, Federal Reserve Bank Chairman Bernanke stated ". . . we do support scaling up these efforts, and the best way to do that is by creating some more systematic approaches to doing so." See also Henry M. Paulson Jr., "Fact Sheet: Treasury Releases Blueprint for a Stronger Regulatory Structure," U.S. Treasury Department Office of Public Affairs, March 2008, p. 1: "We should and can have a structure that is designed for the world we live in, one that is more flexible, one that can better adapt to change, . . . and one that will better protect investors and consumers. The challenge is to evolve to a more flexible, efficient and effective regulatory framework—and that is the purpose of this Blueprint." CCAF embraces these objectives.
5. E.g., Regulations AA, B, BB, C, Z, and so on.
6. The number of immigrants in 1981–1990 was 7.3 million, and for 1991–2000 the figure was 11 million. An additional 12 million households are expected by the year 2010.
7. These are consumers possessing little or no credit history with the three main credit bureaus in the United States.
8. Pari Sabety, Roundtable on Using Alternative Data Sources in Credit Scoring, Brookings Institution, December 15, 2005.
9. See Steve Lohr, "In Modeling Risk, the Human Factor Was Left Out," *New York Times*, November 4, 2008.
10. This has been suggested as one of the important lessons learned from the crisis. See David Dodge, "Turbulence in credit markets—causes, effects, and lessons to be learned," remarks by David Dodge, Governor of Bank of Canada, to the Vancouver Board of Trade, Vancouver, September 25, 2007.
11. Both prime and subprime borrowers who either have experienced, or will be experiencing, an increase in their monthly payment amount.
12. Such as behavioral factors, alternative data, up-to-date information, and projected risk metrics.
13. Clark Abrahams and Zhang Mingyuan, *Fair Lending Compliance: Intelligence and Implications for Credit Risk Management* (Hoboken, NJ: John Wiley & Sons, 2008), pp. 158–159.
14. Abrahams and Zhang, *Fair Lending Compliance*, pp. 203–216, 222–237, 250–264, and 329–332, describe in detail this process, and the methods utilized.

15. Abrahams and Zhang, *Fair Lending Compliance*, pp. 216–222.
16. Abrahams and Zhang, *Fair Lending Compliance*, ch. 8, pp. 305–346, provides a detailed discussion of how this is performed. This topic is beyond the scope of this chapter.
17. Abrahams and Zhang, *Fair Lending Compliance*, pp. 209–210, shows examples of reports and an inventory of all multidimensional reports for a hypothetical action table.
18. See Stephen Baker, “Want a Loan? Act Responsibly,” *BusinessWeek*, Information Technology Section, October 24, 2008; [http://www.businessweek.com/technology/content/oct2008/tc20081023\\_815373.htm?campaign\\_id=rss\\_daily](http://www.businessweek.com/technology/content/oct2008/tc20081023_815373.htm?campaign_id=rss_daily).
19. Equifax, Experian, and TransUnion.
20. See Naeem Siddiqi, *Credit Risk Scorecards: Developing and Implementing Intelligent Credit Scoring* (Hoboken, NJ: John Wiley & Sons, 2006), pp. 43–45.
21. In this simple example mild delinquency would include “no” delinquency. In practice, “no delinquency” would likely constitute a separate category.
22. See [www.socialcompact.org](http://www.socialcompact.org) for more information.
23. See Michael Turner, S. Alyssa Lee, Ann Schnare, Robin Varghese, and Patrick D. Walker. “Give Credit Where Credit Is Due—Increasing Access to Affordable Mainstream Credit Using Alternative Data,” Political and Economic Research Council and The Brookings Institution Urban Markets Initiative, 2006, available at: [http://www.brookings.edu/reports/2006/12communitydevelopment\\_turner.aspx](http://www.brookings.edu/reports/2006/12communitydevelopment_turner.aspx).
24. Ibid.
25. American Banking Association, Mortgage Banking Association, and Consumer Banking Association.
26. Other terms are *segment number*, or *action table cell number*.
27. Refer to Exhibit 2.28 Descending Cumulative Score Distributions for Good, Bad, and Total Applicants, and find 200 in the column for bad count and read the leftmost column for score to obtain the value 722.
28. Refer to Exhibit 2.29 Segment Impact of a Policy Change in Cutoff. You would find 722 in the leftmost column of the full table (this entry was eliminated due to space limitations) and would read the three column entries in that row to obtain the handle numbers 217, 221, and 257.
29. Nate the salesman (handle 289), Beth the programmer (handle 293), Bob the paralegal (handle 301), and Jill the executive administrative assistant (handle 337).
30. The table in Exhibit 2.25 has been shortened due to space limitations and displays only 27 out of the 87 distinct CCAF scores. For ease of reference, we have made the handles in boldface that are referenced throughout the book.
31. Exhibit 2.27 Ascending Cumulative Score Distributions readily provides this information for the cutoff scores in question. Referring to Exhibit 2.25 Score/Odds Intervals, the change in odds of default at the two extremes (i.e., from 14.9/1 odds associated with a 738 CCAF score versus 3.3/1 odds at a 694 CCAF score, is nearly five times in magnitude). Recall in this example that 20 points in the CCAF scoring scale doubles the odds of default. The entry for 738 was dropped when the table was abbreviated, but 737 was maintained and has a value of 14.1.



## The Lender and the Underwriting Gap

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*Let no loans be made that are not secured beyond a reasonable contingency. Do nothing to foster and encourage speculation.*

—HUGH McCULLOCH, THEN COMPTROLLER OF THE  
CURRENCY OF THE UNITED STATES AND LATER  
SECRETARY OF THE TREASURY, 1886

Two fundamental problems contributed to weakened underwriting standards and degraded loan quality. First, there is a blind spot in today's underwriting practices. That is, current practices overrely on quantitative models and automated underwriting systems. Technology has a vital role to play to boost efficiency and help measure and monitor credit risk. The models have their place and role to play. However, we need to control the models instead of the other way around. Loans need first to be properly classified and then risk rated. Today's process has that backwards. Second, credit scoring has not done an adequate job of assessing risk in the subprime mortgage market. Lenders who depend on these credit scoring systems were measuring credit risk inaccurately and incompletely. Improper use of credit scoring and automated underwriting creates incomplete risk analyses and weakened underwriting standards and policy and the end result is a drop in loan quality.<sup>1</sup>

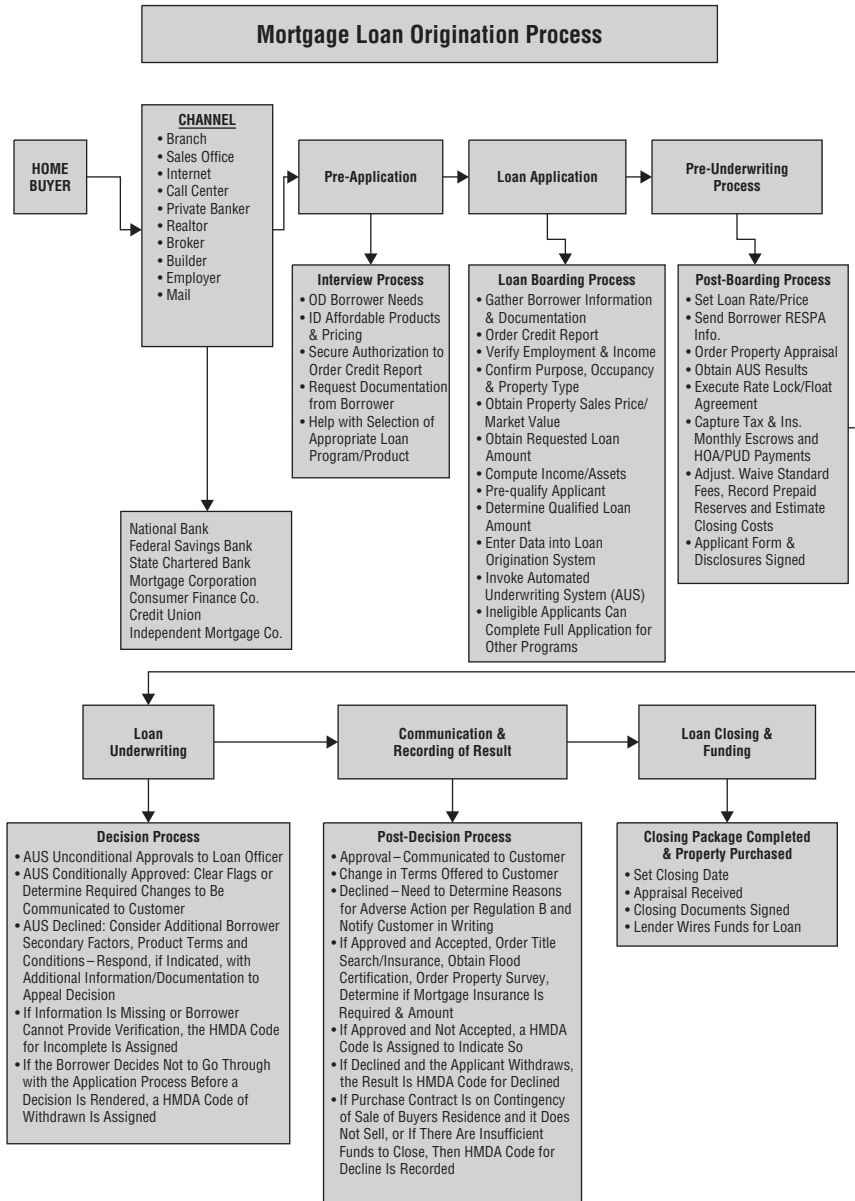
To a large extent, subprime lenders believed any additional risk they were taking on was covered using advances in credit scoring, and scoring system policy overlays, that enabled them to effectively price that risk and charge borrowers on the basis of their fully quantified creditworthiness. It turned out that those loans were *not*, in fact, “secured beyond a reasonable contingency.” This factor further played into the industry’s “originate to distribute” business model, where mortgage originators often pooled the loans for repackaging and sale to the secondary market in a variety of highly complex investment securities that were awarded the highest of investment grades by the rating agencies. All of this “served to foster and encourage speculation” and lessened the lender’s incentive to ensure the loan would be serviced.<sup>2</sup> These factors contributed to the underwriting gap and the rapid development of the subprime loan market.

In this chapter, we discuss how the Comprehensive Credit Assessment Framework (CCAF) can help lenders reduce the underwriting gap and improve their loan quality and affordability. We first review the main processes performed by current underwriting systems, and we examine subprime lending. We then define and identify the underwriting gap and its associated components, and we show how they weakened underwriting standards and practices. We then illustrate how our new framework, and the methodology associated with it, closes these component gaps. Specific CCAF-based lending strategies are proposed, and examples are provided that strengthen lending practices and standards.

## MORTGAGE UNDERWRITING PROCESS BASICS

As a basis for understanding the underwriting gap concept, we discuss mortgage underwriting and subprime lending. We then describe how CCAF can improve mortgage lending by better connecting the borrower, lender, and investor. Understanding the big picture of the mortgage underwriting process is also a prerequisite for the discussion in Chapter 5 relative to the investor’s concerns. A key focus for us in our review of loan production is the loan origination process itself, which has several components, as depicted in Exhibit 3.1.

As shown in Exhibit 3.1, loan origination can be broken down into several discrete workflow milestones. The first is pre-application, where the



borrower comes through a channel to the lender and describes the nature of the mortgage loan request and inquires about products and pricing. During the interview, an authorization to order a credit report is typically obtained. The next step is referred to as boarding the loan, and it consists largely of gathering information from the borrower and transmitting it to the lender's loan origination system. At this time a credit report is ordered, and the borrower is prequalified. The next step is called postboarding, which mainly involves making disclosures to the borrower, who must read the disclosure documents and complete and sign various forms. The lender also executes a rate lock, or float, at this stage, which will enable the borrower to know what rate, or maximum rate in the case of a float-down option, will be available for the mortgage. Underwriting entails basically approving or denying the mortgage application. To qualify a borrower, the underwriter must determine if internal guidelines are met for the requested loan amount, as well as whether debt service and collateral coverage sufficiently meet agency or investor standards. Sales to the secondary market through the government sponsored enterprises (GSEs) require that loans conform to the GSE underwriting and documentation requirements, which vary by loan type. We see opportunities for CCAF to enhance the process of making these determinations, and we go further to suggest new and streamlined ways to convey how those requirements may be met.

Evaluating loan affordability based on the payment history and capacity of the borrower, including employment and credit histories, are key aspects of mortgage underwriting. Today, an automated underwriting system (AUS) usually takes a first pass at qualifying borrowers, and it flags any conditions that are necessary, but not met, to approve the loan. This greatly simplifies the task for the underwriter. We see CCAF as further streamlining the process and as providing the underwriter with a more complete context for loan evaluation and a deeper understanding of the risks posed by each and every mortgage application. After a decision is reached, it must be conveyed to the borrower. In the case of a declined application, CCAF can provide far more useful information to the borrower than is currently available. This is because it can put the result in a general context using the Five Cs of Credit primary factors, in addition to providing specifics relative to secondary factors.

Once a loan approval decision is conveyed to the borrower, the borrower elects to move forward, and the lender commits to originate

the loan, then it is put into the *pipeline*, where it stays until the loan is closed. If, for any reason, the loan fails to close, then the mortgage banker has to worry about meeting its commitment to the investors to deliver a specified amount of loans in a given time frame. Here, business analytics can help to predict fallout rates in the pipeline. There are also implications for interest rate hedges for pipeline loans that are impacted by fallout, and it is common therefore for banks to hedge less than 100% of their pipeline.

The final step in the origination process is the closing and funding of the loan. Prior to the closing date the remaining tasks are completed, including verifying completeness, accuracy, and quality of property appraisals, securing title insurance, obtaining flood certification, checking the accuracy of all calculations and disclosures, and so on. The lender obtains all necessary documents before the loan proceeds are disbursed. As part of the closing process, a postclosing review is performed to ensure that the mortgage bank closed each loan following the underwriter's instructions and that it properly executed all documents.

## THE UNDERWRITING GAP AND ITS KEY COMPONENTS

As discussed in Chapter 1, the financial crisis revealed a significant underwriting gap in today's lending system. The underwriting gap refers to the difference between the underwriting decisioning model and the business, product, market, and borrower's realities. The realities we refer to encompass how well the loan approval and pricing process meshes with (1) borrower objectives (such as home ownership), coupled with their true credit qualifications and the sacrifices they are willing to make to attain their objectives; (2) the lender's business objectives, risk tolerance and policies; and (3) the ever-changing levels of market prices, interest rates, loan demand, and liquidity.

### Gap Components

As shown in Exhibit 3.2, the underwriting gap consists of five main components: information gap, model factor gap, sampling gap, model formulation gap, and process validation gap. Now we discuss each of them in detail and show how they created the gap.

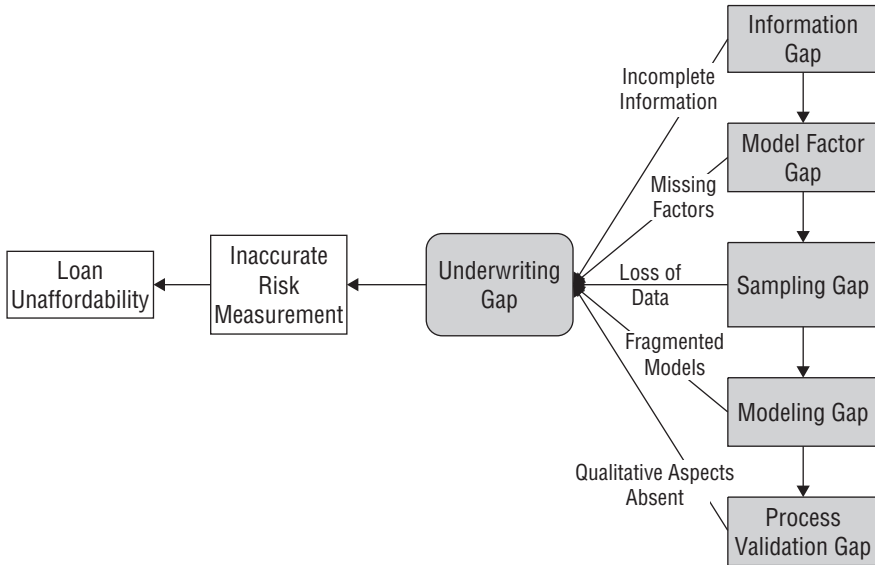


EXHIBIT 3.2

UNDERWRITING GAP COMPONENTS

## Information Gap

This component refers to the data that is used to define and derive underwriting factors and identify good versus bad loans. We believe there is a significant gap in information captured by the current underwriting systems, which are based on insufficient data coverage (that is, the individual fields of information that are input to the system). We distinguish this from a lack of inclusiveness (that is, which records are dropped or included). We discuss the issue of inclusiveness later on in our coverage of the sampling gap. When working with incomplete information, it is not possible to properly construct model factor weights.

For example, credit bureau scoring systems are developed based on performance definitions that stress payment history. Other information, such as the Five Cs, is not included in the model. Credit scores have a one-to-one correspondence with the odds that a loan will go bad, where the lower the score, the higher the likelihood of a bad outcome. Credit bureau scores in particular put substantial weight on payment history for credit accounts (35%), and on how much a consumer owes relative to how much credit is available (30%), and they also take into account



the average age of the aggregate trade lines and the types of debt carried.<sup>3</sup> As a result, (1) even mild infrequent delinquency can significantly lower a credit score; (2) closing older, less used accounts can both lower the average age of aggregate trade lines and increase the aggregate utilization rate—both of which can adversely affect the score; (3) opening new accounts will also lower the average age of aggregate trade lines, which can lower the score; and (4) paying cash for cars or major appliances, or quickly paying them off, will adversely affect the credit score because of the lack of installment versus revolving debt. Provided a borrower has sufficient liquid capital reserves (for instance, checking or savings account funds, short-term certificates of deposit [CDs], Treasury-bills) and/or capacity to repay the loan through sources of income (for instance, base salary, commissions, bonuses, earnings from investments), none of the factors cited should carry much weight, if any, relative to the likelihood of loan default. Yet the bureau credit score has a significant impact on how much consumers pay for their financing needs. Conversely, if a consumer has little capital or capacity, the risk is greater that the loan will default than the credit score would indicate, because it is based on a population of consumers having the full range of capital and capacity resources. The foregoing discussion points out ways that these gaps in the typical loan decision-making process can be addressed.

It is important to note that the factors included in an underwriting scorecard do not cause credit applicants to default on their loans. Unfortunately, scoring models do not put context around the pure statistical correlations that form the basis for their decisions. If we can all agree that credit underwriting seeks to answer the basic question “Is the loan application creditworthy or not?” then we must ask ourselves the question “Based on what?” So far, the resounding answer has, in large measure, been “Whatever is in your credit file.” So, we must ask ourselves if creditworthiness should depend on how often we seek credit. Why should seeking credit (that is, number of credit inquiries) cause greater risk? A model may indicate so. The problem is that with any observed phenomenon there are always plenty of supporting theories that can be posed. But theories are theories, and when we are trying to convince ourselves that a model is correct, then theory can become all too compelling. If consumers make other choices, such as not using installment credit to finance purchase of cars or major appliances, does that, or should

that, affect their credit standing? Suppose they do use installment credit, but if they do not respond to credit card offers that fill their mailbox so that the ratio of their revolving to installment credit is within an expected range of, say, six to one, does that mean they are any less creditworthy?<sup>4</sup> An obvious question for consumers is how can they know what impact any particular choice they make will have (for instance, to open, or not open, or close, or not close a credit account, or apply for a loan, or move their residence, or change jobs, and so forth).<sup>5</sup> The point is that people's creditworthiness should depend on their ability and willingness to repay an obligation. Suppose consumers could know exactly how points are assigned to come up with their credit score. Are we to tell consumers that being responsible in their financial affairs means that they need to modify their behavior so as to maximize their credit score?

Historically, there were guiding principles in lending that related creditworthiness directly to the borrower's ability to repay the loan. Then science came along, and we determined that our models could find suitable substitutes for common sense. The CCAF approach seeks to revisit that fork in the road, and retain the guiding principles, while incorporating comprehensive information, including alternative data, and data that transcends the credit domain, which we discuss next. Before doing so, however, it is important to distinguish between information that bears a direct relationship to the loan decision versus independent outcomes that amount to stereotyping borrowers and can lead to bias in our lending systems. For example, whether a credit applicant pays his cell-phone bills, or other noncredit obligations, on time may be a legitimate factor for loan underwriting. However, saying that "people who get in traffic accidents and do not pay their taxes on time are often bad credit risks," is another matter entirely.<sup>6</sup> A recent study found: "People who pay their bills on time seem more likely to stick to exercise regimens at the health club."<sup>7</sup> Are we to conclude that losing weight should make the person's credit score go up?! "Already, a number of industries have used Fair, Isaac and Company's (FICO) credit risk score for a broader read on a person's responsibility. The FICO score is based on limited data regarding credit and payment history. But it turned out to be a predictor for auto and home insurance claims."<sup>8</sup> The following quote from Chapter 2 comes to mind: "According to Fair, Isaac CEO Mark Greene, research indicates that 'bad people are bad people are bad people.'"<sup>9</sup> Models developed on

one population for a particular purpose cannot be simply applied to different populations for different purposes. To do so might prove detrimental to both the borrower and fail to serve the intended purpose of the lender.

Data coverage of the current underwriting systems is also limited to credit domain and does not utilize rich predictive information of other areas such as insurance. Consumers and small business owners purchase a variety of policies for different types of coverage (for instance, life [whole, term, and possibly credit life], automobile [public liability and property damage, collision, theft], medical/dental/vision, income replacement insurance, homeowners and renters [hazard, theft]), in addition to umbrella policies that kick in when maximum coverage for designated policies are exceeded. These policies offer benefits, especially to those consumers who do not possess much of a capital cushion, or an ability to quickly build cash-equivalent reserves. The main benefit is risk transfer in the event a disruptive event should occur, such as job loss, illness, accident, or even death. In addition, some insurance products, such as whole life, variable annuity, or single premium deferred annuities can accumulate cash values that can be tapped if necessary. Insurance coverage addresses known causal factors associated with foreclosure and loan default in general. Some statistics on the causes of foreclosures are shown in Exhibit 3.3.

Clearly, the breadth (types of policies and corresponding risks covered) and depth (policy maximums, deductibles, and coverage limits) of insurance possessed by a borrower should be accounted for in her risk profile and, intuitively, it should improve her credit score. Consider subprime borrower A who works for an employer who provides health and income-continuation benefits and carries higher than required maximums on auto insurance in addition to collision coverage, versus another subprime borrower B who has minimal, or no such, insurance coverage. If these borrowers are similarly situated otherwise relative to creditworthiness, borrower B represents a higher risk than borrower A. Yet, the vast majority of mortgage underwriting systems do not take insurance coverage into account. Ironically, credit bureau scores are often used to qualify consumers for these types of insurance policies! If the insurance information were captured, it would have significant predictive value relative to loan default in general.

## EXHIBIT 3.3 CAUSES OF FORECLOSURES

Percentage	Cause
19	Job loss
17	Cause unknown—no contact with loan servicer or response to delinquency notices
14	Health crisis, disability leave, workmen's compensation (injury on the job), automobile accident
13	Poor money management, overspending
13	Divorce, separation
10	Borrower deceased, other death in family
6	Property repairs needed
3	Property tax, insurance, utility cost
4	Other

*Source:* Material summarized from Consumer Bankers Association CRA Conference held at Ritz Carlton Pentagon City, Arlington, VA, April 23–25, 2006. Specific session entitled “Loss Mitigation Strategies” moderated by Deborah Oakley, SVP Home Ownership Preservation, National City Corporation, and presentations by panelists Heidi Coppola, VP & Director Public Policy, Citibank; Bonnie Boards, VP & Director, Chase Homeownership Preservation Office, JPMorgan Chase.

There is also an information gap for emerging markets, particularly for those consumers having little or no credit history. Research has produced compelling empirical evidence that noncredit payment data can help predict credit risk, which, in turn, can help qualify consumers for loans provided that they pay their cash obligations as agreed. However, there are some hurdles to tapping this rich source of predictive information. Credit model developers will have to navigate challenges around alternative data acquisition, interpretation, normalization, and validation. There is variation on what currently gets reported across, and within, industries (such as electric, gas, water, telephone, and so on). Some companies choose not to report due to expense and the time-consuming aspects of doing so. Those who do choose to report vary in practice relative to:

- How much is reported (for instance, positive and/or negative information)
- What information to report (for instance, only balances greater than a policy-specified amount)
- When to report (for instance, if the number of days past due is greater than a set number of days, as determined by policy)

There are different jurisdictions, sometimes state boundaries, that have differing laws and regulations that impact reporting, such as forbearance policies that may not permit reporting in winter months (Wisconsin), bans on reporting without first obtaining affirmative consent (California Public Utility Commission, New Jersey, Ohio). Furthermore, federal legislation<sup>10</sup> has had some privacy and data security issues around reporting alternative data. The upshot is that lenders who operate in multiple jurisdictions and whose prospective borrowing population use different service providers have to address the issues of inconsistency resulting from differing practices.

### **Model Factor Gap**

*Model factor gap* refers to the failure to include important factors for segmentation and loan decision model development. A more inclusive and accurate model should maximize the breadth of potential model factors. Factors used in model development should be forward-looking, and they should be able to capture a borrower's loan affordability. Current underwriting systems fail to incorporate future scenarios and extreme economic conditions into underwriting factors. As a result, when the housing market weakened, loan quality and performance deteriorated rapidly.

Credit scoring, which relies on historical data, does not have this capability, nor does it possess a feedback mechanism to adjust factor weightings over time as experience accumulates. Even when credit scoring systems are redeveloped the factors are again considered one at a time and selected in a particular sequence. Also, the ability to tailor factor definitions is important in order to maximize the information value of the data. An example of just such an alternative data-based capacity factor is an "obligation to income ratio" that combines a proposed loan payment with the sum of all payments of any kind in the numerator of the ratio.<sup>11</sup> Examining future, in addition to current, financial ratios is of key importance for adjustable rate mortgages (ARMs) and option-based mortgages. Here, behavioral and historical variables are needed to capture more than a snapshot. For this purpose current income and income 12 and 24 months ago are averaged to calculate the annual increase in the denominator for a debt-to-income (DTI) ratio. For the numerator of the DTI ratio, the maximum rate on the next ARM reset date can be used

to gauge the borrower's future ability to repay the loan. Property is valued using best, worst, and most likely to come up with an estimate of the range of property values. This enables borrowers, and lenders, to view the range of possible loan-to-value (LTV) ratios that may occur, which reflects the borrower's future equity position.<sup>12</sup>

## Sampling Gap

Another critical area is determining which loan applications, in addition to items of information, are included. This is an area where missing, or too few, items can cause loan applications to be disproportionately excluded for certain population segments, which can cause biased and skewed results. Sample selection is concerned with how to classify observations based upon their performance (that is, defining what constitutes a good or bad loan). Inclusion of loans in various stages of delinquency in the bad loan category can pose problems that carry over to the model's predictive power overall, and individual factor weightings in particular. Another hurdle is whether to define a good loan as any loan that is not a bad loan, or to attempt to define a third category corresponding to indeterminate performance. Indeterminate loans would have performance insufficient to be classified as either good or bad. In credit scoring models, samples are "factored up" to reflect the true proportion of good and bad credit applicants in the general, or through-the-door, applicant pool. At the end of that process, there are only good and bad loans in the reconstructed loan population. Exclusion of indeterminates can cause a gap in representation that is magnified when the sample is scaled up.

For example, in credit card scorecard development, as much as 40% of the sample can be lost to the "inactive" category of performance (for instance, insufficient account activity), 35% can be lost to the indeterminate category, and 5% to other exclusions. The end result in such a case is a scorecard that is purported to have "reconstructed the total through-the-door applicant population," when in fact it has totally ignored 80% of the observations. The result is an overstatement of the system's ability to decide which loans will turn out to be either good or bad, and the associated estimated default probabilities may lack precision. We recognize the legitimate reasons for scoring system developers to restrict samples. We are simply pointing out possible consequences of those restrictions.

The time frame that the model development sample is drawn from may not reflect a full economic cycle and consequently the results can be misleading. To illustrate, suppose that an observation window was based on the prior four to five years when there may have been a prolonged housing boom, a strong economy, and falling interest rates. This would produce data-driven factor weightings that may not be a good indicator of how future loans will perform. This is especially true if the future reality becomes a recession, with a housing slump, coupled with rising interest rates. Credit scoring models are based on observed good/bad performance for a set period of time. Their information weights of evidence may not be a good indicator of how future loans will perform if it turns out a recession with rising interest rates occurs.

Finally, there is the issue of population performance definitions. These are necessary to create a development sample for a credit scoring system, and they relate to classification of observations into various performance categories (for instance, exclusions, inactives [for revolving credit], indeterminates, bads, and goods). In addition to determining how observations are to be classified for modeling purposes, the performance definitions specify the time frame over which performance is to be observed, and the behavior patterns that are indicative of class membership. Interestingly, the time frame for delinquent behavior does not vary by severity of delinquency. In other words, consumers are penalized for having even mild late payments going back 24 months, the same as for 60- and 90-day past due occurrences. This means that borrowers who experience a temporary hardship for a few months but avoided severe delinquency have to wait two years for a clean slate even if they have been current with all accounts for the past year. This is a common consumer complaint relative to credit scores. It takes a long time for credit scores to improve, whereas the CCAF contours can change immediately when new information becomes available. In statistical terms, we would consider the likelihood of delinquent payments given the borrower has defaulted on a loan to be virtually 100% (a very sensitive test). However, the likelihood of delinquent payments, given the borrower will not default on a loan is typically greater than 50% (not too specific a test).<sup>13</sup> This means that by including delinquent payers in the “bad” sample we are mixing both good and bad credit applicants together, making it nearly impossible for any model to tell them apart. Further, relative to every factor in the scoring model, the relationship to actual loan default is clouded at

## EXHIBIT 3.4

## SUBPRIME PERFORMANCE CRITERIA

**Severity****High-to-Low****Performance Criteria**

1	Bankruptcy filed within the past five years
2	Foreclosure public record filed during the past 24 months
3	Judgment or tax lien or garnishment initiated during the past 24 months
4	Repossession during the past 24 months based upon the data reported in the trade line
5	Charge-off during the past 24 months based upon the data reported in the trade line
6	Sixty days past due two or more times, or ninety days past due one or more times, during the past 24 months
7	Sixty days past due one time during the past 24 months
8	Thirty days past due three or more times during the past 12 months
9	Thirty days past due two times during the past 12 months

best by the inclusion of nondefaulters in the bad sample. Due to the delinquent nondefaulters included in the “bad” sample, the credit score probability of “bad” includes as “predicted bad outcomes” cases where borrowers go delinquent, but never default on their loan.

Population performance definitions will be different for a subprime lender than a prime lender. Subprime actually consists of layers of risk. Typically, borrowers having a credit bureau score of 660 or less are considered to be subprime. Within the subprime pool, one can further segment by credit history specifics by severity. Exhibit 3.4 provides an example of nine such layers.<sup>14</sup>

The importance of population performance definitions cannot be over-emphasized. The expression, “garbage-in, garbage out” comes to mind. That applies not only to input data, but also to input assumptions. To illustrate this point we share a situation where scorecard developers were hired by a nationwide finance company, based in the South, to build two credit scoring systems, one for new or existing customers and one for scoring former customers, in order to qualify them for a new loan. It turned out that the systems were shelved and never used because their initial use resulted in a 66% rejection rate for their new and current customers and a 75% rejection rate for their former customers. Puzzled and shocked at this outcome, the lender undertook a study to understand why



this had occurred and to see if there was some problem with their data. It turned out that the root cause was their good/bad loan definitions. The vendor had used industry standard definitions for bad loans nearly identical to those listed in Exhibit 3.4 for subprime loans. For the finance company in question, a typical good performing loan was one where only four or fewer payments were delinquent over a 12-month period. Their business model was to refinance loans after two years to allow for a lower payment for the borrower, but to keep them paying on the same debt over a much longer term than originally was intended by the borrower. They also used a *recency*, versus *contractual*, delinquency method of assessing borrower payment standing, whereby delinquency severity only depended on whether there was a payment made last month, and not the total number of payments borrowers were behind in their loan agreement. Hence, a borrower who missed three payments, but paid last month, was considered to be current. This example illustrates what can happen if the problem being solved is not first well-defined.

### **Model Formulation Gap**

In model building there is also the dilemma of what factors to include and how much weight to put on them individually. This is complicated by the reality that many credit factors are correlated with one another. The simple fact is that the primary underwriting factors possess deep interrelationships and, as such, their interactions and conditional nature should be reflected in the model formulation to the greatest extent possible. Failure to do so contributes to inaccurate and unrealistic credit assessment.

At any stage of variable selection, it is the marginal contribution with previously selected model factors that determines what, if any, factor is selected. It is entirely possible that debt ratio will not make it into the model, even though it is a key indicator of borrower capacity, and this does occur in fact with many underwriting scoring models. This points out the problem with letting the data drive what is in the model, versus proven principles that far surpass the time frames from which the model data is drawn. Alternatively, some of the more predictive factors may be withheld from selection until the end of the process because their early inclusion will result in only two or three factors being selected if correlations are high. As a consequence, if the factors that are highly predictive

on their own do make it into the model at a late stage, their weight will be substantially less than if they were allowed to enter the model without restriction. Unfortunately, factors that qualify as key credit indicators may be precluded from consideration for various technical reasons. For example, despite its obvious relevance, income may not be used because its thresholds for the point intervals can become less accurate due to inflation. There is anecdotal evidence that a major mortgage underwriting system in use today does not include debt ratio as a factor because reportedly other model variables capture all of its predictive content. Other factors are abandoned by model developers due to the incidence of missing data, despite their relevance.

Credit scoring models typically assign point values to perhaps 6 to 12 factors,<sup>15</sup> every credit applicant is considered on all factors, and the same points are assigned irrespective of the responses on any of the questions. The process of selecting variables often consists of picking the candidate variable that has the greatest predictive strength as the initial choice, and then picking the next factor that jointly provides the greatest predictive strength. That means that the second variable selected may not be as predictive on its own as many of the other remaining candidate variables. For example, suppose there are several variables to choose from and the strongest variable represents the most severe credit delinquency during the past two years—so it gets selected first. Further suppose that debt ratio is the next most predictive factor among the remaining choices, but that it is obviously highly correlated with credit delinquency. The next variable to be included may be the number of years at address, although it is a much weaker predictor, because in combination with the first factor it provides the greatest lift. In other words, the length of time someone lives at an address does not cause them to perform well or badly. It may be a measure of stability, but financial capacity and capital can arguably better determine ability to pay. In addition, credit scoring system factors such as years at address do not consider the circumstances associated with a residential move (for instance, whether it is due to a promotion and career advancement with greater pay, or the loss of a job and move to a job with lower pay, or to get into a neighborhood that is zoned for better schools, or some other reason). Moreover, credit score point values associated with these factors may provide false signals if the borrowers they represent differ significantly in primary credit factors that are not included

in the scorecard. On a final note concerning years on job, years in profession, years at current residence, and years at previous residence, there are frequently “reversals” in good/bad odds as the length of time increases. Often, scorecard developers will smooth out these irrational-looking patterns so that the likelihood of going bad decreases steadily as the length of time increases, which invariably reduces the predictive power of the system.

Scoring system technology was originally sold chiefly on its ability to (1) speed the process, (2) enforce consistency, (3) precisely quantify bad performance risk, and (4) outperform individual loan officers on bad loan prediction. To the first point, credit scoring was faster, even when performed in a manual environment, because it does not agonize at the cutoff-margin who is good or bad—it simplifies all those choices to a simple series of point assignments and totaling of the score, where scores at or above the cutoff are approved, and those below the score cutoff are declined. Choices around the threshold risk tolerance are always the most difficult ones. On the second point, credit systems enforce consistency, because two consumers falling into the same categories for the factors being scored will receive identical scores. However, two credit applicants falling into different categories for the factors being scored may still receive identical scores, because differences in point assignments for one factor may be offset by those on one or more other factors. The point is that two applicants may have identical scores, but not identical credit characteristics.

Relative to the third point, custom credit systems for specific lenders and loan products are capable of quantifying the odds of bad performance because they are developed based on the compilation of large numbers of similar loans where the historical performance is known. The same is true for bureau-based credit scores, except for the fact that they encompass multiple lenders and may span multiple loan products (for instance, revolving, installment, mortgage, and so on). The credit score is simply the odds of repayment, scaled to be a positive number that ranges within a few hundred points.

On the fourth point, historically when judgmental systems consisted of a collection of fairly autonomous loan officers, the scoring system always outperformed any individual loan officer. This was because it was based on all, and not just some, of the cases to be decided. Hence, a loan officer

may be correct in assessment, but graded failure because in a particular instance in the past a loan went bad despite passing obvious tests—this is where credit granting has become a data mining exercise of separating out who did and did not repay in the past, irrespective of causality, and not a reasoned response to who will likely repay. The real issue is which decision is actually most likely to be correct.<sup>16</sup>

## Process Validation Gap

Constant redevelopment of scoring models is very resource-intensive. For most lenders, this translates to a burden of scorecard redevelopment every two years or so. When the sample used is drawn during times of economic change, or transition, the future results of the scorecard produced can significantly vary from those of the holdout sample used to validate, and back-test the system. This is because bad credit payment behavior correlations change relative to the scorecard factors when new economic and demographic circumstances present themselves. In these cases, scorecard validation may not immediately surface the problem, and when the issues do become apparent, the scorecard will likely need to be replaced earlier than expected. Even then, the same sample issue can persist, and the cycle may repeat itself.

There are many choices that can be, and are being, made in model development. Weights may not be optimal, especially when you start varying certain assumptions, or drop into certain population segments. For example, there may be regional differences, product differences, or differences in customer culture or life cycle, and so forth. Perhaps consumers who use credit more sparingly are more disciplined to live within their immediate means and are more risk averse. Models developed on a more mainstream population may tend to overestimate risk for such a segment. Furthermore, one has to ask the question “Is the object of the exercise purely to predict default risk, or should fair credit access also be part of the objective?” There are families of scorecards that perform very similarly relative to credit default prediction, but differ significantly relative to acceptance rates for specific borrower population segments. This is often the case in underserved markets.

The process validation/compliance gap also has contributed to unfair or predatory lending practices as current process validation is performed only

from a credit perspective and ignores other regulatory compliance aspects. As discussed in Chapter 1, predatory lending has been one of the key factors that reduced borrowers' affordability.<sup>17</sup> The connection between process validation gap and fair lending becomes more apparent when one attempts to balance credit access and credit risk in a more holistic framework as described. Fair lending self-evaluation normally entails systematic compliance testing for different outcomes (for instance, loan product selection, loan approval or denial, loan price) based on how loans are decisioned, but not necessarily based on who is actually most qualified. When significant findings persist, the final analysis involves construction of sets of similarly situated borrowers in different protected classes that can be compared with one another. It is possible that even if borrowers are treated consistently by the underwriting system, individual matched-pair cases can be found where more-qualified borrowers are disfavored over less-qualified counterparts.<sup>18</sup> In such instances, this may, or may not, involve protected versus nonprotected class differences (that is, the differences may occur "in-class" as well). In situations where there is a difference in distribution for the protected and nonprotected classes relative to the comprehensive credit assessment framework segmentation and if those segments fall into "underwriting gap" categories, then the results will signal potential discrimination.

The process validation/compliance gap widens as inconsistencies in lending results occur, or in pricing, among similarly situated borrowers that fall into protected and nonprotected classes. The CCAF handle solves this problem, because, by definition, the borrowers in the same handle will be decisioned and priced identically. Credit scoring cannot make this same claim, because it does not have the ability to holistically determine borrowers who are similarly situated. Inconsistencies are identified *after-the-fact* with credit scoring. In contrast, they are *pre-empted* with CCAF.

## HOW TO CLOSE THE UNDERWRITING GAP

In a nutshell, the above underwriting gap components can be addressed by (1) inclusion of more complete data and information from various domains and markets, (2) inclusion of a broader set of model factors such as future financial ratios into the models, (3) inclusion of more observations that

might otherwise be excluded due to missing data and indeterminate loan performance, (4) improving modeling methodology, (5) integration of judgmental factors into the modeling process, and (6) integration of compliance requirements into process validation. Exhibit 3.5 describes those elements at a high level.

Adoption of CCAF will significantly close the underwriting gap, which will result in the following benefits:

- An adaptive system that becomes more predictive over time and does not need total replacement periodically, like credit scoring.
- A far broader range of outcomes and scenarios being considered.
- More accurate loss predictions for lenders: putting borrowers, and their credit transactions, in the proper context before attempting to determine creditworthiness or how much to charge for a particular loan.
- Fairer treatment of the borrower relative to loan qualification, product selection, and pricing.
- Greater borrower financial literacy because the CCAF number is interpretable (unlike credit scores).

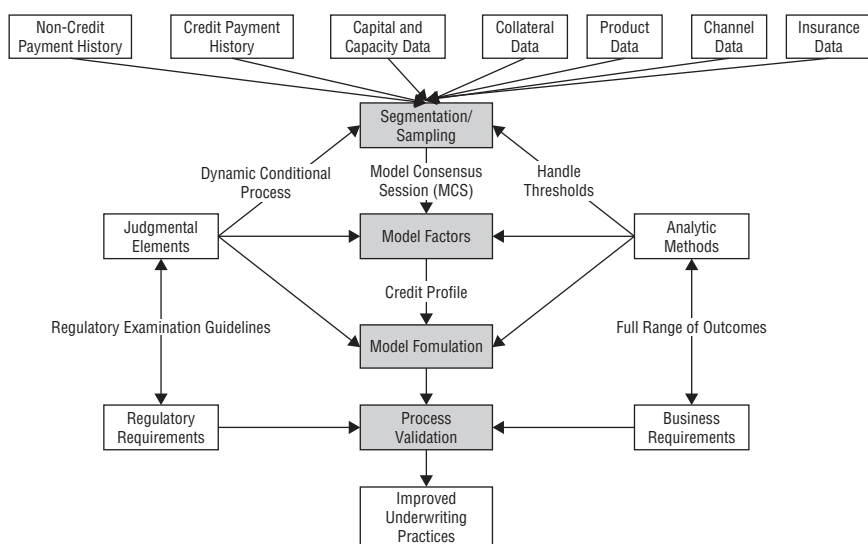


EXHIBIT 3.5

CLOSING THE UNDERWRITING GAP

- More responsive risk assessment (delinquent borrowers do not have to wait years for their credit standing to improve).
- Better informed investors.

We proceed to describe these key components in detail.

## More Complete Information and Model Factors

It is critical to include complete information and more predictive factors that cover the full spectrum of relevant qualification criteria. Such a system should both determine, and reveal, how factors combine to produce outcomes. These considerations are absolutely crucial inputs for sampling, segmentation, and model formulation.

An important consideration is how a particular subprime lender characterizes good and bad performance for the purposes of scorecard development, and underwriting in general.

Subprime designation is given to loans that are perceived to have more risk. Because the current definition is primarily based on the bureau credit score, which mainly measures willingness to pay, it may fail to capture true default risk (over- or underestimate the risk). CCAF can define *subprime* based on primary credit qualifications that also take into consideration capital and capacity. This approach is more accurate for grading credit into A, Alt-A, B, C, and D tiers so they can be properly priced. This will also result in a more clear and complete picture of riskier loans in the marketplace.

Data that is important for estimating loan default for consumers would include, but not be limited to (1) an inventory of all current obligation terms, balances and monthly payment amounts with all lenders, service providers, landlords, insurers, and counterparties; (2) current sources of income and time in profession and with current employer; (3) liquidity and value of personal assets and net worth; (4) nature, and value of collateral (or asset being financed) based on both current appraisal and future value ranges, and the amount/percentage of loan down payment (or loan-to-value ratio); (5) payment and delinquency history for credit and noncredit obligations and any past loan defaults; (6) insurance coverage by type, including policy limits and cash values; and (7) loan conditions including maturity, loan amount, pricing mechanism, payment schedule

and terms, and other borrower elected or lender-specific transaction requirements.<sup>19</sup>

Model factors that take into account future circumstances, and their impact on loan repayment and collateral value, need to be included. One way to accomplish this is through the creation of future financial ratios, which we previously described.

Models should not overly rely on historical data. CCAF immediately recognizes changes that impact creditworthiness. For example, if people have an inheritance, or bonus, or their capital position changes significantly, their credit contour immediately changes. The same would be true if they experienced a change in capacity. Also, with additional sources of information, their satisfactory trade line information can be bolstered, which will be explained in the next section on alternative data. As discussed in Chapter 2, the CCAF enables lenders to classify credit risk and to decision all transactions in a fair, effective, and transparent manner. Classification of credit transactions is performed sensibly and comprehensively using the Five Cs of Credit, and it requires that all primary underwriting factors be simultaneously weighed, rather than letting a model dictate what is, and is not, important. Exhibit 3.6 summarizes how CCAF broadens the coverage of model factors. It shows that compared to other existing lending systems, CCAF shores up the information gap by including additional information and model factors.

## **An Improved Modeling Methodology**

The current modeling methodology can be improved from three perspectives. First, the model should rely less on the assumption that the past determines future outcomes. It is also required that factors with a known relationship to loan default are included as opposed to letting the data determine what is included based on pure statistical correlations in the sample. A fundamental question that must always be addressed in model building is “What is the objective function?” Typical credit scoring systems are posed as discriminant analysis problems, where the objective function to be maximized measures the separation between observations that have been classified into “defaulter” and “nondefaulter” loan applicant groups.<sup>20</sup> This approach carries with it assumptions concerning the form of the statistical distribution of the sample and general population



## EXHIBIT 3.6

INCLUSION OF MORE INFORMATION AND  
MODEL FACTORS

GAP Components	Judgment	Credit Bureau Score	Custom Credit Score	Status Quo	CCAF
<b>Data—Inclusiveness</b>					
Not limited to loans made by individual loan officer		✓	✓	✓	✓
Includes loans w/ missing information	✓				✓
Based on default only	✓		✓		✓
Addresses sampling timeframe	✓				✓
<b>Data—Coverage</b>					
Credit bureau data	✓	✓	✓	✓	✓
Application data	✓		✓	✓	✓
Deposit data	✓		✓	✓	✓
Alternative data			✓		✓
Insurance data			✓		✓
Customer-specific data	✓		✓		✓
<b>Model factors</b>					
Credit bill payment	✓	✓	✓	✓	✓
Non-credit bill payment			✓		✓
Capacity	✓		✓		✓
Capital	✓		✓		✓
Collateral	✓		✓		✓
Conditions/vulnerability	✓		✓		✓
Factor choice not purely data driven	✓				✓
Factor importance not data driven	✓				✓

of credit seekers, and also the properties of the score distribution, such as equal variance of “defaulter” (bad) and “nondefaulter” (good) groups. There are other approaches that have modeled default risk as a propensity and that have included expected profit as the outcome to be predicted. These models produce different outcomes from those in standard use today, and they take into account a greater portion of the true business

reality.<sup>21</sup> CCAF is not dependent on distributional assumptions or properties of the sampled data. It can consider multiple objectives, including profitability, prepayment likelihood, spending propensity, and default probability.<sup>22</sup>

Second, CCAF uses a dynamic conditional process (DCP) in modeling decision factors.<sup>23</sup> In model building there is always the dilemma of what factors to include and how much weight to put on them individually. This is complicated by the reality that many credit factors are correlated with one another. The simple fact is that the primary underwriting factors possess deep interrelationships, and, as such, their interactions and conditional nature should be reflected in the model formulation to the greatest extent possible. It is important for the lender to view the borrower's answers to the most relevant credit qualification questions simultaneously in order to evaluate the credit risk and to know what type of credit is affordable, and most suitable for the borrower's needs. The selection of factors for scorecards does not require that all primary factors be considered, and often they focus on payment history, search for credit, and type/mix of credit used and ignore factors that have a direct relationship to ability to repay the loan, such as capacity and capital. When included, factors relating to capacity, capital, collateral, and conditions, or some combination of them, are often applied serially after a credit score is produced, and those factors are usually considered as distinct and independent overlays (sometimes two or, at most, three factors are considered jointly for risk-based pricing adjustments to mortgage points). The result can be a series of adjustments that can mount up to large incremental pricing offsets.<sup>24</sup> With CCAF, one can maximize the breadth of candidate model factors, which results in greater inclusiveness and accuracy. In addition, factor definitions may be tailored in order to maximize the information value of the data.

Third, CCAF integrates model factors in the modeling process in a transparent manner. Current credit scoring systems lack transparency as industry models are maintained as proprietary property of the companies that develop the scorecards and those that gather and report credit data and credit scores, which are simply a numerical rating. Unlike a credit score, CCAF uses the Borrower Contour (BC) to convey transparency and the essence of the borrower's qualifications. As CCAF rates credit

transactions within the context of the transaction contour (TC), it can help avoid significant overstatement or understatement of risk on individual loan transactions. More important, the borrower's contour affords transparency and conveys the essence of the borrower's qualifications. CCAF risk rates credit transactions within the context of the borrower's credit characteristics to avoid significant overstatement or understatement of risk on individual loan transactions. In terms of financial disclosure, CCAF provides consumers with their categorization relative to all primary underwriting factors via a transaction contour identifier. With this single number, strengths and weaknesses relative to the primary qualification criteria are immediately apparent. In addition, a simplified 1 to 10 rating scale may be used to describe the overall credit rating when all factors are combined. This rating is the same for all consumers sharing the identical transaction contour.

In some cases, as we explore the dimensions of a more comprehensive framework, we reserve the option to deploy individual credit scoring models to categorize and assess the risk of one or more dimensions in the framework. Exhibit 3.7 summarizes how CCAF improves credit risk modeling methodology and compares them with credit scoring and other lending systems.

### **Segmentation within a Business Context**

We now address the sampling and segmentation component of the gap. Segmentation can be used to account for a variety of structural differences in a sampled population, such as demographic differences, economic differences, product differences, channel differences, or differences in customer culture or lifestyles.

By way of a model consensus session (MCS), the CCAF affords a complete credit categorization of borrowers prior to risk rating them, unlike most of the prevailing approaches today, which are piecemeal and risk rate certain aspects of borrower creditworthiness. In contrast, the CCAF adopts a more holistic view, drawing upon the well-known Five Cs of Credit.<sup>25</sup> The primary factors to encompass the first three Cs of Credit can be extended to create a Borrower Contour (BC), which is a distinctive pattern of values relating to character, capacity, and

## EXHIBIT 3.7 IMPROVING MODELING METHODOLOGY

GAP Components	Judgment	Credit Bureau Score	Custom Credit Score	Status Quo	CCAF
<b>Modeling Methodology</b>					
Past determines the future		✓	✓	✓	
Default odds calculated based on all relevant factors					✓
“One size fits all” with identical factors and fixed factor weights		✓	✓	✓	
Statistical correlations among factors are unchanged over time		✓	✓	✓	
<b>Model Properties</b>					
Sensibility	✓				✓
Objectivity		✓	✓	✓	✓
Consistency					✓
Based on sound lending principles	✓			✓	✓
Quantitatively monitored & validated		✓	✓	✓	✓
Qualitatively monitored & validated					✓
<b>Operational Properties</b>					
Speedy decision		✓	✓	✓	✓
Flexibility	✓				✓
Transparency					✓
Accuracy increases over time					✓
Powerful controls to limit risk at borrower segment					✓
Cost effectiveness					✓
Reliability					✓
Adaptive to market, economic, consumer shifts					✓
Easily updated					✓

capital for a consumer or business. We can further introduce the notion of a lending transaction contour (TC), which is based on all Five Cs of Credit plus secondary factors, pertaining to a particular obligation. The TC can encompass BC, or it can operate across segments defined by BC. The TC may also encompass channel and market factors.<sup>26</sup> It is essential that both TC and BC indicators be included in

each loan application and origination record. This enables a comprehensive view of credit risk. As a result, lenders can evaluate and monitor lending practices to identify subprime credit deterioration, and potential predatory or discriminatory issues. In terms of financial disclosure, CCAF provides consumers with their categorization relative to all primary underwriting factors via a transaction contour identifier. With this single number, strengths and weaknesses relative to the primary qualification criteria are immediately apparent. For the example in Chapter 2, BC consisted of 36 segments, while TC consisted of 432 segments. In addition, a holistic score (scaled so that 20 points doubles the odds of default), is used to describe the overall credit rating when all factors are combined. This rating is the same for all consumers sharing the identical transaction contour.

Segmentation results including TC or BC will be integrated with proper business context or external factors relating to the economy, market states, and underlying asset valuation to fine-tune model specifications. As a result of segmentation performed in the previous stage, this modeling process is significantly simplified. For example, when modeling with logistic regressions, each TC or BC will naturally correspond to a unique covariate pattern associated with a probability of default. The TC can accommodate changes in economic or business factors, such as the value of the underlying asset being financed, or the collateral pledged, for a secured loan transaction. For example, in the case of a mortgage, property reappraisal may result in a different loan-to-value (LTV) ratio that can change the TC value. Another example would be a borrower's working capital position, which may change due to assets being marked to market, or possibly due to longer-term asset liquidations.

Specifically, this process is accomplished through a dynamic conditional process, in which the impact of business context or external factors is associated with each TC or BC to create a conditional and interactive structure for model specifications. This is completed in two steps and is adaptive at different levels. Step one is to enumerate and separately consider all possible combinations of the primary variables. The actions taken in step two would depend on how the borrower was initially classified according to the primary credit risk factors. To illustrate with a mortgage example, consider how one might appropriately decide what weight to

apply on a value for the factor DTI based on knowledge of the LTV ratio. Consider the following three scenarios:

1. Suppose you know that LTV is 20%, so that the customer has an 80% equity stake in the property being financed. Knowing this fact, how would you weigh the importance of DTI? How would you rate the following values of DTI, relative to risk in this case:

DTI = 20%? DTI = 40%? DTI = 60%?

2. Next, suppose you know that LTV is 70%, so that the customer has a 30% equity stake in the property being financed. How would you rate the following values of DTI, relative to risk in this case:

DTI = 20%? DTI = 40%? DTI = 60%?

3. Finally, suppose you know that LTV is 100%, so that the customer has no equity stake in the property being financed. Again, how would you rate the following values of DTI:

DTI = 20%? DTI = 40%? DTI = 60%?

The foregoing scenarios could be repeated holding the value of DTI constant and then varying the values of LTV under different scenarios. The point is that if you have a different weighting of one variable based on the value of another then the new approach should make business sense. This is achieved with a transparent model validation process as detailed in the next session.

### **A More Natural Model Formulation Process**

CCAF is not an expert system. It can be based on pure science, pure judgment (initially), and common sense, or a combination of all three. Expert judgment is not performed by CCAF based on individual opinions, as was the case prior to the age of credit scoring. Judgmental elements are carefully and systematically deployed through consistent business rules that have stood the test of time in the larger sense. This approach is a better fit for the evolving nature of today's business climate than a static and inflexible empirically based scorecard, which diminishes in effectiveness from the day it is put into use.

CCAF affords greater control of loan decisioning through its ability to integrate expert judgment with statistically based criteria in the risk evaluation process. Moreover, the CCAF risk evaluation process encompasses

not only default risk, but also concentration risk, fair lending noncompliance risk, and a host of other important objectives. In this way, CCAF loan decisioning is not restricted to a numerical score cutoff, which must be overridden from time to time. In addition, CCAF's transparent approach fosters trust and confidence that comes from knowing exactly how loans are evaluated and how credit quality and credit access will be maintained and improved. CCAF provides fair access to credit and ensures suitable loan products for consumers, and a more profitable, safe, and sound loan portfolio for lenders.

The question of protected class treatment is a complex one. CCAF provides greater transparency than credit scoring or application scoring processes. If minorities are disadvantaged in any way, CCAF can better detect it and also can correct for it more effectively and precisely than any other method in use today. Furthermore, relative to 12 C. F. R. §202.2 (p) (iii), CCAF can be developed, like credit scoring models, on a data-driven basis. The fact is that the credit scoring development process itself entails a host of judgmental decisions and has always been recognized by practitioners as being both an art, as well as a science. In some cases the flavor of statistical methods used may differ, but that is of no consequence. In fact, CCAF may be based on a more general class of discrete multivariate models than the standard credit scoring regression models, and they are in many cases mathematically equivalent, depending upon how the developer chooses to formulate the decision model.<sup>27</sup> Even if a CCAF system is developed using factors having purely judgmental-based weightings that are applied universally, it should still fall into the statistical model category. An example might be the quality of management for a small business loan. If there are well-defined descriptions of what constitutes strong (value of 3), fair (value of 2), or weak (value of 1) management based on objective criteria such as years of experience, education, track record, and so forth, then these numerical ratings can be treated as data just the same as with any other model factor. Customer relationship is another such factor, which may depend on the length, depth, and breadth of the loans, deposits, and services a banking customer has with a particular financial institution. Again, business rules would be used to determine the value rating for customer relationship in the underwriting model. Finally, patterns may appear to indicate redlining, or avoidance to lend in certain geographic areas, when in fact they may be due

to borrower qualifications, coupled with concentration risk limits on the loan portfolio that are imposed for safety and soundness reasons. In this instance, a lending institution finds itself in a Catch-22 situation, where it either appears to be redlining or it appears to have too large a subprime concentration. CCAF can sort this out and make those tradeoffs transparent so that lenders can address and correct any misperceptions about their lending record. We will revisit this issue of how CCAF should be considered from a regulatory perspective in our discussion of the Equal Credit Opportunity Act (ECOA) in Chapter 6.

From a modeling perspective, the CCAF approach does more than simply introduce judgmental factors into the modeling process. It affords the simultaneous consideration of all relevant factors via the handle cell. This allows for both a conditional structure and interaction effects that scorecards simply cannot capture with their one-size-fits-all assignment of points. It can also perform the standard risk grouping and ranking of handle cells using actual data. This way, CCAF affords greater control of loan decisioning through its ability to integrate expert judgment with statistically based criteria in the risk evaluation process.

CCAF can be considered as a “systematic” judgmental decision process that can be fully automated and that is continuously updated with loan applicant data and loan performance information in order to validate judgmental factors, their associated thresholds, and the system’s credit decisions. Since it can be executed in a similar automated fashion as credit scoring, it can overcome some shortcomings inherent with traditional judgmental systems,<sup>28</sup> and provide fast, consistent, and efficient credit assessment. This is crucial in the context of most consumer and small business loans, and also for microlending. By systematically integrating judgmental elements, CCAF is in fact more consistent than credit scoring because it can greatly minimize, or eliminate entirely, system overrides. For example, in practice, with credit scoring, low side override rates can approach 5% and high side override rates can approach 10%. For hybrid systems, the number of overrides can be less than 0.5%.<sup>29</sup> Finally, relative to the consistency argument, it is worth noting that credit scoring advocates often observe that with credit scoring, two people having identical credit factors will have identical credit scores. This should come as no surprise that a formula applied to identical inputs yields identical results! The converse, however, is not true. Two



consumers with identical credit scores can be vastly different. So why does it matter if they are different if they have the same score? A simple medical analogy drives home the point. Suppose you are in an accident in the middle of the night and you are being transported to a trauma center with a severe spinal injury. Two physicians are on call, Physician A and Physician B. Both had identical scores on their USMLE<sup>30</sup> they completed at the end of their second year in medical school. Physician A performed best on the psychiatry and pediatric sections of the exam, while Physician B excelled in the sections on neurology and surgery. Do you care which physician examines you and decides what should be done to you? Turning back to the credit scoring discussion, credit bureau scores do not measure borrower capital positions or capacity. Borrower A possesses \$75,000 in savings, earns \$150,000 a year, and is purchasing a home priced at \$240,000. Borrower B has no capital, earns \$100,000 a year, and is purchasing a home priced at \$300,000. Although they both have identical credit bureau scores of 712 at one of the three major credit bureaus, Borrower B clearly is higher risk.

The table in Exhibit 3.8 explicitly shows how CCAF addresses the model formulation gap that exists with today's fragmented, scoring-based approach.

Exhibit 3.8 indicates specific measures for credit scoring-based underwriting systems and CCAF. It notes whether the measure is covered in either approach, whether it can help qualify the borrower (that is, a positive factor that can only increase the score), or hurt the borrower (that is, counted as a negative factor that can lower the score), or if it can do either one. The weight of the variable, or category, is also indicated in the case where it is generally known (for instance, for the Fair, Isaac Credit Score). In the case of CCAF, there are no weights for the primary factors (like Capacity) and the measures that make them up (like debt-to-income ratio and savings rate) because they are dynamic through borrower classification and constantly updated over time. The same factors, if included in today's underwriting systems are fragmented and applied serially with static weights. Scorecard factors can never be adjusted, and they become less predictive over time. Nonprimary factors are integrated into the process by CCAF through the secondary factor classification that is included in the primary classification framework. In this way, each of the 432 handle classifications has its own set of factors that consider the

EXHIBIT 3.8 CCAF ADDRESSES THE FORMULATION GAP IN TODAY’S UNDERWRITING SYSTEMS

Factor Number	Typical Underwriting System Using FICO Credit Score					New Lending System Using SAS CCAF Score				
	Coverage	Helps	Hurts	Both	Weight	Coverage	Helps	Hurts	Both	Weight
CREDIT SCORE										
1	Payment History	✓		✓	35%	See (7)				Integrated
2	Outstanding Debt	✓		✓	30%	See (15)				Integrated
3	Credit History	✓		✓	15%	See (6)				Integrated
4	Pursuit of Credit	✓		✓	10%					
5	Mix	✓		✓	10%					
CHARACTER										
Current/Past Handling of										
Accts.										
6	Established Record	✓		✓	Redundant	✓			✓	Adaptive
7	Payment Performance	✓		✓	w/Credit	✓			✓	Adaptive
8	Defaulter/Non-Defaulter	✓		✓	Score	✓			✓	Adaptive
Stability										
9	Years on Job (Now/Past)	✓		✓	Fragmented	See (26)	✓			Integrated
10	Years at Residence (Now/Past)	✓		✓	Fragmented	See (26)	✓			Integrated
11	Veteran					See (26)	✓			Integrated

12 13 14	<b>Employability</b>						
	Years of Education	✓	✓	Fragmented	See (26)	✓	Integrated
	Years in Profession	✓	✓	Fragmented	See (26)	✓	Integrated
15 16 17	Professional Certifications				See (26)	✓	Integrated
	<b>CAPACITY</b>						
	Debt to Income Ratio	✓	✓	Fragmented	✓	✓	Adaptive
18 19 20	Discretionary Income	✓	✓	Fragmented	See (26)	✓	Integrated
	Savings Rate				✓	✓	Adaptive
	<b>CAPITAL</b>						
21 22	Months of Reserves	✓	✓	Fragmented	✓	✓	Adaptive
	Liquid Assets	✓	✓	Fragmented	See (26)	✓	Integrated
	Net Worth	✓	✓	Fragmented	See (26)	✓	Integrated
23 24	<b>COLLATERAL</b>						
	Loan-to-Value Ratio	✓	✓	Fragmented	✓	✓	Adaptive
	Non-Owner Occupancy	✓	✓	Fragmented	See (26)	✓	Integrated
25 26	<b>CONDITIONS (Vulnerability)</b>						
	Projected Payment Increase				✓	✓	Adaptive
	Projected Loss of Equity				✓	✓	Adaptive
27 28 29	<b>SECONDARY FACTORS</b>						
	Considered Serially	✓	✓	Fragmented			Fragmented
	Varies by Handle Context				✓	✓	Integrated

specific context of the borrower when determining any particular secondary factor's amount of weight in the credit decision. In contrast credit scorecards have fixed values and fixed factors, and they are a one-size-fits-all approach.

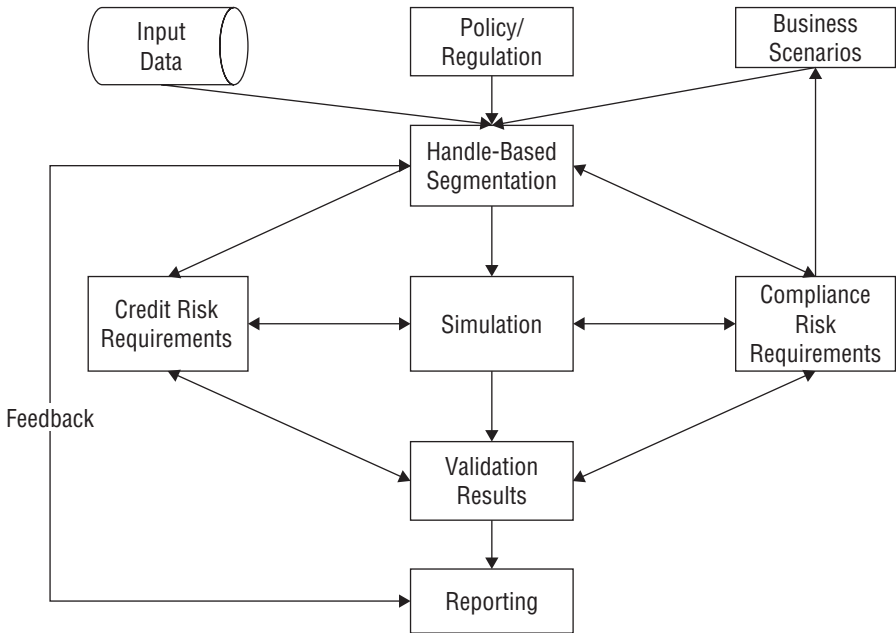
It should be noted that with the exception of nonowner occupancy, CCAF treats secondary factors as only being positive to help the borrower qualify for the loan. In contrast, today's underwriting systems use these factors, and other substitutes, in ways that can cause loans to be denied, or make them more costly. Years on job is a case in point. Borrowers with less than 24 months in their current job will be penalized by virtually every loan system in use today. This is unfair, and contributes to the model factor gap between the true context of the borrower's job situation and the historical statistical samples that indicate shorter-term people are more risky. Only when viewed within the context of CCAF does one clearly see that any underwriting rule based on a single factor result, even if empirically based and statistically sound, is going to be dead wrong when applied to borrowers in specific handles (segments).

What all of this boils down to is that CCAF is a more flexible, adaptable, granular, powerful, and enforceable lending system that can fairly and accurately evaluate credits, quantify transaction risk, maintain appropriate risk levels based on policy-dictated risk tolerances, and more effectively provide information used to monitor and manage loan portfolios.

### **More Balanced Process Validation**

It is critical for a lender to continuously improve model predictability over time as information accumulates to maintain, or improve, the accuracy of the risk measurement system. This requires building a more effective model deployment/operation to continually gather and incorporate information to improve decisions over time, and to eliminate any override processes, which can lead to inconsistency in treatment. Unlike credit scoring, the system becomes less reliant on the original data sample as time progresses and any changes in borrower qualification rules or ratings are handled within CCAF, not after the fact.

The expected frequencies of credit applicants and the weights associated with CCAF factors, by primary factor segment, are updated dynamically as information becomes available.<sup>31</sup> It allows for in-depth analysis of


**EXHIBIT 3.9      PROCESS VALIDATION**

all possible multiway primary factor comparisons relative to the mix of accepted applicants and also acceptance rates at any point in time.<sup>32</sup> Because the credit segments are immediately interpretable and comparable to one another relative to credit risk, CCAF validation affords an additional measure of transparency and confidence that nonintuitive patterns can be detected, investigated, and remedied early on to head off unwanted consequences. This also presents a cost-effective approach to monitor and validate the consistency of the risk rating system for the banks that want to implement, or already use, Basel II's Internal Rating Based Approach.

A typical validation process can be described as follows (see Exhibit 3.9):

- Create segment handle structure for input data if needed. When the system being validated is either pure judgmental, or credit scoring, a model consensus session (MCS) is required to create the corresponding handle cells. The same approach can be used to segment model output associated with the probability of default.

- Associate both credit risk requirements and compliance risk requirements with model input through the handle structure. In this step, model results are analyzed by handle cells together with constructed business scenarios. At a minimum, rank orderings of the TC are verified both empirically and through expert judgment, and risk estimates are tested for validity using both holdout, and out-of-time, credit observations based upon availability.
- Compute the residual score points for secondary factors, together with the system cutoff, and establish a “base” qualification rule within each cell. The residual between the predicted risk score and the input risk distribution (or profile) are further analyzed for root causes. In addition, outliers, or applicants that do not belong to that handle cell are identified and tested to determine how removing these outliers can improve model fit and reduce residual values. This also can be performed to some degree by logical comparisons to identify illogical patterns between the observed risk and the predicted risk.
- Perform simulation with handle structure. This is achieved by using variance reduction techniques<sup>33</sup> to obtain maximum homogeneity in each handle segment. Simulation results from this step are also used to enhance lending policy rules.
- Analyze validation results against both compliance and credit risk requirements. In this step, optimization approaches may be required to achieve optimal balance between those two types of risk. The optimal score cutoffs and segmentation thresholds will be selected so as to minimize the discrepancy between the predicted and actual loan performance. The results will be used to update or modify underwriting policy and rules.

The key point here is that both business and compliance requirements need to be integrated into the validation process as shown in Exhibit 3.9. In other words, the validation process is performed from both credit risk and compliance perspectives aided by an optimization process. The objective function is constructed based on the steps outlined in the first two bullets under the validation process description. The goal is to select optimal thresholds to maximize model predictability for “good versus bad” performance, or to minimize disparate impact on all relative constituencies, subject to a set of constraints that encompass both regulatory

and business requirements. A risk quadrant plot is used to balance the tradeoffs between compliance risk and credit risk. The outputs from this optimization process can help banks make decisions on model updating or rebuilding activities. A detailed example of the mathematical representation of the type of model compliance constraints that can be used in this context has been provided in the literature.<sup>34</sup>

At the same, CCAF offers a process validation that allows the lender to improve credit default estimation, and also better identify predatory lending patterns. The lender will have the ability to assess whether predatory lending patterns cross over to fair lending problems, and immediately isolate unfair lending patterns occurring within the homogeneous risk classifications. This has implications for avoiding predatory and fair lending problems through predictive analytical approaches and optimization relative to the CCAF handle structure.

### **More Effective Loan Risk Rating**

Unlike commercial lending, where financial statements and tax returns are regularly monitored throughout the life of the loan, consumer lending has historically focused only on delinquency and losses to monitor and measure loan quality. Portfolio managers typically monitor delinquency trends to spot higher losses coming their way. While this makes perfect sense, we see that approach as being ineffective if the goal is to anticipate and minimize losses. Furthermore, delinquency trends do not impart sufficient information to tell exactly where the problem lies and what actions should be taken.

There are three key concepts that we offer to help lenders deal with the situation:

1. *The notion that overall portfolio delinquency trends begin earlier in certain segments.* By examining the relative magnitude of deteriorating loan performance in some key segments, several months of lead time may be gained to restrict lending not only in those segments, but also in other related segments. The segmentation that CCAF provides, via handles, provides what is needed to perform the necessary monitoring, so as to avoid surprises.
2. *The need to monitor segment concentrations.* It is painful to sit on a loan committee and hear someone observe, “Every one of the

loans currently facing default was solid as a rock when originated, but who would have anticipated that the entire sector would go south?” Those exact comments were made in the mid-1980s during the energy bust, again in the early 1990s when the commercial real estate market cratered, and now people are wondering why warning bells were not ringing when subprime mortgage skyrocketed. It is vital to put a risk limitation system in place that can effectively monitor the underwriting process and warn when prudent concentration thresholds are exceeded. CCAF can easily be put to this task, and it will perform effectively.

3. *The loan's CCAF handle classification can be updated periodically, just as credit bureau scores are refreshed today.* This is accomplished either through automated means with one or more consumer data aggregators, or it can be customer supplied and then verified. As we will see in our discussion of mortgage-backed securities, this can be made a requirement at the time of pool certification to the packager and also by the rating agencies prior to sale in the capital markets.

Following are judgmental-based definitions of CCAF-based loan ratings (“loan” being intended to include all types of consumer loans).

- **Rating 1 (High Quality).** This category includes loans that have been made to consumers exhibiting superior financial position, very stable income, and high savings trends with a good payment track record. These borrowers possess strong liquidity and superior capital position. They have low debt ratios. Historic and projected performance indicates that the borrower is able to meet obligations under almost any economic circumstances and the impact of any negative cyclical factors in any particular industry is minimal.
- **Rating 2 (Good Quality).** This category includes loans that have been made to consumers exhibiting strong financial position, stable income, and moderate savings trends with a good payment track record. These borrowers possess good liquidity and strong capital position. They possess low debt ratios. Historic and projected performance indicates borrower is able to meet obligations under most economic circumstances.



- **Rating 3 (Average Quality).** This category includes loans that have been made to consumers exhibiting adequate financial position, stable income, and low savings trends with a good payment track record. These borrowers possess some liquidity and a moderate capital position. They possess moderate debt ratios. Historic and projected performance indicates that the borrower is able to meet obligations under modest economic downturns, but equity in their home is their primary savings vehicle and the impact of a housing downturn or unforeseen expenses could leave them exposed.
- **Rating 4 (Acceptable Quality).** Credit risk exceeds normal standards. Payment history is fair, and capacity is moderate to low. Other weaknesses exist, including lowest ratings in one or more of the four remaining categories.
- **Rating 5 (Special Mention).** A special mention loan has weaknesses that deserve closer monitoring. Payment history is fair, and capacity is moderate to low. Other weaknesses exist, including lowest ratings in at least two of the four remaining categories.
- **Rating 6 (Substandard Loan).** A substandard loan is not adequately protected by the borrower's current financial position or by the current and projected value of the collateral. Payment history is poor, and three or more of the remaining primary factors are rated in the lowest category. These loans represent a potential loss to the lender.
- **Rating 7 (Doubtful Loan).** A loan classified as doubtful has all the weaknesses inherent in a substandard loan with the added characteristic that only one of the primary factors is rated above the lowest rating category. These weaknesses make it improbable that the lender will recover the money owed.

CCAF combines science and data with judgment. The judgmental definitions above form a necessary baseline and starting point. Since the CCAF score encompasses all primary and secondary factors, it is capable of rank-ordering the handles (borrower segments) according to loan default risk. The statistical table in Exhibit 2.28 provides a descending cumulative score distribution that would allow for the definition of ratings by CCAF score band. Recall that there are 87 distinct CCAF scores in the example, and the highest rating category (high quality)

might include handles associated with the *top ten scores* (that is, scores in the range of 818 to 833). The handles associated with these scores are found using the cross-reference table in Exhibit 2.29. For example, the handles corresponding to the top score 833 are 431 and 432, which correspond to the most highly rated borrower segments. After some period of time, the table in Exhibit 3.10 can be inserted into the lender's credit policy manual in order to provide more granularity around loan grading.

EXHIBIT 3.10 CCAF LOAN GRADING BY HANDLE

Loan No.	Quality	Average CCAF Score	No. Handles	CCAF Handle Range	CCAF					Secondary Factors
					1st C	2nd C	3rd C	4th C	5th C	
1	High	813	48	385–432	G	H	L/M/S/S	L/M/H	H/L	Y/N
2	Good	780	24	361–384	G	M	S/S	L/M/H	H/L	Y/N
			4	333–336	G	L	Superior	H	H/L	Y/N
			48	241–288	F	H	L/M/S/S	L/M/H	H/L	Y/N
3	Average	760	8	353–360	G	M	M	M/H	H/L	Y/N
			4	329–332	G	L	Superior	M/H	H/L	Y/N
			4	321–324	G	L	Strong	H	H/L	Y/N
			24	217–240	F	M	S/S	L/M/H	H/L	Y/N
			8	209–216	F	M	M	M/H	H/L	Y/N
			8	313–320	G	L	Strong	L/M/H	H/L	Y/N
4	Acceptable	737	4	349–352	G	M	M	L	H/L	Y/N
			12	337–348	G	M	L	L/M/H	H/L	Y/N
			4	325–328	G	L	Superior	L	H/L	Y/N
			8	305–312	G	L	M	M/H	H/L	Y/N
			24	193–216	F	M	L/M	M/H	H/L	Y/N
			12	133–144	P	H	Superior	L/M/H	H/L	Y/N
5	Special Mention	715	4	301–304	G	L	M	L	H/L	Y/N
			4	297–300	G	L	L	H	H/L	Y/N
			24	169–192	F	L	S/S	L/M/H	H/L	Y/N
			24	109–132	P	H	M/S	L/M/H	H/L	Y/N
			24	73–92	P	M	S/S	L/M/H	H/L	Y/N
6	Substandard	684	8	289–296	G	L	L	L/M	H/L	Y/N
			12	157–168	F	L	M	L/M	H/L	Y/N
			8	97–108	P	H	L	L/M	H/L	Y/N
			4	57–60	P	M	L	H	H/L	Y/N
			2	47–48	P	L	Superior	HIGH	L	Y/N
			2	23–24	P	M	M	HIGH	H/L	Y/N
7	Doubtful	664	12	145–156	F	L	L	L/M/H	H/L	Y/N
			12	61–72	P	M	M	L/M/H	H/L	Y/N
			2	35–36	P	M	Strong	HIGH	H/L	Y/N



their lending programs, usually by line of business. In addition to looking at ratios relative to total assets, which makes sense from a business standpoint, banks also view their concentrations relative to Primary Capital (Tier 1 Capital plus Reserves), outstandings, or total exposure (funded plus unfunded commitments). By establishing target values for portfolio concentration measures, lenders can monitor loan portfolio concentration

**EXHIBIT 3.12 MACRO-LEVEL CONCENTRATIONS**

	Policy Limit
<b>Aggregate Loan Ratios to Selected Balance Sheet Accounts</b>	
1 Total Loans to Deposits	100%
2 Total Loans (Excl. Held-for-Sale) to Earning Assets	90%
3 Total Loans to Equity	10.0 ×
4 Non-Performing Loans to Total Loans	1.0%
5 Non-Performing Loans & Past Dues to Total Loans	1.25%
6 Classified Items to Tier 1 Capital Plus ALLL	18.0%
7 Classified Items to (Total Loans + OREO + Repos)	2.5%
8 Classified Items to Total Assets	1.5%
9 Non-Performing Assets to (Total Loans + OREO + Repos)	1.5%
<b>HLT Ratios (to Tier-1 Capital + ALLL)–Exposure Exceeding LTV Guideline</b>	
10 Commercial (Supervisory)	30%
11 Commercial (Supervisory or Bank Policy)	25%
12 Total Loans (Supervisory)	100%
<b>Industry Exposure Ratios (to Tier 1 Capital + ALLL)</b>	
13 Top 3 Commercial Classifications Combined	50%
14 Individual Industry (Regulatory Guideline)	25%
15 Subprime Ratio (to Tier 1 Capital + ALLL)	25%
<b>Borrower Relationship Concentration Limits (to Tier 1 Capital + ALLL)</b>	
16 Commercial (Sum of all borrowers having exposure above 20% of Legal Lending Limit)	25%
17 Construction (Sum of all borrowers having exposure above 80% of Legal Lending Limit)	75%
<b>Limiting % of Loan Portfolio by Line of Business</b>	
18 Commercial	30%
19 Construction and A&D	20%
20 Installment	20%
21 Indirect Auto	25%
22 Mortgage	20%
23 Equity Lines	15%

risks and work closely with line management to ensure that measures exceeding target values are appropriately addressed. Exhibit 3.12 shows an abbreviated high-level concentration report.

Exhibit 3.13 shows a lower-level report that uses capital ratios instead of outstandings and sets benchmark values. These tolerances are then referred to in a policy that specifies what actions are to be taken if thresholds are exceeded. CCAF can help to make those policies more specific when actions are needed to bring concentrations back within guidelines.

Tolerances are calculated as a percentage of loan category aggregate balance to Tier 1 Capital, and are set by each line of business executive, based on historical performance, peer lender and industry trends, product profitability, and prevailing market conditions. The net charge-offs

EXHIBIT 3.13

**BANK COMMERCIAL AND CONSUMER  
PORTFOLIOS—RATIOS BASED ON TIER 1  
CAPITAL ASSET QUALITY STANDARDS—  
RANGES OVER ECONOMIC CYCLES**

Consumer Loans								
Category	Installment		HELOC		Indirect Auto		Mortgage	
	Low	High	Low	High	Low	High	Low	High
Net charge-offs	0.35	0.8	0.02	0.15	0.3	1	0.03	0.1
Nonperforming	0.1	0.25	0.2	0.6	0.05	0.2	0.3	1
Classified	0.5	1.5	0.6	1	0.9	1.5	0.4	1.2
Past due > 90 days	0.1	0.25	0.1	0.25	0.05	0.2	0.2	0.65
Past due > 30 days	0.9	1.5	0.6	1.5	1.2	2.1	1.5	2.5

Category	Commercial		Construction	
	Low	High	Low	High
Net charge-offs	0.2	0.5	0.15	0.4
Nonperforming	0.75	2	0.5	1.5
Criticized	2	7	1.5	5
Classified	1	4	0.75	2
Past due > 90 days	0.1	0.25	0.05	0.2
Past due > 30 days	0.75	1.75	0.5	1.5

threshold (rolling 12 months) relates to the amount of loss realized by the bank after recoveries are taken into account over the prior 12-month period (that is, gross losses minus recoveries), divided by the average of outstandings over the same period. The nonperforming threshold is measured against the balances of all loans on nonaccrual as of month-end, divided by Tier 1 Capital as of month-end. The *criticized* loan threshold is compared with balances from all loans with a risk rating of 5 (special mention) or greater, as of month-end, divided by Tier 1 Capital as of month-end. The *classified* loan threshold seeks to limit balances from all loans with a risk rating of 6 (substandard) or greater, as of month-end, divided by Tier 1 Capital as of month-end. Past due greater than 90 days threshold caps loan balances whose payments are in arrears 90 days or more, as of month-end, divided by Tier 1 Capital as of month-end. Similarly for 30 days past due, the threshold definition is analogous. The point of this exercise is to force management to specify in advance, and measure their performance to, a set of agreed-upon limits to risk exposure. This exercise should be carried out on a monthly basis. For example, if net charge-offs and nonperforming ratios for the mortgage business line were 0.2 and 0.5, respectively in the current month, then net charge-offs would exceed the tolerance by 0.1, and the nonperforming result would be within the allowable range (that is, between 0.3 and 1.0). Unless out-of-range results are brought within corporate asset quality guidelines within three months of occurrence, they are reported at the next quarterly board meeting as an exception, together with a proposed plan to bring any exceptions back within board-approved guidelines.

At this point we invite the reader to consider the possibilities for concentration exposure that CCAF brings to the table. Imagine having the capability to rank exposures by borrower contours, and transaction exposures by the CCAF handle framework. This type of monitoring would not only afford better early warning of trends and areas of deterioration, but it also connects directly to the loan origination process. The handle becomes a common denominator between loan portfolio management and loan underwriting. It repairs the disconnection between the borrower and lender. Further, as we will soon see, when the lender constructs a pool of loans for sale to the secondary market, CCAF's handle structure and key segment distributions can be passed along to the packager for use by the rating agencies and, ultimately, to reconnect investors to the underlying loans in the securities they purchase.

## Closer Monitoring of Subprime Concentration

Many lenders engage mostly in prime lending activities. They may have a “secured” card product or student credit cards for those who are new to credit. As a byproduct of prime lending programs, some subprime loans may be underwritten as exceptions to credit policy standards. In addition, there are prime loans that develop credit problems after acquisition, and there are also community development loans as defined in CRA regulations—all of these loans are normally closely monitored.

Subprime lending, in contrast, refers to the process of acquiring on a regular or targeted basis, either through origination or purchase, subprime loans to be held in the institution’s own portfolio or accumulated and packaged for sale. The definition of subprime borrowers is based on their individual credit characteristics, and typically looks like the following: Borrowers are subprime if they have credit bureau scores of 660 or lower and any of the following characteristics:

- Two or more 30-day delinquencies in the last 12 months, or one or more 60-day delinquencies in the last 24 months
- Judgment, foreclosure, repossession, or charge-off in the prior 24 months
- Bankruptcy in the last five years
- Relatively high default probability
- Debt service-to-income ratio of 50% or greater, or otherwise limited ability to cover family living expenses after deducting total monthly debt-service requirements for monthly income

In summary, to be a subprime lending program generally requires knowingly and purposely focusing on the subprime lending markets through planned business strategies, tailored products, and explicit borrower targeting. Any lender doing subprime lending should have in place proper internal controls and the means to identify, measure, monitor, and mitigate risk stemming from the loans they hold to own or to sell. Specifically, lenders must:

- Develop and maintain information processing systems in order to properly identify subprime loans and have adequate business intelligence and business analytics to effectively measure and monitor risk.

- Evaluate the potential of prime lending risk existing in any new product being considered or related to any change to an existing product.
- Monitor and review allowance for loan and lease losses (ALLL) policy to ensure that allocations for portfolio subprime segments can absorb estimated credit losses.
- Maintain adequate capital needed to offset any additional risk found to exist in subprime lending activities and fully document the methodology and analysis supporting the amount specified.

It is important to note that risk measurement for subprime loans is complicated by the fact that the definition of *subprime* depends on behavior of a borrower with respect to all reported borrowing activity as reflected by the dynamic bureau credit score and past due performance measures. In some sense, subprime is a moving target. That is why it is especially important for lenders to anticipate and head off problems in order to minimize any impact on portfolio performance. Exhibits 3.14 and 3.15 describe subprime loans classifications by product line and credit bureau score band that are typical for a lender's corporate subprime exposure monitoring.

Subprime balances over all products total close to \$82 million. When measuring subprime exposure on lines of credit and credit cards, regulators require that the total line amount, not just what is used, must be counted. Loans held for sale at the reporting date are included in the calculation. The top three products relative to subprime dollar balances for this reporting period are indirect auto, credit card, and direct auto, which make up 40%, 21%, and 18%, respectively. In the foregoing example, the lender's Tier 1 Capital plus allowance for loans and lease losses (ALLL) is given in Exhibit 3.15. When viewing subprime exposure by outstanding loan commitments, the percentages seem small. But when viewed by Tier 1 Capital plus ALLL, the ratios indicate that collectively the subprime exposure is 37%, well above the regulatory threshold of 25%. As a result, this bank will be required to perform additional reporting on their subprime loans, based upon the credit score and other criteria previously described. Of course, one alternative would be to sell subprime mortgages to Fannie Mae!

Exhibit 3.15 also shows the actual subprime percentage by credit score band. It does so by using CCAF to estimate the likelihood of



## EXHIBIT 3.14 SUBPRIME EXPOSURE BY PRODUCT LINE

Estimated Subprime Exposure by Product Line					
Twenty Point Beacon Bands	Indirect Auto (\$000)	Equity Lines (\$000)	Direct Auto (\$000)	Mortgage (\$000)	Credit Card (\$000)
<440	64	0	0	0	125
441-460	96	0	0	0	188
461-480	128	0	0	0	250
481-500	192	0	0	0	375
501-520	256	0	0	0	500
521-540	513	0	0	0	750
541-560	1,154	0	500	0	900
561-580	1,500	0	900	0	1,200
581-600	3,000	500	1,300	750	2,000
601-620	5,000	1,000	2,300	1,200	2,800
621-640	8,000	3,000	3,700	2,300	3,200
641-660	13,000	5,000	6,000	3,100	5,000
Est. Subprime (\$000)	32,904	9,500	14,700	7,350	17,288
% Subprime (\$000)	40%	12%	18%	9%	21%
Total Outstanding (\$000)	1,553,125	200,000	907,500	189,438	80,000
Unfunded	0	60,000	0	0	320,000
Total Commitments (\$000)	1,553,125	260,000	907,500	189,438	400,000
O/S Dollar Ratio	2%	4%	2%	4%	4%
% of Tier 1 Capital 1 ALLL	15%	4%	7%	3%	8%

default, and it found that based on a holistic view that the methods used today overestimate the subprime exposure in certain score bands. This is not a surprising result, given the incomplete view afforded by prevailing methods to measure risk. In practice, we have seen higher percentages than these in cases where lenders have tracked accounts that are subprime by the definitions to see there are no late payments after 24 months. If they achieve that milestone, then they are no longer considered to be in a subprime classification for reporting purposes. We also note that there are loans in higher score bands that should fall into the

## EXHIBIT 3.15

**TIER 1 CAPITAL PLUS ALL VALUES AND TRUE  
SUBPRIME INCIDENCES BY BEACON BAND**

Tier 1 Capital	172,402
Allowance (ALLL)	49,261
Tier 1 Capital +ALLL	222,053

**CCAF-Based “True Subprime Incidence” by Beacon Band**

<b>Twenty Point Beacon Bands</b>	<b>Indirect Auto</b>	<b>Equity Lines</b>	<b>Direct Installment</b>	<b>Mortgage</b>	<b>Credit Card</b>
<440	100%	n/a	n/a	n/a	100%
441–460	100%	n/a	n/a	n/a	100%
461–480	100%	n/a	n/a	n/a	100%
481–500	100%	n/a	n/a	n/a	100%
501–520	100%	n/a	n/a	n/a	100%
521–540	100%	n/a	n/a	n/a	100%
541–560	100%	100%	100%	100%	100%
561–580	100%	100%	100%	100%	100%
581–600	99%	96%	98%	94%	100%
601–620	97%	94%	96%	92%	100%
621–640	95%	89%	94%	86%	98%
641–660	93%	83%	91%	81%	95%

subprime classification, despite high credit bureau scores. In those cases, CCAF demonstrates that the risk is being understated. Unfortunately, the current financial crisis provides ample examples of that fact, and we give five detailed examples at the end of Chapter 4 for qualifying borrowers for affordable products using credit scoring versus CCAF (see examples 5 through 9).

All lenders must take into consideration the impact of their product and marketing choices on their capital position. Some forms of lending are riskier than others, and subprime lending is at the top of the list, relative to asset risk categories. Unsecured lending is usually riskier than secured lending, because there is collateral that can be seized, if necessary, and liquidated to recoup the money owed plus the lender's

expense to acquire, manage, and liquidate the asset. However, because secured lending involves higher loan amounts, and because valuations of collateral may fluctuate, the lender can have very substantial exposure in, say, residential mortgages held on the balance sheet. When a mortgage defaults and the bank forecloses, the lender must hold and maintain the property in its other real estate owned (OREO) portfolio until such time as it can be sold. If the market is slow, or illiquid, for homes in a particular price range or location, then the lender can face a bigger loss on one mortgage than it would if 10 credit card accounts failed to pay their \$5,000 balances. This is what happened to many banks in the current financial crisis.

## SUMMARY

This chapter discussed how CCAF can help lenders improve their loan underwriting practices. We analyzed the current lending systems and pointed out gaps associated with them. We then examined the consequences of those gaps. Components of the gap were identified and mapped to specific lending issues. We then described how CCAF can be used to close the underwriting gap. In particular, CCAF was compared against the current credit assessment approaches to show key advantages of the new system for lenders.

Exhibit 3.16 recaps some of the more critical gap areas. Today's fragmented underwriting systems are derived from questionable loan performance classifications that take things out of context and substitute pure correlations for common sense. These underwriting systems significantly deviate from reality and have brought about the *gap fallout*, which has left us with confusion, huge losses, inaccurate predictions, and finger pointing. The *reality* side of the gap rests with the borrower's true condition and qualifications, and the fact that the future is not what it used to be, the world is not all black or white, and the undeniable truth that there is no substitute for common sense. Gap fallout can be effectively addressed by CCAF. Simply put, CCAF shores up the gaps in today's prevailing loan decision processing by affording a complete credit categorization of borrowers prior to risk rating them, unlike current approaches, which are piecemeal and risk rate only certain aspects of borrower creditworthiness and fail to fully categorize them.

**EXHIBIT 3.16      CCAF FILLS THE UNDERWRITING GAP**

<b>Underwriting Systems</b>	<b>Reality</b>	<b>Gap Fallout</b>	<b>CCAF Solutions</b>
Borrower information taken out of context	Ability and willingness of the borrower to repay the loan	Misinterpretation of data	Transaction contour (handle) based on five Cs of Credit
Questionable loan performance definitions	Large grey area to classify	Good risks included in bad group and factor weights are wrong	Handle-based segmentation looks at much more than credit payment history
Fragmented model factors	Underwriting factors are interrelated	Wrong factors and improper emphasis	Integrated segments and dynamic conditional risk assessment
Future = past	Future events are often independent of past history and outcomes may vary significantly	Inaccurate estimation of loan default risk	Forward-looking scenarios and adaptive decisioning
Substitution of statistical proxies for common sense factors	Quantitative data-driven analysis is insufficient	Irrelevant data and wrong conclusions	Framework for decision making based upon proven primary factors that make sense
Secret methods and formulas for evaluating loans	Regulators can't manage what they don't know; borrowers and investors can't understand a black box	Lack of transparency; hinders oversight; confuses borrowers; undermines investor trust	Straightforward methodology promotes understanding and facilitates oversight

## ■ NOTES

1. Ben S. Bernanke, "Subprime mortgage lending and mitigating foreclosures," testimony before the Committee on Financial Services, U.S. House of Representatives, September 20, 2007.
2. The banks buying the mortgages failed to check what they were buying. This involves asset securitization and will be discussed in detail in Chapter 5.
3. Janice Horan, "Alternative scoring and other consumer-focused innovation," roundtable on using alternative data sources in credit scoring, Brookings Institution, December 15, 2005.
4. It has been rationalized that consumers who do have a lower revolving to installment ratio are people who do not get a lot of offers in the first place. The fact that they are not on the prescreen mailing lists may be viewed as a signal that they do not meet the prescreening criteria and therefore are probably higher risks.
5. Common practice is to penalize mortgage applicants if they have been less than 24 months on their job. The data indicates that the longer someone is at a job, the lower the credit risk. It makes intuitive sense. The problem is that other relevant facts are missing, such as the circumstances of the job move. Was it to take a better job for more money, versus a layoff? Are we saying the people who get promoted are higher risk because they are grouped in with their statistical counterparts? Variables in a model may lack valuable context.
6. Stephen Baker, "Want a Loan? Act Responsibly," Information Technology Section, *BusinessWeek*, October 24, 2008, Information Technology Section.
7. Ibid.
8. Ibid.
9. Ibid.
10. 2005 Energy Bill—FTC has significant rule making, and the rules/timing were still at issue last year, and 2005 Broadband Bill requires consent in order to report.
11. See Abrahams and Zhang, *Fair Lending Compliance*, p. 225, Exhibit 6.29, for further details and examples.
12. See A. Servigny and O. Renault, *Measuring and Managing Credit Risk* (New York: McGraw-Hill, 2004), pp. 110–111, for suggested process to select credit factors in a linear logit scoring model.
13. Jacob Yerushalmy, "Statistical problems in assessing methods of medical diagnosis, with special reference to X-ray techniques," *Public Health Reports* (1947):1,432–1,449.
14. See Abrahams and Zhang, *Fair Lending Compliance*, p. 309, especially note 15, for a discussion of factors used by various players to assign loans to risk grades of Alt-A, B, C, and D. Specific definitions vary among subprime market participants.
15. Servigny and Renault, *Measuring and Managing Credit Risk*, p. 110.


16. For a detailed review of credit scoring and judgmental system, see Abrahams and Zhang, *Fair Lending Compliance*.
17. On October 6, 2008, Bank of America agreed to an \$8.6 billion settlement of predatory lending charges that includes (1) potential lowering of adjustable-rate mortgages to as low as 2.5%; (2) potential lowering of the principal on some mortgages; and (3) capping mortgage payments at 34% of homeowner's income.
18. For an explanation of matched pairs, see Abrahams and Zhang, *Fair Lending Compliance*, pp. 107–112.
19. For small business lending, additional factors play key roles, such as customer relationship. See Abrahams and Zhang, *Fair Lending Compliance*, pp. 225–234, for a detailed example.
20. See Abrahams and Zhang, *Fair Lending Compliance*, p. 189, note 10, for the mathematical formula for this type of model. Today, the formulas are held as proprietary and there are alternative formulations that involve multiple objective functions.
21. One such study was conducted by Professor William Greene, Stern School of Business, New York University and is entitled “A Statistical Model for Credit Scoring,” Speech Contents. See Reference section for citation. See also Abrahams and Zhang, *Fair Lending Compliance*, pp. 291–297, for a discussion of default risk versus profit views for a credit card portfolio.
22. Abrahams and Zhang, *Fair Lending Compliance*, pp. 305–344.
23. See Abrahams and Zhang, *Fair Lending Compliance*, pp. 158–159, for a description of DCP and MCS.
24. See Abrahams and Zhang, *Fair Lending Compliance*, p. 117, Exhibit 4.21, for an illustrative mortgage pricing example that shows nine separate pricing offsets for a typical mortgage loan.
25. Character includes payment history, savings history, stability measures such as years in profession, and so on. Capacity is measured by such factors as income, debt obligations, cash obligations, living expenses, number of dependents, and so on. Capital includes such factors as net worth, amount and liquidity of assets, and so forth. Collateral includes attributes of the property, including appraised value, sales price, age, location, physical properties, and so on. Conditions include such factors as the loan amount, the term of the loan, the pricing mechanism, the payment schedule and payment options, the amount of down payment, applicable fees, and so on.
26. In addition, a primary factor in mortgage lending is the ratio of the loan amount to the collateral market value (LTV), which actually spans collateral and conditions, the last two Cs of the five Cs of Credit.
27. Abrahams and Zhang, *Fair Lending Compliance*, Appendix 6B, p. 254.
28. Abrahams and Zhang, *Fair Lending Compliance*, p. 187, for a list of shortcomings associated with a traditional judgmental system.
29. Hybrid system estimated override performance is based on the authors' expert opinion.
30. United States Medical Licensing Examination. In the United States, individual medical licensing authorities grant a license to practice medicine. Results of the

USMLE provide them with a common evaluation system for applicants for initial medical licensure.

31. Abrahams and Zhang, *Fair Lending Compliance*, pp. 216–222, describes hybrid system maintenance.
32. Abrahams and Zhang, *Fair Lending Compliance*, pp. 209–210, for specific examples and an enumeration of all possible combinations of these multidimensional acceptee mix and acceptance rate views.
33. Variance reduction procedures, such as importance sampling and stratified sampling, are typically used to improve model estimation precision. For detailed discussion on this topic, see, for example, Sheldon Ross, *Simulation* (Burlington, MA: Harcourt/Academic Press, 1997), pp. 131–180.
34. See Abrahams and Zhang, *Fair Lending Compliance*, pp. 337–338.







## The Borrower and Loan Affordability

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*What the people cannot understand, they must accept on faith.*

—UNKNOWN

Borrowers today face a challenge. Basically, they seek to meet their financing needs in the least expensive way. To do so, they need information on what loans are available, and they need to understand product features, pricing, how much they can borrow, and how their individual qualifications will be evaluated. The more information and education they can obtain about the lending process, the better they will be able to negotiate price and terms for an affordable loan. Part of the challenge is unavoidable—armed with necessary information they still need to shop around for the best deal. However, lack of transparency and product complexity hinder the borrower's quest for information and understanding. A commonly used measure of borrower risk is the credit score in the borrower's credit bureau file. Borrowers can see that their score moves up and down, but they do not really understand exactly what triggers those movements. Credit scores are created using a secret formula, and the method for developing it is not even shared fully with regulators, much less the borrower. Many complex loan products that were prevalent in subprime lending possessed significant latent risk associated with future housing price and interest rate movements that

many borrowers simply did not recognize and failed to take into account. Underwriting systems obviously allowed the riskiest borrowers to take out those riskier loans. As a result, borrowers who were already at risk were put at greater risk.

Subprime mortgage lending has been synonymous with making loans to borrowers possessing weak credit histories or to those who failed to meet the normal guidelines to qualify for a loan. Wide application of automated underwriting tools in prime mortgage markets in the later 1990s contributed significantly to homeownership growth. Many more borrowers with little or weak credit were able to obtain subprime loans, and it turns out that many of them, unfortunately, were unaffordable. Since mid-2006, the delinquency rate in the subprime market has increased significantly, from 5% to about 25%, especially among riskier adjustable-rate, interest only, and payment option mortgages.<sup>1</sup> The subprime market plummeted from \$139 billion in the fourth quarter of 2006 to \$14 billion at the end of 2007. As discussed in Chapter 1, some have argued that if the lenders had only made loans to the borrowers who could afford the loans, we would not see a financial crisis. So it was suggested not to make subprime loans in future in order to prevent future crisis. Actually it was the prevailing automated underwriting systems that failed to qualify loan affordability for the borrower by taking into consideration more economic factors in the underwriting process. Subprime lending itself was not to blame for the crisis.

This chapter describes how the Comprehensive Credit Assessment Framework (CCAF) can be used to improve the borrower's long-term loan performance. We first describe and define loan affordability using the borrower's contour and forward-looking criteria, in addition to typical loan characteristics. Next, we demonstrate how those criteria enable lenders to manage reserves, gauge suitability and affordability of different financial products, and capture early warning signals. Particular to the borrower contour, lenders can drive product offering choices relative to specific credit risk segments. Presumably, the most suitable mortgage product will vary widely by segment, and what turns out to be most suitable in a given circumstance may not be the most profitable loan for the bank, or the most inexpensive loan for the borrower. Relative to affordability, we share outcomes at the close of the chapter where borrower

mortgage applications are evaluated and decisioned by CCAF. In this chapter we also show how CCAF can be used to impose limits on loan portfolio segments, so that crises can be averted and performance problems minimized. Portfolio limits can be based on more granular regulatory guidelines made possible by CCAF, in addition to the institution's experience using CCAF, which will afford greater information for portfolio management over time. The new lending system affords stronger internal controls that can head off trouble before it cascades into huge losses for the institution.

## LOAN AFFORDABILITY

As discussed in Chapter 3, the underwriting gap reflects weakened underwriting practices and standards. It also causes inaccurate loss and default predictions, and can trigger unfair treatment of borrowers. Many underwriting systems have evolved to become convoluted in the sense that they incrementally work off of partial information throughout the decision-making process. As a result, consumers may be overcharged, or they may be approved for loans that are not affordable. Borrowers should not be offered loan products that pose significant risk of hardship due to future market conditions and other factors outside their control. Borrowers need to know what factors qualify them for affordable loans so that they can anticipate the impact of choices that they make relative to their day-to-day financial affairs. Borrowers also need to understand how their past performance in meeting financial obligations, their income and degree of indebtedness, and their savings and tangible assets help shape their credit risk profile. The new lending system we are proposing will take a substantial step to ensure that borrowers end up with loans for homes that are within their price range and continue to be affordable over the term of the loan agreement.

Loan affordability has several facets. Circumstances can change for the borrower, the markets, and the economy. A complete loan affordability assessment must go beyond a rigorous analysis of current borrower qualifications, loan payment amounts, and property appraisals to account for the impact of future possible states of nature. CCAF covers this future-looking *vulnerability* requirement by means of its fifth primary factor, which we defined in

Chapter 2. Typically, loan affordability is measured by loan characteristics and borrower considerations, which may include the following factors:

### *Borrower Considerations*

- **Desired mortgage amount.** The total loan amount a borrower is seeking to finance.
- **Monthly housing expenses.** Monthly housing expenses include loan principal, interest, taxes, hazard insurance, mortgage insurance, homeowners association dues, and any payments on second mortgages.
- **Monthly liabilities.** Monthly liabilities include monthly payments on other debts, including home equity lines. We suggest it would make sense to also include utility payments (for instance, water, gas, and electric power) based on an annual average amount.
- **Monthly housing payment (PITI).** This is the amount of monthly housing expenses that pertains to principal, interest, real estate taxes, and insurance. There are different rules for determining the maximum allowable PITI for a borrower. One such method calculates it as monthly gross income multiplied by 28%. Another does so by taking the product of the monthly gross income and 36% and then subtracting other loan payments. Yet a third method of calculating PITI is to take the lesser of the two previous calculations.
- **Collateral value and borrower equity position.** The amount of down payment, relative to the loan amount requested, and the history of property value changes are key elements of loan affordability and borrower motivation to repay the loan as agreed. Larger down payments are better. Twenty percent is a good basic rule. But even with a sizable down payment, if the home is significantly overvalued, then the equity position of the borrower, and lender, are at risk. A complete analysis of loan affordability must therefore include an analysis of the range of possible future values of the property and the amount of borrower equity, which depends also on the amount of loan principal payments they are making over time.
- **Choice of loan product.** This directly affects loan affordability through the method used to calculate interest, the extent to which that can change over time, the loan term, and the schedule of principal repayment. Choice of product also affects the speed at which the borrower's equity in the property will increase. Even within fixed rate products, borrowers who elect to take out a 15-year mortgage,

versus a 30-year mortgage, will pay more toward principal from the onset, in contrast to a 30-year mortgage, which is so heavily skewed toward interest repayment in the early years. Fixed rate products are not affected by changes in market interest rates, and they tend to be more affordable for that reason, coupled with the fact that borrowers typically will tend to qualify for a smaller loan than would be the case with a hybrid adjustable rate mortgage (ARM).

Other borrowers' factors can include residual income, number of dependents, geographic region, and so on.<sup>2</sup>

### *Loan Characteristics*

- **Maximum principal and interest (PI).** This is the maximum monthly principal and interest payment. It is calculated by subtracting monthly taxes and insurance from the monthly PITI payment. Normally, borrowers are qualified for loan amounts based on PI and not PITI.
- **Initial interest rate.** The interest rate on the mortgage at the start of the contract. For an ARM, this is used as the starting point for displaying a range of interest rates and the resulting mortgage amounts.
- **Index.** The market rate that the loan rate is based on, for example, prime rate, London InterBank Offering Rate (LIBOR), one-year Treasury note, and so on.
- **Frequency of adjustment.** This indicates how often the loan rate can change, based on prevailing rates in the market (for instance, one year, five years, and so on).
- **Interest rate margin.** This refers to an offset that is added, or subtracted, from the underlying market rate at the time of reset. For example, an interest rate margin of 200 basis points<sup>3</sup> on a LIBOR-based loan would be adjusted at the reset date to be at the prevailing LIBOR rate on that date plus 2%. If LIBOR is at 6%, the rate on the loan becomes 8%, with an interest rate margin of 2%.
- **Fully-indexed rate.** This is the sum of the interest rate margin plus the current value of the base index.
- **Interest rate caps.** These are maximum limits on how much the rate on the loan can rise on any particular reset anniversary or over the lifetime of the loan, or both. An ARM can have an annual cap of 2% and a lifetime cap of 5%.

- **Payment caps.** These are maximums on the amount that the monthly payment can increase on a price reset date. A possibility for easing the burden on the borrower, these could be used in situations where borrowers are facing foreclosure, where the differences may, or may not, need to be repaid at the end of the contract period, or may simply extend the period of the loan as needed to make up the shortfall.
- **Teaser rate.** For the initial period of an ARM, all or some portion of the interest rate margin can be eliminated for some introductory period. Borrowers can be tempted to take out larger loans with significantly lower initial payments when teaser rates are in effect. The general comment here is that borrowers electing a loan product with a teaser rate should possess significant excess capacity and/or capital to enter into these loans and they tend to be unaffordable for at least the subprime market.
- **Term in years.** The number of years over which the loan will be repaid. The most common mortgage terms are 15 and 30 years.
- **Prepayment penalty.** This refers to an amount, usually calculated as a percentage of the loan balance, that borrowers are required to remit to the lender if they elect to prepay the loan during some initial period of the term that can be several years in length. The speed at which homes turn over slows as interest rates rise (potential buyers get priced out of the market) and tends to accelerate when interest rates decline. Mortgage prepayment rates track housing turnover rates. People tend to refinance when rates go down significantly. Prepayment penalties make loans less affordable for borrowers.
- **Negative amortization.** This occurs whenever the amount of interest charged on the loan is greater than the interest paid in a given period, and where the difference is capitalized (for instance, added to the principal amount owed) or deferred for later repayment. This may be a temporary feature of a loan during an introductory period that sounds tempting (for instance, only paying 1% interest on the loan amount for the first two years, but can result in tremendous payment shock at the close of that introductory period). Loans having this feature should not be considered affordable for subprime borrowers.

## Additional CCAF Factors

Again, circumstances can change for both the borrower, the markets, and the economy, the notion of loan affordability must encompass future possible states of nature, and not just a rigorous analysis of current borrower qualifications and current loan payment amounts and current property appraisals. In CCAF, we cover this future-looking requirement by means of our fifth primary factor, namely vulnerability.

CCAF also incorporates the following factors as shown in Exhibit 4.1:

- **Borrower's contour based on the CCAF handle structure.** It is vital that borrower's qualifications be put into the proper context. This is done through an examination of their past payment history,

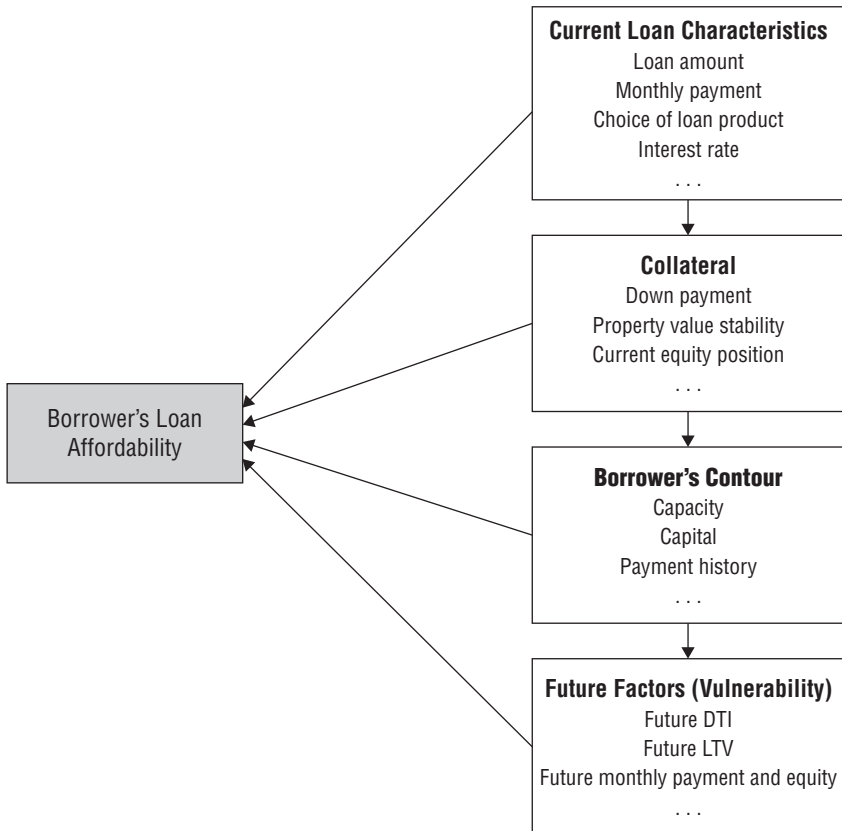


EXHIBIT 4.1

MEASURES OF LOAN AFFORDABILITY

their capacity, and their capital. Unfortunately, current underwriting systems fail to do this effectively. Instead of applying criteria across the board, a more focused approach is required that considers the 36 different possible combinations of borrower ratings based on the first three primary factors as shown in Exhibit 4.7. Only within that context can meaningful thought be given to what is affordable for a given borrower.

- **Forward-looking measures.** These include the future loan-to-value ratio (LTV), future debt-to-income ratio (DTI), future housing expense ratio, and so on under a wide range of possible outcomes. The values of these measures should be compared against current guidelines and also with thresholds associated with tighter lending policies, which occur over the range of economic cycles. We provided examples in Chapter 2 in our discussion of borrower classification relative to the fifth primary factor (vulnerability). There, we illustrated how these measures can be defined and used to rate loan vulnerability.

Lenders ran into trouble in the loan qualification process, which should not have presented loan products to borrowers that were unaffordable and should not have qualified them for a higher loan amount than was affordable. There are some rules of thumb regarding home loan amounts that they should not exceed more than two times gross annual income in periods of high interest rates, or three and a half times annual income in periods of lower interest rates. For example, if someone was making \$34,000 a year and bought a home for \$72,000 with a 20% down payment and took out a 30-year fixed rate loan to finance the balance of \$68,000 at 18%, their monthly PI would be around \$1,000, for a very high 35% housing expense ratio. Conversely, if someone making \$80,000 per year took out a 30-year mortgage for \$300,000 to finance the purchase of a \$378,000, with 20% down and an interest rate of 5%, the monthly PI would be around \$1,500, for a housing expense of 23%. In the first example, the borrower is financing an amount equal to twice the annual salary, and in the second example the amount of the mortgage is 3.5 times the annual salary. The level of interest rates makes a big difference on the housing expense ratio. There is anecdotal evidence that suggests many subprime, and prime, borrowers bought more real estate



than they could afford, with some estimates as much as 30% of the cases based on informal conversations with bank lending executives and private mortgage insurers.

## **SUBPRIME LENDING AND LOAN AFFORDABILITY**

There were several major reasons for the growth of subprime lending. Compression in spreads (profit margins) in traditional prime markets driven by government sponsored enterprises (GSEs), technology, competition, and consolidations in the industry drove lenders to look elsewhere for lending opportunities. There was a significant increase in consumer debt, especially in credit cards, that caused previously prime borrowers to fall into the subprime ranks. There has usually been a boom in credit-impaired consumers after recessionary cycles since the early 1990s. Prime lenders have mounted initiatives aimed at the Alt-A market to increase total loan volume at times when conventional market segments showed little, or insufficient, growth to meet their sales targets. Over time there has been increasing demand by both domestic, and foreign, investors for higher-yielding securitized assets. Layered on top of that is the promise of subprime lending to provide opportunities for home ownership to those who were either disqualified for a loan in the past or subject to discrimination. Subprime lending was often pursued in neighborhoods having high concentrations of minorities and weaker economic conditions. However, because poor credit history is associated with substantially more delinquent payments and defaulted loans, the interest rates for subprime loans were significantly higher than those for prime loans. Many subprime loans were awarded to borrowers without traditional screening processes, including checking the borrowers' income figures to make sure they could pay back the loans. Research indicates that the probability of default is at least six times higher for nonprime loans (loans with high interest rates) than prime loans.<sup>4</sup>

### **Subprime Mortgage Market**

The total home mortgage loans in the United States grew dramatically from \$639 billion originated during 1995 to \$3.3 trillion originated in 2005.<sup>5</sup> Back on December 31, 1996, the total value of subprime loans

outstanding was \$350 billion, compared to \$3.9 trillion outstanding in the prime mortgage market. Of the \$785 billion in mortgage originations in 1996, subprime loans made up 11.5%. Subprime lending has experienced dramatic growth from \$35 billion in 1995 to \$807 billion in 2005. On average, prior to 2005, subprime mortgage loans accounted for approximately 10% of mortgage loans.<sup>6</sup> By year-end 2006 they represented 20% of new residential mortgage loans (compared to the historical average of approximately 8% of new residential mortgage loans).<sup>7</sup> Exhibit 4.2 depicts the subprime share of mortgage loan originations over time.

To recap our earlier comments, the rapid growth of the subprime mortgage market was mainly due to the following factors:

- Technological advances in mortgage lending, such as the automated underwriting process, enabled the lenders to make rapid underwriting decisions.

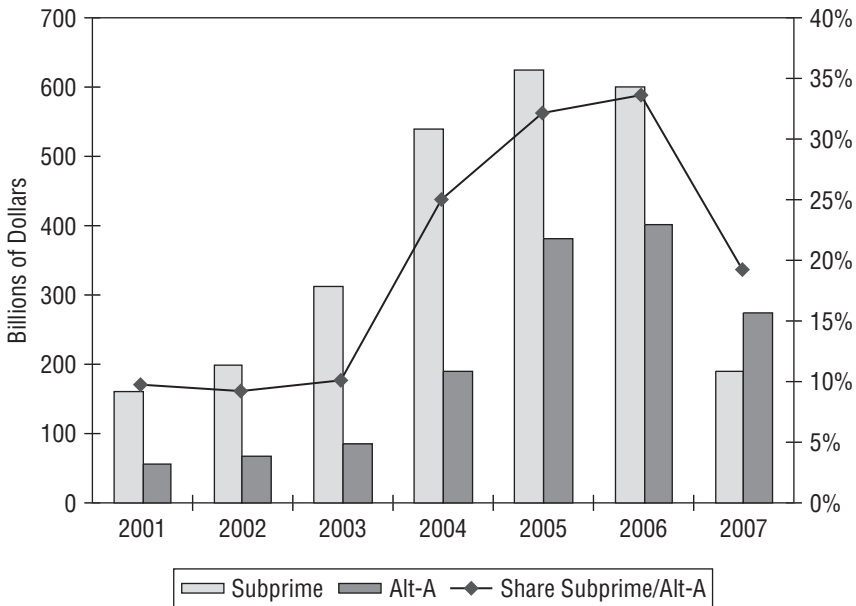


EXHIBIT 4.2

**SUBPRIME AND ALT-A MORTGAGE ORIGINATIONS: VALUE AND SHARE OF TOTAL ORIGINATIONS**

Source: "Mortgage Market Statistical Annual," *Inside Mortgage Finance*, May 20, 2008.

- Relaxed underwriting criteria: favorable economic condition and housing market.<sup>8</sup>
- Securitization of subprime loans made innovative loan products available. This will be discussed in Chapter 5.

The subprime loan market is composed of several risk layers that are denoted by Alt-A, B, C, and D grades. Factors that are used to assign loans to these subprime grades transcend borrower-based criteria, and they include product and transaction-related information. Some examples include (1) past due history for housing payment (separate from revolving and installment payments), (2) presence or absence of any major adverse records (together with explanations and whether the debts were brought current or cleared), (3) any history of bankruptcy or foreclosure, (4) qualifying debt ratio values (often specified in combination with loan-to-value [LTV] ratio ranges), (5) residual income requirements, (6) indication if fully documented income versus stated income, (7) maximum original LTV ratio (which varies based on owner-occupancy of the property financed), (8) product (fixed or variable and term), (9) loan type (purchase, refinance), (10) cash out or debt consolidation condition, (11) loan amount, (12) property type (second homes, condos, primary single family dwelling), (13) self-employment, and so on. We explore the way the industry currently views these layers, and propose some improvements using CCAF a few sections later in this chapter where we examine the Alt-A segment and the notion of layered risk.

Lenders saw rewards for subprime lending. These included

- The ability to offer a broader set of financing alternatives to a more diverse set of borrowers. Historically, many large mortgage banks set up specific subsidiaries for this purpose, such as NationsBank Mortgage Corporation (Nations Credit Home Equity Services), First Union Mortgage Corporation (First Union Home Equity bank), GE Capital Mortgage (GE Capital Home Equity Services), Fleet Bank (Option One Mortgage Corporation), Chase Manhattan Mortgage Corporation (Chase Financial Corporation), Banc One Mortgage Corporation (Bank One Financial Services), Norwest Mortgage Inc. (Directors Acceptance), and Countrywide Home Loans (Indy Mac Subprime Division).

- Maintain and improve relationships with real estate brokerage offices and corporate relocation departments, who are natural conduits for very profitable transactions. Many of these brokers and realtors seek a “closed shop” environment to do business with—full-service lenders that can provide one-stop shopping for all of their financing needs.
- The ability to leverage the loan securitization programs offered by Fannie Mae and Freddie Mac. Lenders sought to improve returns on the origination of more marginal credits that could be originated solely for investor purchase, and sold regardless of price, and that might otherwise have remained on the balance sheet in the lender’s mortgage portfolio.
- Boosting CRA-related mortgage origination volume.

Next, we examine the subprime borrower segment, and then we survey the major subprime loan products.

### **Subprime Borrowers**

Subprime borrowers generally have high credit risk characteristics.<sup>9</sup> Statistics show subprime borrowers to be higher risk than prime borrowers, to pay more for loans, to be predominantly minority, to have lower income, be less well financially educated, and less likely to search for the best interest rates and terms for their mortgage loans. Lower credit scores reflect broader issues of social equity, such as access to education and employment. Specifically, subprime borrowers have the following characteristics:

- Delinquencies: two or more 30-day delinquencies in the past 12 months, or one or more 60-day delinquencies in the last 24 months.
- Judgment, foreclosure, repossession, or charge-off in the past 24 months.
- Bankruptcy in the last five years.
- Low credit bureau score: Fair, Isaac and Company (FICO) credit score less than 660. It should be noted that the average FICO score for subprime ARMs in 2006 was only 623. That score equates to repayment odds of approximately 15 to 1, or in other words, a 6.25% bad rate. Lenders price mortgages so as to cover their cost of funding, their overhead, their losses, and a margin of profit. A 6%

projected loss rate translates to an interest rate on the loan that will be several percent higher for the borrower.<sup>10</sup> Credit score has perhaps been the most distinguishing attribute of subprime borrowers.

- **High Debt-to-Income (DTI):** A ratio greater than 50%.
- **No or low documentation:** over 65% of the borrowers had no or low documentation.<sup>11</sup>

From the lender's perspective a common definition of a subprime loan is a loan where the primary borrower has a credit bureau score (used for the purposes of decisioning the loan, which may or may not be industry-adjusted) of *660 or below* and meets *any* of the *subprime sufficient* criteria as discussed in the section "Mortgage Underwriting Process Basics" of Chapter 3.

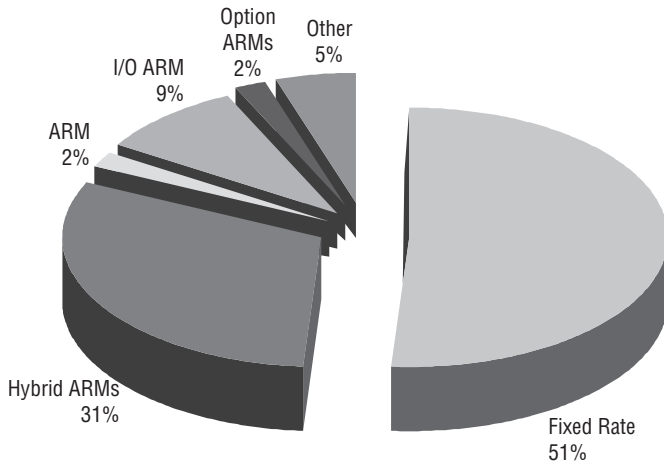
If a bank makes a loan to a subprime borrower, and that borrower meets all payment obligations on a timely basis for a period of 24 months, then the bank may remove the loan from its subprime reporting requirement. As noted in Chapter 3, this has implications for adjusting capital reserves, which are higher for subprime than for prime loans.

## Subprime Loan Products

On average, for subprime portfolios, nearly half of the loans are not traditional 15- and 30-year fixed-rate mortgages (FRMs). These are ARMs in which the borrowers take most of the interest risk. For example, the pie chart in Exhibit 4.3 provides a snapshot taken for the month of October 2007, based on 13 mortgage servicing companies that processed over 5.1 million subprime and Alt-A loans making up approximately 58% of the total loans in the subprime servicing market.

Typical subprime mortgages include

- **Fixed rate, fully amortizing.** A fixed rate of interest and are fully amortizing.
- **Hybrid ARMs (2/28, 3/27 or similar).** Loans having a low initial payments based on a fixed rate that expires after a short introductory period (two or three years), and then adjusts on a regular basis (for instance, every six months) to a variable rate plus a margin for the remaining term of the loan.
- **Adjustable rate, fully amortizing.** All other adjustable rate, fully amortizing loans not meeting the definition of a hybrid ARM.



**EXHIBIT 4.3 SUBPRIME AND ALT-A LOAN DISTRIBUTION BY PRODUCT TYPE**

Source: State Foreclosure Prevention Working Group, Data Report No. 1, February 2008: <http://www.csbs.org/Content/NavigationMenu/Home/StateForeclosurePreventionWorkGroupDataReport.pdf>.

- **Interest-only mortgage loan.** A nontraditional mortgage where the borrower is required to pay only the interest due on the loan for a specified number of years (for instance, three or five years), during which time the rate may fluctuate or may be fixed. After the interest-only period, the rate may be fixed or fluctuate based on the prescribed index and payments include both principal and interest.
- **Payment Option ARMs and other loans with negative amortization feature.** A nontraditional mortgage that allows the borrower to choose from a number of different payment options. For example, each month, the borrower may choose a minimum payment option based on a “start” or introductory interest rate, an interest-only payment option based on the fully indexed interest rate, or a fully amortizing principal and interest payment option based on a 15- or 30-year loan term, plus any required escrow payments. The minimum payment option can be less than the interest accruing on the loan, resulting in negative amortization. The interest-only option avoids negative amortization but does not provide for principal amortization. After a specified number of years, or if the loan reaches a certain

negative amortization cap, the required monthly payment amount is recast to require payments that will fully amortize the outstanding balance over the remaining loan term.

- **Other.** Remaining loans that do not fit any of the above definitions, such as a loan with an extended amortization (for instance a “40/30” loan with a 40-year amortization on a 30-year term (with a balloon payment at the end of the 30th year).

Product features found among many subprime loans are

- Little or no documentation of borrower’s income or capital are required. Sometimes referred to as “stated income loans.”
- Little or no down payment.
- Loans with very high or no limits on how much the payment amount or the interest rate may increase (that is, “caps”) at reset periods, potentially causing a substantial increase in the monthly payment amount, referred to in the industry as “payment shock.”
- Balloon payment, or other features, likely to result in periodic refinancing to maintain an affordable monthly payment.
- Loans that include substantial prepayment penalties and/or prepayment penalties that extend beyond the initial interest rate adjustment period.
- Property taxes and insurance not included in escrow to minimize monthly obligation.
- High loan-to-value ratios (for instance, home equity loans as high as 125% of a home’s appraised value).

The once-popular 2/28 loans made up approximately 65% of the origination volume in the 2006 subprime market. At the time, the 2/28 product was offered by many of the larger banks, and they were considered to be a good mortgage for the home buyer and also a reasonable underlying security for investment vehicles, such as collateralized debt obligations (CDOs), that were sold to investors. However, on July 20, 2007, Wells Fargo Bank, the nation’s fifth-largest bank at the time, halted sale of the product. Countrywide Financial Corporation, Washington Mutual Inc., Merrill Lynch & Co.’s First Franklin, and H&R Block Inc.’s Option One Mortgage also decided to pull the plug on 2/28 mortgages. Two factors that influenced the timing of the demise of the 2/28

mortgages included recent downgrades by the rating agencies of subprime mortgage-backed bonds and guidance from government regulatory agencies that urged lenders to qualify borrowers based on the maximum interest rate of the loan after it resets, instead of the lower, initial rate. In our prior section on loan and home affordability, we discussed how devastating payment shock can be to the borrower when interest rates climb and drive up their monthly payment amounts.

### **Alt-A Loans and the Notion of Layered Risk**

There are several risk tiers that fall below prime lending guidelines. Alt-A classification refers to the best tier of subprime loans. A record \$400 billion Alt-A loans were originated in 2006, which accounted for 13.4% of all mortgage loans made in 2006.<sup>12</sup> In Exhibit 4.4, we highlight the core characteristics of Alt-A loans. There is no bright line definition for Alt-A loans, because Alt-A is a grading category for the entire loan much like the generic grading categories that we supplied for CCAF primary factors in Exhibit 2.14. Just as CCAF thresholds for the grading of primary factors vary by product, the Alt-A grading for loans often differs somewhat by rating agencies and providers of mortgage products for this market tier.<sup>13</sup>

Additional requirements and restrictions for these loans may apply based on other applicant secondary factors (including employment), the property type and location, and mortgage insurance coverage.

## **SUBPRIME LOAN PERFORMANCE**

### **Default, Delinquency, and Foreclosure**

When a borrower misses a mortgage payment, the loan is said to be delinquent. Lenders typically will allow an account to remain delinquent for 90 days or more, to permit the borrower time to make additional payments, before exercising their right to take possession of the borrower's property—that is, to begin foreclosure.<sup>14</sup>

For delinquent borrowers, the following factors may determine if a foreclosure will occur:



# EXHIBIT 4.4

## ALT-A LOAN DEFINITIONS VARY BY FOUR ACTUAL SUBPRIME MORTGAGE ORIGINATORS AND ONE RATING COMPANY

Characteristics	Rating Agency	Originator 1	Originator 2	Originator 3	Originator 4
Max. LTV	80 to 85%—Owner-Occupied 70 to 75%—Nonowner-Occupied	Maximum LTV varies based on product or loan type (e.g., Fixed Purchase, Rate/Term Refinance); Fully Documented Income Primary Residence: Single Family Residence: Loan Amt. \$250,000 – \$400,000 Max. LTV 85% Cash-Out Refi: \$250,000 – \$400,000. Max. LTV 85%; Max. Cash-Out \$100,000. Additional ranges apply to Public Utility Dist./Condos, 2nd homes, & non-owner property.	Maximum LTV varies based on product or loan type (e.g., 15/30) Fixed, 3/1 ARM, 6 months LIBOR; Primary months LIBOR; Purchase/Rate/Term Refinance; Fully Documented Inc. Loan Amt. ≤\$400,000 LTV/CLTV 90/90% Debt Consolidation Refinance ≤\$200,000 LTV/CLTV 85/85% Additional ranges apply to 2nd homes & non-owner property.	\$50,000–\$400,000 Fully Documented Income Single Family residence: 80% owner-occupied condo; 75% owner-occupied All: 70% if non-owner-occupied	Purchase/Rate/Term Refi: ≤\$300,000 max. LTV 85%; Cash-Out Refi ≤\$300,000 Max LTV 85%; Second Home ≤\$300,000 Max. LTV 75%; Non-owner-occupied ≤\$300,000 Max LTV 75%; Condos ≤\$300,000 Max LTV 85%; Self-Employment/Alt Doc ≤\$300,000 Max LTV 80%.
Max. DTI	≤45%	≤ 50%	≤50% (restricted products) 50.01–55% for Fully Documented Income with LTV ≤ 65% and subject to residual income requirements	≤45% up to 80% LTV ≤50% up to 75% LTV	≤45%
Credit Score	Not specified	580–599	Not specified	Not specified	Not specified
Foreclosure	Not specified	None in last 3 years	None in last 2 years	Not specified	No foreclosures

(Continued)

EXHIBIT 4.4 (*CONTINUED*)

Characteristics	Rating Agency	Originator 1	Originator 2	Originator 3	Originator 4
Bankruptcy	No bankruptcy or notice of default in last 5 years	None in last 3 years	Discharged fully, re-established credit and 2 years good history	2 years re-established credit history since discharge	No bankruptcies
Housing Payment	2 times 30 days late in last 12 months; never 60 days late in last 12 months	2 times 30 days late in last 12 months (rolling late payments allowed)	2 times 30 days late in last 12 months	2 times 30 days late in last 12 months (w/restrictions)	2 times 30 days late in last 12 months
Installment & Revolving Trades	Not specified	Not specified	3 times 30 days late or 1 time 60 days late per account or no more than 25% of active accounts. May have delinquencies in last 12 months	Generally good in last 12 months	Excellent credit history
Worst Credit in Bureau File	Minor derogatory ratings explained	All major adverse credit must be paid or brought current at closing.	Isolated (max. \$500) judgments, collections, or charge-offs last 12 months w/satisfactory explanation	Any major derogatory ratings over 30 days past due must be explained in writing and be an isolated event	Not specified

- Delinquency duration: Typically it is 120 days.
- Borrower's equity in the home: If the home's market value is greater than the loan balance, the borrower may be able to avoid a foreclosure by selling the house.
- Loan modification: working with the lender to restructure the mortgage so the payment is affordable.

The worst payment problems came from the subprime adjustable-rate mortgages (subprime ARMs).<sup>15</sup> More than one-fifth of the 3.6 million loans outstanding were seriously delinquent at the end of 2007.<sup>16</sup> Given the drop in home prices and higher interest and unemployment rates, delinquent borrowers find it difficult to refinance or sell their house, or negotiate with lenders to modify their loan. As a result, many delinquencies end in foreclosure. For example, 303,879 foreclosure filings, default notices, auction sale notices, and bank repossessions were reported on U.S. properties in August 2008. This is a 12% increase from the previous month and a 27% increase from August 2007. One in every 416 U.S. households received a foreclosure filing during the month.<sup>17</sup> Lenders initiated roughly 1.5 million foreclosure proceedings last year, up from an average of fewer than 1 million foreclosure starts in the preceding two years. More than one-half of the foreclosure starts in 2007 were on subprime mortgages.<sup>18</sup>

The subprime mortgage delinquency rate surpassed 17% by the fourth quarter of 2007. Exhibit 4.5 provides an example based upon specific securities issued. This example shows that delinquency and foreclosures surged from March 2007 to March 2008.<sup>19</sup> Additionally, it was estimated that 400,000 loans, or \$68 billion in loan authority, were subject to subprime vulnerability.<sup>20</sup> See the next chapter for further discussion of this topic.

There is no doubt, however, that subprime mortgages that were booked with fixed rate loan products having a higher monthly payment for the identical loan amount fared much better. This difference in payment performance, and hence affordability, is attributable to two primary reasons. First, subprime borrowers who took out those more traditional loans bought less house to begin with. Second, they were immune to payment increases due to rising interest rates. In fact, prime borrowers who either bought a much more luxurious primary residence, and/or a second

## EXHIBIT 4.5

**DELINQUENCIES AND  
FORECLOSURES FOR TOP  
THREE A-RATED TRANCHES**

<b>Delinquency Status</b>	<b>March 2007</b>	<b>March 2008</b>
30+ Days	9.01%	17.42%
60+ Days	3.85%	12.26%
90+ Days	1.42%	8.55%
120+ Days	0.00%	0.00%
Bankruptcy	0.33%	2.21%
Foreclosure	6.24%	13.07%
REO	0.47%	8.54%
Cumulative Net Loss	0.05%	2.22%
Loss Severity	96.22%	49.30%

*Source:* Morgan Stanley ABS Capital (reference Obligation MSAC 2006-HE6 Prospectus by Saphir Finance Public Limited Company, pp. 56–57).

or even third home with nontraditional mortgage products have found themselves also to be at risk of foreclosure. As those prime borrowers, and their subprime counterparts, saw housing prices fall, credit standards tighten, and mortgage interest rates rise, they began to struggle, and over time their performance deteriorated dramatically.

ARM payments are reset from low initial rates after their introductory periods expire. This represents a significant payment shock to most borrowers. Typically, the borrower can refinance or sell if there is enough equity present. However, borrowers may not be able to cope with large resets. If there is not enough equity to enable refinance or sale and the borrower cannot pay the higher payments, default is likely.<sup>21</sup> It was estimated that approximately \$768 billion loans of the \$1.88 trillion adjustable-rate active first mortgages originated in 2004 and 2005, are subject to reset sensitivity. These loans are vulnerable under the pressure of mortgage payment resets and may have the highest reset impact. Among them about \$300 billion will be at risk of default starting 2007, 2008, or later.<sup>22</sup> With the ongoing financial crisis, resetting ARMs to higher rates will significantly reduce loan affordability and increase delinquencies and foreclosures.

Most ARM borrowers expected to refinance prior to their loan reset-date. In general, mortgage refinancing is generally considered to have social benefits, and it also represents a financially sustainable business model.<sup>23</sup> However, negative equity values, deteriorating credit worth, and a *down* credit market, have combined to make it difficult for many borrowers to refinance. For them, there were no good options remaining, and delinquency or foreclosure became the path of certainty.

## Classifications of Subprime Performance Tiers

This section illustrates how lenders can use CCAF to classify subprime tiers. We begin first with a comparison across lenders and one rating agency of the Alt-A loan inclusion criteria, as shown in Exhibit 4.6.

Alt-A loans are usually thought of as loans where the borrower has a credit bureau score below 660 at one or more credit bureaus, or loans that do not meet standard underwriting guidelines for debt-to-income or loan-to-value ratios, or who have more than one 30-day delinquency during the past two years, or who fail to meet documentation requirements, and so on. CCAF could be used to provide a standard for the

EXHIBIT 4.6

CCAF CLASSIFICATION OF ALT-A LOANS

Characteristics	Rating Agency	Originator 1	Originator 2	Originator 3	Originator 4
Handles CCAF Score Range	342 and 344 710–727	150 and 152 695–704	146 and 148 669–684	150 and 152 695–704	342 and 344 710–727
Handle Components					
Payment History	Good	Fair	Fair	Fair	Good
Capacity Capital	Moderate (Assume Low)	Low (Assume Low)	Low (Assume Low)	Low (Assume Low)	Moderate (Assume Low)
Collateral Vulnerability	Moderate High and Low	Moderate High and Low	Low High and Low	Moderate High and Low	Moderate High and Low
Secondary Factors	Yes, explanations for derogatory credit	Yes, must bring adverse credit current at closing	Yes, e.g., residual income	Yes, explanations for derogatory credit	Yes, alternative documentation

industry in defining Alt-A loans. It would only require two rows for the handle and the CCAF score and it could greatly simplify the table in Exhibit 4.4 as shown in Exhibit 4.6.

Knowing the CCAF handle is equivalent to specifying the ratings for all primary factors and also indicating the need for secondary factors. Because there can be variation in the rating threshold values, it is also useful to provide the CCAF score, which says how risky the loan is based on all of the relevant factors. There are a couple of things to note here. The Alt-A tier is a rather narrow risk band in terms of default odds, in each case having a CCAF score range of less than 20 points (for instance, 10 points for originators 1 and 3, 15 points for originator 2, and 18 points for the rating agency and originator 4). The second point is that in this example<sup>24</sup> from a CCAF perspective (and at 20 points double the odds), the Alt-A definition for originator 2 is associated with handles (borrower segments 146 and 148; see Exhibit 2.15) having twice the risk of those handles (150 and 152) for originators 1 and 3, which again has twice the risk of the handles 342 and 344 for the rating agency and originator 4. Clearly, with a variance of four times the default odds based on the Alt-A risk tier definition, we see value in standardizing this classification using CCAF.

In terms of performance, Alt-A loans have higher default rates than prime loans, but lower default rates than B and C grade loans, which are the next two tiers below Alt-A in the subprime category. In general, the difference between subprime grades Alt-A, B, C, and D is higher debt and LTV ratios and greater frequency and severity of delinquent payments and presence of judgments, liens, and other public record entries in the credit bureau file as you move down in the grading tiers.

## CREDIT SCORING SYSTEMS AND LOAN AFFORDABILITY

As discussed in Chapter 3, the underwriting gaps in the existing lending systems contributed to reduced loan affordability. This section provides a further discussion of how credit scoring hurt loan affordability.

Prior to the 1960s consumer loans were made using loan officer judgment, with some guiding principles. Common practice was to consider the Five Cs of Credit, namely Character, Capacity, Capital, Collateral,

and Conditions when evaluating a consumer loan request.<sup>25</sup> This approach looked at the ability of the borrower to repay the loan through income (Capacity) and, in the event of any interruption in income, their savings or liquid assets (Capital). It also considered the borrower's character by evaluating indicators of stability, his performance in meeting current and past credit obligations, and the liquidation value of any collateral and the borrower's equity share in cases where the loan collateral was the property being financed (for instance, real estate, automobile, boat, and so on). Finally, conditions were considered that related to the general economic climate, and also the terms of the loan agreement, such as loan amount, interest and fees, and repayment schedule. This represented a comprehensive approach that had been validated over a long period of time.

The judgmental approach, as practiced back then, was not without its shortcomings.<sup>26</sup> Because each loan officer constituted "a system," resulting loan decisions were sometimes inconsistent because the breadth and depth of experience varied by loan officer, and there was also a concern that bias might exist. Indeed there is anecdotal evidence that some occupational biases existed by virtue of the 3Bs: "Never lend to beauticians, bartenders, or barbers," or the 3Ps: "Never lend to preachers, plumbers, or prostitutes."<sup>27</sup> Credit scoring appeared to offer a more objective approach that afforded consistency, speed, and also a quantification of the odds that a borrower might default on the loan. Furthermore, scoring was asserted to be more accurate—because no single loan officer could see all loans and contests to see who could best predict loans that would go bad, this invariably demonstrated the superior predictive ability of the scoring model over any particular loan officer. This argument seemed to make sense. The loans that experienced loan officers failed to predict accurately were indeed real. However, there was more to the story that needs to be understood. The scorecards used for the comparisons were not modified to make the point values assigned to credit applicant attributes look reasonable. Nor were all relevant credit factors included, a fact that does not bother scorecard developers who assert that correlations make it unnecessary to consider more than 7 to 10 factors. It is not surprising that given the scorecard factors, individual loan officers could not perform as well as the computer model. However, we assert that the conclusion that the scoring model is a better predictor of loan default does not follow if you

widen the set of factors considered beyond those used in the scorecard and apply proven credit principles.<sup>28</sup>

The apparent demonstrable superiority of credit scoring over judgmental methods was based on a comparison of credit scoring with individual loan officer judgment that was prevalent at the time, not systematic, judgmentally-based rules like those making up the CCAF. At the core of the issue is the realization that credit scoring models are not causal models. In other words, although the factors used in credit scoring have correlations with loan default outcomes, they do not cause them to occur. Loan defaults are caused by a variety of circumstances, some of which are beyond the control of the borrower and not necessarily due to a deliberate failure to agree to repay an obligation. Examples such as job loss and illness were previously identified in Exhibit 3.3. As an example, consider years on job, which is a common underwriting factor. Because loss of a job is a leading cause of mortgage loan defaults, it stands to reason that the characteristic “years on job” is correlated with bad loan performance. As a result, usually the longer the time a borrower is at a job, the higher the number of points. This means that if you get a better job offer for greater salary and move to another job, you will be penalized, because the model fails to consider the context of your employment change. The threshold number on years on job for some mortgage issuers is 24 months—rather a long time to wait to get out of the penalty box for someone who voluntarily moved to take a better opportunity.

When a factor like years on job is in a scorecard, it usually exhibits illogical point assignments or reversals in point values. This is due to correlations with other variables. Credit scoring models do not necessarily make sense when you look at individual factors. The standard argument is that there is no single factor, or subset of factors, but rather it is all of the factors that combine to predict the creditworthiness of a loan. When scorecards are adjusted to make the value assignments for factors more palatable, the predictive power of the model can be significantly diminished, which we previously noted contributes to the model formulation gap. In other words, in the majority of cases, if the scorecard makes logical sense, it is less accurate than if one or more of the point values does not make sense!

As for the assertion that credit scoring is more consistent than judgment, actually the reverse is true if by judgment we mean systematic, versus individual, judgment as we note later in this book where we discuss



scoring overrides. As noted in Chapter 3, two consumers with identical credit scores can be vastly different. This is important because borrowers having significantly different capital positions or capacity have significantly different probabilities of default, which is what the credit score is supposed to measure. Suppose borrower A has \$1 million in capital, earns \$200,000 a year, has \$3,000 in additional credit card debt and \$7,000 in additional installment debt and is purchasing a home as a primary residence that is priced at \$390,000 with an interest-only 5/1 ARM. Borrower B has no capital, earns \$100,000 a year, also has \$3,000 in additional credit card debt and \$7,000 in additional installment debt, and is purchasing a primary residence that is identically priced and financed and is in the same subdivision. While they both have identical credit bureau scores of 740 at one of the three major credit bureaus, borrower B intuitively has a higher probability of default.

With the general acceptance of credit scoring after decades of use, it should not be entirely surprising that some economists believe that some of the Five Cs aren't predictive. We have been told by some that income was found to have no predictive value many years ago. In addition, it is believed in some circles that wealth (level of capital reserves) has also been found to have no predictive value, because rich people do not pay their bills, either. Our responses to these counterintuitive assertions are as follows:

- Those who advocate that one or more of the Five Cs is no longer predictive will need to carefully qualify under what assumptions they expect that proposition to hold. The Five Cs were around for a much longer time than credit scoring, and each one of the Five Cs has been considered and proven to be relevant to lending over centuries of commerce. If income, or wealth, were found not to be predictive using scoring technology, then that should have cast a shadow on credit scoring, and not the other way around. The millions of foreclosures due to subprime mortgage loans that were all credit scored and application scored and turned out to be unaffordable could have used a bit more emphasis on borrower capacity, capital, and collateral value. The result would have undoubtedly been a lower loss rate.
- Let us examine history for some clues to the real answer. Scorecard development by the mid-1970s was performed during a prolonged

high inflationary economic cycle in the United States (partly a period of stagflation). Because income as a scorecard variable was deemed to be “inflation bound,” major scorecard developers chose not to include it in the scorecard. In other words, scoring assigns points based on absolute thresholds, and income that is indicative of good loan payment behavior today may prove to be insufficient in a relatively short period of time, and steady inflation would translate to steady performance degradation for the system. Because scoring systems can leverage on the correlation between different factors in predicting outcomes, the storyline was that income was no longer predictive versus other alternatives. On that score it is inaccurate to say that income is not predictive, rather it was determined that surrogates for income existed that could be substituted in a model.

- Next, we need to examine what we mean by a bad loan. Scorecard developers lump a lot into this category, and that is what may be causing confusion and these counterintuitive propositions. Typical bad loan definition is a loan that, had you known what the ultimate performance would have been, you would not have approved. That is certainly a simple definition, but the translation to what the computer model can understand is the key. Historically, scoring system developers were sample bound on loan defaults. In other words, for a historical sample going back a few years, there are insufficient numbers of charge-offs to build a model. As a result, the definition of bad loan performance was stretched to include any accounts that were ever delinquent 90 days, twice delinquent 60 days, or three times delinquent 30 days. This is where we start to run into a problem. Today’s scoring systems still include in the bad loan sample “purely delinquent” as opposed to “actual defaulted” loans. Hence, wealthy people who choose to pay late for convenience, and don’t mind the late fee penalties, get thrown into the bad loan pool. Then when a model is built on good and bad loans, it turns out that income and capital are not predictive! This is self-fulfilling because of the way the model samples are constructed. It is interesting to note that the most profitable credit card customers are those who revolve their balances and pay lots of late fees. But then, credit scoring is used to predict loans that will default rather than loans that will be profitable.

For example, suppose a borrower wanted to buy, rather than rent, housing while attending medical school for four years. Further suppose that she found a home selling for 85% of appraised value, and on the lower end of property values in the neighborhood.<sup>29</sup> In this case, a 5/1 Interest-Only ARM having a monthly payment amount that is 50% of the prevailing rate for a comparable rental unit makes perfect sense. Any principal repayments made by the borrower immediately reduce the next month's interest payment, due to the simple interest feature of this type of loan. Even without additional paydowns, the 5/1 Interest Only ARM is more affordable than a conventional loan and will be liquidated prior to the five year reset date in this example. The borrower is positioned to realize a gain on sale if the property value goes up, but is also protected if there is some depreciation (up to 15% in this case) if property values are depressed at the time of liquidation. Again, the cost of renting in this example is twice that of financing the purchase, with no possibility of any capital appreciation on a comparable home over the same period of time.<sup>30</sup> Furthermore, it is unfortunate that these same products, which are no longer available, or have a tarnished name, are precisely the type of loans that would offer advantages to a very broad segment of home buyers when the housing market is in a slump and home values are significantly depressed! Sadly, the removal of these types of financing vehicles will serve only to drive real estate prices down even further and lengthen the time it takes to sell the oversupply of housing stock that continues to be fueled by foreclosures.

Over the years scorecard developers determined that they could find substitutes among data in the credit bureau files that captured the information values originally attributed to such things as borrower income and assets, borrower liquidity, borrower equity stake in the property financed, borrower cash flow, and volatility of collateral value. As a result, there has been an overreliance in the credit score, which generally tends to either overstate, or understate, the risk of default for many borrower segments. Proponents of scoring assert that credit bureau scores, while not the total solution, still do a good job of rank-ordering borrowers and loans by default risk and that they can demonstrably separate good and bad credit applicants at a statistically significant rate. We see considerable room for improvement in the "rank ordering" claim, and this point is elaborated with some examples at the end of this chapter. As for scoring's ability

to separate “good” and “bad” loans, it is important to consider what is meant by “good” and “bad” loan performance. For example, a borrower who has regular savings and lives within his means, but encounters hardship, and ultimately makes good on an obligation, may be less risky than another borrower who has never been delinquent in the past, but who has a lifestyle that keeps him on the financial edge.

## HOW CCAF QUALIFIES THE BORROWERS

### The Borrower’s Contour and Transaction Contour

To construct a borrower contour, agreement would need to be reached on the exact factors that would be used to determine payment performance, capacity, and capital. Once the factors are agreed on, thresholds relative to those factors would need to be specified to determine how many distinct classifications would be required for each of the three major categories, and how borrowers would be assigned to them. Once this system is put into place, lenders could capture and verify the credit contour for loans that are approved, and then report it to the credit bureaus along with the first report on that loan’s payment performance. The credit bureaus would then possess a common definition of borrower qualification that is consistent and that would have immediate interpretation for the consumer. The consumer could request her credit bureau borrower contour to verify that it is accurate. There would be no need to keep the definitions secret. Exhibits 4.7 and 4.8 provide a pro forma acceptance rate forecast and loan origination mix by borrower contour, respectively, that correspond to the detail example provided in Chapter 2.

The transaction contour would be constructed by augmenting the borrower contour relative to the last two Cs of Credit, namely collateral and conditions. This process would be specific to the type of loan (for instance, credit card, auto loan, mortgage, and so on). For a credit card, the additional categories might relate to features such as line amount and pricing tiers. For a mortgage loan, collateral categorization might be determined by the borrower’s equity position relative to property valuation that is based on either current appraised value for fixed rate loans or estimated future value for variable rate loans. The thresholds might fall into three classifications (for instance, weak—less than 15%, moderate—15 to 30%, and strong—greater than 30%). For a mortgage loan, the

EXHIBIT 4.7

**CCAF ACCEPTANCE RATE FORECAST BY  
BORROWER CONTOUR**

Pay History	Capacity	Capital			
		Low	Moderate	Strong	Superior
Poor	Low	10%	24%	31%	42%
Poor	Moderate	12%	27%	52%	65%
Poor	High	30%	35%	76%	82%
Fair	Low	24%	69%	76%	97%
Fair	Moderate	54%	70%	92%	90%
Fair	High	86%	90%	99%	100%
Good	Low	29%	70%	78%	100%
Good	Moderate	63%	82%	100%	100%
Good	High	95%	100%	100%	100%

EXHIBIT 4.8

**CCAF ORIGINATED LOAN MIX BY  
BORROWER CONTOUR**

Pay History	Capacity	Capital			
		Low	Moderate	Strong	Superior
Poor	Low	0.1%	0.3%	0.4%	0.5%
Poor	Moderate	0.2%	0.5%	1.3%	1.9%
Poor	High	1.6%	2.0%	2.8%	3.0%
Fair	Low	0.4%	1.5%	2.0%	3.3%
Fair	Moderate	1.2%	2.9%	3.2%	4.0%
Fair	High	3.9%	4.0%	4.1%	4.2%
Good	Low	0.7%	2.2%	2.4%	4.8%
Good	Moderate	1.9%	3.4%	5.7%	5.2%
Good	High	5.4%	6.0%	7.0%	9.1%

conditions category might classify loans according to whether they are fixed or variable priced and whether they are conforming, which would lead to four possible values (for instance, fixed and conforming, and so on). For a home equity loan, a similar scheme to that for mortgages might be used, where borrower equity would need to take into consideration any and all senior lien positions for the equity position

calculation and possibly whether the loan is a piggyback and whether the purpose of the loan is to improve the underlying loan collateral, and/or possibly whether the collateral is the borrower's primary residence. By appending the collateral primary factor to the borrower contour, as shown in Exhibit 4.9, we can gain greater insight into the justification for the acceptance rate shown in Exhibit 4.7. For example, in Exhibit 4.7, we see that borrowers with poor payment history and low capital capacity have a projected acceptance rate of 10%. Looking at the first row of Exhibit 4.9, we immediately see that only borrowers with high down payments (over 30%) will be accepted when payment history is poor and capital capacity is low.

## Main Process

Referring to Exhibit 4.10, we highlight the process in which a borrower is qualified for a particular loan. In this process, affordability comes in play because the product choice will affect the underwriting outcome.

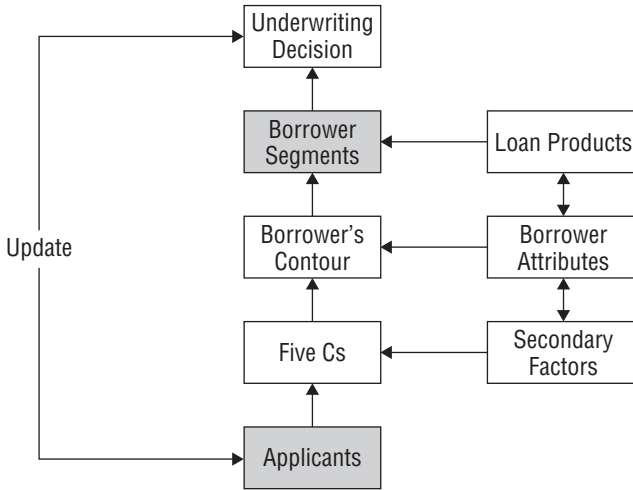
This process involves the following aspects:

- Attributes of loan applicants and products, together with the five Cs, are used to create the borrower's contour.
- Borrowers are classified into homogeneous groups based on their contour and product attributes. For example, different loan types or purposes would have different sets of criteria for grouping.
- The handle-based segments are matched with the loan products.
- Changes in the borrower's attributes are reflected in the borrower's contour and this may result in warnings due to an increase in the default risk.
- Borrowers would be advantaged by the system in that it would allow them to take more control over their classification and qualification rather than having to wait years to cure delinquent behavior, as is the case with current credit scoring-based systems. Reclassification will occur when their primary factor ratings change. One example of a trigger would be the increase in a running 12-month average of their savings rate that surpasses a rating category threshold, such as from 2% (low) to 3% (moderate) per the example in Chapter 2. Another trigger would be if their debt ratio<sup>31</sup> dropped below a threshold, say

## EXHIBIT 4.9

CCAF ACCEPTANCE RATES: ADDING  
COLLATERAL TO BORROWER CONTOUR

Pay History	Capacity	Capital	Collateral		
			Low	Moderate	High
Poor	Low	Low	0.0%	0.0%	20.0%
Poor	Low	Moderate	0.0%	6.7%	23.9%
Poor	Low	Strong	0.0%	7.1%	34.2%
Poor	Low	Superior	0.0%	18.8%	55.9%
Poor	Moderate	Low	0.0%	0.0%	30.0%
Poor	Moderate	Moderate	0.0%	38.2%	40.0%
Poor	Moderate	Strong	0.0%	45.2%	70.4%
Poor	Moderate	Superior	72.6%	60.0%	82.3%
Poor	High	Low	0.0%	32.8%	57.1%
Poor	High	Moderate	0.0%	38.0%	89.2%
Poor	High	Strong	20.0%	77.0%	100.0%
Poor	High	Superior	62.8%	83.2%	100.0%
Fair	Low	Low	0.0%	0.0%	77.1%
Fair	Low	Moderate	0.0%	76.9%	100.0%
Fair	Low	Strong	0.0%	100.0%	100.0%
Fair	Low	Superior	100.0%	100.0%	100.0%
Fair	Moderate	Low	0.0%	44.2%	100.0%
Fair	Moderate	Moderate	0.0%	100.0%	100.0%
Fair	Moderate	Strong	100.0%	100.0%	100.0%
Fair	Moderate	Superior	100.0%	100.0%	100.0%
Fair	High	Low	35.0%	100.0%	100.0%
Fair	High	Moderate	49.5%	100.0%	100.0%
Fair	High	Strong	100.0%	100.0%	100.0%
Fair	High	Superior	100.0%	100.0%	100.0%
Good	Low	Low	0.0%	0.0%	55.8%
Good	Low	Moderate	0.0%	65.3%	100.0%
Good	Low	Strong	0.0%	100.0%	100.0%
Good	Low	Superior	100.0%	90.9%	100.0%
Good	Moderate	Low	0.0%	42.9%	100.0%
Good	Moderate	Moderate	50.0%	100.0%	100.0%
Good	Moderate	Strong	100.0%	100.0%	100.0%
Good	Moderate	Superior	100.0%	100.0%	100.0%
Good	High	Low	85.0%	100.0%	100.0%
Good	High	Moderate	100.0%	100.0%	100.0%
Good	High	Strong	100.0%	100.0%	100.0%
Good	High	Superior	100.0%	100.0%	100.0%



**EXHIBIT 4.10 HOW CCAF QUALIFIES A BORROWER FOR A LOAN**

from 31% (moderate range) to 27% (low range) because they paid off a debt or cut spending.

- With a more complete set of factors, that are also simultaneously considered, the weight that had been put on payment performance should be expected to diminish somewhat. Consideration can be given to shortening the system's memory on past due payments as Exhibit 4.11 shows.

Borrowers get frustrated when they are told that they have to wait for their record to slowly repair itself. Today's system puts additional hardship on those who can least afford it. It also fails to put their current situation into the proper context and assign weight on more important factors than how they paid their bills two years ago, such as how much financial capacity they possess and the level of their savings, and so on.

### Nontraditional Data Can Help Borrowers Qualify

The use of alternative data can shore up gaps in the credit evaluation process, especially relative to payment history for noncredit obligations and borrower capacity. The information value contained in alternative



## EXHIBIT 4.11

**PAYMENT PERFORMANCE WINDOW  
COMPARISON**

<b>Number of Days Payment Is Past Due</b>	<b>Current Standard Time Period</b>	<b>CCAF Time Period</b>
30	2 years	3 months
60	2 years	6 months
90	2 years	9 months
120 or more	2 years	1 year
Public Record or Default w/Min. Bal.	3 or more years	3 years
Bankruptcy	5 years	5 years

data<sup>32</sup> and community data<sup>33</sup> has made it increasingly apparent that significant ground can, and must, be gained in enhancing the state-of-the-art in consumer and small business lending relative to those segments in particular, and perhaps for all borrowers in general.<sup>34</sup> The use and understanding of IT for credit decisioning continues to develop rapidly, and the principal technical barrier remaining to extending this financial innovation to noncredit economic transaction data in most countries around the world is one of data aggregation.<sup>35</sup> There are a number of benefits to the use of noncredit economic transaction data.<sup>36</sup> Through the use of noncredit transaction data, vast numbers of consumers can be brought into the financial mainstream and gain access to credit. With greater information, lending decisions become better, with lower rates of delinquencies, less overextension, and an increase in the number of performing loans. Inclusion of alternative data will shore up data gaps in the credit evaluation process, especially relative to payment history for noncredit obligations and borrower capacity.

Alternative data can be readily fed into CCAF's handle structure for the purse of segmentation and modeling. Without changing any model factors, one can incorporate noncredit trade lines into the set of credit trade lines usually considered for payment history. In this way, the credit factor "number of times 30-days past due" will be calculated identically, because it will simply include counts from the noncredit trade lines. Similarly, the factor "number of satisfactory trade lines at least 24 months old" would

## EXHIBIT 4.12 SOLUTION COMPARISON FOR BORROWERS

GAP Components	Judgment	Credit Bureau Score	Custom Credit Score	Status Quo	CCAF
Financial literacy/consumer concerns					
Ease of understanding factors					✓
Ease of understanding individual factor ratings					✓
Consumer ability to know primary strengths and weaknesses					✓
Ability of consumers to improve their rating without waiting years for credit history to cure			✓		✓
Enables consumer to qualify for credit without having to assume unnecessary debt simply to create a satisfactory credit history			✓		✓
Ability to offer consumer the most affordable product			✓		✓
Perform risk-based pricing more holistically than the credit bureau score			✓	✓	✓
Allows consumers to see their credit rating changes and know the reasons why					✓
Takes into account borrower circumstances					✓
Mild delinquency will most likely hurt the credit rating		✓		✓	
Closing credit accounts can adversely affect credit rating		✓		✓	
Opening new credit accounts can adversely affect credit rating		✓		✓	
Paying cash for cars or major appliances, or quickly paying them off, can adversely affect the credit rating		✓		✓	
High utilization of credit lines, even if paid in full, can adversely affect credit rating		✓		✓	
Credit factors used “out of context” can unfairly penalize borrowers (e.g., months on job)		✓	✓	✓	

be calculated the same, only now it would include noncredit trade lines as input to the calculation. We provide more detailed examples on how alternative data is used for loan underwriting in our companion book.<sup>37</sup>

Exhibit 4.12 summarizes some key aspects of the new lending system with other approaches, relative to borrower concerns. In the next section we look at some examples of approval and decline outcomes from CCAF's loan decisioning for a number of borrowers having different qualifications.

## **EXAMPLES: CCAF QUALIFIES LOAN AFFORDABILITY FOR BORROWERS**

In this section, we provide realistic examples that demonstrate how a typical CCAF Mortgage Underwriting System will qualify a wide range of borrowers for credit. In some situations, the decision can be rendered based on five primary factor ratings. In other situations, one or more additional factors are required. In instances where the borrower does not qualify, CCAF provides information that can help borrowers determine where they need to strengthen their qualifications, and the system indicates the degree of improvement that can be achieved by any one single factor and what the resulting decision would be in that case.

1. Nate is a salesman for a leading tire manufacturer. He is purchasing a condo in a high-rise in Miami for \$120,000. Nate's front-end and back-end debt ratios are 40/46. Nate's current monthly housing expense of \$1,200 will remain virtually unchanged (the new ITI is \$1,300—no principal payment for five years). He has a \$4,000 average balance on his credit card month to month and he makes minimum payments. He has one other debt, a \$560/month child support payment (paycheck deduction), in addition to his mortgage payment. Nate saves about 2% of his income currently in his 401(k) retirement plan. When asked to produce proof of timely payments on his child support, Nate said, "I pay my ex with cash mostly and Buster, my six-month-old pit bull, got into the shoe box where I keep my cancelled checks and chewed them up. Besides, I know I have a great credit score." Nate's FICO score is 752. The HUD1 closing statement calls for \$15,743 from the borrower at closing, and Nate has a total of \$16,000 in savings to cover this, which includes his 10%

down payment. Finally, Nate has opted to apply for a hybrid 5/1 ARM to maintain low monthly payments.

**Result:** With no qualifying secondary factors, Nate is classified into handle 289, with an associated CCAF score of 670. His loan request is denied. Exhibit 2.24 indicates that Nate can add 87 and 80 points, respectively, with stronger capacity or capital, and he would be approved in those cases.

2. Beth is a programmer who works in the IT department of a large financial institution. Beth has only herself to support, but has trouble controlling her urges to take expensive vacations and wear the latest fashions. Beth drives a late model BMW that has proven expensive to maintain and which she financed at the dealer on the installment plan. She owes a lot of money, but always pays all of her obligations on time, even though they are the minimum payment she can get away with. Beth's FICO score is 761. She has virtually no savings, and her capacity is low. Beth currently lives in an apartment, and she wants to have her own place and has spotted a townhouse that appears to be a great deal. She can make a 20% down payment with the help of her parents. So her collateral rating is moderate.

**Result:** With no additional factors in her favor, Beth would be classified into handle 293, with a CCAF score of 678. The greatest improvements in score would result from improvement in Beth's capacity and capital, which would net her an additional 119 and 52 points, respectively. The lowest qualifying score is currently 713, which is the lender's CCAF cutoff score to maintain an 80% acceptance rate. If Beth could increase her savings and cut spending, she would be able to qualify for the loan in time. At present, however, CCAF would deny her request.

3. Bob is a paralegal, with a lot of debt for his annual income of \$42,000 per year. Bob is attending law school at night, and he has managed to save some money, which he hopes to use to get his law practice started. His capital is rated moderate. Bob has had his eye on a 1,400-square-foot 1950s cottage in the neighborhood where a legal aid nonprofit is located and where he has lined up an opportunity to do some community work. Bob wants to finance the purchase using a hybrid 5/1 ARM with monthly interest, taxes, and insurance payments totaling \$675. Bob has

financed his motorcycle, some stereo equipment, and his home computer all with installment credit that he makes minimum payments on, but always stays current. He is loaded with credit card debt, and is 90% utilized on two cards, with current balances of \$7,800. Bob's FICO score is 756.

**Result:** His information puts him into handle 301, with associated CCAF score of 674. Bob's loan request is denied. Bob can realize the greatest improvement in the areas of capacity, capital, and collateral (for instance, a larger down payment), which could net him 108, 83, and 71 additional points and a favorable result. This actually may be the best result for Bob, who would rapidly have become *house poor* and would not have had his nest egg available to start his new career.

4. Jill is an executive administrative assistant at a large insurance company. Jill has an excellent credit standing, with a FICO score of 747. Her capacity is moderate, and her only debt is her Toyota car payment on an installment plan and a small revolving balance of \$800 on her credit card that she pays minimum payments on. Jill lives paycheck-to-paycheck, however, and she is unable to save a dime due to her love of eating out and music. Jill has an amazingly complete and up-to-date collection of hundreds of music CDs, she regularly travels to live concerts, and she takes music lessons for piano and vocal training. She hopes to perform for a living some day. Jill spotted a condo loft in a transition neighborhood that she wants to move into, and her parents have agreed to make a 10% down payment for her. Jill is applying for a 3/1 ARM in order to take advantage of currently low interest rates.

**Result:** CCAF classifies Jill's loan in handle 337, with an associated CCAF score of 667. Like Bob, Jill can realize the greatest improvement in the areas of capacity, capital, and collateral (for instance a larger down payment), which could net her 125, 83, and 60 additional points and her loan request would be approved. Unfortunately, Jill may need to choose which plans she wants to put on hold, her career or her home ownership.

5. Now we come to Joe the plumber. Joe's credit history is five years (established). Joe has one instance of loan default that occurred almost three years ago in the amount of \$300. His payment history over the past two years has seen two 60-day past due and six 30-day past due occurrences among revolving credit trade lines (moderate delinquency), and

his credit bureau score is 658. Joe has no installment debt—he pays cash for cars and major appliances. He owns his own plumbing business. He employs four journeyman plumbers, and the majority of his trade is residential repairs, together with some hotel accounts downtown. Annual gross income from the business is \$144,000 or \$12,000 per month. Outstanding debt is a primary residence \$300,000 30-year fixed rate mortgage with a monthly payment of \$2,000 including principal, interest, taxes, and insurance, together with a \$112,000 mortgage on a second home he is renovating that has a \$850-per-month payment including principal, interest, taxes, and insurance, plus \$2,000 average monthly credit card balance. Joe's debt ratio is 41%, and he has monthly savings of \$1,000, for a savings rate of  $\$1,000/\$12,000$  or 8.3%. Joe's high savings rate and moderate debt ratio afford him a strong capacity rating. Joe has saved his down payment over time, but his capital is low because he has to put money into the business from time to time to cover overhead during periods of slack demand. Joe's mortgage down payment is 20%, or \$28,000. Mortgage product is 30-year fixed-rate loan. Home value has increased \$40,000 over the past five years (average price was \$120,000), with a current value of \$140,000. Two standard deviations in historical price is \$28,000. For vulnerability classification based on the future loan-to-value ratio five years from the loan closing date, the future value is assumed to be the current value less two standard deviations in historical price (\$28,000) or \$112,000. The loan amount is the home price less down payment, less principal paydown of 8%, or \$140,000 less 20% (\$28,000), less \$9,000, which amounts to \$103,000. Our rule is that the future loan-to-value ratio must be less than or equal to 100%. In this case, the ratio is the future loan amount in five years to the future home value at that time, which equals  $\$103,000/\$128,000 = 80\%$ . Hence, vulnerability is low based on home value depreciation. Future capacity is another important area relative to borrower financial vulnerability, in this case since the loan has a fixed rate. Had it been an adjustable rate, as in the case of a 30-year, 5-year reset, interest-only option ARM with no principal paydown during the first five years, that would have been a different story and result. For that product, we may assume that interest rates move up 3% over five years, a magnitude that is entirely feasible. The impact in that case on monthly payment is \$700—almost doubling

the current \$600 (P&I) plus \$250 (taxes and insurance) monthly payment to \$1,550. The current debt ratio of 32% would be updated to reflect the higher obligation, and this gives a future debt to income ratio of 37%, which is in the moderate range. As a result, the savings rate would drop to a little over 1% ( $\$150/\$12,000$ ), which drops the borrower into the low savings category.

**Result:** CCAF would classify Joe according to his payment history (fair), capacity (strong), capital (low), collateral (moderate), and vulnerability (low). As a result, Joe would be assigned a CCAF handle number of 247, and would be approved for the loan with associated risk score of 737. Joe's 658 credit bureau score does not capture his income. Joe is penalized severely for the moderate delinquency and for not having installment credit at all. As a result he will pay a subprime premium (that is, a significantly higher rate, on his mortgage and also on an auto loan in the event he decides to finance his next car!).

6. Carl is a construction worker. He has a fair credit history due to the seasonality of his work. Although he comes up short from time to time, Carl is hardworking and proud of his trade. Carl's FICO score does not take into consideration the circumstances, it just sees the tardiness, and his score of 645 is a stinging reminder of that fact. Carl has a moderate capacity. He seldom borrows, but helps his invalid mother with private nursing care. This is a big drain on his finances, but Carl is not about to let his mother down during her time of need. This has eaten up all of Carl's savings, with the exception of the down payment of 20% he will make on the purchase of a modest ranch home in an older middle-class neighborhood in Cleveland. Carl is applying for a 15-year fixed rate mortgage. The value of the home he is looking at has seen no price change in the past 10 years.

**Result:** CCAF would classify Carl according to his payment history (fair), capacity (moderate), capital (low), collateral (moderate), and vulnerability (low). As a result, he would be assigned a CCAF handle number of 200, and would be approved for the loan with associated risk score of 750. Carl qualifies for preferred pricing under CCAF. His 645 credit bureau score overpenalizes him for his payment history and his

lack of credit usage, and does not see his sizable down payment using hard-earned savings over the years. As a result Carl will pay a subprime premium under today's system, which punishes those borrowers who can least afford it. To raise his FICO score, Carl could stop paying for his mother's sitters and run up a tab on his credit card and go out and buy a new car on the installment plan. Fortunately, Carl's love for his mother and his financial discipline prevent that from happening.

7. Salina is a nurse in the critical care unit of a major hospital. She deals with life and death every day. She is very devoted to her patients and compassionate about her work. Salina has a modest capacity rating. She donates 10% of her gross income to her church, but still manages to save a moderate amount, 3% of her monthly salary of \$5,000. She contracted a virus from her job two years ago and missed several months of work. As a result, she fell behind on her credit card payments. Her FICO score of 653 reflects that fact, although she has been current on all accounts for the past 11 months. Salina has always dreamed of having her own home. Her work is intense, and going back to an apartment is just not the same as being able to have a yard and some flowers and green space to help her put it all into perspective. She does have a dog that she has to keep locked up in the apartment all day, and she would love to have a fenced yard so the dog could run free. She has found the perfect place, modest and affordable and within walking distance from the hospital. Salina has a modest capital rating and can afford to put the customary 20% down on the home, which also nets her a modest collateral rating. She is applying for a 15-year mortgage that she hopes to pay off early. The price of the home is \$68,000 and is situated in a lower-middle-class neighborhood that borders the city's downtown.

**Result:** CCAF would classify Salina according to her payment history (fair), capacity (moderate), capital (moderate), collateral (moderate), and vulnerability (low). As a result, she would be assigned a CCAF handle number of 211, and would be approved for the loan with associated risk score of 759. Salina's 653 credit bureau score overpenalizes her for the illness she had to endure that caused her to fall behind on her credit card payments, and does not see her sizable down payment using hard-earned savings over the years. As a result Salina, like Joe and Carl, will pay a subprime premium under today's system.



8. Xavier is an independent accountant, in practice by himself. Xavier is thrifty and has managed to save sufficient money to earn him a strong capital rating. He works out of his home and has outgrown his current place. He needs an additional 500 square feet in order to include a conference room where he can meet with his clients to review their tax returns with them. He has a 20% down payment for the home he is seeking, a two-story, three-bedroom home with a large room over the garage that would be perfect for his needs. His debt ratio is 34% and current savings rate is 6.5%, which earns him a moderate capacity rating. Xavier made the mistake of ignoring some of his bills during the busy tax season and explains that he really lost track of where things stood for three months. He made commitments to clients to handle their returns, and he just got overcommitted. He barely had time to eat and sleep. The impact on his credit score was predictable. His FICO score is 640. It does not see his strong capital position and sizable down payment. Xavier has applied for a 30-year fixed rate mortgage. He has no exposure to rising interest rates. The property he is interested in has actually depreciated 2% over the past five years, and it will require some repairs, including a new roof. He is not exposed to the sort of home price declines that have occurred with homes that have seen dramatic increases in value over the same period. Xavier has low vulnerability with this transaction.

**Result:** CCAF would classify Xavier according to his payment history (fair), capacity (moderate), capital (strong), collateral (moderate), and vulnerability (low). As a result, he would be assigned a CCAF handle number of 223, and would be approved for the loan with an associated risk score of 742. His 640 credit bureau score overpenalizes him for his preoccupation with his business. As a result his credit score does not accurately reflect his true risk of loan default. He has never failed to repay his debts, and he has sufficient capital and strong earnings to render his chances of default to be almost negligible. Like all the other borrowers having credit scores below 660, Xavier will pay more.

9. Julie is a third grade teacher and has been in the profession for 10 years. Her capacity is rated low due to some high credit card balances that she frequently gets behind on paying. Her capacity is low on her teacher's salary, but she has still managed to put aside sufficient capital to earn her a moderate rating. In fact, she is pooling a portion of her savings

EXHIBIT 4.13

**SUMMARY OF BORROWER CLASSIFICATIONS  
UNDER CCAF UNDERWRITING RATINGS**

No.	Borrower	Occupation	CCAF Handle	1st C	2nd C	3rd C	4th C	5th C	Sec. Factors
1	Nate	Salesman	289	G	L	L	L	H	N
2	Beth	Programmer	293	G	L	L	M	H	N
3	Bob	Paralegal	301	G	L	M	L	H	N
4	Jill	Exec Admin	337	G	M	L	L	H	N
5	Joe	Plumber	247	F	H	L	M	L	N
6	Carl	Construction	200	F	M	L	M	L	Y
7	Salina	Nurse	211	F	M	M	M	L	N
8	Xavier	Accountant	223	F	M	ST	M	L	N
9	Julie	Teacher	167	F	L	M	H	L	N

with a generous check from her parents to make a 40% down payment on a renovated bungalow two blocks from the elementary school where she teaches. As a result, Julie's collateral rating is high. She has opted for a 15-year fixed rate loan, and her property has experienced a 30% price increase over the past five years, some of which is due to the renovation by the current owner. Due to her sizable down payment, the future loan-to-value calculation puts her in an acceptable range. This result is also due, in part, to the principal paydown with the 15-year term she has elected.

**Result:** CCAF would classify Julie according to her payment history (fair), capacity (low), capital (moderate), collateral (high), and vulnerability (low). As a result, she would be assigned a CCAF handle number of 167, and would be approved for the loan with associated risk score of 762. Her 658 credit bureau score fails to see the substantial down payment of 40% and choice of a loan product that will quickly build even greater borrower equity in the property. According to the FICO score, Julie is classified as subprime.

The foregoing examples are summarized in Exhibit 4.13 for quick reference. The CCAF handle numbers and their associated primary factors and thresholds were discussed in Exhibit 2.15.

For the underwriting results associated with each of these examples, we turn to Exhibit 4.14. These results are pretty stark, relative to subprime classification and loan approval. There is no question, but that a

## EXHIBIT 4.14

**SUMMARY OF BORROWER EXAMPLE  
RESULTS: CCAF VERSUS CREDIT  
SCORING-BASED UNDERWRITING**

No.	Borrower	Occupation	FICO / Bureau		CCAF Spanning 5s		
			Credit Score	Subprime?	Subprime?	CCAF Score	Loan Decision
1	Nate	Salesman	752	No	Yes	670	Decline
2	Beth	Programmer	761	No	Yes	678	Decline
3	Bob	Paralegal	756	No	Yes	674	Decline
4	Jill	Exec Admin	747	No	Yes	667	Decline
5	Joe	Plumber	658	Yes	No	737	Approve
6	Carl	Construction	645	Yes	No	750	Approve
7	Salina	Nurse	653	Yes	No	759	Approve
8	Xavier	Accountant	640	Yes	No	742	Approve
9	Julie	Teacher	658	Yes	No	762	Approve

significant number of the loans in trouble today would not have been approved if CCAF had been in place.

That is not to say that Nate, Beth, Bob, and Jill could not have gotten approved by CCAF if they had selected a home that was more in their price range, or a loan product that did not have associated risks relative to the value of the property or the potential future increase in their payments. In retrospect, borrowers facing foreclosure were harmed, not helped, by underwriting systems that failed to identify and properly measure the risks associated with those transactions.

## SUMMARY

In this chapter, we discussed how current underwriting systems overlooked important borrower qualification combinations. Today's fragmented systems tend to approve the high-risk borrowers for high risk-risk product and that prove to be unaffordable. In Exhibit 4.15, we show the four possible outcomes from matching borrowers with loan products. High risk product refers to nontraditional loan products, while high risk borrowers have weakest qualification combinations. CCAF considers both the borrower's current and future financial strengths, collateral value relative to the loan amount outstanding at the time, and the terms and conditions

## EXHIBIT 4.15

**BORROWER AND PRODUCT  
RISK COMBINATIONS**

Borrower	Loan Product	
	Low Risk	High Risk
Low risk	Affordable	Affordable
High risk	Affordable	<i>Unaffordable</i>

of the loan product in order to limit the amount of money available relative to a specific loan product to better ensure affordability.

Loan affordability directly impacts loan performance, which in turn affects the return on investment for mortgage-backed securities and derivative products. In Chapter 5, we will discuss how the new lending system can help investors better understand the risk associated with these innovative financial products.

## ■ NOTES

1. See “The State of the Nation’s Housing 2008,” *Joint Center for Housing Studies of Harvard University* (2008), p. 19.
2. See 38 CFR Book H *Loan Guaranty*, in 36.4337, “Underwriting standards, processing procedures, lender responsibility and lender certification,” Department of Veterans Affairs, June 5, 2007, pp. 2–4.
3. A basis point (bp) is equal to 1%.
4. See Souphala Chomsisengphet and Anthony Pennington-Cross, “The Evolution of the Subprime Mortgage Market,” *Federal Reserve Bank of St. Louis Review* 88(1) (January/February 2006), pp. 31–56.
5. Total subprime loans make up 25% of the housing mortgage market. See Kerry Capell, “Britain’s Coming Credit Crisis” *BusinessWeek*, September 6, 2007.
6. Frank L. Raiter, “Credit Rating Agencies and the Financial Crisis,” written statement, before the Committee on Oversight and Government Reform, United States House of Representatives, October 22, 2008.
7. Sheila C. Bair, Chairman, Federal Deposit Insurance Corporation, on “Possible Responses to Rising Mortgage Foreclosures,” testimony before the Committee on Financial Services, U.S. House of Representatives, April 17, 2007.
8. For a discussion of the factors that contributed to a rapid growth in subprime lending, see Allan N. Krinsman, “Subprime Mortgage Meltdown: How did it Happen and How will it End?” *Journal of Structured Finance*, 13, No. 2 (Summer 2007).

9. See the 2001 Interagency Expanded Guidance for Subprime Lending Programs.
10. As we point out in this book, credit scores are unfortunately an incomplete measure of default risk. Despite that fact, they are used routinely to estimate and price the risk of loan default for individual loans, and in the aggregate for pools of loans that are stratified and constructed, in part, using FICO score bands.
11. Based on research based on May 2008 Loan Performance data by First American CoreLogic Marketing Reports. See Ashok Deo Bardhan, Robert H. Edelstein, and Cynthia A. Kroll, "Subprime Crisis Research Council," University of California, Berkeley White Paper, Presented at Hudson Institute, Washington, DC, September 15, 2008.
12. See *Inside Mortgage Finance*, May 20, 2008.
13. These definitions were compiled from working in the field over the past 10 years and some of the institutions are no longer in business. The purpose here is to show the variation in definitions.
14. For a discussion on the subprime mortgage market, see Jacob Vigdor, "What Should Government Do About the Subprime Mortgage Market?" White Paper, Duke University and NBER, July 2007.
15. Even in the housing market boom time of 2002, subprime loans were delinquent at more than five times the rate of conventional loans and were 10 times more likely to enter the foreclosure process. See Michelle Danis and Anthony Pennington-Cross, "The Delinquency of Subprime Mortgages," Federal Reserve Bank of St. Louis Working Paper 2005-022A, March 2005.
16. Ben S. Bernanke, "Reducing Preventable Mortgage Foreclosures." Speech at the Independent Community Bankers of America Annual Convention, Orlando, FL (March 4, 2008).
17. The RealtyTrac, "U.S. Foreclosure Market Report," September 2008, and October 2008. Foreclosures in October grew 25% nationally over the same month in 2007, and more than 84,000 properties were repossessed in October.
18. Ben S. Bernanke, "Reducing Preventable Mortgage Foreclosures."
19. Louis Perwein and Haiou Zhu, "Solutions to the Subprime Crisis—Anatomy of a Mortgage Backed Security," Center for Community Capital, University of North Carolina, April 2008. This presentation reveals that the top three A-rated tranches (A-1, A-2fp, and A-2a) had the principal paid off only between 48% and 66%, mainly due to defaults.
20. Congressional Budget Office (CBO) cost estimates, June 9, 2008, p. 10.
21. Cagan, "Mortgage Payment Reset," Real Estate Research Council of Southern California Quarterly Luncheon Meeting, Cal. Poly. University, May 30, 2008.
22. Ibid.
23. To the contrary some research suggests that discouraging refinancing penalties might have the unintended consequence of raising interest rates, increasing mortgage default, and limiting available credit for the riskiest borrowers. For issues associated with refinancing, see Christopher Mayer, Tomasz Piskorski, and Alexei Tchisty, "The Inefficiency of Refinancing: Why Prepayment Penalties are Good for Risky Borrowers," Columbia University Working Paper, April 2008.

24. We stress that this example is hypothetical, meant for illustration purposes only, and does not necessarily reflect the actual differences in relative risk between these institutions' ratings for the Alt-A mortgage tier.
25. For examples of the Five Cs, see Clark Abrahams and Mingyuan Zhang, *Fair Lending Compliance: Intelligence and Implications for Credit Risk Management* (Hoboken, NJ: John Wiley & Sons, 2008), pp. 185–186.
26. For a list, see Abrahams and Zhang, *Fair Lending Compliance*, p. 187.
27. Abrahams and Zhang, *Fair Lending Compliance*, p. 187, Exhibit 6.3, note (a).
28. For a review of typical credit scoring methods, see Arnaud De Servigny and Olivier Renault, *The Standard & Poor's Guide to Measuring and Managing Credit Risk* (New York: McGraw-Hill Professional, 2004), pp. 73–108.
29. This is not uncommon for properties held in corporate relocation programs or in banks' other real estate owned (OREO) portfolios.
30. This example is based on an actual market analysis and loan originated in the Atlanta metropolitan area in 2006.
31. This is the fully loaded ratio that includes all recurring debt, referred to in mortgage lending as the *backend debt ratio*. In contrast, the *front-end debt ratio* includes purely the housing payment of principal, interest, taxes, and insurance (PITI).
32. Research conducted by PERC and the Brookings Institution produced compelling empirical evidence that noncredit payment data can help predict credit risk, which, in turn, can help qualify consumers for loans provided that they pay their cash obligations as agreed. For a list of alternative data, see Information Policy Institute, "Giving Underserved Consumers Better Access to the Credit System: The Promise of Non-Traditional Data," July 2005, p. 11.
33. See [www.socialcompact.org](http://www.socialcompact.org) for more information.
34. See Michael A. Turner, Ann B. Schnare, Robin Varghese, and Patrick Walker, "Helping Consumers Access Affordable Mainstream Credit: Measuring the Impact of Including Utility and Telecom Data in Consumer Credit Reports," IPI Research Publication, 2006.
35. Other barriers include regulation, public policy, and privacy concerns, which we touched on in earlier chapters.
36. See Michael Turner, S. Alyssa Lee, Ann Schnare, Robin Varghese, and Patrick D. Walker, "Give Credit Where Credit Is Due—Increasing Access to Affordable Mainstream Credit Using Alternative Data," Political and Economic Research Council and The Brookings Institution Urban Markets Initiative, 2006.
37. See Abrahams and Zhang, *Fair Lending Compliance*, pp. 234–237.



# The Investor and Financial Innovation

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*Innovation can be a dangerous game.*

—ANDREW W. LO<sup>1</sup>

Over the past quarter century, loan securitization and related innovations in mortgage products have greatly fostered credit access. The securitization of loans and creation of mortgage-backed securities (MBS) have allowed lenders to increase the volume of originations, while facilitating transfer of the default risk to other parties, such as credit enhancers, insurance companies, government-sponsored enterprises (GSEs), and capital market investors. Securitization also contributed to the expansion of credit to additional borrower segments.<sup>2</sup> However, as mentioned in Chapter 1, recent years' financial innovations and loan securitization have also contributed to the financial crisis. As former Federal Reserve governor Mishkin said, "Financial development involves innovations or liberalization of financial markets that improve the flow of information. Unfortunately, financial liberalization and innovation often have flaws and do not solve information problems as well as markets may have hoped they would. When these flaws become evident, financial markets sometimes seize up, often with very negative consequences for the economy."<sup>3</sup>

In fact, loan securitization weakens, if not breaks, the traditional link between borrowers and lenders, and issuers and investors. At the

same time, securitization has also exacerbated the problems associated with lending systems, such as loan affordability and transparency issues. Investors need to know that there is a reasonable basis for ratings assigned to innovative products. As a rule, however, investors cannot monitor the performance of the underlying assets of the securities they hold in their portfolio. Construction of MBSs and collateralized debt obligations (CDOs) has become so complex and opaque that investors rarely fully comprehend the risks they are taking and the issuers routinely assumed that the mortgages backing their securities would perform satisfactorily. In reality these differences in perception have served to further distance the investors from the issuers who, in turn, were further distanced from the lenders. There are substantial issues associated with the current rating system, and they have played a big role in the subprime mortgage meltdown. It is evident that this knowledge vacuum existed not only for investors, but for issuers, lenders, and borrowers as well, and one has to wonder who, if anyone, actually understood what was transpiring.

In this chapter, we examine the connection between financial innovation and the financial crisis. In particular, we discuss the roles of MBS, CDs and credit default swap (CDS), as well as that of rating agencies. We first discuss how the mortgage securitization process obscured the attributes of the underlying mortgage loans. We identify the key issues associated with the current securitization process and credit rating process and show how a comprehensive credit assessment framework (CCAF) can be used to improve the process with greater transparency and simplicity. We demonstrate how CCAF methodology can be applied to improve the current rating system and reestablish the connection between lenders and investors. In particular, we show how CCAF enables investors to track underlying loan performance associated with their investments so that they can more effectively manage their investment risk. Financial innovation helped to get us into this mess, and analytical innovation will help lift us out of it.

## **MORTGAGE BANKING BUSINESS VALUE CHAIN**

To understand how mortgage loans and their performance can affect the investors, we first review the mortgage banking business value chain. Mortgage production involves sourcing mortgage applications,



loan underwriting, and closing the loans (that is, obtaining funding). Warehousing deals with holding closed loans and financing them until they are sold. Secondary marketing is concerned with selling pools of loans to investors (or to an intermediary who will package them for sale). Servicing consists of collecting payments from borrowers, remitting payments to investors, and managing all matters with the borrower relative to such things as past due, escrow, tax, and insurance payments. The servicer is paid by the investor for performing these services. A mortgage servicing portfolio may be created internally, or it may be purchased. Revenue sources for mortgage banking include fees associated with loan origination, interest, servicing charges to borrowers and investors, and finally realized gains when loans are sold.

### **Mortgage Banking Business**

Mortgage banking is concerned with the acquisition of mortgages in order to sell them in the secondary market. It encompasses mortgage lending, but there are a few more complications than in the cases where lenders keep the loans they originate or purchase on their balance sheet. Operationally, lenders conform to standards that are determined by the Federal National Mortgage Association (FNMA or Fannie Mae) and the Federal Home Loan Mortgage Corporation (FHLMC or Freddie Mac) for conventional loans. On the government loan side, the Government National Mortgage Association (GNMA or Ginnie Mae)<sup>4</sup> sets standards for guaranteed loans associated with programs run by the Federal Housing Administration (FHA), the Department of Veterans Affairs (VA or the Veterans Administration), the Department of Housing and Urban Development (HUD)<sup>5</sup>, and the Department of Agriculture.<sup>6</sup>

The main areas of mortgage banking are depicted in Exhibit 5.1.

### **Mortgage Production**

Loans are originated and priced to sell in the secondary market, which broadens mortgage product offerings and creates a conduit for generating servicing rights, while lessening interest rate risk. Basically, there are two types of mortgages: conventional and government. Conventional mortgage loans are further divided into conforming or nonconforming categories. Conforming mortgage loans must meet agency (that is, Fannie Mae



or Freddie Mac) loan size limitations, amortization periods, and underwriting guidelines. Conforming mortgage loans are sold to the GSEs with, or without, recourse. However, government loans are insured by the FHA or guaranteed by the VA. These government-sponsored mortgages are commonly sold into GNMA securities. The FHA and VA underwriting standards are strict, and they impose maximum loan amounts among other requirements. Lenders sell their conventional nonconforming mortgages as whole loans, or under a private label structure. For conventional mortgages originated with a loan-to-value ratio in excess of 80%, private mortgage insurance (PMI) is usually required. PMI reimburses the lender, or loan pool trustee, when loan default occurs and costs are not fully recovered after the foreclosure and sale of the property. This insurance is paid by the lender, but passed along to the borrower and may be paid at origination, or capitalized and included in the monthly loan payment. Nonconforming loans include nontraditional products, which we cover in the next chapter. Examples of nontraditional products include those with teaser rates, low documentation, negative amortization loans, and interest buydowns.

In terms of sources, mortgage bankers obtain mortgage production from both retail (internal) and wholesale (external) sources. Retail sources include their own loan applications, brokers, and referrals from builders, real estate agents, and corporate relocation departments. Loans from each of these sources are more tightly controlled and are closed in the bank's name. Retail production affords good cross-selling opportunities, and we see some great potential for CCAF in this area, which we discuss in Chapter 6 relative to the borrower. Loans purchased from correspondents or third-party sources make up wholesale production. Wholesale activities include cases where loans are purchased, together with their servicing rights and subsequently sold with the servicing rights retained by the seller. Another activity is bulk acquisition, where a servicing portfolio is

purchased, but the underlying mortgages are never owned by the mortgage bank. Assignment of trade and coissue/transfer programs represent other wholesale sources of loan production. Wholesale production is appealing because it offers the mortgage banker expanded volume without proportionately increasing fixed costs. The wholesale business has been fiercely competitive in the past. It should be noted that there is an increased potential for fraud in wholesale mortgage banking, especially if proper controls are not in place.

## **Warehousing**

*Warehousing* refers to the storing and financing of a closed loan that resides on the bank's balance sheet until it is sold to an investor. Usually, loans remain in the warehouse for 90 days or less. Warehousing risks include illiquidity (that is, inability to sell the loan), exposure to market interest rate movements, and funding. Mortgage bankers can execute forward sales contracts for their entire warehouse to hedge interest rate risk. Naturally, this presumes that the bank has performed proper underwriting and has obtained all necessary documents to meet secondary market requirements. Mortgages that default on first payment are not saleable to federal agencies, so if a bank does sell forward all of the warehouse, this could impair the mortgage bank's ability to fulfill its commitments. The mortgage bank's funding risk can be minimized by ensuring that it has adequate funding in place, and by having a sufficiently large margin between the yield on the loans in the warehouse and the cost to fund them. Loans in the warehouse must be properly segregated from mortgages that reside on the bank's books. Warehouse business intelligence and business analytics must address current and projected mortgage volume, hedges, past due payments, and foreclosures for various loan categories.

## **Servicing**

The growth and widespread acceptance of mortgage-backed securities has allowed banks to securitize and sell their mortgage production while retaining the servicing of the underlying loans. Banks can also purchase mortgage loans and servicing rights from their originators, or purchase servicing rights only for investor pools, where the investors already own the underlying mortgages. Mergers and acquisitions are yet another way a mortgage

bank can acquire mortgages. Loan servicing entails several main functions. These include cash management, investor accounting and reporting, custodial responsibilities, escrow account management, collections, and management and marketing of foreclosed properties, better known as Other Real Estate Owned (OREO). Revenue stems from contractual servicing fees, interest on custodial balances, payment float, and other fees associated with collections and other activities. If the servicer fails to properly administer its functions, the investor can take away its servicing rights without reimbursement. A servicing agreement details all of the servicing conditions and specifies how the servicer will be compensated for all of its activities, which we touch on below.

- **Cash Management.** Relative to the cash management function, mortgage payments are received and are deposited into a custodial account. Principal, interest, and escrow payment components are captured separately. Investor accounting and reporting consist of payment of principal and interest to individual investors, or a central payment agent, according to an agreed-upon schedule.
- **Investor Accounting and Reporting.** Servicers must report on payments collected, delinquencies, foreclosures, charge-offs, and marketing progress on real estate acquired through foreclosure, among other things. They also report payment performance to the credit bureaus.
- **Custodial Responsibilities.** Relative to their custodial responsibilities, servicers must store all documents in a vault and must follow up on any missing documents. If outsourced by the servicer (some investors may require third-party custodians), the responsibility for quality of work performed by its vendor cannot be outsourced!
- **Escrow Account Management.** Servicers administer escrow accounts, whose funds are used to pay taxes and property casualty insurance premiums for borrowers. Limits on how much can be collected, and for how long, are imposed on the servicer by the Real Estate Settlement Procedures Act (RESPA) and also by state law.
- **Collections.** Perhaps the servicer's biggest responsibility is collecting past due payments, and to that end, investor requirements relating to when and how collection activities should be undertaken must be followed. Those efforts consist of notifying delinquent borrowers

that their payment is overdue, in addition to seeing that property inspections are made, and when necessary, initiating the foreclosure process, or forbearance arrangements that can delay foreclosure and provide for deferral of payments or possible modification of the loan agreements. Because they can potentially impact the investor's return on investment, prior approval from investors may be required in advance on entering into any forbearance agreements with the borrower.

- **Other Real Estate Owned.** Property acquired through mortgage default and subsequent foreclosure must be maintained adequately, which involves periodic on-site inspections, getting appraisals, and marketing activities through local realtors and various forms of advertising.

## Secondary Marketing

Government-sponsored programs and private offerings are the primary vehicles for selling mortgage production. Secondary marketing covers product development, pricing, packaging, sale, and delivery. Selling mortgages is fairly straightforward. For example, a mortgage bank may get commitments from investors to buy a certain amount of loans. A *master agreement* provides the dollar amount and maturity of a particular commitment. It specifies underwriting standards that may be unique to the seller. Generally, master agreements mandate the time frame for delivery of loans, and if that mandate is not met, then the mortgage bank must either purchase sufficient loans to make up the difference or pay the investor a penalty fee. A mortgage bank may sell loans into the secondary market as individual (whole) loans or as pools of loans. Loans may also be “swapped” for Fannie Mae or Freddie Mac pass-through certificates. In that case, the bank would give up a fraction of the interest income in exchange for having a more liquid asset. An added benefit is more favorable risk-based capital treatment. Banks typically keep the loan servicing on these mortgage pool sales.

Pool certification is an important facet of secondary marketing. Sellers must deliver mortgages with complete documentation. Prior to delivery, sellers certify that each file contains the required documents, such as the actual note, title policy, mortgage deed, guarantee certificate, and so on. Any missing documents usually must be produced by the seller within

120 days. Failure can result in the bank having to repurchase the loans in question. Some GSEs (for instance, Ginnie Mae) require independent certifications. A file custodian attests to the completeness of the documentation before a final certification can be issued. Even a single loan in the pool with a missing document can cause the entire pool to fail to be certified. Some GSEs allow sellers a maximum number of uncertified pools outstanding over a period of time, say a year. Once exceeded, the seller may be forced to obtain a letter of credit on behalf of the GSE to safeguard against a loss.

CCAF can be carried through the secondary market processes (in the case of mortgages, Fannie Mae and Freddie Mac would standardize what they expect as factors, grading, and classification for a “universal CCAF” as an integral part of their master loan agreements with loan originators). Once in place at the GSEs, CCAF’s comprehensive view will enable the rating agencies and the Securities and Exchange Commission (SEC) to better assess the risk that is embedded in a security composed of cash flows from loans. The end result will be a more accurate rating for the security, which will benefit the investor. It is suggested that while securitization may have weakened the relationship between the investors and lenders, it is the players, not the game, to blame. A comprehensive solution to the current problem must strengthen the lender-investor relationship that was weakened by securitization. It must do so by establishing a mechanism that effectively measures the underlying loan performance and risk of the securities. Once this has been accomplished, investors will be better able to make more informed asset allocation decisions based on the risk and return of the securities they are considering adding to their portfolio.

### **Lender and Government Service Agency Master Agreements**

Banks and other mortgage lenders enter into legal contracts with Fannie Mae, Freddie Mac, and Ginnie Mae to sell and deliver mortgages that are underwritten to those organizations’ guidelines for designated lending programs, or a collection of such programs. Each lending program has specific parameters associated with it that lay out the type of loans that can be included. Typical requirements and conditions include such things as the type of loan product (for instance, fixed rate or adjustable rate), the maximum loan amount allowed (this may vary by state), the property being

financed (for instance, owner-occupied, single unit, condo/town home), the value of the property being financed (such as a certified appraisal requirement), maximum allowable loan-to-value and debt-to-income ratio thresholds, minimum requirement for length of employment (may require year-to-date pay stubs dated within a set period of the time from the date of the loan application), borrower job status (for instance, self-employed or temporarily unemployed, or retired persons who do not furnish current and historical tax returns or documentation to support source and amount of stated income may be excluded), hazard insurance (for instance, flood, fire) and title insurance, in addition to many other factors, such as restrictions on cash-out transactions, which we will explore in greater depth. The terms and conditions of these agreements amount to pledges from the lender to meet stated loan volume floors and caps (for instance, eligible mortgages of at least \$10 billion, not to exceed \$12 billion, plus or minus a small percentage) for the sale of mortgages into one of the GSE's mortgage-backed securities programs under the terms of existing loan pool purchase contracts, or possibly a standard portfolio purchase commitment program under prevailing terms and conditions that apply. Our focus here is on the underwriting of these mortgages, because that is where we see an opportunity for CCAF to significantly improve current practices. This will be discussed in a later section.

## **LOAN SECURITIZATION AND THE FINANCIAL CRISIS**

Soaring subprime mortgage delinquencies have caused the value of risky MBSs to fall sharply, and it has been estimated that U.S. financial institutions lost about \$500 billion due to exposure to these subprime mortgage securities.<sup>7</sup> The potential losses associated with securities made up of an undisclosed concentration of subprime mortgages were difficult to estimate and came as a total surprise to holders of those securities. In this section, we delve further into the connections between the secondary mortgage market and the financial crisis.

### **Loan Securitization Process**

Asset securitization began with the structured financing of mortgage pools in the 1970s and became an extremely popular tool for banks.<sup>8</sup> Securitization is a process of pooling and repackaging of cash flow of

financial assets into securities for investment purposes. Banks can use the securities markets to support loan growth and allocate capital more efficiently. Securitization also affords them access to diverse and cost-effective funding sources and enables them to better manage business risks. Securitization can benefit all major parties of the transaction including lenders, investors, and borrowers. The main benefit for investors is securitization's associated structural credit enhancements and diversified asset pools that were thought to alleviate the need for them to obtain a detailed understanding of the underlying loans. For lenders, securitization can improve their returns on capital by converting an on-balance-sheet lending interest revenue stream into an off-balance-sheet fee income stream that is less capital-intensive and improves liquidity and reduces loan pricing risk due to interest rate movements. Borrowers benefit from lower costs and extended credit availability on terms that lenders otherwise could not provide.<sup>9</sup> Despite problems with liquidity experienced with the financial crisis, these basic benefits of securitization remain.

To understand how the securitization of subprime loans played a role in the financial crisis, we first briefly review the loan securitization process and its key participants. Exhibit 5.2 describes a typical securitization process.

In this process, the lender originates loans or purchases them from mortgage brokers (commonly referred to as production flow) and transfers them to a special-purpose vehicle (SPV), which packages them into collateralized debt obligations (CDOs) for sale to investors. From Exhibit 5.2 we can see that securitization is a complicated process and involves many additional parties in addition to the borrower, lender, and investor. Once the loan is made, the borrower and lender are no longer directly connected. Instead borrowers are handed off to the servicer, which may be a separate department in the lending institution or another company entirely in the case of whole loan sale with servicing released. A mortgage bank can also purchase just the mortgage servicing rights for a securitization (not the loans themselves) through what is known as a bulk acquisition. In that case, the investors already own the underlying mortgages, and the servicing right is considered to be an intangible asset. Mortgage banks can capitalize their cost of purchasing servicing rights based on the expected life of the anticipated revenue stream rather than the contractual maturity.



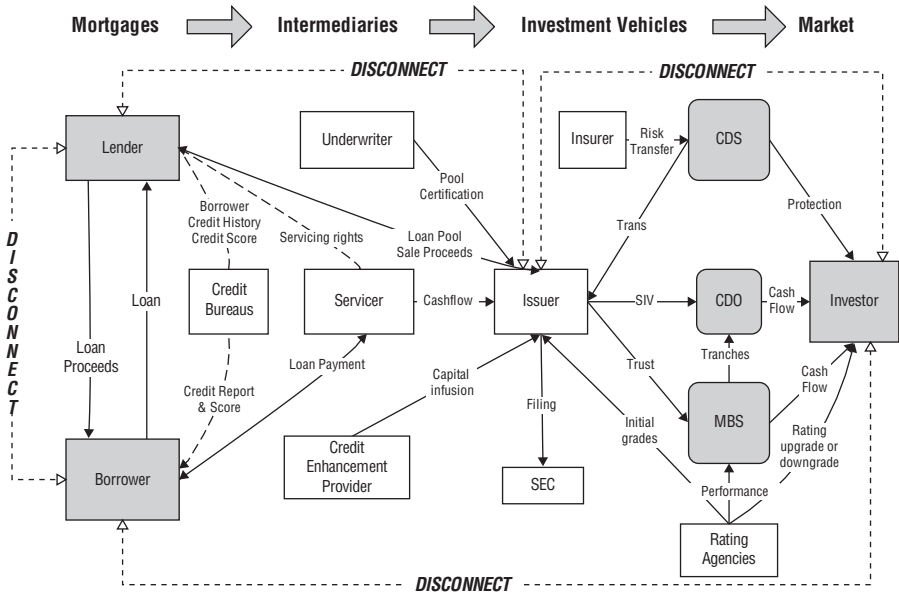


EXHIBIT 5.2

MAIN PROCESS AND MARKET PARTICIPANTS

As a result, by the time loans get to the servicing stage in the process, investors are in effect *disconnected* from both the mortgage lender and borrower in the sense that they have no access to information relating to the performance of the underlying assets or the credit qualifications of the borrower. The process involves the following key players and milestones:

- The *lenders*, including institutional retail channels and also wholesale channel brokers who originate subprime mortgage loans. The mortgage broker relationship to borrowers is severed once the loan is made. About two-thirds of the subprime loans were originated by mortgage brokers in 2006. The vast majority of mortgages, including subprime, were processed through automated underwriting systems such as described in Chapter 3.<sup>10</sup>
- The *servicer*, who collects loan payments from the borrowers and remits them to the issuer for distribution to investors in exchange for a fee. The servicer is also responsible for handling delinquent loans and foreclosures.

- The *underwriter*, typically an investment bank, acts as CDO structures and arranger. The underwriter structures debt and equity tranches. This includes the purchase of mortgages by investment banks from lenders and pooling them into MBSs.
- The *trustee* holds title to the assets of the CDO for the benefit of the investor.
- The *rating agency* rates the securitized assets. The individual bonds within each CDO were classified into different tranches and many of them received AAA/Aaa rating, the highest available, even in MBSs that were collateralized by subprime loans. Some of a CDO's lower-rated tranches might have been repackaged into new CDOs for sale to investors. Those investors had insufficient information or ability to track or evaluate the underlying debt.
- The *credit enhancer* provides contingent capital infusion in the event that credit losses surpass contractual thresholds.
- The *issuer* purchases the pools of mortgage loans from the originator and sells the repackaged loans in a CDO or an MBS to investors. The issuer is responsible for bringing together all the elements for the deal to close. In particular, the issuer creates a bankruptcy-remote trust that will finalize the purchase details in consultation with the credit rating agencies, file necessary documents with the SEC, and underwrite the issuance of securities by the trust to investors. The issuer is typically compensated through fees charged to investors and through any premium that investors pay on the issued securities over their par value.
- The *insurer* provides tranche insurance by means of the credit default swap (CDS) on MBSs and CDOs.<sup>11</sup>
- Finally, the *investor* purchases CDO securities and their protection (CDS) from the insurer. The higher-risk-taking investors such as hedge funds who purchase MBSs leverage them to borrow money and for trade in other markets. These investors constantly look for ways to cover their leverage position from other markets when required by margin calls. The more risk-averse investors buy senior debt tranches.

There are so many intricacies in the processes just described that it is difficult for each participant to see the forest through the trees.

## How Connections Are Lost

The key factors that complicate the securitization process are multilevel participants (intermediaries) and a set of conflicts of interest. It is in the securitization process that mortgage loans lost their transparency, and the information barrier was created as described in the next section. They also weakened the traditional relationship between loan originators and borrowers, and lenders, issuers, and investors. The transition process contributed to the disconnection between the true quality of the underlying assets and the promised performance of the structured instruments backed by them.

These counterparty frictions contributed to the loss of connection and transparency:

- **Borrower and lender.** Traditional mortgage lending created a simple relationship between a borrower and lender. Loan securitization has changed this kind of relationship and has involved more parties in this process. Securitization helps transfer the lender's risk to other parties such as investors and provides incentives for the lenders to make more loans in order to meet aggressive targets set forth in master note agreements with government-sponsored agencies (that is, Fannie Mae and Freddie Mac). However, the borrower is often financially unsophisticated, and the lender may have a financial incentive to sell the borrower a loan product that is unsuitable or unaffordable.<sup>12</sup> Loan affordability was not a focus and was not accurately measured by the lending systems. The focus was on qualifying the borrower for the largest loan possible with the minimum initial monthly payment amount as opposed to determining what the borrower could actually afford in many instances. Predatory lending made matters even worse.
- **Lender and issuer.** Lenders pass the majority of the risk associated with their lending operation to the issuer who packages the loans originated by the lender for sale in the secondary market. This process is usually handled by the arranger who performs due diligence in assessing the transaction which includes review of the originator's financial statements, loan pool composition and performance, underwriting guidelines, background checks, and so forth. Oftentimes, subprime lenders who securitized a large portion

of their loans and sold them to investment banks did not eliminate all of the risk associated with these loans. They retained a residual portion of the securitized loan pool on their books, which left them partially exposed to credit risk. Even in instances where the lenders could transfer most of the risk on to the investors they were still not entirely off the hook. This is because pool loan performance could result in damage to their reputation, with the attendant consequences (for instance, lower stock price, greater regulatory scrutiny, lower corporate debt rating, and more importantly future securitizations would be jeopardized).<sup>13</sup> That said, empirical research suggests that securitization creates a distance between the lenders and investors, and it potentially reduces lenders' incentives to carefully screen and determine loan affordability.<sup>14</sup>

- **Issuer and investor.** The issuer purchases a pool of mortgage loans from the lender or originator. The issuer is supposed to conduct due diligence relative to the lender and the quality of the loan pool. The devil is in the details relative to what constitutes an adequate loan pool due diligence effort. Only too often historical simulations (model back-testing), recent performance, and the credit bureau score distribution are the focus. There may be additional segmentation performed by one or another loan characteristics, such as loan-to-value ratio. A complete analysis would need to include an analysis of future outcomes that are not necessarily reflective of past experience, but nonetheless are feasible (for instance, a major downturn in the housing market). That analysis should also include a more comprehensive portfolio segmentation scheme that captures all of the relevant factors needed to construct risk-homogeneous groups of loans.
- **Investor and rating agencies.** There is a potential conflict of interest here as rating agencies are paid by the issuer and not investors. The investors lack the ability to evaluate rating agency's models. Most of the investors simply trust the ratings, despite the fact that they do not even understand the basis for them. They do not perform their own analysis.

As we have shown, discontinuity between various parties abounds in the whole securitization process. In the case of subprime mortgages,

borrowers were sold loans that proved to be unaffordable due to the size of the debt, the terms of repayment, and the reality of the borrower's true financial strength and resources. The decline in real estate values not only eroded the borrower's equity position and the lender's security interest, but in most cases it also removed borrower options, such as tapping their home equity to ease their financial burden or selling their home. Mortgage-backed securities that were created over the past several years had increasing concentrations in these subprime loans, and so they were heavily exposed to deteriorating loan performance and default. These securities had already been sold to investors at high ratings when the bottom fell out and banks and other lenders discontinued making mortgage loans with little money down, low introductory interest rates, and deferment of principal repayment for years, among other loan terms that had become commonplace. Hence, lenders stopped issuing new mortgages, CDO issuers stopped buying mortgages, hedge funds sought to exploit the situation via leverage and short-selling, institutional investors sought to limit their exposure, and issuers of mortgage-backed securities saw appetite for their paper dwindle. This caused the mega credit crunch as shown in Exhibit 5.3.

## THE ROLE OF INVESTMENT VEHICLES

### **Mortgage-Backed Security**

A mortgage-backed security (MBS) is a securitized interest in a pool of individual mortgages, which ranges from 1,000 to 25,000 loans. Instead of paying investors fixed coupons and principal, it pays out the cash flows from the pool of mortgages. Payments are typically made over the lifetime of the underlying loans. In addition to credit risk, MBS investors are also subject to the risk of prepayment.<sup>15</sup> Prepayment risk in MBSs comes from the option in most U.S. residential mortgage loans that borrowers have the right to prepay all or part of their loans at any time without penalty.<sup>16</sup> This feature distinguishes MBSs from most other fixed income investments.

Most MBSs are issued or guaranteed by one of the three mortgage-related agencies or government-sponsored enterprises (GSEs): Ginnie Mae, Fannie Mae, and Freddie Mac. According to the *Inside the MBS &*



**EXHIBIT 5.3**      **HOW THE MEGA CREDIT CRUNCH EMERGED**

ABS, Fannie Mae and Freddie Mac generated \$301.54 billion of single-family mortgage-backed securities in the second quarter of 2008, up 5.3% from the first quarter of 2008.<sup>17</sup> Those guarantees protect MBS investors from credit risk on the underlying loans. Separately, private sector entities also issue MBSs and they are called “private label MBSs” or nonagency MBSs, which create MBSs from loans that do not qualify for the GSE programs.<sup>18</sup>

MBSs provides essential funds for residential mortgage loans and may help reduce mortgage loan interest rates for borrowers and increase the

availability of mortgage loans. The MBS market has helped to shape lending practices. It has standardized the application process for most mortgage loans, thereby providing faster decisions to applicants. MBS has played a significant role in boosting the homeownership rate, particularly over the past decade.

In the securitization process, the mortgage loan pool is typically broken into three different tranches. The credit rating of MBSs is usually very high and most of the pool is classified as senior and receives AAA rating, while only a small part of the pool is lower rated and classified as mezzanine class or junior class. The holder of the senior tranche has priority of payment over the holders of mezzanine tranches, and any residual cash flow is paid to equity tranches.

### **Collateralized Debt Obligations**

High yields in MBSs in the past several years led to a massive infusion of collateralized debt obligations (CDOs) into the MBS sector. A CDO is a structured finance product in which a special purpose vehicle (SPV) issues various classes of liabilities against an investment in an underlying asset pool. The tranches have varying credit risk and return profiles and are rated accordingly. CDOs represent an investment in the cash flows of the underlying assets through derivatives, rather than a direct investment in the underlying collateral like that of mortgage-backed securities. Each MBS is separated into “tranches” based on risk, order of payment, and degree of credit support (subordination, excess spread, and so on). A typical subprime residential MBS is usually broken down as 75% senior rated AAA. AAA tranches are the safest, and thus pay the lowest yield to the investor. AAA-rated tranches are paid first, and the equity tranche (which is created through over-collateralization) is paid last. Equity tranches are the riskiest but could pay the highest yield. In general, the CDO can meet the needs of investors in different risk and return profiles while affording greater portfolio diversification.

The main driver for the fast growth of the structured finance CDO market was the explosion in the mortgage-backed securities (MBS) market, especially subprime and home equity loans. In 2004 CDO total issuance was just over \$157 billion, and it reached \$559 billion in two years before the CDO market began to collapse.<sup>19</sup> The share of MBSs in CDO

assets grew tremendously from 2001 to 2007, and the Federal Deposit Insurance Corporation (FDIC) reported in 2006 that 81% of CDOs issued in 2005 were made up of MBSs.<sup>20</sup> Many CDOs backed by mortgage-backed securities had increasing exposure to subprime mortgage bonds. In 2006, about 80% of total mortgage originations in the United States were securitized into MBSs.

As delinquencies and defaults on subprime mortgages climbed, CDOs backed by significant mezzanine collateral experienced rating downgrades and loss of value. The prices of existing and new issues of CDOs backed by MBSs declined significantly after the second half of 2007 due to the subprime crisis. Since 2008, new issues of CDOs were almost all backed by bank-owned loans instead of residential MBSs.

### **Credit Default Swaps**

Credit default swaps (CDSs) contributed to the woes of the financial system. CDSs “ballooned into a \$62 trillion market before ratcheting down to a \$55 trillion market.”<sup>21</sup> Companies like AIG insured the mortgages on those houses by issuing CDS. By the time AIG was bailed out, it held \$440 billion of CDSs. The multitrillion dollar market for credit default swaps is facing intense scrutiny from legislators and regulators regarding its role in the current subprime crisis.<sup>22</sup>

CDSs represent insurance-like contracts that provide protection against default on bonds, corporate debt, and mortgage securities. CDSs were first created in the mid-1990s and did not trade in any significant volume until the beginning of 2000. They can be used as a hedging device or for speculative investment. The protection sellers are normally banks, hedge funds, or others such as insurance companies. For protection buyers, they pay premiums for a period of time to help preserve their capital. Although the CDS holders typically seek insurance to guarantee that the debts they are owed can be repaid, the original protection buyer for bonds does not need to realize an actual loss in order to be eligible for compensation if a credit event occurs.<sup>23</sup> In other words, risk speculators can take advantage of defaults on loans or MBS without actually owning the underlying credits.

Essentially there are two types of CDS: one is the corporate CDS, and another is the MBS CDS (corresponding to corporate CDO and mortgage-backed CDO, respectively). The biggest distinguishing feature between



an MBS and a corporate CDS is that each tranche in an MBS securitization has a different credit quality rating. In other words, each subprime mortgage is backed by a unique pool of heterogeneous assets with its associated collective credit quality. Therefore an MBS CDS has to focus on each specific tranche for maturity and amortization purposes. The MBS CDS valuation depends largely on the value of its underlying assets, like any other financial derivative. That valuation dependence is shrouded in ambiguity rather than exhibiting specificity. For example, for an MBS, each tranche has its own credit quality, but there is no clear-cut “on-the-run” relationship between distress (that is, severe delinquency, default, or bankruptcy) in the underlying loan pool (either as a whole or within specific segments) and the prevailing credit rating.<sup>24</sup>

When the housing market was booming and corporate defaults were rare, credit swaps were used to protect against default on subprime mortgage securities, and they were considered a low-risk way to collect premiums. Commercial banks were among the biggest participants in the credit default swap (CDS) market. By the end of the third quarter of 2007, the top 25 banks held CDSs, both as insurers and insured, worth \$14 trillion, up \$2 trillion from the previous quarter. JPMorgan Chase was the largest player, with \$7.8 trillion, and Citibank and Bank of America trailed with \$3 trillion and \$1.6 trillion, respectively.<sup>25</sup> The investors, which included banks, investment banks, insurance companies, hedge funds and others, bought subprime mortgage pools that were overrated by rating agencies. However, the housing market bust propagated the subprime credit crunch into other credit areas, and the delinquency and foreclosures in the subprime mortgage market combined to significantly lower the value of credit default swaps.<sup>26</sup> The deterioration in market liquidity has not only affected CDS investors. It has also affected insurers, who have been forced to write down the value of their CDS portfolios. American International Group (AIG), the largest insurer in the world, reported the biggest loss in the company’s history due to largely an \$11 billion write-down on its CDS holdings.<sup>27</sup>

There are two principal issues associated with the way that the CDS market operates:

1. **The market is unregulated.** CDS contracts can be traded or swapped from investor to investor without oversight. There is

no guarantee that losses can be recovered in case of default. The instrument can be bought and sold from both sides. A great many institutions were chained together through these deals. For example, Lehman Brothers made more than \$700 billion worth of swaps, and many of them were backed by AIG.<sup>28</sup> Heavy trading volume on CDS further exacerbated the situation. When a default occurs, it is sometimes unclear to the insured or hedged party who is responsible for covering the losses, since one original CDS can be traded 15 to 20 times.

2. **Losses associated with the mortgage debacle are difficult to estimate.** Take, for instance, the \$57.9 trillion notional value in credit default swaps. It is not clear exactly how much would be lost or won if all of the underlying securities defaulted. We cannot pinpoint net losses because the amounts of recoveries depend on the circumstances surrounding the default. Banks that bought protection to cover their exposure assumed they were hedged. Therefore they did not anticipate incurring any net loss on their “insured” holdings (write-off of the loss is offset by payment from the CDS seller). If the CDS seller cannot pay on the claim, then the bank’s net losses have to be realized and subsequently reflected on its books.

The potential losses caused by the CDS market can be far-reaching. As credit insurance becomes too costly, it will be more difficult for lenders to make loans and this will in turn affect many other areas. Both protection buyers and sellers need to adequately measure the risk associated with the underlying assets so they can accurately value credit default swaps. Given the role of CDSs in the subprime mess, the federal government is expected to roll out new regulations and oversight and enforcement guidelines. For state-regulated entities, additional oversight may come from state insurance commissions.

## ROLE OF CREDIT RATING AGENCIES

### Credit Ratings and Subprime Mortgage Crisis

Credit rating agencies play an important role in modern capital markets, and the reliability of their credit risk assessments has a significant impact on investor’s confidence in financial markets. Their role has become

increasingly more important as the financial markets have grown more complex and comprehensive. The three leading credit rating agencies, Standard & Poor's (S&P), Moody's, and Fitch, are essentially financial gatekeepers.

A credit rating is an overall credit assessment of a debt obligation's creditworthiness based on relevant information available regarding the issuer or borrower (obligor), and the market and economic conditions and outlook. Credit rating quality is critical to investors and the public. Credit ratings by the agencies are claimed to be an accurate measure of credit quality globally and across all types of debt instruments. Ratings should reflect an unconditional view and be forward looking and independent of the economic cycle.<sup>29</sup> In other words, a wide range of future economic conditions should be factored into the credit rating process or models so that a rating will not change with economic ups and downs. For example, an AAA rating, the highest possible rating, would universally represent safety and security of investment.

However, the subprime crisis suggests that credit ratings provided by credit rating agencies were inadequate and inconsistent in distinguishing the risks of different securities, and mortgage-backed securities were rated with significant errors.<sup>30</sup> Rating agencies have taken a lot of heat for their role in the crisis. The three major agencies (Moody's, S&P, and Fitch) played a critical role in helping underwriters to structure and ensure the ratings of CDOs (and the tranches within them) so that securitizers and originators would have a ready market for subprime debt.

In particular, rating agencies have been criticized for being too generous with their AAA rating relative to mortgage-backed securities and collateralized debt obligations (CDOs). Both of these securities were backed by low-quality subprime loans during 2002 to 2007. For example, for a subprime pool of loans issued in September 2006, 80.6% were classified as senior tranche and received AAA rating, the highest possible.<sup>31</sup> It was argued that had the agencies not given so many AAA ratings to the securities backed by subprime mortgage debt, lenders would not have been so willing or even able to originate such mortgages in the first place.<sup>32</sup> And investors would not have such high demand for the structured financial products.<sup>33</sup>

As the subprime mortgage loan performance deteriorated, delinquencies, foreclosures, and bankruptcies surged. Since mid-2007, a wide

range of structured financial products have experienced intensive downgrading. Rating agencies downgraded many of mortgage-backed securities to reflect the deterioration in quality of the underlying portfolio and announced changes in their methodologies for rating such products. Many subprime mortgage-backed securities rated single A were downgraded by more than three or more notches, and many of the AAA-rated securities were also downgraded and suffered a significant decrease in value, as shown in Exhibit 5.4. Rating agencies lowered the credit ratings on \$1.9 trillion in mortgage-backed securities from third quarter 2007 to second quarter 2008. Standard and Poor's has downgraded more than two-thirds of its investment-grade ratings, while Moody's has downgraded over 5,000 mortgage-backed securities.<sup>34</sup>

This placed additional pressure on financial institutions to lower the value of their MBS. In turn, these institutions were forced to acquire additional funding to maintain their capital ratios at acceptable levels. Those institutions that chose to raise capital in the equity markets saw

EXHIBIT 5.4

## CHANGES IN TRANCHE RATINGS

Tranche	Initial Rating	Recent Rating	Value	%
A-1	AAA	A-	\$325 Million	22.09%
A-2fp	AAA	AA	\$250 Million	17.00%
A-2a	AAA	AAA-	\$223 Million	15.16%
A-2b	AAA	AA	\$69 Million	4.69%
A-2c	AAA	A	\$174 Million	11.83%
A-2d	AAA	BBB-	\$111 Million	7.55%
M-1	AA+	BB	\$64 Million	4.35%
M-2	AA	CCC	\$62.5 Million	4.25%
M-3	AA-	CCC	\$22.8 Million	1.55%
M-4	A+	CCC	\$30.9 Million	2.10%
M-5	A	CC	\$23.5 Million	1.60%
M-6	A-	CC	\$21.3 Million	1.45%
B-1	BBB+	CC	\$21.3 Million	1.45%
B-2	BBB	CC	\$12.5 Million	0.85%
B-3	BBB-	CC	\$17.7 Million	1.20%
x	Over-collateralization	\$42.7 Million 2.90%		88%

Source: Morgan Stanley ABS Capital (reference Obligation MSAC 2006-HE6) Prospectus by Saphir Finance Public Limited Company, pp. 56–57).

the value of existing shares reduced. In other words, rating downgrades put downward pressure on MBS value and stock prices. This process hurt investors' confidence in the rating agencies' abilities to evaluate risks of structured finance products and caused them to pull back from structured products in general. This caused large fluctuations in prices and volume in the financial markets.

It was in this process that some of the worst-performing loans were structured and ultimately sold to investors. The risks related to the inability of homeowners to meet mortgage payments were distributed broadly, with devastating impacts. Exhibit 5.5 portrays the transformation of subprime mortgage pools into investment securities.

### Rating Methodology for Structured Financial Products

Modeling structured instruments is challenging. As early as the mid-1990s, rating agencies had realized that it was complicated to rate a mortgage-backed

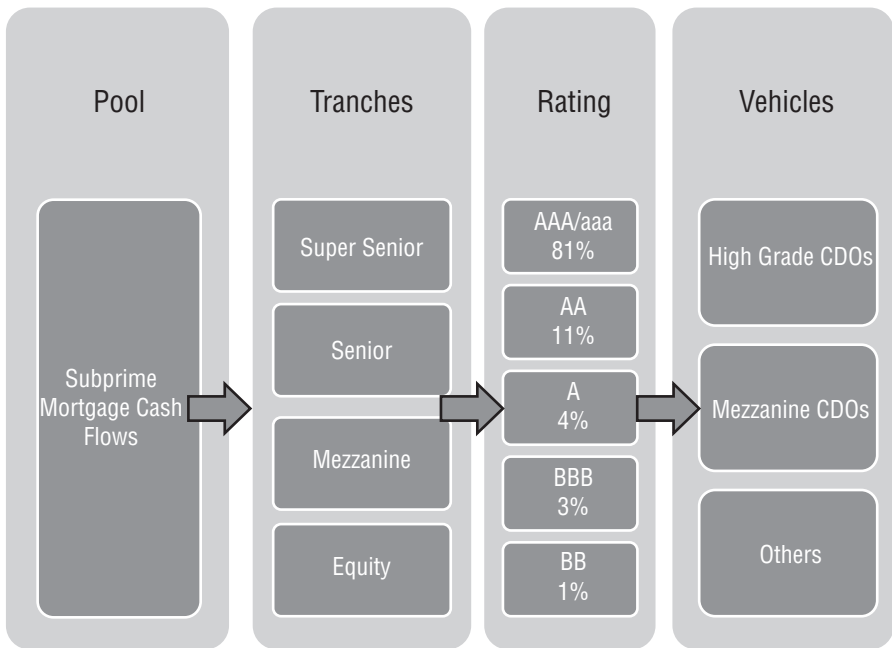


EXHIBIT 5.5

**EXAMPLE OF HOW SUBPRIME MORTGAGES  
COULD BE POOLED AND RATED**

security, particularly when the underlying collateral consisted of a diverse class of subprime mortgages. Adding to the difficulty was lack of sufficient subprime performance data that reflected a full economic cycle. Overreliance on subsets of rating factors such as the loan-to-value ratio and credit score can prove unsuccessful due to market influences. Therefore, it is important that the rating process be supported by a comprehensive framework.<sup>35</sup> Unlike the single name instruments, which are one dimensional, the structured instruments can have as many dimensions as the number of instruments in the mortgage pool. Therefore, estimating the impacts of various events on these heterogeneous assets and their related probability of default PD can be extremely complicated and computationally intensive. Usually, sophisticated statistically based approaches are required to estimate the default and loss of a large number of individual loans and pools. This model development process can be costly and time consuming. For example, S&P started to develop a new version of the rating model from 2003 based on approximately 9.5 million loans to cover a full spectrum of new mortgage products including the Alt-A and fixed/floating payment type categories. The model still has not been implemented due to resource and budgetary constraints.<sup>36</sup>

Efficient CDO valuation requires homogeneous portfolios. Portfolio homogeneity depends on the characteristics of the underlying mortgage. Various research methods and practical approaches have been developed to cope with this challenge and simplify the valuation process. For example, Moody's RiskFrontier adapted a semianalytic approach with simplifying assumptions.<sup>37</sup> This methodology is based on a few fundamental assumptions. One key assumption is that collateral terms and conditions and correlations are assumed to be uniform across the pool. This homogeneity assumption can be a concern although some practical approaches have been suggested to offset the effects of this assumption.<sup>38</sup>

In any securitization process, the assets must be segmented according to their risk profile. Issuers do this by dividing the assets being securitized into tranches, grouping similar loans, debt instruments, or other assets with similar underlying risks. Each tranche is then created, and the resulting product may be rated by a credit rating agency. Because structured financial products are designed to take advantage of different investor risk preferences and investment time horizons, they are, in a sense, designed for a particular credit rating.

Reliability of the rating critically depends on the rating agency's ability to measure the credit risk of the underlying mortgage pool and to model the cash flow distribution from the underlying pool to the investor or other note holders. Typically all three agencies follow a two-stage rating process. First, they develop analytical models to assess pool credit risk. The second stage is to model cash flow with structural analysis. This stage also involves evaluations of any third parties such as servicers and asset managers. The results are mapped into a single tranche rating. However, there are differences in rating agencies' modeling assumptions and approaches. It was suggested that those differences can lead to different rating outcomes for individual tranches and may have important implications for CDO investors and originators.<sup>39</sup> There are two common valuation techniques:

1. Moody's primary quantitative approach for generating expected loss (EL) estimates for CDO tranches, called the binomial expansion technique (BET).
2. An alternative method is the Monte Carlo simulation technique, used by all three major rating agencies. This approach estimates probability of default (PD) of the underlying asset pool on the basis of large numbers of replications of random defaults with a simplified correlation structure. Therefore it may generate more accurate loss distribution estimates at the cost of computation time.<sup>40</sup>

Examples of commonly encountered models for credit rating, in general, also include:

- **CreditMetrics (JP Morgan).** Based on a *credit migration model* (a transition matrix, based on average historical transition frequencies produced by rating agencies for each credit risk classification, completely specifies the probability density function [PDF], associated with default). The model assumes interest rates follow a deterministic path. Credit VaR (value at risk) of a portfolio, using this approach, is similar to that for market risk (that is, the distance from the mean to the percentile of the pdf at the desired confidence level).<sup>41</sup>
- **Moody's KMV (Kealhofer, McQuown, and Vasicek).** This approach relies on expected default frequency by issuer, rather than the average historical transition frequencies produced by rating

agencies. They have an extensive database to assess default probabilities and the loss distribution related to both default and migration risks.<sup>42</sup>

- **CreditRisk+ (Credit Suisse Financial Products [CSFP]).** Based on actuarial science, focus is on default, not migration. Assumes dynamics of default follow a Poisson distribution. It assumes the mean default rate follows a random process or chances, and it does not try to explain the cause of the default, although, it allows the users to link default rate with macroeconomic factors. This model is typically used for corporate bonds, in conjunction with Monte Carlo simulations.<sup>43</sup>
- **KPMG (Reduced Form Models).** This approach decomposes risky bond yields into the credit risk-free rate plus a credit risk premium.<sup>44</sup> The credit spread is calculated based on the estimated PD multiplied by loss given default (LGD). KPMG's loan analysis system (LAS) and Kamakura's Risk Manager (KRM) are two specific applications of using the risk-neutral probabilities to value risky loan assets.

The underlying assumptions for credit rating models determine what and how much data is required as well as the computational needs. Simplification of assumptions regarding the behavior of the underlying assets (for instance, the correlation between different loans or assets or risk factors) can improve the computational efficiency. However, oversimplification and unrealistic assumptions can lead to an underestimate of the true risk, given significant changes in economic factors (home prices, unemployment rates, and so on). Mainly, these models either use limited historical data to construct credit migration matrices and scenarios to calculate default probabilities and loss distributions, or they assume defaults follow a certain statistical distribution (for instance, Poisson distribution), or stochastic process. These approaches have been criticized for excessive reliance on quantitative models and may not reflect business reality nor incorporate extreme economic events. To overcome this limitation, CCAF can incorporate information from all resources including business policy and rules into the model development and maintenance process. This method is more consistent with the principles and concepts of Bayesian methods, and it is a more robust statistical method that reflects



existing information in a constant learning and updating process.<sup>45</sup> In Exhibit 3.10 we illustrated how the CCAF handle structure can be used to define loan grades. This serves as a more solid foundation for the credit migration model approach. For certain loan portfolios, there are regulatory rules of thumb that are used to estimate losses based upon loan grades. One such guideline is the “5-15-50 Rule,” which requires that, unless there is empirical evidence to the contrary, lenders should allocate 5%, 15%, and 50% of their special mention, substandard, and doubtful rated category loan amounts to their loan loss reserve. Through the use of CCAF, lenders will be able to reserve for losses more accurately (possibly higher or lower than the regulatory guideline), and credit rating models will benefit in a similar fashion.

### Credit Rating Banana Skins

Rating agencies have been criticized for their role in the financial crisis relative to

- **Methodology.** It has been alleged that rating models did not include complete parameters and sufficient number of extreme scenarios of economic conditions. It is argued that the agencies underestimated the risk of the subprime-related securities they rated. In particular, they extrapolated the relatively low delinquency rates of subprime mortgages during the post-2001 economic expansion and the associated run-up in housing prices and wrongly assumed that these trends would continue indefinitely.<sup>46</sup> In existing model development processes, often large amounts of data are required to develop the models due to heterogeneity in risk characteristics of the pools. As a result, model development can require extended time and resources, and fail to meet pressing needs fueled by business growth in a timely fashion. The fact that rating agencies failed to update the outdated models was one key reason that ratings missed changes in performance of the new-prime products. This contributed to the unprecedented number of AAA downgrades and collapse of prices in the MBS market.<sup>47</sup>
- **Transparency issues.** Rating agencies and investment banks have been criticized for lack of transparency of their products and processes. In a recent survey, 88% of the 333 respondents from 57

countries think lack of understanding of the instruments of rating agencies rate is a concern.<sup>48</sup> This magnifies the investor's reliance on credit ratings and increases their vulnerability. The investors oftentimes do not have the necessary information nor the ability to evaluate or validate the ratings and models. They are also unable to evaluate the quality of the underlying assets of the structured products. It is argued that no simple methods can estimate future losses on subprime deals and which bonds will be written down given the estimated loss amount. It is generally agreed that this process is beyond the average investor's ability to fully understand.<sup>49</sup>

- **Procedures.** Rating agencies' downgrades of mortgage-backed securities appear to have been lagging indicators of subprime mortgage problems rather than leading ones. The recent widespread downgrading wave of instruments suggested that rating agencies have not been diligent enough in their initial ratings. This also suggested that their rating approach is not "cycle neutral" as they claimed. It has been said the rating agencies did not perform due diligence on validation of the data that were used in credit analysis to determine credit enhancement levels.
- **Independence.** It has long been a concern as to how a rating agency can maintain its independence and avoid conflicts of interest. According to the same survey mentioned previously, 86% of 333 respondents from 57 countries expressed concern about conflicts of interest with respect to rating agencies.<sup>50</sup> Rating agencies are paid by issuers of securities to provide advice about structuring securities in order for them to receive the most favorable ratings.<sup>51</sup> In some ways, this makes good sense. If the ratings agencies possess information about what generates riskier or less risky payment streams, then it is beneficial for security issuers to have that information. At the same time, this elevates the risk that the ratings agencies' incentives will be aligned more with those of security issuers than with the investors.

## Rating Agency Regulation and Reform

Rating agencies have acknowledged the issues in the above areas, and they have sought opinions about reforms that can rebuild investor confidence. They also have made efforts to improve model transparency,

disclose valuation models, test model assumptions, and strengthen rating model validation over the last several years. Each rating agency has announced major adjustments in their analytical procedures in an effort to restore some confidence in their ratings. For example, S&P is trying to provide transparency and insights to market participants by simplifying and offering borrower market access to rating criteria, underlying models, and analytical tools. It also includes “what if” scenario analysis in rating reports to explain key rating assumptions and the potential impact of positive or negative events on the rating. An early warning indicator is also proposed to investors to signal a key credit quality attribute including delinquencies or losses.<sup>52</sup> While the rating agencies have made significant progress in certain areas, there is still plenty of room to improve in the future.

While credit ratings can save investors time and effort in researching for the credit risk associated with the securities, the investment community has lost confidence in the agencies’ actual ratings in practice. Given rating agencies’ role in the subprime mortgage crisis, more strict regulations and broad reforms are expected in order to regain investors’ faith and confidence. However, there are potential obstacles to rating agency reform. In particular, some structural features of the credit rating business complicate any efforts at reform.<sup>53</sup>

## How CCAF Can Help Improve the Rating Process

Currently, rating agencies monitor the performance of approximately 10,000 pools of mortgage loan collateral. Challenges associated with a large loan database and heterogeneity in risk characteristics make the model development process resource-intensive, and time-consuming.

Lack of transparency was most pronounced for investors in mortgage-backed securities. They were almost entirely at the mercy of the rating agencies to tell them the investment grade of these securities. There was no window into the risks associated with the underlying securities stemming from

- Loan maturity
- Geography
- Borrower risk segments

- Types of mortgage products
- Delinquency and prepayment rates

It is important for investors to understand how the loans were originally pooled, together with any diversification criteria. Investors want to ensure that any cause for a few of the loans in a pool to default does not correlate to the majority of the remaining loans in the pool! Key enhancements that can help investors gauge any skew in risk exposure associated with the security would include such things as

- Leveraging the handle to segment and then combine loans in the pool for the purpose of more accurate loss estimation. The handle structure can help create more homogeneous pools of mortgages. As discussed previously, a big challenge to valuation of a CDO is the heterogeneity of the mortgage pool. The handle-based segmentation in CCAF can be used to classify the mortgage pool into more homogeneous classes prior to applying PD models.
- Handle-based segmentation can also help relax the homogeneous assumption about the collateral terms and conditions in the mortgage pool, because those aspects are partially, if not fully, addressed within the framework.

This process is shown in Exhibit 5.6.

Exhibit 5.7 shows the CCAF implementation process and it involves the following steps:

**Step 1.** Initial loan classification: Mortgage loans are classified into handle cells based on the borrower's contour and transaction contour. As discussed in Chapter 4, BC and TC are constructed based on selected primary and secondary variables, such as LTV, DTI, bureau score, terms and conditions, and so forth, such that each handle cell contains homogeneous loans in terms of default risk.

**Step 2.** Segmentation: Tranches are created based on concentration risk calculated from the handle cells. Tranche size and selection are based on concentration risk. The PD and EL for each tranche is estimated using a dynamic conditional process (DCP).<sup>54</sup>

**Step 3.** Simulation of cash flows: Monte Carlo simulation is typically required and demands a large computation resource. However,

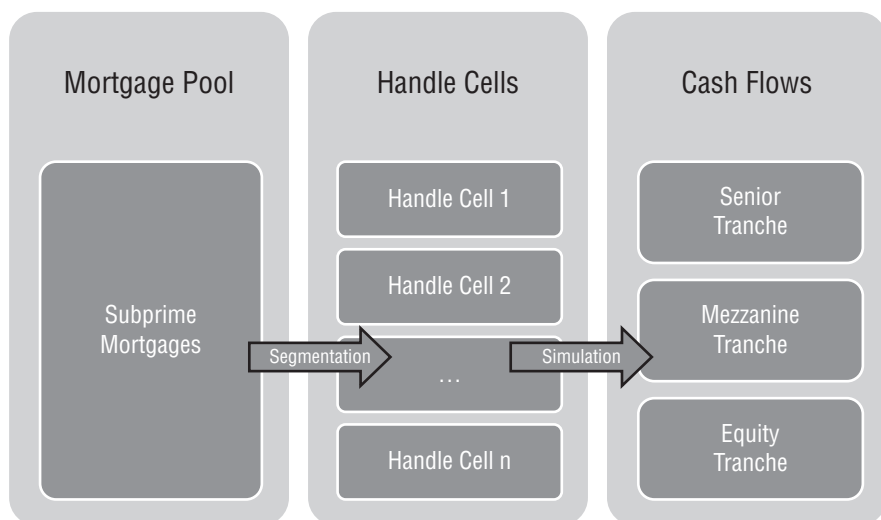


EXHIBIT 5.6

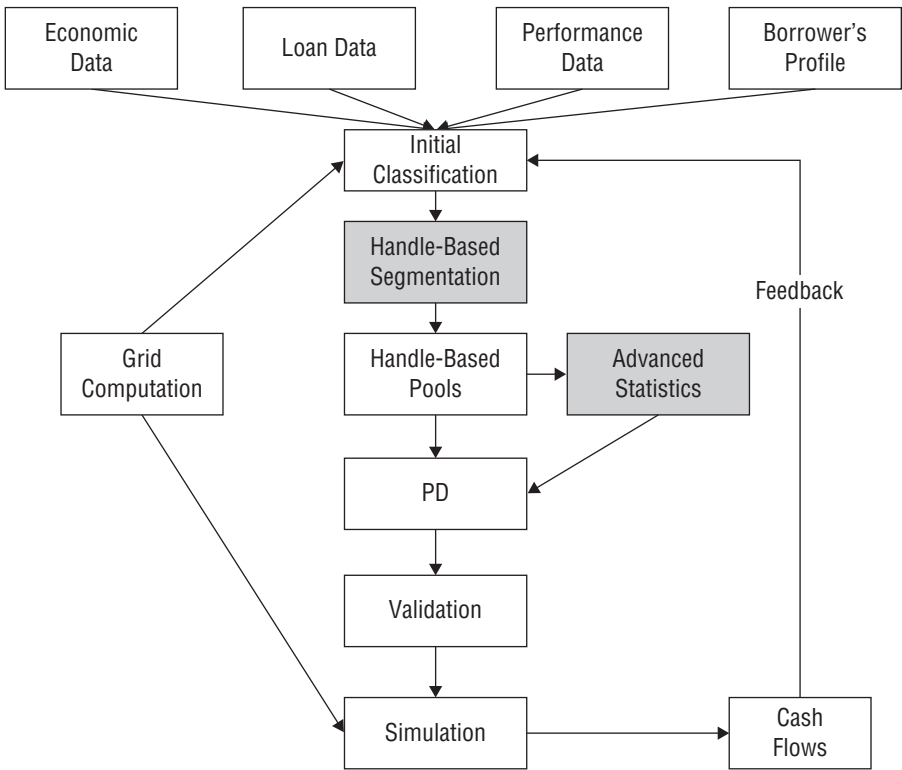
#### HOW CCAF CAN IMPROVE THE SECURITIZATION PROCESS

greater computational efficiency can be achieved through grid computation technology.<sup>55</sup>

**Step 4.** Model maintenance and update: CCAF handle-based structure offers an efficient way to validate, monitor, and report data dynamics and population changes. Effective model management is important as the number of models grows.<sup>56</sup> It has been said rating agencies often were unable to keep their models current, in part, due to insufficient capacity in managing large numbers of models and a growing loan database.

### Example of Mapping Handles to Rating Tiers

In both a \$6 billion “held” portfolio and \$3 billion securitized “pool” of credit card loans, our past research has demonstrated that 90% of the losses in a 54 handle segmentation scheme occur in 6 cells.<sup>57</sup> That segmentation scheme was able to leverage account payment and utilization behavioral variables, account age, and pricing and thus was a less finely sliced segmentation than our CCAF example in Chapter 2, which has 432 handle combinations. In our mortgage underwriting example we see the default risk spread more uniformly across handle combinations of



**EXHIBIT 5.7      CCAF IMPLEMENTATION PROCESS**

the primary variables (that is, the Five Cs of Credit). For the credit card example, the behavior of delinquencies, prepayments, and losses varied widely across different groups of handle cells.<sup>58</sup> We can expect mortgage portfolios to more or less *rhyme* with these findings.

We refer to common security ratings for the purposes of our discussion. Exhibit 5.8 shows a finer classification within investment tiers than we explore here. In a later example in Chapter 6, we make reference to these subtler ratings, which can be mapped to CCAF handles.

Based on the detailed CCAF example in Chapter 2, we can allocate mortgage loans into the standard rating tiers by leveraging the handle structure, as shown in Exhibit 5.9. The CCAF handle structure can more accurately determine default probabilities for the various loan risk rating categories by using continuous CCAF holistic score bands, as shown in the second column from the right in the table. The reader can refer to Exhibit 2.29

EXHIBIT 5.8

**COMPARISON OF RATING  
GRADES AND DEFINITION**

<b>Moody's</b>	<b>S&amp;P</b>	<b>Fitch</b>	<b>Definitions</b>
Aaa	AAA	AAA	Prime. Maximum Safety
Aa1	AA+	AA+	High Grade High Quality
Aa2	AA	AA	
Aa3	AA–	AA–	
A1	A+	A+	Upper Medium Grade
A2	A	A	
A3	A–	A–	
Baa1	BBB+	BBB+	Lower Medium Grade
Baa2	BBB	BBB	
Baa3	BBB–	BBB–	
Ba1	BB+	BB+	Non-Investment Grade
Ba2	BB	BB	Speculative
Ba3	BB–	BB–	
B1	B+	B+	Highly Speculative
B2	B	B	
B3	B–	B–	
Caa1	CCC+	CCC	Substantial Risk
Caa2	CCC	—	In Poor Standing
Caa3	CCC–	—	
Ca	—	—	Extremely Speculative
C	—	—	May be in Default
—	—	DDD	Default
—	—	DD	
—	D	D	

Source: Bondsonline Group Inc., 2006, [[www.bondsonline.com/asp/research/bondratings.asp](http://www.bondsonline.com/asp/research/bondratings.asp)].

to determine which handles are actually included by score range. It turns out that in the top rating category, handles 429 and 430 were not included. This is due to the very low number of loan defaults in the highest quality segments and also due to the lumpiness of the data as evidenced by reviewing the score interval counts of goods and bads in Exhibit 2.25 It is not uncommon to see this phenomenon and typically these situations are

EXHIBIT 5.9

**SYNCHRONIZING THE HANDLE STRUCTURES  
WITH RATING TIERS**

Security Rating Tiers	Four-Year Average Cumulative Corporate Bond Default Probability	CCAF Four- Year Average Cumulative Mortgage Default Probability	Weighted-Average Good/Bad Odds	CCAF Holistic Score Range	Number of Handles
AAA	0.150	0.147	678 to 1	822–833	12
AA	0.250	0.286	349 to 1	818–821	5
A	0.440	0.448	222 to 1	811–817	14
Baa	1.270	1.240	80 to 1	770–810	103
Ba	8.680	5.502	17.2 to 1	718–766	138
B	19.400	19.596	4.1 to 1	715–690	86
CCC	35.970	32.045	2.1 to 1	678–684	35
Below CCC	n/a	42.643	1.35 to 1	652–677	39

Source: Steven Allen, *Financial Risk Management: A Practitioner's Guide to Managing Credit and Market Risk* (Hoboken, NJ: John Wiley & Sons, 2003), p. 334. Data source cited as Standard & Poor's, *Credit Week*, April 15, 1996, and based on 20 years' worth of data.

addressed by smoothing the raw data.<sup>59</sup> The four-year average bond default probabilities are similar in magnitude across rating agency sources.<sup>60</sup>

We will return to this example in Chapter 6 when we discuss improved financial literacy for investors. Suffice it to say that shifts in the handle-based distribution of loans, and their associated cash flows, translate to shifts in loan pool rating tiers. These changes usually occur gradually, and they precede changes in the overall security rating. The upshot is that this expanded view provides the investor with better information early on about underlying asset quality. As a result of this added transparency, rating agencies will be encouraged to make appropriate rating downgrades quicker than before, which addresses a common investor complaint.

## HOW CCAF TRACKS THE UNDERLYING LOAN PERFORMANCE

It has long been realized that in loan securitization, “loan performance can quickly erode the lucrative profits in subprime lending . . . burn investors and smother demand for these securities.”<sup>61</sup> An important related concern has been discussed relative to the need to be able to trace



loans in investor pools back to their source through a unique identifier, like the nine-character CUSIP<sup>62</sup> associated with all North American securities that facilitates clearing and settlement of trades. We advocate that in designing the identifier, additional thought be given to also including some extra intelligence. To uniquely identify a loan, the originating institution, the loan booking system, and the original loan number would need to be codified at a minimum.<sup>63</sup> We would like to see the transaction contour also imbedded in the universal loan identifier.<sup>64</sup> The power afforded by having the contour in the identifier would be substantial. Pool performance could be monitored at the loan level and improved projections on delinquency, loss, and prepayments would be possible by building separate models based upon the contour segments.<sup>65</sup>

Having CCAF in place would be advantageous not only to lenders for more accurate pricing of the true transaction risk, and to borrowers for more affordable loans, but CCAF also benefits the institutions, creating homogeneous pools of assets for securitization and sale. CCAF helps reduce the friction in the securitization process<sup>66</sup> and establish a connection between rating agencies and investors with the CCAF handle structure. It also enables rating agencies to better evaluate loan quality.

It is unnecessary to burden the investor with a mountain of information on the loans that back their investment. Digesting and monitoring that much detail would prove too costly and time-consuming. Thus CCAF can be used to boil down the information in the following manner. The composition of securitized pools, or loans bundled for sale (with servicing retained or released) could be regulated by the transaction contour classifications. This simply means that the underlying loans and their associated cash flows can be mapped into a relatively small number of risk rating tiers (perhaps 20 tiers as shown in Exhibit 5.8, or 8 tiers as depicted in Exhibit 5.9). In the credit card arena, the credit score has played a dominant role in pricing credit risk for sale to investors in the capital markets. We see the secondary market players embracing CCAF in time as a best practice.

As shown in Exhibit 5.10, the enhancement process can involve the following steps:

**Step 1.** CCAF classifies all loans into handle-based segments. Each segment contains homogeneous loans in terms of default risk.

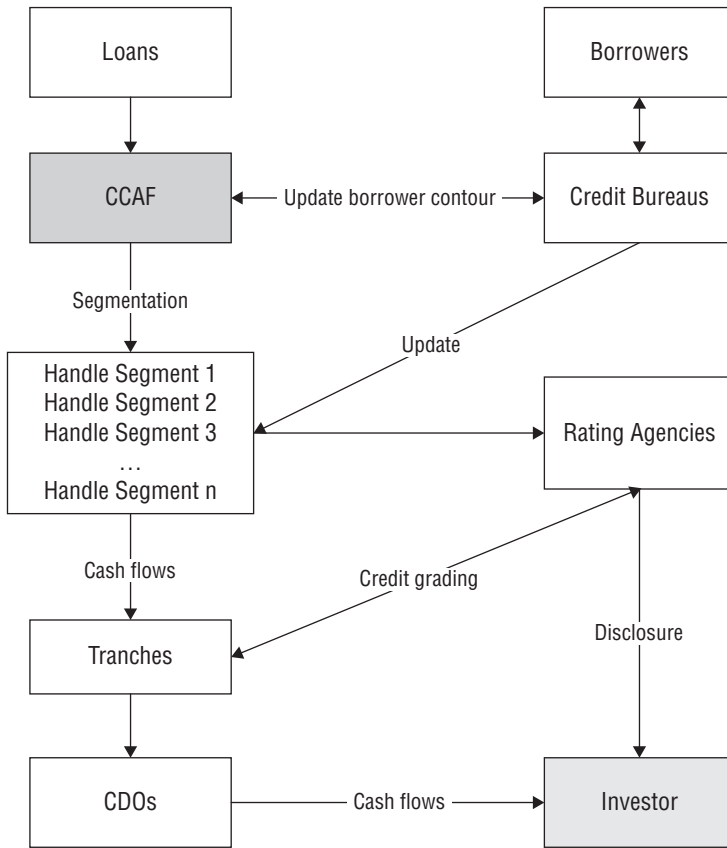


EXHIBIT 5.10      IMPROVED LENDING SYSTEM WITH CCAF

In other words, the handle number associated with each segment implicitly captures the common attributes related to default risk.

**Step 2.** Rating agencies can use the handle cells, which are all possible combinations of all relevant variables, to create all possible extreme cases for simulation of loss distribution.

**Step 3.** Tranches are created based on the handle segments. And CDOs are created based on concentration risk calculated from the handle segments.

**Step 4.** The investors can easily trace a CDO offering back to the default risk and concentration risk associated with each tranche. For greater transparency, the handle associated with median ratings for the six primary factors can be embedded in the CDO CUSIP.

**Step 5.** Changes in the attributes of the underlying mortgage/borrowers can be updated and reported to investors. Any deterioration in loan quality would be identified to give the investors an early warning of increasing risk.

**CCAF for GSE Pool Construction**

In order to understand how CCAF can support secondary market creation and sale of loan-backed securities, we outline what is typically considered relative to a mortgage lending program that is sponsored by a GSE. Space limitations preclude a more thorough treatment that would delineate all of the distinctive features between conventional and government (FHA/VA) programs. Exhibit 5.11 lists some generic requirements

EXHIBIT 5.11      MASTER NOTE AGREEMENT KEY FEATURES	
Program Eligibility	Typically lists specific community lending programs available through the sponsoring agency or programs structured through local government or nonprofits.
Property Eligibility	Number of units; type of units, owner occupancy; appraisal and inspection; whether property is new, existing, or rehabilitated; property location relative to neighborhood (stability or targeting for revitalization) and census tract (low, moderate, middle, or high income); zoning restrictions (mixed use property zoned for residential) combined with owner-occupancy and loan-to-value (LTV) maximums.
Mortgage Eligibility	Loan term; fixed or variable rate; amortization method; lien status; presence of teaser interest rate or balloon principal payment or other irregular payment schedules; HMDA loan purpose.
Borrower Eligibility	Completion of education program on buying and owning a home if the loan pool includes special assistance mortgage programs; restriction on number and type (occupying and nonoccupying) of co-borrowers relative to: (a) front-end and back-end debt ratio thresholds (e.g., 26/38) of the combined incomes from all borrowers, (b) occupying borrowers must qualify for at least a minimum percentage of the mortgage amount based on a proscribed front- and back-end ratio combination (e.g., 32/40).
Lender Eligibility	Restrictions to only certain originating channels.
Underwriting Conditions	

*(Continued)*

## EXHIBIT 5.11 (CONTINUED)

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Credit History	Must be from an independent credit reporting agency, such as the major credit bureaus; no adverse or derogatory information (bankruptcy, judgment, or collections); relative to late payments must consider frequency, severity, balance size, time since late payment occurred over past 24 months; for past 12 months restrictions on the number of times 60 days past due and 30 days past due separately, and with different maximums, for revolving, installment, and mortgage trade lines; conditions for re-establishment of good credit standing after judgments, garnishments, liens, or bankruptcies (Chapter 13—debt reorganization and Chapter 7—debt liquidation).
Capacity	Maximum monthly housing expense-to-income ratio (e.g., 33%); maximum total obligations-to-income ratio (e.g., 38%); ratio ranges may vary by loan program; borrower income verification (minimum number of consecutive years, method of calculation of components: salary, Social Security, military commission, overtime, bonus, alimony, seasonal income, part-time income); and, in cases where the loan pool includes special assistance mortgage programs, there may be income percentage maximums that are based on area median income (or in some cases the greater of area or statewide median income).
Capital	Payment reserve requirement (usually up to two months, but varies).
Collateral	Maximum LTV ratios based on the lower of sales price or appraised value are specified, and they vary by loan program and primary insurance coverage amounts; maximum combined loan-to-value-ratio thresholds when there is a second lien and possibly other subordinate liens on the collateral property; minimum downpayment.
Conditions	Minimum or maximum loan amount; cash-out conditions; closing costs (limitations on third-party assistance from realtors, builders, developers, and lenders based on a set percentage of the lesser of the sales price or appraised value depending on the range of the LTV).
Insurance	Title insurance requirement; primary mortgage insurance based on loan-to-value ranges and covering the excess over a set percentage of the property valuation.

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and parameters associated with qualified loan production for a typical master agreement.

A review of the master note agreement elements makes it abundantly clear the benefit that CCAF's holistic credit risk evaluation provides. Together with the handle structure and handle-based score, CCAF can divide the loan pool into more homogeneous segments for pool construction by the lenders, for risk rating by the agencies, and for investors who will ultimately purchase shares in them. The underwriting portion of the pool eligibility requirement maps directly into the CCAF's Five Cs of Credit framework. The insurance consideration, as well as other eligibility requirements, such as program, property, mortgage type, borrower, and lender can all be addressed via a combination of loan exclusion logic coupled with the secondary factor construct in the framework. The pool construction is enhanced because the handle structure allows for more granular rules based upon families of handle classifications (macro segments) as opposed to the prevailing individual (fragmented) restrictions that are applied to the entire pool of loans. The increased power comes both from selective specification and application of pool restrictions and also from the integration of all underwriting factors within a unified framework. It is envisioned that loan handle classification will be updated periodically to enable rating agencies to spot any deterioration in the distribution of the pool relative to the holistic handle-based score ranges (we use quintiles in Exhibit 5.12 for purposes of illustration).

CCAF can promote financial innovation while adding more transparency to benefit the market and investors. For example, handle-based

**EXHIBIT 5.12 CCAF DEFAULT RISK QUINTILES**

Quintile	Score Range	Good/Bad Odds Range	Number of Handles	Target Pool Distribution
Best	808–833	237–397 to 1	40	81%
Next Best	782–806	142–228 to 1	58	11%
Middle	757–779	76–140 to 1	80	8%
Next to Worst	724–755	39–57 to 1	83	0%
Worst	652–722	12–37 to 1	171	0%

segments in CCAF can help create tranches that consistently distribute default risk and concentration risk across the mortgage pools. Further, the concentration risk in those pools can be managed in part by allocating loans, and their associated cash flows, based on the handle structure. Diversification of risk relative to loan exposure, products, and so forth can be achieved in a similar fashion. Changes in default risk relative to tranches or segments of the underlying loan pools can be fed back through the issuer and other intermediaries to better inform the lenders and can be reported to the investors in conjunction with a new reporting regimen that we describe in Chapter 6 (see Exhibit 6.5 and related discussion).

## FUTURE OF FINANCIAL INNOVATION

Financial innovation, such as mortgage securitization, has proven to be valuable for the financial and housing markets and for balance sheet and risk management. The U.S. economy can benefit from an efficient and transparent CDO market, especially during the recovery period when MBS and CDO growth will resume and play a vital role.<sup>67</sup> However, it appears that the fast growth and innovative nature of structured products got completely out of control, and now they have been blamed for the worsening, if not the origins, of the financial crisis. Because of their complexity and opacity, it is difficult for average investors to understand and manage the risks associated with them. Structured financial products were difficult to value, and they have produced spillover effects to other market segments that are not directly linked to the subprime market.<sup>68</sup> Additionally, the securitization process can further distance investors from borrowers and complicate the risk assessment process. From the investor's perspective, it is critical to be able to understand the credit risk associated with the underlying assets and to effectively monitor their performance. From the rating agency's perspective, it is very important to be able to accurately measure and portray credit risk associated with the structured products.

Significant effort is required to establish an effective regulatory framework regarding their structuring, issuance, ratings, and pricing to support economic stability and market liquidity. This will also foster meaningful and standardized financial innovation in the future. Such a framework can

only be built upon a greater transparency. To that end, we believe the methodology of CCAF can help effectively communicate the characteristics and performance of the underlying loans, borrowers, and collateral, as well as the *pooled risk profile* to the investors and issuer so they can rely less on (or independently validate) external credit ratings.

A key characteristic of this episode of financial disruption is that it has spread far beyond leveraged financial institutions. It has led to a sharp decline in securities issuance; this decline has to be an important part of the story of why the current financial market turmoil is affecting economic activity. In other words, mortgage credit losses are a problem because they are hitting bank balance sheets at the same time that the securitization market is experiencing difficulties.<sup>69</sup> The federal government plans to unlock frozen markets by buying up troubled securities. While this represents perhaps a necessary and effective tactical response, we see the only sustainable solution as one that will involve putting a better process in place than the one that now exists. By *process*, we are referring to the mortgage value chain, and by *better* we mean the new lending system together with its comprehensive framework that needs to be implemented throughout the value chain. Relative to the loan-backed derivative markets, we see adoption of CCAF as the most effective way to provide needed transparency and relevant information so as to fully restore market liquidity based on investor confidence and trust in the resulting *new and improved valuations and ratings* associated with MBSs and CDOs.

The power of CCAF can be best leveraged if widespread adoption is achieved by using standardized thresholds for primary factors and by setting appropriate general guidelines for allowable secondary factors. This could be accomplished by a task force set up by the American Bankers Association (ABA), Risk Management Association (RMA), or a similar organization. At the same time, individual lending institutions would possess sufficient flexibility to determine their own secondary factors for loans they wanted to keep in their on-balance-sheet, versus held-for-sale, portfolio. Such loans may not conform to the standard measures and thresholds for loan approval and pricing, but they still represent profitable business for the lender. The government-sponsored enterprises (GSEs) could specify criteria that must be met for a loan to be suitable for inclusion in a particular loan pool that will be repackaged for sale to investors. Loans that would qualify for the secondary market based on primary factors,

but that do not meet secondary factor conditions, could be held for an interim “break-in” period of 18 to 24 months, after which the loan may qualify for pooling, provided performance has been satisfactory.

## SUMMARY

Undoubtedly, financial innovation, as evidenced by structured financial products, has played an important role in improving the efficiency of the global financial market. Securitization has provided banks and lenders with more flexibility in managing their credit risk exposure. MBSs and other innovative products have provided investors a wide range of investment choices in terms of risk and return. From a social welfare perspective, the development of structured financial products has helped achieve more efficient distribution of credit risk across various market areas and different types of investors beyond the mortgage market. It has provided a powerful and more fluid market dynamic that has afforded greater inclusion of participants possessing varying capacities and capital with the promise of a better housing market and greater economic returns. At the same time, we have witnessed a side effect of overall financial market instability of massive proportions.

In this chapter, we have described how CCAF can help improve transparency of financial innovation, and CCAF contours are used to provide greater information and deliver superior pool performance over time, which will lower risk due to better diversification, lower cost in terms of fee charges by credit enhancers and insurers, and improve returns due to more reliable and sustainable cash flows. For investors, CCAF delivers more complete and timely information relative to the riskiness of loan-backed securities. Rating agencies will benefit from a greater ability to measure risk and assign ratings appropriately, so that investors can rest assured that highly rated securities will live up to their investment grade and the more risky securities will have greater transparency relative to the risk, and any deterioration in quality, associated with the underlying loans. This framework will benefit both the individual investor and the rating agencies.

In Chapter 6 we will discuss the role and impact of regulatory crisis interventions and what is needed to prevent similar crises in future. The new lending system can significantly help to make regulatory intervention and preventive measures more effective.



## ■ NOTES

1. Professor at the MIT Sloan School of Management. See Steve Lohr, "In Modeling Risk, the Human Factor Was Left Out," *New York Times*, November 5, 2008.
2. See Atif Mian and Amir Sufi, "The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis," Working Paper, University of Chicago, May 2008.
3. Governor Frederic S. Mishkin, on "Leveraged Losses: Lessons from the Mortgage Meltdown," at the U.S. Monetary Policy Forum, New York, New York, February 29, 2008.
4. Ginnie Mae guarantees loans, but does not purchase or sell them, nor does it issue mortgage-backed securities.
5. Office of Public and Indian Housing (PIH).
6. Rural Housing Service (RHS).
7. David Greenlaw, Jan Hatzius, Anil K Kashyap, and Hyun Song Shin, "Leveraged Losses: Lessons from the Mortgage Market Meltdown," U.S. Monetary Policy Forum, Report No. 2, 2008.
8. As of the second quarter of 2008, the estimated outstanding is \$10.24 trillion in the United States and \$2.25 trillion in Europe.
9. OCC, "Asset Securitization," *Comptroller's Handbook*, November, 1997, pp. 1–4.
10. For example, New Century Financial's Internet-based loan submission and pre-approved system called FastQual.
11. On occasion, a trust Special Purpose Vehicle (SPV) is formed as a distinct legal structure that issues the securities.
12. See Adam B. Ashcraft and Til Schuermann, "Understanding the Securitization of Subprime Mortgage Credit," Federal Reserve Bank of New York, Staff Report No. 318, March 2008. This paper identified five frictions among key participants including investor, issuer, borrower, lender, rating agency, and servicer. These frictions involve moral hazard, conflicts of interest, and principal-agency issue, and contributed to the subprime crisis.
13. See Laurie Goodman, Shumin Li, Douglas J. Lucas, Thomas A. Zimmerman, and Frank J. Fabozzi, *Subprime Mortgage Credit Derivatives* (Hoboken, NJ: John Wiley & Sons, 2008), p. 312.
14. See Benjamin J. Keys, Tanmoy Mukherjee, Amit Seru, and Vikrant Vig, "Did Securitization Lead to Lax Screening? Evidence From Subprime Loans," Sorin Capital Management Working Paper, April 2008.
15. There is also a risk of curtailment in which a mortgage borrower chooses to pay more than the required monthly payment.
16. There is a large body of academic and industry research on mortgage prepayment risk. For details about modeling prepayment risk, see Frank Fabozzi, Anand K. Bhattacharya, and Williams S. Berliner, *Mortgage-Backed Securities: Products, Structuring, and Analytical Techniques* (Hoboken, NJ: John Wiley & Sons, 2007), pp. 45–96.

17. This accounted for 76.3% of new MBS issued during the second quarter of 2008. See "Inside The GSE," *Inside Mortgage Finance, Inc.*, October 2008.
18. Generally speaking, there are three major sectors for the private-label industry: subprime, Alt-A, and jumbo loans.
19. Another important factor was continuously declining interest rates through actions of the Federal Reserve.
20. Joseph R. Mason and Joshua Rosner, "How Resilient are Mortgage Backed Securities to Collateralized Debt Obligation Disruptions?" Paper presented at Hudson Institute, February 15, 2007.
21. Matthew Philips, "The Monster that Ate Wall Street," *Newsweek*, October 6, 2008. According to the Bank of International Settlements (BIS), the total notional amount of credit default swaps was \$57.9 trillion in December 2007. See Edward Vincent Murphy, "Credit Default Swaps: Frequently Asked Questions," CRS Report for Congress, July 30, 2008.
22. Senate Agriculture committee chair Tom Harkin has suggested banning the product altogether. See Dan Freed, "Regulation Helps Exchanges, Hurts Banks," *TheStreet.com*, October 28, 2008.
23. For a business-oriented discussion about the CDS, see Michael Crouhy, Dan Galai, and Robert Mark, *Risk Management* (New York: McGraw-Hill, 2001), pp. 452–455, and for a more technical treatment see Christian Bluhm, Ludger Overbeck, and Christoph Wagner, *An Introduction to Credit Risk Modeling* (Chapman & Hall/CRC Financial Mathematics Series, 2003), pp. 214–218.
24. See Goodman, Li, Lucas, Zimmerman, and Fabozzi, *Subprime Mortgage Credit Derivatives*, pp. 128–131.
25. Gretchen Morgenson, "Arcane Market Is Next to Face Big Credit Test," *New York Times*, February 2, 2008.
26. The reason for this is that the seller of the protection in conjunction with a CDS transaction is said to possess a "long position" in the CDS and its underlying credit, whereas the buyer of the protection has a "short position" relative to the CDS and the underlying credit.
27. Janet Morrissey, "Credit Default Swaps: The Next Crisis?" *Time*, March 17, 2008.
28. *Ibid.*
29. This is also called to rate "through the cycle," see S&P Credit Ratings, "Rating Methodology: Evaluating the Issuer," New York, September 2001, p. 41.
30. See Barry Eichengreen, "Thirteen questions about the subprime crisis," Working Paper, University of California, Berkeley, January 2008.
31. MSAC 2006 Heb Bloomberg, from Louis Perwein and Haiou Zhou, Center for Community Capital, University of North Carolina, April 2008. For Alt-A MBS, 92.9% were rated as AAA.
32. Martin Neil Baily, Douglas W. Elmendorf, and Robert E. Litan, "The Great Credit Squeeze: How It Happened, How to Prevent Another," Discussion Paper, Brookings Institution, May 21, 2008, p. 118.
33. However, the rating agencies contend that their ratings were never intended as a substitute for investor's own research to evaluate risk.

34. Rep. Henry A. Waxman, "Credit Rating Agencies and the Financial Crisis," Opening Statement, Committee on Oversight and Government Reform, United States House of Representatives, October 22, 2008.
35. See Anita Willis-Boyland, "Riding Herd on Subprime," *Mortgage Banking*, May 1997. A decade ago, rating agencies learned that borrower capacity (front- and back-end debt ratios) and capital (minimum two months of payment reserves not including cash to close the loan) were important additional criteria. While some models that emphasized credit scores and LTV held up better in markets that avoided declines in home prices, they were still vulnerable to that violation in their assumption that credit scores and LTV were largely sufficient to measure risk.
36. See Frank L. Raiter, "Credit Rating Agencies and the Financial Crisis," Written Statement, before the Committee on Oversight and Government Reform, U.S. House of Representatives, October 22, 2008.
37. For details about the semianalytic approach, see Moody's KMV, "An Overview of Modeling Credit Portfolios—Modeling Methodology," February 14, 2008, pp. 10–11. See also John Hull and Allen White, "Valuation of a CDO and an nth to Default CDS without Monte Carlo Simulation," *Journal of Derivatives* 2 (2004): 8–23.
38. See Andrew Kaplan, Amnon Levey, and William Morokoff. "Analyzing a CDO Tranche within a Credit Portfolio," *Moody's Whitepaper*, September 2006.
39. For detailed discussion of the two stages, see Ingo Fender, and John Kiff, "CDO rating methodology: Some thoughts on model risk and its implications," BIS Working Papers No. 163, November 2004.
40. For a detailed discussion, see William Morokoff, "Simulation Methods for Risk Analysis of Collateralized Debt Obligations," WSC 03: Proceedings of the 37th conference on Winter simulation, December 2005.
41. See A. Saunders and L. Allen, *Credit Risk Measurement*, 2nd ed. (New York: John Wiley & Sons, 2002), pp. 86–92.
42. See Moody's KMV, "An Overview of Modeling Credit Portfolios Methodology," February 14, 2008.
43. See JoEtta Colquitt, *Credit Risk Management: How to Avoid Lending Disasters and Maximize Earnings* (New York: McGraw-Hill, 2007), pp. 280–282.
44. This model was first proposed by Jarrow & Turnbull (1995), and enhanced by Duffie and Singleton. See Robert A. Jarrow and Stuart Turnbull, "Pricing Derivatives on Financial Securities Subject to Credit Risk," *Journal of Finance* 50 (March, 1995). See also Darrell Duffie, and Kenneth J. Singleton, *Credit Risk-Pricing, Measurement, and Management* (Princeton, NJ: Princeton University Press 2003).
45. For a detailed discussion on the application of asset pricing and valuation, see Svetlozar T. Rachev, John S.J. Hsu, Biliana S. Bagasheva, and Frank J. Fabozzi, *Bayesian Methods in Finance* (Hoboken, NJ: John Wiley & Sons, 2008).
46. Martin Neil Baily, Douglas W. Elmendorf, and Robert E. Litan, "The Great Credit Squeeze: How It Happened, How to Prevent Another," Discussion Paper, Brookings Institution, May 21, 2008, p. 118.

47. See Frank L. Raiter, "Credit Rating Agencies and the Financial Crisis," Written Statement, before the Committee on Oversight and Government Reform, U.S. House of Representatives, October 22, 2008.
48. KPMG, "Beyond the credit crisis: the impact and lessons learned for the investment managers," July 2008.
49. See Laurie Goodman, Shuman Li, Douglas J. Lucas, Thomas A. Zimmerman, and Frank J. Fabozzi, *Subprime Mortgage Credit Derivatives* (Hoboken, NJ: John Wiley & Sons, 2008), p. 316.
50. KPMG, "Beyond the credit crisis: the impact and lessons learned for the investment managers," KPMG Financial Services White Paper, July 2008.
51. For detailed discussion on how conflicts of interest can affect the objectivity of analysis or ratings, see International Organization of Securities Commissions, "Report on Analyst Conflicts of Interest," September, 2003.
52. See Standard & Poor's, "Progress Update: S&P's steps to further manage potential conflicts of interest, strengthen the rating process, and better serve the markets," April 10, 2008.
53. For some obstacles to the rating reform, see Baily, Elmendorf, and Litan, "The Great Credit Squeeze," pp. 120–121.
54. For a full explanation of the dynamic conditional process (DCP) see Clark Abrahams and Mingyuan Zhang, *Fair Lending Compliance: Intelligence and Implications for Credit Management* (Hoboken, NJ: John Wiley & Sons, 2008), pp. 151–168.
55. Grid computing provides an innovative, strategic approach to building and managing a lower-cost IT infrastructure based on commodity computing hardware that can flex to meet rapidly changing and growing computing requirements. Grid computing offers a cost-effective solution for customers who want to accelerate the processing or increase the scale or scope (number of users, size of data sets, frequency of analysis).
56. Model management is all about enabling processes to effectively manage and deploy analytical models by delivering all the necessary functionality for each stage of the model life cycle. This makes it easier to conduct the necessary collaboration across departments and internal agencies in order to derive ROI from analytics. Project management capabilities include documentation for both the data and the decision models as they are pushed to operational production, with extensive tracking, validating, auditing reports produced along the way.
57. Abrahams and Zhang, *Fair Lending Compliance*, Exhibit 7.17, pp. 292–293.
58. *Ibid.*, Exhibit 7.20, pp. 295–296.
59. Chris Matten, *Managing Bank Capital—Capital Allocation and Performance Measurement* (New York: John Wiley & Sons, 2000), p.190. Table 11.1 shows AA-rated bonds having a higher default rate than A-rated bonds at the one year vintage point.
60. *Ibid.*, p. 190. The last column of Table 11.1 provides average cumulative default probabilities for corporate bonds for the period 1973–1997 sourced from Moody's Investor Service.
61. Anita Willis-Boylund, "Riding herd on Subprime," *Mortgage Banking*, May 1997.

62. CUSIP is an acronym for Committee on Uniform Security Identification Procedures. It is owned by the American Bankers Association and operated by Standard & Poor's.
63. In some lending institutions, separate instances of the loan booking system are used in separate regions or states, which means that a region or state identifier also needs to be appended. In short, lenders need to come up with a unique identifier that can then be associated with their lending institution code to make unique identification possible.
64. Building in this intelligence can be accomplished either through a coding algorithm that can accept an alphanumeric string of digits and decipher it, or by designating a position in the string of digits where the transaction contour will reside so it can be easily retrieved.
65. See Abrahams and Zhang, *Fair Lending Compliance*, pp. 291–297, for a discussion and examples of how having a separate loss forecast for each segment proves beneficial.
66. See Adam B. Ashcraft and Til Schuermann, “Understanding the Securitization of Subprime Mortgage Credit,” Federal Reserve Bank of New York Staff Report No. 318, March 2008.
67. Financial innovation can push economic volatility in different directions for several reasons, see Douglas W. Elmendorf, “Financial Innovation and Housing: Implications for Monetary Policy,” Working Paper, The Brookings Institution (April 21, 2008).
68. Markus K. Brunnermeier, “Deciphering the 2007–08 Liquidity and Credit Crunch,” *Journal of Economic Perspectives* (forthcoming).
69. Governor Frederic S. Mishkin, On “Leveraged Losses: Lessons from the Mortgage Meltdown,” at the U.S. Monetary Policy Forum, New York, New York, February 29, 2008.





## Crisis Intervention and Prevention

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*Capitalism without failure is like Christianity without hell.*

—WARREN BUFFETT

In Chapter 1 we examined the causes of the financial crisis. We found that there were three primary causal drivers: flawed risk management, lack of transparency, and greed. In this final chapter, we discuss how the current crisis can be addressed and how future crises can be avoided through improved lender internal controls, strengthened regulation, and a local-to-global credit risk monitoring system that fosters greater transparency and reconnects the broken mortgage lending and investment value chain that spans borrowers, lenders, and investors.

As for greed, the solution is less clear, but what is readily apparent is the moral hazard that incentive and information asymmetries have created in the originate-to-distribute model adopted by mortgage lenders. This has been especially true in the Alt-A and subprime markets. Simply put, the people who make the loans are not the same people who have to collect on them if they sour. *Incentive asymmetries* abound. One such asymmetry arises due to a lack of accountability and strong compensation structure, whereby most sales forces in a lending institution are willing to risk the possibility of large losses for the firm that they will not have to bear so that they can make significant gains for the firm that they will fully share. Since

rating agencies are retained by issuers of securities, and not investors, they also operate under an incentive asymmetry. Even regulators, who someday may seek highly compensated employment in the very industry they are overseeing, operate in somewhat of an incentive asymmetry. A major *information asymmetry* arises when loans are sold to the secondary market and repackaged through very complicated processes, to the point where the investor who holds the credit risk for the mortgage-backed securities (MBS) or collateralized debt obligations (CDO) does not possess sufficient knowledge, much less thorough knowledge (as possessed by the originating loan underwriters) to effectively balance risk and reward.

Government bailouts create an incentive asymmetry for any enterprise that is deemed too big or too connected to fail as the enterprise enjoys all of the after-tax profits of its risk taking, but only bears a fraction of the losses in the event of a massive failure. Many argue that those firms and their management who bear responsibility for the crisis should suffer the consequences of their actions. In the current financial crisis, some firms like AIG and Citibank have been rescued,<sup>1</sup> while others like Lehman Brothers, Wachovia, Washington Mutual, and Merrill Lynch have faced forced mergers, government takeover, or bankruptcy. The fallout associated with these failures has been losses for shareholders, and financial hardship, even ruin, for their employees. For millions of borrowers, failures in both loan underwriting and the borrowers' ability to make better choices have resulted in foreclosures. For rating agencies and the government-sponsored enterprises (GSEs), their failures in internal controls and risk evaluation have resulted in improper ratings for securities and pools of distressed loans. Finally, for investors, overreliance on flawed ratings and failure to perform more careful asset allocation have resulted in staggering losses. Perhaps a silver lining relative to recent financial failures is that the fallout from pervasive flaws in our financial system is so massive that there is now sufficient motivation, priority, and funding to take a more reflective, fundamental, and comprehensive approach to properly address them.

The immediate questions before policymakers and legislators are

- How to effectively intervene in the current crisis in order to mitigate the losses and stabilize the market and economy?
- What regulatory and legislative changes are needed to prevent any reoccurrences?



This chapter discusses policy implications and applications of the comprehensive credit assessment framework (CCAF) to crisis intervention and prevention. We first review some pertinent lending regulations. We then discuss the key elements for crisis intervention while addressing the concerns about helping those who are genuinely in need. To prevent future financial crises we propose a new framework that can better address the key issues, including improving transparency, financial literacy, and monitoring both risk and greed. We describe how CCAF can help achieve the above goals and, in particular, how to build an effective loan monitoring system from the regulator's perspective that also benefits borrowers, lenders, and investors. Examples are used to illustrate potential applications to facilitate crisis intervention and prevention. We also discuss the applicability of CCAF from a global perspective. We end this book with a discussion of our vision of how credit markets will operate in the future, bolstered by more information, far greater transparency, better integration of information at all levels, strong predictive analytics, expanded process validation, and a much improved early warning capability that can isolate and surface risk problems far in advance to limit risk and head off a crisis scenario.

## LENDING-RELATED REGULATIONS

The financial industry in general and mortgage industry in particular, are highly regulated. In preparation for our discussion of how a regulatory response can aid crisis intervention and prevention, we first review some of the main existing regulations.

### Basel II

Issued by the Basel Committee on Banking Supervision in June 2004, Basel II established an international standard that all banking regulators can apply to determine how adequately banks are capitalized, given the financial and operational risks that they face day-to-day. It accomplishes this through very rigorous risk and capital management requirements for all asset classifications. These requirements were designed to make banks hold capital reserves that are appropriate to the risk the bank takes on through its lending and investment practices (that is, the greater the risk exposure, the greater the amount of capital that is required to maintain

solvency and stability). It has been proposed recently that capital adequacy requirements shift from focus on the *levels* of risk-weighted assets to their *rates of growth* so that capital and liquidity are maintained at higher levels during periods where lending and asset prices are rising quickly and relaxed in a cyclical downturn.<sup>2</sup>

Market economies, consumer demand, low interest rates, and innovation spurred the growth of the secondary market for mortgage-backed securities in the late 1980s and thereafter (first pass-through certificates, then CMOs, Real Estate Mortgage Investment Conduits (REMICs), Collateralized Mortgage Obligations (CMOs), and structured investment vehicles). The original 1988 Basel Accord certainly did nothing to discourage banks from shifting activities off balance sheet, which led to the *originate to distribute* model discussed in Chapter 5. However, as Charles Goodhart quipped in his recent paper on the crisis, the model might more accurately be referred to as the “originate and *pretend* to distribute model,”<sup>3</sup> because many banks tended to retain a lot of the risk and what was widely distributed in those instances was fear, uncertainty, and doubt! Typically banks assume that a loan, once sold, is gone for good. In practice, however, they may later feel compelled to repurchase securities that they previously sold. Going forward, it is a safe bet that regulators will take into greater account the riskiness of a bank’s overall portfolio, including contingencies, when establishing capital requirements. This could reduce the incentive to shift riskier assets into a special purpose vehicle or conduit, insofar as the probability that the position will come back onto the bank’s balance sheet is explicitly accounted for in the analysis. At present it is unclear how much discretion banks will exercise in estimating that likelihood. We note that in April 2008 the Basel Committee on Banking Supervision proposed new regulations that seek to impose higher charges for banks that manage asset-backed securities.<sup>4</sup>

## Community Reinvestment Act

The Community Reinvestment Act (CRA), a law passed in 1977, revised in May 1995, and implemented by Regulation BB, was intended to encourage depository institutions to help meet the credit needs of all segments of the communities in which they operate, including low- and moderate-income (LMI) neighborhoods, consistent with safe and sound

banking practices. The only recent amendment of interest to CRA occurred in 2005 relative to the definition of an institution's assessment area, taking into account the Office of Management and Budget's new designation of metropolitan divisions within Metropolitan Statistical Areas having 2.5 million plus residents. The Detroit area saw the most controversy due to a flip-flop of areas previously designated as moderate income to be middle income, and vice versa. The smallest feasible assessment area for a bank would simply be the census tracts that its main office, branches, and deposit-taking ATMs are located in. Practically speaking, assessment area boundaries fall along municipality boundaries in which the bank operates (for instance, whole cities, counties, MSAs, and so on). Business, farm, and community development lending data, summarized by census tract, are filed annually according to Regulation C of the Home Mortgage Act.

The real bite in this piece of legislation comes from the fact that a bank's CRA record *directly impacts* its applications for opening new branches and ATMs, and regulatory approval for any proposed mergers and acquisitions. The CRA requires periodic evaluation of each bank's record in helping its *entire* community. Frequency of examination depends on the last examination rating and any more recent developments that may cause regulatory concern; CRA examinations are conducted by the federal agencies that are responsible for supervising depository institutions: the Board of Governors of the Federal Reserve System (FRB), the Federal Deposit Insurance Corporation (FDIC), the Office of the Comptroller of the Currency (OCC), and the Office of Thrift Supervision (OTS). In addition to their Home Loan Disclosure Act (HMDA) and CRA data, banks can optionally report on the following consumer loans:

- Motor vehicle loans
- Credit card loans
- Home equity loans
- Other secured consumer loans

For these optional categories, banks must provide data collected on loans originated and purchased during the evaluation period. This data must include a unique numeric identifier, geography, borrower income, loan size, and date. We advocate inclusion of the CCAF handle and CCAF holistic score for these consumer loans.

As discussed in Chapter 4, CRA embodies several noble causes, including promoting community transformation and development, job creation, and helping to improve home ownership in the United States. Community development actually has four components, as defined in the Code of Federal Regulations, specifically 12 CFR 25.12(h), as detailed below:

1. Affordable housing for low- or moderate-income people
2. Community services targeted to low- or moderate-income people
3. Promoting economic development by financing small businesses or small farms
4. Revitalization or stabilization of low- or moderate-income geographies

“Over the last decade, CRA helped spur a doubling of lending by banking institutions to small businesses and farms, to more than \$2.6 trillion, and a tripling of community development lending to \$371 billion. In addition, CRA projects often act as catalysts for other investments, for job creation, and for housing development, and can leverage public subsidies, perhaps as much as 10 to 25 times, by attracting additional private capital.”<sup>5</sup> There is no question that CRA has played an important role in increasing home ownership in the United States since the late 1980s, and it became increasingly influential from 2001 to 2005.<sup>6</sup> Improving home ownership was considered as a way to both help neighborhoods in need and to stimulate a slow economy. Subprime lending became a fast vehicle to achieve those goals.

It has been argued that CRA has encouraged, and motivated, banks to create innovative and/or flexible loan products and credit-related programs targeted to low- and moderate-income individuals and geographies. Proponents of CRA assert that “not only has CRA not caused this crisis, it has helped build our nation’s economy during the past three decades, demonstrating that investment in low- and moderate-income communities pays off for all of us.”<sup>7</sup> OCC Chairman John Dugan has categorically rejected claims that CRA is partly responsible for the subprime mortgage lending abuses or the broader ongoing credit crisis. In response to CRA criticism he has said “Indeed, the lenders most prominently associated with subprime mortgage lending abuses and high rates of foreclosure are lenders not subject to CRA. A recent study of 2006 Home Mortgage

Disclosure Act data showed that banks subject to CRA and their affiliates originated or purchased only six percent of the reported high cost loans made to lower-income borrowers within their CRA assessment areas.”<sup>8</sup>

Over the past couple of years, the U.S. home ownership rate has fallen somewhat. By the first quarter of 2008, the overall rate dropped to 67.8% from its 2005 peak of 69.1%, a drop of 1.44 million units, given the occupied stock of 110.8 million occupied units at the end of April 2008 (Census, 2008).<sup>9</sup>

### **Equal Credit Opportunity Act**

Enacted in 1974 and implemented via Regulation B, the Equal Credit Opportunity Act (ECOA) makes it unlawful for a lender to discriminate against a loan applicant on the basis of gender and marital status. In 1976 Congress passed amendments to ECOA and effective March 23, 1977, race, color, religion, national origin, age, being a recipient of public assistance, or the exercise of rights under the Consumer Protection Act were added as prohibited bases. The purpose of ECOA is to promote the availability of loans to all creditworthy applicants; to prohibit discrimination; to provide notification of adverse action to declined credit applicants; and to collect, retain, and report information. Up until 1977, credit scoring technology was largely unregulated by the government. Anyone could construct a system using any factors they wanted and lenders could use any system they thought would benefit them.

ECOA divides all credit underwriting systems into two categories: (1) judgmental systems and (2) demonstrably statistically sound and empirically derived credit scoring systems. Only systems that comply with very detailed regulatory requirements fall into category 2.<sup>10</sup> All other approaches to loan underwriting are classified as judgmental.

Due to the hybrid nature of the new lending system, it is unclear if the emergence of this new technology will require a change to ECOA to allow for a third category of underwriting system, or if CCAF will fall into one of the two existing classifications. Only time will tell, but our position is that since it is empirically derived, statistically sound, and also supported by sound credit principles and common sense, it really deserves to be in a newly defined “hybrid” category.

System validation is a key regulatory requirement for credit scoring systems, both at system development time and after the system is installed. This is because credit scoring systems' ability to predict the creditworthiness of loan applicants diminishes over time to the point where eventually they require replacement. System validation seeks to determine when this is necessary.<sup>11</sup> A key property of the new system is that it is adaptive and as such is continuously updating and self-validating. Further, it must submit to and satisfy qualitative, in addition to quantitative, validation methods that are more stringent and reliable than those used to assess the effectiveness of credit scoring systems.

## **Home Mortgage Disclosure Act**

Enacted by Congress in 1975 and implemented by the Federal Reserve Board's Regulation C, HMDA mandates annual reporting of public dwelling-secured loan data by loan originators. The purposes of HMDA are to

- Determine the extent to which financial institutions are serving the housing needs of their communities.
- Assist public officials in making public sector investment to attract private investment to areas where it is most needed.
- Help identify possible discriminatory lending patterns in support of antidiscrimination law enforcement.

In 2002, HMDA was amended to include the gathering and reporting of high-priced loans beginning in 2004. The initial triggers were 3% over the comparable Treasury yield for first lien mortgages, and 5% for second lien mortgages. These triggers have been changed, as noted in the following discussion of the Home Ownership and Equity Protection Act. We recommend that HMDA be amended to include the handle identifier, the CCAF holistic credit score, and channel designation in the core data elements that lenders are required to report on an annual basis for each loan application they take. Inclusion of these few elements would greatly expand the information available to assess and compare lending areas across communities and lending institutions. It would greatly improve the ability of regulators to define the performance context for a lending institution relative to the CRA Examination.

## Home Ownership and Equity Protection Act

The Home Ownership and Equity Protection Act (HOEPA), which took effect in 1994, amended the Truth in Lending Act (Regulation Z) and set requirements for loans having high rates or fees in an effort to curb unfair and deceptive practices in mortgage and home equity lending. On July 14, 2008, the Federal Reserve Board adopted final rules amending HOEPA that will become effective October 1, 2009.<sup>12</sup> With few exceptions of greater restriction, the final rule mirrored the proposal made in December 2007. The scope of the definition of high priced mortgages (HPMs) was intended to capture all of the subprime market tiers below Alt-A, and not to include prime dwelling-secured mortgages and home equity loans.<sup>13</sup> Previously, the HOEPA trigger for HPMs was 8% above the comparable maturity Treasury security for first liens and 10% for second liens. The rate spread calculation itself was changed by replacing the use of Treasury securities having comparable periods of maturities with the average prime offer rate<sup>14</sup> for a comparable transaction<sup>15</sup> as of the date the interest rate is set.<sup>16</sup> The new trigger spread for reporting for HPMs under HOEPA, and also under HMDA, is 150 basis points (bp) for first lien mortgages on a dwelling and 350 bp for loans secured by a subordinate lien on a dwelling. For 2009, loans are flagged as a HOEPA loan when the total points and fees paid by the borrower exceed the greater of \$583 or 8% of the loan amount. Some additional rules for HPMs under the new regulation are

- **Ability to Repay.** Prohibits lenders from extending credit without considering the borrowers' ability to repay the loan from income, or from other sources besides the collateral.
- **Verification of Income and Assets.** Requires lenders to verify borrower income and assets by means of third-party documents.
- **Prepayment Penalties.** Prohibits prepayment penalties where the payment can change in the first four years of the loan's term. Otherwise, prohibits prepayment penalties beyond the first two years of the loan's term.
- **Escrow.** Lenders must establish escrow accounts for taxes and insurance for first lien mortgages on the consumer's principal dwelling.
- **Inaccurate Appraisals.** Prohibits lenders and brokers from coercing or influencing real estate appraisers from misrepresenting the value of the property.

## Real Estate Settlement Procedures Act

Passed by Congress in 1974 and administered by the Department of Housing and Urban Development (HUD), this law mandates that consumers be provided with information on the nature and costs of the mortgage settlement process and that borrowers be protected from unnecessarily high settlement costs. Specific objectives of the Real Estate Settlement Procedures Act (RESPA) are to (1) provide timely disclosures of settlement costs to applicants so they can become better shoppers for settlement services, (2) eliminate kickbacks and referral fees, (3) ensure amounts borrowers must place into escrow accounts are proper and provide an initial escrow account statement, (4) provide advance disclosures about an institution's mortgage servicing portfolio, and (5) provide error resolution.

RESPA reform has been around since the early 1990s and HUD published its final rule on November 17, 2008, on changes that have been in the works for nearly three years and generated in the neighborhood of 12,000 comments since HUD's release of the proposed rule on March 14, 2008.<sup>17</sup> The changes are sweeping and designed to foster greater *transparency, understanding, and comparison shopping*. Some of the more important components of the final RESPA rule are

- A clear and easy-to-understand *Good Faith Estimate* (GFE) that specifies
  - The loan term
  - The way interest is calculated and whether the rate is fixed
  - Any prepayment penalties if the borrower decides to refinance at a later date
  - Balloon payments
  - Total closing costs
- Disclosure of broker yield spread premiums (YSPs) as a "credit" to the lender or origination fee to the broker.
- HUD-1 Settlement Statement that makes comparison shopping for mortgages easy for consumers, especially with respect to closing costs and loan terms per the GFE by summarizing costs into broad categories (this eliminates miscellaneous junk fees) and by prominently positioning the total estimated settlement costs on the top page. Also specific lines on the final HUD-1 will include a line cross-reference to the GFE.



- Closing cost items that can change at settlement are restricted and in the case of fees, HUD limits the amount of change via specified tolerances.

HUD estimates that the impact of the strengthened RESPA regulation will amount to approximately \$668 savings in total closing costs.<sup>18</sup> While some of the new provisions go into effect on January 16, 2009, the new GFE and revised HUD-1 forms will not be required until January 1, 2010.

### Truth-in-Lending Act

Passed by Congress in 1968 and implemented by Regulation Z, the purpose of this regulation is to promote the informed use of consumer credit by requiring disclosures about its terms and cost. The regulation gives consumers the right to cancel certain credit transactions that involve a lien on a consumer's principal dwelling, regulates certain credit card practices, and provides a means for fair and timely resolution of credit billing disputes. The regulation does not govern charges for consumer credit. The regulation requires a maximum interest rate to be stated in variable-rate contracts secured by the consumer's dwelling. It also imposes certain limitations on home equity plans.

### Other Important Laws and Regulations

In the area of predatory lending enforcement, Regulation AA has direct applicability, and at least 31 states have predatory lending statutes.<sup>19</sup>

- **Unfair or Deceptive Acts or Practices (UDAP).** Regulation AA sets forth consumer complaint procedures, and it defines unfair or deceptive acts or practices in connection with consumer lending and makes them unlawful. The Fair Housing Act and the previously mentioned Equal Credit Opportunity Act are the primary laws that apply in enforcement relating to fair lending violations. Federal regulation imposing greater uniformity in the definition and prosecution of abusive subprime lending may be preferable to a patchwork of potentially inconsistent state regulations, or more nebulous standards of behavior. Borrowers, moreover, are more likely to understand and exercise their rights if they are protected by uniform federal standards.

- **Fair Housing Act of 1968 (Title VIII of the Civil Rights Act of 1968).** This law prohibits discrimination in the sale, rental, and financing of residential dwellings and in other housing-related transactions against consumers based on race, color, national origin, gender, religion, familial status, and disability.

Later, we will discuss how some of the more applicable regulations we reviewed in this section can be implemented more effectively by leveraging on particular features associated with the new lending system.

## CRISIS INTERVENTION

### Current Government Responses

Market turmoil and the collapse of several large financial institutions have led to increased calls for legislative and regulatory action to intervene in the current crisis. The federal government and regulatory agencies have rolled out a set of plans to improve the current system. On October 3, 2008, the Emergency Economic Stabilization Act of 2008, commonly referred to as a bailout of the U.S. financial system, was passed by the U.S. House of Representatives to authorize the Secretary of the Treasury to spend up to \$700 billion to purchase distressed assets, especially mortgage-backed securities, from the nation's banks and to raise the limit on deposit guarantees by the FDIC for some period of time. Since the bill was signed into law, the treasury secretary has been criticized for changing the focus of the program from buying up distressed mortgage assets to using a large chunk of the \$700 billion to taking ownership stakes in the banks.<sup>20</sup> Treasury Secretary Paulson explained his reluctance to directly purchase distressed mortgages in the following way: "In designing broad-based programs, there is a balance to getting money to those who need it as opposed to those who don't need it."<sup>21</sup> Another proposal by the Federal Reserve Board involves purchasing distressed mortgage-backed securities.

The near-collapse of the mortgage market, rising delinquencies and foreclosures, and impairment of large financial institutions such as AIG, Fannie Mae, and Freddie Mac, have combined to create turmoil in broader financial markets and the global economy, with no real end in sight. Various questions have been raised about corrective actions that the federal government and agencies should be taking in order to steer

the economy from a deep recession.<sup>22</sup> On the global scene there are several good recent reports from a broad array of experts that deal with aspects of financial system reform. One is a G7-endorsed report put out by The Financial Stability Forum, a body whose purpose is to oversee global financial stability, which makes dozens of recommendations.<sup>23</sup> Relative to regulation of financial derivatives, mortgage-backed securities, and counterparty risk there is a report by the Institute of International Finance.<sup>24</sup> Relative to the financial system in the United States, the Department of the Treasury issued a report on its views for financial system modernization, and there was a similar forward-looking report that came out in the United Kingdom.<sup>25</sup>

While the imperative to infuse capital to boost liquidity and keep markets open is a vital first step, there are concerns relative to fixing the flaws that still exist in the financial system that allowed the crisis to blossom and to assisting the victims of this crisis to regain some stability and semblance of normalcy. Of immediate, and ongoing, concern is the identification of the segments of borrowers, lenders, or investors who should be helped or rescued.<sup>26</sup> We discuss primary aspects of managing the fallout relative to three key questions in the following section.

## Helping Borrowers, Lenders, and Investors

1. How can the government help borrowers and mortgage servicers to minimize foreclosures?

- **Sizing the Problem.** First, what borrower and loan information needs to be assembled to assess the aggregate financing need (for instance, loan origination data, the loan payment schedule, past and projected payment increases and repayment history, current and projected property valuation, current and projected past due payment status, current borrower financial capacity and capital resources, and so on)? Second, what are the borrower/loan qualification criteria that can be applied consistently and fairly to enable borrowers to obtain assistance? After these two questions have been addressed, the loan records can be categorized and tallied to determine how many loans (1) do not require assistance currently, but may in the future, (2) require assistance and can be helped, (3) are in distress, but are too far behind and too deep in debt for help to make any difference in the outcome.

- **Loan Qualification.** Near term, how can the government systematically qualify those financially distressed mortgage holders who are truly in need of loan modification? Certainly a financial argument can be made that the bank, borrower, and investor may all be better off if the net present value of the modified loan is likely to be greater than would result from an imminent foreclosure; then the loan should be considered as a candidate. That is not to say that there may be other factors that need to be weighed. For loans held in investor-owned pools, it has been suggested that loan modification be considered relative to whether it is in the best interests of all investors without regard to the specific impact on any particular class of investors. In the case of a CDO, this would help to avoid complications arising from having to gauge the impacts on a tranche-by-tranche basis.
- **Loan Modification Options.** What sorts of accommodation are allowed for borrowers who qualify and are unable to meet the terms of their loan agreement? Should there be a limit on the amount and percentage of monthly payment relief that is allowable? If a borrower is living in a home that is far more than he could ever afford, then no amount of help will be sufficient.
- **Regulation.** Longer term, what regulatory changes in the mortgage industry need to be made?

2. What are mortgage-backed securities worth today, and how can the market for them be restored?

- **Rating and Valuation.** How can securities be better rated and accurately valued under normal market conditions?
- **Safety and Soundness.** How should the government improve its oversight of rating agencies and strengthen regulation of financial derivatives and mortgage-backed securities?

3. Which financial institutions are at greatest risk of failure due to exposure to toxic and illiquid assets?

- **Exposure Measurement.** Which borrowers and loans are at risk and how sufficient is the collateral liquidation value to cover potential losses? Which securities held, or special purpose vehicles (SPVs) created, are underperforming to the extent that they harbor significant losses, legal, or reputational risks?

- **Concentration Assessment.** How should individual loans be segmented and then aggregated to identify portfolio concentrations posing high risk?
- **Capital Requirement.** What additional level of capital is required based on the exposures and concentrations identified relative to loans, securities, and SPVs that are at higher-than-normal risk?
- **Portfolio Monitoring.** How can regulators monitor exposures and concentrations going forward in order to spot problems early on and avoid future crises?

We begin with what is being done and what more can be done for the borrowers. We illustrate how the new lending system can play an important role in keeping people in their homes.

## Foreclosure Prevention

Increased foreclosures have had significant negative impact on households and neighborhoods.<sup>27</sup> Reducing the rate of preventable foreclosures would promote economic stability for households, neighborhoods, and the nation as a whole. Although lenders and servicers have scaled up their efforts and adopted a wider variety of loss-mitigation techniques, more can, and should, be done. The fact that many troubled borrowers have little or no equity suggests that greater use of principal write-downs or short payoffs, perhaps with shared appreciation features, would be in the best interest of both borrowers and lenders. This approach would be facilitated by allowing the FHA the flexibility to offer refinancing products to more borrowers.<sup>28</sup>

There have been various government responses for preventing and minimizing foreclosures. The Foreclosure Prevention Act of 2008 (FPA) is designed to help borrowers keep their homes that are facing foreclosures and to stabilize the overall housing market in light of the foreclosure crisis. The goals of this bill are (1) assisting communities devastated by foreclosures; (2) providing pre-foreclosure counseling for families in need; and (3) enhancing mortgage disclosure.<sup>29</sup> And the government and the mortgage industry are preparing to unveil a plan to hasten the process for renegotiating hundreds of thousands of delinquent loans held by Fannie Mae and Freddie Mac. Mortgage holders would have to be at least three months behind on their home loans and owe 90% or more

than the home is currently worth in order to qualify under the plan. There would be a reduction in the interest rate to ensure that borrowers would have a housing expense-to-income ratio (front-end debt ratio) of 38% or less. Other options for borrowers under the plan include term extensions and deferral of principal.<sup>30</sup>

The Federal Reserve System, in particular, has put a lot of effort into reducing preventable foreclosures with their strength in the area of analytical and data resources. One of the main focuses is sharing relevant and timely data analysis of mortgage delinquencies with community groups and policymakers to efficiently target resources to areas most in need. Federal Reserve Chairman Bernanke suggested that it would help reduce preventable foreclosures if investors acting in their own self-interests were to permit servicers to write down the mortgage liabilities of borrowers by accepting a short payoff in appropriate circumstances. For example, servicers could accept a principal write-down by an amount at least sufficient to allow the borrower to refinance into a new loan from another source. A write-down that is sufficient to make borrowers eligible for a new loan would remove the downside risk to investors of additional write-downs or a re-default. This arrangement might include a feature that allows the original investors to share in any future appreciation.<sup>31</sup>

A key objective of government reaction to the subprime crisis is to improve the long-term affordability of the loans. One milestone is the HOPE for Homeowners Act of 2008, which creates a new, temporary, voluntary program within the Federal Housing Administration (FHA) to back FHA-insured mortgages to distressed borrowers. The new mortgages offered by FHA-approved lenders will refinance distressed loans at a significant discount for owner-occupants at risk of losing their homes to foreclosure. In exchange, homeowners will share future appreciation with the FHA. The program is built on the idea, expressed by Federal Reserve Chairman Bernanke, that creating new equity for troubled homeowners is likely to be a more effective way to avoid foreclosures. New loans will be based on a family's ability to repay the loan, ensuring affordability and sustainable home ownership.<sup>32</sup>

The primary tool to prevent foreclosure is loan modification. Loan modifications involve any permanent change to the terms of the mortgage contract. Loan modification may be the preferred course of action

when the borrower cannot cope with the higher payments associated with a repayment plan. In such cases, the monthly payment is reduced through a lower interest rate, or an extension of the maturity of the loan is granted, or arrearages are capitalized, or a write-down of the principal balance is made. In addition to helping borrowers avoid foreclosure, loan modification has been suggested as an important tool for minimizing losses to investors in subprime MBSs.

Various proposals at the state and federal level have been made to assist existing borrowers who may face delinquency or foreclosure. Mainly those proposals involve financial assistance to borrowers, encouraging loan modifications and negotiation between borrowers and lenders, and education programs to improve borrower's financial literacy. In a speech earlier in 2008, Federal Reserve Chairman Bernanke spoke to foreclosure risk mitigation efforts, saying, "Policymakers and stakeholders have been working to find effective responses to the increases in delinquencies and foreclosures. Steps that have been taken include initiating programs designed to expand refinancing opportunities and efforts to facilitate and increase the pace of loan workouts. Troubled borrowers will always require individual attention, and the most immediate impacts of foreclosures are on local communities. Thus, the support of counselors, lenders, and organizations with local ties is critical."<sup>33</sup>

A large number of subprime or Alt-A loans originated in 2005 and 2006 will reach the reset date in 2008 and 2009. As discussed in Chapter 4, upon loan reset, many subprime borrowers will have to pay for a much higher fixed interest rate, or the adjustable rate,<sup>34</sup> unless the borrowers can refinance or find subsidies (that is, through the FHA) or get their lender to agree to a loan modification.

## NEW FRAMEWORK

We now explain how CCAF can help borrowers and mortgage servicers to minimize foreclosures relative to the areas previously mentioned.

- **Sizing the Problem**

- First, the primary factors for qualifying borrowers for loan modification would need to be specified. For the purposes of illustration we will assume those factors were identified and appear in Exhibit 6.1. For capacity, we recommend using the

EXHIBIT 6.1

**LOSS MITIGATION GENERAL STRUCTURE: RISK RATINGS  
FOR PRIMARY/SECONDARY FACTORS**

Factors	Risk Ratings (Best [1] to Worst [4])			
	1	2	3	4
Payments Behind	At Risk 1–2 Payments	Serious 3–4 Payments	Critical 5–6 Payments	Doubtful 7 or more
Capacity	High	Moderate	Low	N/A
Capital	Strong	Moderate	Low	N/A
Collateral (LTV)	Low 80 or less	Moderate 81–89	Marginal 90–99	High 100 or more
Benefit Ratio	High	Low	N/A	N/A
Secondary Factors	Yes	No	N/A	N/A

same definition as that for our underwriting example (refer to Exhibit 2.5), understanding that the housing expense ratio may be capped at some threshold, say 38%, similar to the government plan for Fannie Mae and Freddie Mac loans mentioned previously. Capital also can be defined as before in Exhibit 2.6, except that we combine the top two categories into a strong rating. For collateral, we use the loan-to-value ratio as the measure with thresholds as defined in Exhibit 6.1, and for the benefit ratio we compute the ratio of the net present value (NPV) of the cash flows over the actuarial life (not contractual) of a pro forma mortgage modification to the net result of a near-term foreclosure. Secondary factors allow for some consistent flexibility relative to any other program qualification parameters. This includes vulnerability to product features and future economic and market conditions. As we noted in Chapter 4 where we discussed subprime mortgage products, some have a built-in repeated payment shock features.

Exhibit 6.1 is analogous to Exhibit 2.14. In this case we have defined the rating scheme such that the ratings are from best to worst. This means that loans that are most at risk will tend to have higher handles and those least at risk will have lower handles. The associated handle score will be defined as the likelihood of foreclosure, based on all of the risk mitigation factors.



- Due to space considerations Exhibit 6.2 does not display the full table of risk mitigation segments, but it is perfectly analogous to the table that appears in Exhibit 2.15. The key point is that there is a unique handle corresponding to each of the 476 combinations of primary risk mitigation factors in this example.
- We then classify all potential loan modification candidates. This will give the size of the problem, based on both the number of loans and dollar amounts. With handle assignments made, the handle distribution of loans will give a good first cut at the problem via the natural risk ranking afforded by the primary factor rating definitions. This common sense, or qualitative, analysis will prove useful in the validation of the loan qualification task and beyond. Concentration patterns can form a basis for early warning of additional future problems in the loan modification pool.
- **Loan Qualification.** Treasury Secretary Paulson expressed concern that assistance be given to those who really need it, versus

EXHIBIT 6.2

**LOSS MITIGATION BORROWER  
SEGMENTS (HANDLES)**

Payment Behind	Capacity	Capital	LTV	Handle Number			
				Benefit Ratio			
				High	High	Low	Low
				Secondary Factor			
				Yes	No	Yes	No
At Risk	High	Moderate	Low	17	18	19	20
At Risk	High	Moderate	Moderate	21	22	23	24
At Risk	High	Moderate	Moderate	25	26	27	28
At Risk	High	Moderate	High	29	30	31	32
At Risk	High	Low	Low	33	34	35	36
At Risk	High	Low	Moderate	37	38	39	40
At Risk	High	Low	Marginal	41	42	43	44
At Risk	High	Low	High	45	46	47	48
At Risk	Moderate	Strong	Low	49	50	51	52
At Risk	Moderate	Strong	Moderate	53	54	55	56
At Risk	Moderate	Strong	Marginal	57	58	59	60
At Risk	Moderate	Strong	High	61	62	63	64

everyone who may want it. Bank of America Chairman, Chief Executive Officer (CEO), and President Kenneth Lewis was quoted in the *American Banker* with similar sentiments, saying, “Foreclosure mitigation programs have to be structured so as not to attract homeowners who don’t need them. Unfortunately this is happening too often, as people who are under water on their loan, but who are able to make their payments, seek the same benefits they’re seeing their neighbors get.”<sup>35</sup> The new framework can alleviate most of the concerns expressed by both gentlemen. It provides the means for systematically qualifying those financially distressed mortgage holders who are truly in need of a loan modification in order to avoid foreclosure. Furthermore, the process we are referring to is entirely straightforward. Unlike credit underwriting, there is no reject inference to contend with in this application of the framework methodology. Loan foreclosure probabilities can be derived after a sample of foreclosed loans has been drawn and the loans have been classified.<sup>36</sup> The identical tables for loan modification decisioning can easily be produced as shown in the detailed example in Chapter 2. The bottom line is that CCAF can build the segmentation scheme and then identify which loan segments (handles) are candidates for the modification of loan terms and which ones are not. The action specified in the corresponding decision table (Exhibit 2.22) will specify “approve” for loans that qualify, “decline” for loans that are not yet in sufficient need. Loans that are too impaired to benefit would be screened and eliminated from consideration during data preprocessing. For declined loans, the reasons for those actions are specified as shown in Exhibit 2.24. In this example, the decision is based on a cut-off probability of foreclosure that could be adjusted as needed.

An alternative to sampling data would be to opt for a rules-based approach. In that case the decisions associated with the combinations of factors would be based on multifactor conditional logic. The identical operational tables and reports associated with the framework would be produced. Once the system was put into operation, data would be captured and used for system updating purposes and periodic system validation.

- **Loan Modification Options.** After sufficient time, it will be possible to analyze which types of loan modifications work best on

a segment-by-segment basis. In this way, the new framework would replace the “approve” and “decline” decisions, with modification recommendations, such as “write-down,” “extend term,” “lower rate,” and so on. The effect of loan modification or refinance on future loan performance will be monitored and reported to the lender, servicer, and investor.

- **Regulation.** In our review of the various regulations we made specific suggestions as to regulatory changes that would prove helpful, including the addition of the handle and CCAF holistic score in annual HMDA filings. We also seek recognition of CCAF as a new method of credit granting that is neither purely judgmental nor credit scoring-based via an amendment to ECOA, or appropriate rule-making in conjunction with it.

We next explain how the risks associated with mortgage-backed securities can be better understood and how the market for them can be restored.

- **Rating and Valuation.** Under normal market conditions we advocate additional investor reporting. We describe this with a detailed example in a later section on financial literacy. Essentially, the handle structure needs to carry through the value chain such that the loan pool handle distribution can be summarized and reported in well-defined segment rating tiers that are already in place at the rating agencies. In this way, investors will not only be able to see how the underlying loans they are investing in are distributed by rating classification, but they can also decipher by the handle identifier what the characteristics of the underlying loans, collateral, and borrowers are in generic terms having standard definitions that can be readily understood. In other words, an investor will know if he is buying into a security where 30% of the underlying loan pool reflects borrowers with no savings, only a fair credit history, that are living paycheck-to-paycheck, with very little equity, and have bought a loan product with built-in payment shock, and are living in a home whose property value tripled in the last five years and is highly vulnerable to future depreciation. We refer to this type of transparency as connecting the borrower to the investor through the handle structure.
- **Safety and Soundness.** Government agencies can improve their oversight of rating agencies and strengthen regulation of financial

derivatives and mortgage-backed securities by requiring that rating agencies adopt a framework that will foster transparency, borrower and investor financial literacy, and provide a window into asset quality and concentration risk exposures that surpasses today's best practices, which have been insufficient to prevent the financial crisis that all have been confronted with in 2008.

Finally we examine how best to determine which financial institutions are at greatest risk of failure due to exposure to toxic and illiquid assets. There are several aspects we need to consider in answering this question.

- **Exposure Measurement.** We advocate a similar approach to determining at-risk loans, borrowers, securities, SPVs, and so on. We assert that the new framework is a natural way to organize and evaluate who or what is at risk. In that context, we can see vulnerability through forward-looking measures so that collateral sufficiency to cover potential losses can be determined. We can also see early-on which loans or securities will likely underperform in the future, even if they are currently performing as expected. Exposures must be identified and quantified, or they cannot be adequately managed.
- **Concentration Assessment.** CCAF affords the means to segment loans and then aggregate them in order to identify portfolio concentrations posing high risk. It is the perfect risk limitation system because it allows the user to enforce caps on the level of loans, either by number or dollar amount, by handle segment. Identifying concentrations is important, but avoiding them in the first place is even better. We covered this point in Chapter 3, where we discussed how important it is for lenders to monitor subprime concentrations, among other matters. The same concentration assessment principles that we apply to loans held in the bank's loan portfolio also apply to securitized loan portfolios, individual securities, and SPVs.
- **Capital Requirement.** The new framework is a natural fit with Basel II and other regulatory guidelines that help banks determine a sufficient level of capital based on their exposures and concentrations. Essentially, a bank's loans, securities held, insurance contracts, in fact any asset class on the balance sheet can have the framework applied to it so as to allow for the identification and quantification

of risk and the easy aggregation of those risk exposures across the enterprise. For simplicity, if we consider consumer loans, the framework would allow all loans to roll up by product, market, channel, and so on up to the total enterprise. Essentially, the distribution of loans by the handle structure could be reported for the total company. This would provide useful input to the bank's capital plan and accompanying corporate risk profile.

- **Portfolio Monitoring.** For individual institutions where the new framework has been adopted, regulators can leverage on it to monitor exposures and concentrations in order to spot problems early on and avoid future crises. With standardization of CCAF primary factors and thresholds within the industry, regulators could perform peer comparisons and also aggregate individual banks in a tier or subpeer grouping to construct a composite handle distribution for a representative bank in a particular performance tier and then use that as a benchmark. Regulators could also put the entire industry through the handle structure and use the total aggregated distribution as a benchmark, or they could restrict the aggregate to only institutions they oversee, sliced by MSA, state, or region. They could also filter portfolios by any of a number of other classification categories and then view them through the handle structure to spot outliers or trends. Certain segments are more sensitive than others are to changes in economic conditions, and trends in those handles can precede larger portfolio trends by several months.

Exhibit 6.3 summarizes pictorially the relationship between elements in the mortgage value chain and their interplay in the process that leverages the CCAF handle-based segmentation in order to identify the foreclosure-preventable loans for loan modification or refinancing. This process connects borrower, lender, investor, issuer, and servicer together to create a complete loan monitoring, loss mitigation, and early warning system.

In the next section, we expand and annotate this diagram significantly as we further explain the nature of the process in relation to crisis prevention.

## CRISIS PREVENTION

Our government's response to the financial crisis is having a significant impact on borrowers, lenders, and investors that will continue to

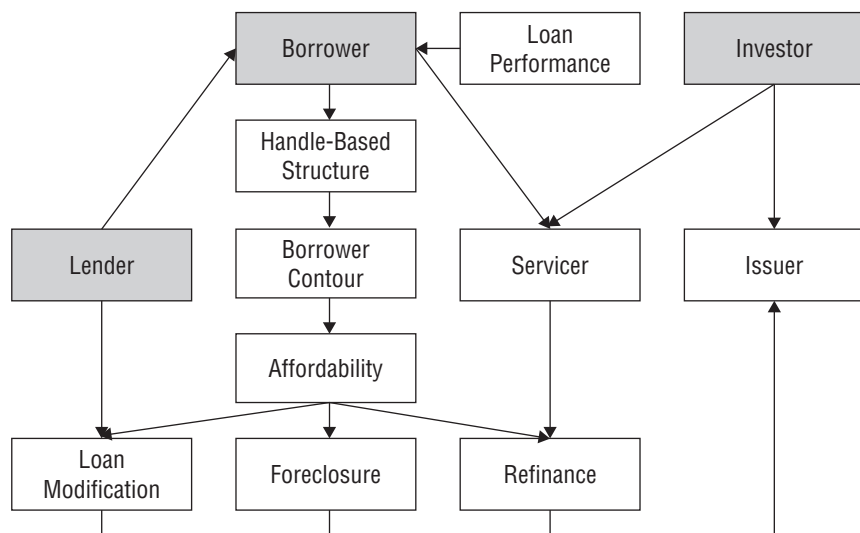


EXHIBIT 6.3

### HOW CCAF CAN HELP EFFECTIVELY INTERVENE IN THE CRISIS

be felt well into the future. Certainly there are differing opinions on the extent to which the government should intervene. Some have suggested that the federal government should not try to bail out financial market participants, perhaps fearing the creation of a future moral hazard, or perhaps due more to a Darwinian view of the world.<sup>37</sup> A couple of things are clear. First, there needs to be a reengineering of the loan underwriting process that will boost accuracy and transparency, and better serve borrowers and lenders. Second, the government needs to rethink the role of regulations in supporting mortgage securitization and stabilize the financial markets.<sup>38</sup> We concur with Federal Reserve Chairman Bernanke that borrower education is vital and lenders must continue their efforts to improve financial literacy, and foster or subsidize organizations that provide counseling to households that face payment difficulties.<sup>39</sup> Lenders should be encouraged to renegotiate loan terms for borrowers who would otherwise face foreclosure. There are also a number of proposals designed to help borrowers who may become subprime borrowers in the future.<sup>40</sup>

We believe regulatory focus, relative to preventative efforts, should center on three primary areas: (1) improving lenders, issuers, and rating

agencies' process transparency, (2) borrowers' financial literacy, as well as (3) the investor's capability to monitor and understand credit risk and return. As shown in Exhibit 6.4, the three objectives are interrelated. However, transparency cannot be achieved without an effective credit and concentration risk monitoring and reporting system. Exhibit 6.4 shows how CCAF can bring all stakeholders together for more integrated government programs.

### Improve Transparency of Products and Processes

As discussed in the previous chapters, lack of transparency is associated with the prevalence of unaffordable loans, the lender's underwriting gap, and the investor's vulnerability, and it persists throughout the entire process of the mortgage lending value chain.<sup>41</sup> Transparency relative to product and process means a more comprehensive disclosure of all necessary information to borrowers and investors than is in place today. This would include rules, policies, and all applicable standards and thresholds that can enable them to make more informed and better financing and investing decisions.

Relative to product transparency, it is important for the borrowers to understand product terms and suitability and the potential risk associated with escalating monthly payments and collateral depreciation. More

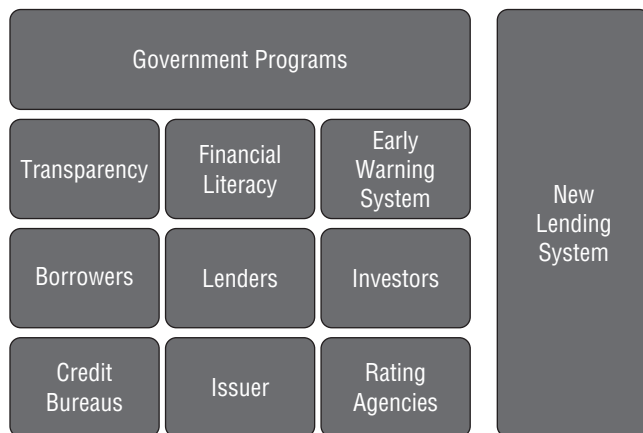


EXHIBIT 6.4

A FRAMEWORK FOR CRISIS PREVENTION

complete, accurate, and intelligible disclosures would aid borrowers. This includes loan terms and conditions, underwriting standards, and risk associated with the loan product. As the Government Accounting Office (GAO) observed, existing disclosure regulations were not designed to accommodate more complex loan products such as alternative mortgage products (AMPs). “The information that borrowers receive about their loans through advertisements and disclosures may not fully or effectively inform them about the risk of AMPs. Federal and state banking regulatory officials expressed concern that advertising practices by some lenders and brokers emphasized the affordability of these products without adequately describing their risks.”<sup>42</sup> For investment or structured products, product transparency is a more vexing issue because of their complexity and that of the processes that are used to create them. Investors need to have sufficient knowledge of the process to comprehend key assumptions in the payment model and how they will be protected in the event that performance falls below expectations. Investors would also benefit from seeing at regular intervals what the status of the underlying loans pool is relative to concentrations of loans in higher risk segments (in addition to overall delinquency and losses).

*Process transparency* for borrowers refers to the qualification and pricing methodologies used to evaluate their loan application. For investors, the focus is on the mechanism that combines cash flows from the underlying mortgage pool and then segregates them for distribution to different classes of investors. For both borrowers and investors the impact of economic and market realities on the processes in question must be made easy to interpret and understand.

The immediate benefits of increased transparency include the following:

- The borrowers can better evaluate loan affordability and negotiate with lenders to align loan terms and conditions with what they can afford to pay.
- The lenders can improve their consistency in measuring and pricing credit risk. They can also better comply with lending regulations, more effectively inform consumers on loan qualifications, and, when necessary, on the reasons for declining a loan application. Many lawsuits related to mortgage lending have been caused by the opacity of lending practices. Greater transparency can help lenders sidestep a variety of legal issues.



- The investors can better monitor and evaluate financial risk and rely less on credit ratings. They also benefit from a deepening of their understanding of the underlying loan pools that produce the cash flows that they depend on for their investment returns.

Transparency can be improved in the following ways:

- For structured investments, MBS and CDO securities represent mature and complicated financial products. At present, even financial regulators are hampered by the opacity of over-the-counter CDO and MBS markets, where only “qualified investors” may peruse the deal documents and performance reports. Currently none of the bank regulatory agencies (OCC, Federal Reserve, or FDIC) are deemed “qualified investors.” Even after that designation, however, those regulators must receive permission from each issuer to view their deal performance data and prospectus’ in order to monitor the sector.<sup>43</sup> It is obvious that understanding the performance of those products is beyond the ability of average investors. Following are suggested improvements for these products:
  - Key additional structures would include the CCAF handle, holistic CCAF score, and handle-based risk quintiles (displayed previously in Exhibit 5.12).
  - Development of an effective reporting system for disclosure of characteristics of the underlying assets and development of an effective and comprehensive monitoring system to monitor and update the performance of the underlying assets. The following would be calculated and reported:
    - Distribution of cash flows by handle-based risk quintiles.
    - Average probability of default (PD).
    - PD-range associated with each quintile.
    - Reducing the complexity and layering are a focus. This is because regulators and investors will put a premium on simplicity. Skepticism of products having complex structures will persist, even on the part of those who offer them.
  - Standardization of structured financial products will be required as all of the parties in the value chain become better aligned and reconnected.
  - Requirement of CDO and MBS securities ownership registration.

- For mortgages
  - Application of restrictions on the design of mortgage contracts under the HOEPA rules and a broadening of HOEPA coverage, along the lines proposed by the Federal Reserve.
  - New RESPA rules, discussed earlier, will help consumers comparison shop and better understand their loan costs.
  - Adoption of CCAF handle and associated holistic credit score in place of today's *secret sauce* Fair, Isaac and Company's (FICO) credit bureau score and fragmented underwriting processes with so many overlay review rules and convoluted loan pricing sheets that typically penalize consumers individually for numerous factors that are neither statistically independent nor separately disclosed to the borrower.
- For credit ratings agencies
  - Greater clarity in rating and modeling process and methodology, and presenting ratings across asset classes.
  - Reporting of the rating agency's track record (including number of downgrades by specific issues of all similar types of security during the past 24 months).
  - Disclosure of the limitations of ratings for newer instruments.
- For commercial banks
  - Clearer accounting of off-balance-sheet activities: The creation of off-balance-sheet entities allowed banks to reduce the required capital for a given risk profile. At the same time, it reduced the transparency of risky assets and hid them from regulatory examinations.
  - Clearer portrayal of the risk in their consumer loan portfolios through CCAF handle-based roll-up reporting on all lending lines of business, broken out by geographic area (MSA, state, Aggregated Low/Moderate Income Census Tracts within MSA and state), product, and channel, and aggregated by legal entity, and total corporation.
  - Expanded reports should be produced for regulatory filings
    - Annual HMDA filing
    - Annual CRA filing
    - CRA Performance Evaluation (P/E) reporting

Finally, and in general, reducing financial reporting complexity would improve transparency. Efforts in that direction have been made to simplify financial reporting systems.<sup>44</sup> By using standard approaches to measure and report on all types of financial instruments, many redundant rules can be eliminated. We next turn our attention to the subject of financial literacy.

### **Improve Financial Literacy**

Financial literacy, or education, is closely intertwined with transparency. A transparent lending system will help improve borrowers' and investors' financial literacy. This is because it will allow borrowers and investors to better understand the risks associated with their loan products and investment vehicles. For example, armed with a better understanding of how loans are put together and priced borrowers can more effectively weigh the features and price of loans with affordability. They can conduct better comparison shopping and negotiate more successfully in order to obtain the best deal. Investors armed with a deeper understanding of their investment choices can better balance risk and return trade-offs, which in turn helps them decide which securities they should purchase.

It has been suggested that increased investor skepticism of the ratings issued by the agencies will make it more difficult for commercial and investment banks in the future to issue and sell securities backed by subprime mortgages. This, in turn, will make those mortgages more expensive and less available. Clearly, the risk associated with subprime loans and their derivative securities has been underestimated. In the aftermath of the crisis, lenders will most certainly demand higher risk premiums from subprime borrowers and the cash flows from those loans will be discounted more heavily by secondary market makers who purchase them. The resulting derivative securities will be rated lower and priced lower as a consequence.

As it was true in the past, it will become even more so in the future that investors must exercise care and perform their own confirmatory research to evaluate the risks associated with their investment choices. Issuers of securities that are derived from pools of loans should provide greater

information to investors so that they can conduct a more meaningful analysis of what they are buying. Typical information that would be useful for this type of analysis includes the standard rating and some performance statistics relating to losses, delinquencies, and prepayments in the underlying pool of assets. In addition, we see utility in providing the kinds of information displayed in Exhibits 5.9 and 5.12.

We can combine these in a meaningful way, as shown in Exhibit 6.5, to portray the risk dynamic in the underlying loan pool. By including the handle distribution of loans, associated remaining loan balances, and corresponding average holistic score by risk tier, the investor can view the current risks through both a performance window and the transaction contour. We recommend including semianual or annual snapshots of this information to identify any basic trends associated with them. We recall from our discussion of an improved modeling methodology in Chapter 3 that the transaction contour conveys risks associated with changes in the borrowers' capacity, capital, payment record, vulnerability to adverse market conditions, and any collateral depreciation.

This type of information provides deeper insight into borrower and collateral strength in the underlying loan pool apart from pure performance information. This can provide an early indication of deterioration in loan quality. The reader will recall that we previously called out the need for this type of information, in addition to performance data, in Chapter 3. We shared our vision for a new internal rating approach, as was illustrated in Exhibit 3.10. The table in Exhibit 2.15 that specified the handle structure is also useful here. We note that the handles could be color-coded or otherwise designated to indicate the rating tier for easy reference.

Imagine that you are an investor and you are considering investing in this particular security. In addition to the security rating, let us assume you know how the underlying loans have performed relative to losses, delinquencies, and prepayments. Further suppose that you possess the additional information in Exhibit 6.5, and a version of Exhibit 2.15 that has handle cell ranges color-coded by rating tier. The added information provided by CCAF is as follows: (1) You have direct insight into the financial strength of the borrower who took out those loans by way of the handle distribution. This is a reality check on the rating agency's assertion that the grading of the security is AAA, or whatever it is adver-

## EXHIBIT 6.5

**RISK PROFILE OF UNDERLYING LOAN  
POOL FOR ARBITRARY MORTGAGE-BACKED  
SECURITY**

Security Rating Tiers	CCAF Four-Year Average Cumulative Mortgage Default Prob.	Weighted-Average Good/Bad Odds	CCAF Holistic Score Range	Number of Handles	Initial Loan Pool Distribution Percentage
AAA	0.147	678 to 1	822–833	12	96
AA+	0.387	257 to 1	821	2	2
AA	0.400	249 to 1	819	2	1
AA–	0.424	235 to 1	818	1	1
A+	0.440	224 to 1	817	2	—
A	0.480	206 to 1	813–815	4	—
A–	0.520	192 to 1	811–812	8	—
Baa	1.240	80 to 1	770–810	103	—
Ba	5.502	17.2 to 1	718–766	138	—
B	19.596	4.1 to 1	715–690	86	—
CCC	32.045	2.1 to 1	678–684	35	—
Lower	42.643	1.35 to 1	652–677	39	—

Security Rating Tiers	Contractual Cash Flows (\$000)		Loan Pool Distribution (Percentage)		
	At Inception 12/31/06	As of 12/31/08	As of 12/31/08	As of 12/31/07	As of 12/31/06
AAA	79,000	62,600	65	77	81
AA+	4,600	4,140	4	3	4
AA	5,200	3,900	4	3	4
AA–	2,700	5,720	6	4	3
A+	1,200	1,930	2	2	1
A	2,300	4,140	4	4	2
A–	800	—	3	2	1
Baa	3,100	1,540	1	3	3
Ba	1,100	2,020	2	1	1
B	—	—	—	1	—
CCC	—	3,600	3	—	—
Below CCC	—	6,520	6	—	—
Total	100,000	96,110	100	100	100

tised to be. If a significant portion of the borrowers have low capital and capacity, that is a danger signal, no matter the historical performance. (2) You can readily see significant concentrations where the borrower's collateral stake is weak and the loan product and economic conditions in the housing market can put the loan under water. (3) Based on historical trends and migration patterns of loans and cash flows relative to the

handle structure, the investor is able to ascertain the direction, speed, and extent of changes in underlying asset quality.

For the foregoing reasons, improving investor and borrower financial literacy should be a task that is given high priority. Next we turn our attention to a new monitoring system that will enable regulators to more effectively identify, measure, and manage credit risk, portfolio asset quality, concentration risk, and potential greed!

### CCAF Early Warning Reporting System

An early warning system is required to identify potential risks of loss due to credit quality deterioration, concentrations, compliance violations, and greed. This can help identify unsustainable lending volume and growth in particular markets, products, channels, or their combinations. With CCAF, regulatory agencies could pool data from all lenders, as well as from secondary market conduits, to monitor industry exposure as part of an early warning system. This could also provide a benchmark to measure individual lenders and secondary market players relative to credit exposures in subprime and other market segments. For example, individual limits could be imposed at portfolio segment levels as defined by the transaction contour. Segments may be further aggregated into broader categories such as subprime. The monetary exposure in these categories can be viewed relative to bank capital to better ensure that corporate portfolio quality standards and regulatory guidelines are satisfied.

As shown in Exhibit 6.6, the benefits of transparency cannot be realized without an effective monitoring and reporting system, which needs to reflect the following key elements:

- **Infrastructure.** Build a solid IT infrastructure that plays an important role in supporting risk management systems, and asset quality control. Frameworks, not Band-Aids, are needed to better capture the full range of risk factors and to ensure they are properly weighed and positioned in the risk quantification process.
- **Integration.** Integrate subject matter expertise and sound business principles to fashion complementary and overarching qualitative risk assessment capabilities. This will afford a complete view and more accurate measurement of the actual risks that exist—risks that

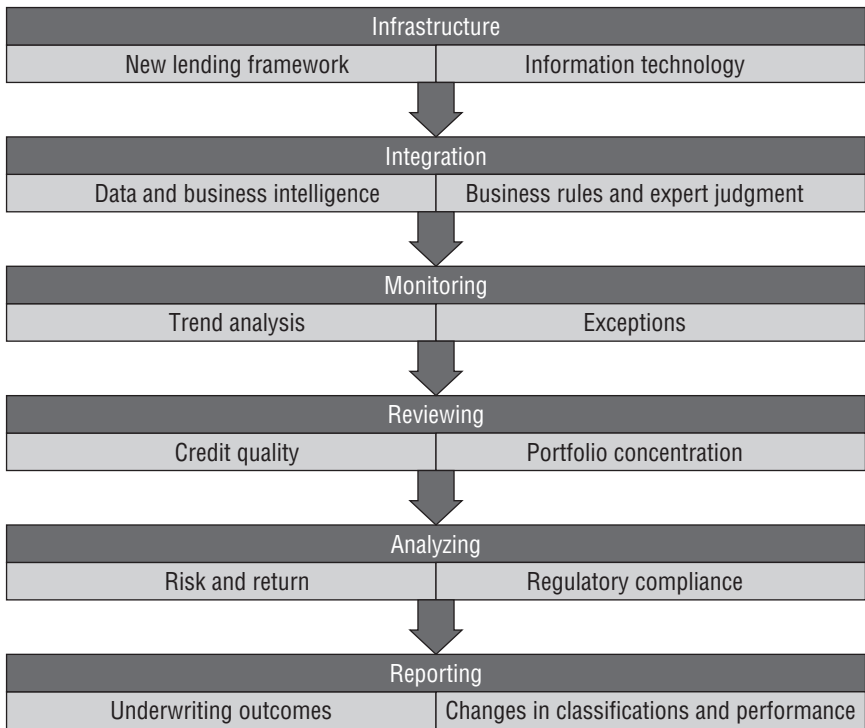


EXHIBIT 6.6

### KEY ELEMENTS FOR AN EARLY WARNING SYSTEM

have eluded today's best practices. Integrated data processing for valuation of structured financial products is necessary. This involves estimating the probability of default and simulation of the loss distribution for underlying asset pools. Those pools contain hundreds of thousands of individual subprime bonds. This is a complicated process and requires access to large databases, intensive computation, and advanced analytical models.

- **Monitoring.** Create periodic snapshots of loans originated for trend analysis as a precursor to rating changes, monitor migration patterns within risk tiers by number and dollar amount of loans, view pricing and volume trends, and control concentration risk within borrower, industry, geographic, product, business entity, investment asset class, and so on, through the handle structure. Track fair and responsive lending patterns with appropriate key exposure indicators

for underwriting, pricing, steering, redlining, and speed of processing/fallout rates, and predatory lending patterns, such as reverse redlining, hidden fees, or pricing irregularities/overcharging.

- **Reviewing.** View in multiple contexts by customer relationship tier, by product line, by channel, by geographic area, by business entity, and for the entire enterprise, borrower segments, subprime segments, loan pool segments, and investment rating segments.
- **Analyzing.** Capture all key aspects of the mortgage banking value chain, including the origination, servicing, securitization, and financial innovation (pooling/packaging/rating) processes in order to uncover indications of greed, such as abnormally high profits, rapid asset growth, consistently mispriced risk, and skewed concentration of loans.
- **Reporting.** Report on primary underwriting factors, and all combinations of them, relative to loan system acceptance rates, loan origination mix, delinquencies, charge-offs, foreclosures, prepayment, and so on.

Building an effective early warning system entails the following aspects as shown in Exhibit 6.7.

- With CCAF, each loan is classified in a handle cell with a handle number signaling the level of risk.
- Regulatory agencies can spot changes in the borrower's default level (probability of default).
- The handle segment reflects both loan affordability to the borrowers and their PD. When the borrower's attributes change, the borrower's contour will be updated and the borrower may be placed in a new handle cell.
- Unfair lending practices can be detected by monitoring loan affordability based on loan product and borrower's contour.
- Loan concentration risk also can be measured and used to monitor bank portfolios and securitization pools.

This framework will be well placed in a regulatory macro-dashboard on the wall of a *command center* for the financial services sector. The output from this monitoring system would enable government agencies to monitor and assess risk intelligence. This output would span lending



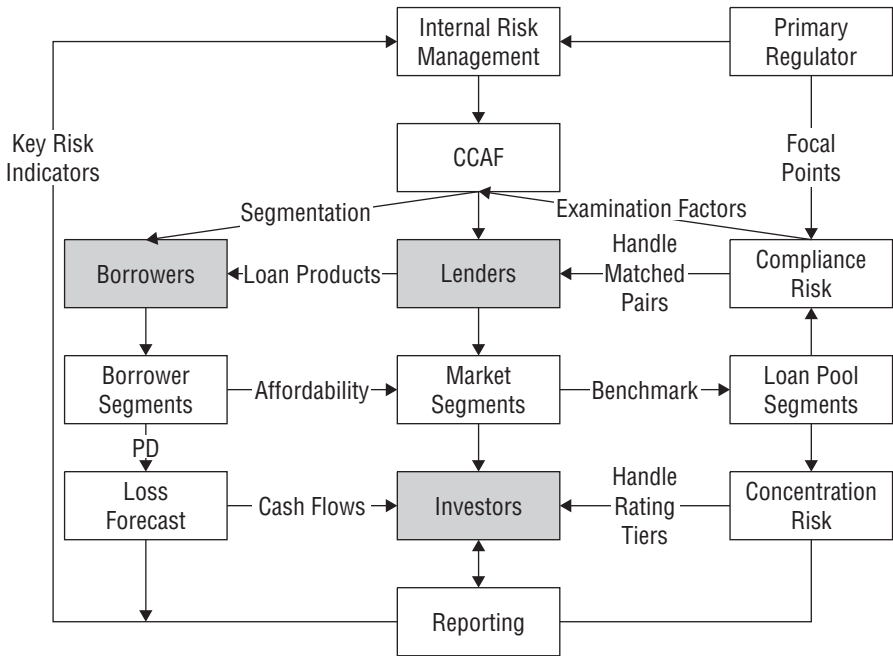


EXHIBIT 6.7

CCAF EARLY WARNING REPORTING SYSTEM

institutions, loan pools, GSEs, investment securities, and investor portfolios, all viewed within the handle structure. It provides drilldown capability into various levels to spot pockets of risk or zoom-out capability to identify high concentrations systemically. It would also possess the ability to drop the entire consumer sector in the framework and assess the financial health of borrowers (for instance, capacity, wealth, performance, and vulnerability), financial institutions (banks, insurance companies, and brokerages), and health of the credit system (for instance, all loans held by lenders, by GSEs, and by investors).

## LOOKING AHEAD

As noted in Chapter 2, credit markets are influenced by what information is made available and also by tools that are used to manage and analyze that set of information. Adoption of our new approach would (1) provide more useful information to all stakeholders, borrowers, lenders and investors alike; (2) provide tools to lenders, financial engineers (who

pool and repackaging loans for sale to investors), rating agencies, and regulators; and (3) afford a comprehensive and quantifiable aggregate view of credit industry risk exposures that would both encompass and also transcend individual loans, loan portfolios held on balance sheets, loan securitizations and loan-backed securities sold in the capital market, bid portfolios of whole loans for sale to lending institutions, individual banks and their subsidiaries, credit unions, mortgage companies, finance companies, individual metropolitan areas and states, regulatory agency jurisdictions by institutional charter, and the totality of domestic and foreign consumer and small business credit markets.

## Future Lending System

Advances in technology and financial innovation have provided dynamics for economic growth and development. In particular, financial innovations were able to lower funding costs for both lenders and borrowers. However, in the wake of financial crisis, financial regulators will rethink and redefine how banks operate to better manage their vulnerability. “Government likely has a role to play in supporting mortgage securitization, at least during periods of high financial stress. . . . Achieving the appropriate balance among these design challenges will be difficult, but it nevertheless must be high on the policy agenda for financial reform.”<sup>45</sup>

For future lending systems, we identified some of the most important properties, along with key capabilities of CCAF that relate to each one. They are:

- **Accurate.** Affords better risk estimation because it is a closer fit to the business reality.
- **Fast.** Computer-driven decisions, data and policy maintenance, operational and management reporting.
- **Cost-effective.** Fewer models required and costs of model redevelopment virtually eliminated.
- **Flexible.** Best of art and science—rules co-exist with formulas.
- **Consistent.** Systematic and more consistent than credit scoring because there are virtually no system overrides.
- **Reliable.** Validated from both a quantitative and qualitative standpoint.

- **Easy to understand.** BC/TC interpretable and foster borrower financial literacy.
- **Coherent.** Based on proven lending principles; Five Cs and common sense.
- **Affordability.** Capacity and capital required as primary factors.
- **Comprehensively monitored.** Handle, and related multifactor views, provide contextual meaning relative to acceptance rates, applicant population mix, and borrower segment performance relative to default risk, delinquency, prepayment, profit, and so forth.
- **More effective controls to limit risk.** Policy caps can be enforced to avoid unwanted concentrations at the handle cell level.
- **Adaptive and easily updated.** Is more, not less, predictive over time!

### Think Global and Reform Local

As the U.S. subprime crisis has spilled over across the world, and direct risk exposure has extended beyond the United States to the European and Asian market, it is key to adapt a dynamic risk management system so as to access credit risk from a global perspective. According to the Global Financial Stability Report (GFSR), global financial risks have increased, and underlying conditions have worsened since April 2007. We will experience much volatility as economic indicators trend toward more sustainable levels associated with the economic recovery.<sup>46</sup> This global nature of the problem identified in the U.S. financial system calls for global solutions.

“Today’s GFSR report shows how serious a crisis we currently face,” IMF Managing Director Dominique Strauss-Kahn stated. “The time for piecemeal solutions is over. I therefore call on policymakers to urgently address the crisis at a national level with comprehensive measures to restore confidence in the financial sector. At the same time, national governments must closely coordinate these efforts to bring about a return to stability in the international financial system.”<sup>47</sup>

Mortgage securities can perform a number of valuable functions in emerging economies. Effort has been made to develop mortgage securities to secure longer-term residential funding in emerging economies. There has been little, if any, subprime mortgage lending in emerging

markets. It is possible to extend the mortgage lending market without repeating the mistakes of the subprime boom and bust in the United States.<sup>48</sup> But there are significant barriers such as<sup>49</sup>

- Regulation, taxation, and legal framework
- Data and information technology infrastructure
- Predictive analytic tools and resources
- Liquidity support
- Standardization of reporting
- Risk management and internal controls
- Loan products, programs, and distribution channels
- Requirements for investors including capacity and ability to invest
- Requirements for lenders including the underwriting system and standards

From a global perspective, CCAF is highly applicable to building an effective credit risk management system in developing countries or emerging markets.

- CCAF's unique and flexible modeling approach allows lenders to fully utilize all forms of data including both traditional and non-traditional information to conduct an accurate and effective credit assessment. This is particularly important for developing countries where consumer credit information may be limited or unavailable for typical credit scoring.
- CCAF's systematic judgmental system can provide a consistent initial assessment based on lending policy and expert rules in lieu of data. As developing markets mature, however, CCAF will help strengthen underwriting standards as lenders recognize the benefits of putting borrowers, and their credit transactions, in the proper context before attempting to determine creditworthiness or how much to charge for a particular loan.

## SUMMARY

This chapter discussed the role of regulation and legislation in fostering safety and soundness throughout the mortgage banking value chain. The discussion encompassed the establishment of improved standards, policies, and procedures coupled with greater information, simplification,

and transparency relative to mortgage origination, servicing, securitization, secondary market packaging, issuance, and offering of structured products. As a result of appropriate regulatory, legislative, and industry reforms, borrowers, lenders, and investors will be much better off than they have been in several respects. First, borrowers will better understand how they will be evaluated for a loan and also the benefits and risks that optional loan terms and conditions pose. As a result, they will make better, more well-informed decisions, and they will enter into affordable loans that they will be able to repay as agreed. Second, lenders will possess the information and controls in place that will ensure that they offer affordable products that are priced within the context of the borrower and her collateral strengths and weaknesses and in consideration of possible future market states and borrower conditions. Lenders will also be able to spot growth in higher-risk exposures early on through better concentration management. Finally, investors in loan-backed securities, including structured products, will benefit from having additional information about the underlying assets relative to pool risk segments and migrations within those segment risk tiers that have preceded rating downgrades in the past. This will enable investors to better determine whether the asset-backed investment poses an acceptable level of risk and whether the returns offered are in line with their exposure to possible deterioration in underlying loan quality.

We also discussed the policy implications for intervening in the current crisis and preventing one in the future. We suggest that current and future regulations and legislation should focus on improving underwriting practices, transparency, and the public's financial literacy. In particular, we described how CCAF can be used to effectively implement regulatory policy by establishing an effective monitoring and early warning system to achieve these goals. Had this new framework been in place, we can safely say that the magnitude of the crisis would have been far less than experienced. Unaffordable loans would, for the most part, not have been made in the first place. For any high risk concentrations that were building in loan portfolios held or loan pools offered for sale, the risk would have been identified and limited before it got way out of proportion at the handle-based segment level. To the extent that borrowers, appraisers, and other participants provided inaccurate information, either prompted or on their own, relative to qualifications, property values and the like,

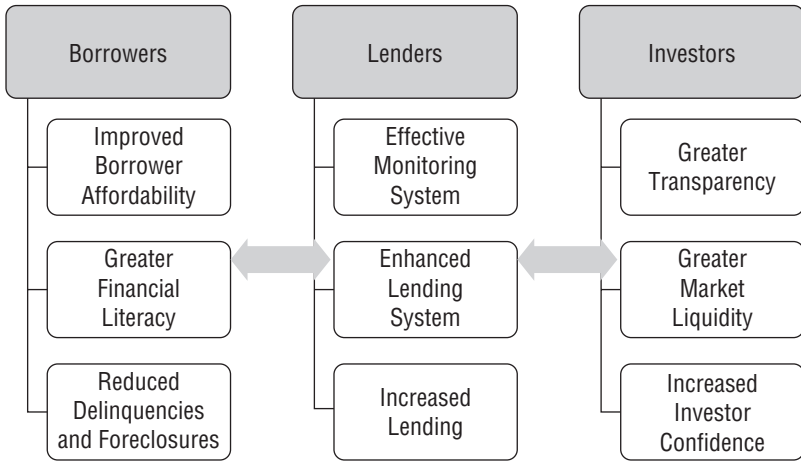
the result would have been the same. Additional safeguards, such as strict verification of information and random auditing to validate processes, are certainly warranted.

CCAF's holistic classification affords transparency, conveys the essence of the borrower's qualifications, and risk-rates credit transactions within that complete context. As a result, significant overstatement or understatement of risk on individual loan transactions can be avoided. CCAF affords greater control of loan decisions through its ability to integrate expert judgment with statistically based criteria in the risk evaluation process, which encompasses not only default risk, but also concentration risk, fair lending noncompliance risk, and a host of other important objectives. This allows for efficiency, transparency, and accuracy. CCAF transparency fosters financial education/literacy relative to the underwriting process and enables easy identification of loans that are truly affordable relative to every borrower segment. Having a standardized version of CCAF would enable regulators to make comparisons across lenders, and more explicitly examine safety and soundness of loan underwriting practices and product offerings. It would also allow them to monitor the diversity and vulnerability of loan portfolios in advance of adverse loan quality trends that not only occur during typical economic downturns, but also surface unexpectedly like the subprime mortgage crisis. Adoption of a standardized version of CCAF by the GSEs would also benefit the secondary markets, as it would strengthen underwriting standards through a comprehensive, transparent, and universal framework that would better serve issuers and investors.

Exhibit 6.8 summarizes the benefits of an improved lending system (CCAF) and how it can intervene in the current crisis.

## CLOSING OBSERVATION

This book has introduced a new framework that can be applied to improve the entire mortgage banking value chain. This framework can, in fact, be extended to any assets that can be pooled, packaged, and sold to investors. We have explained how lenders and borrowers would benefit from the new lending system. We have also considered the plight of investors and demonstrated the need to provide them with greater



**EXHIBIT 6.8 SUMMARY OF CCAF BENEFITS**

information concerning the underlying loans that both generate their returns and pose a risk of principal loss. The new lending system does not remove the asymmetries that render the intermediaries between borrowers and investors in the mortgage value chain more susceptible to the forces of greed. Instead it systematically and comprehensively removes discretion that can be exercised by those intermediaries, while providing transparency and more information to borrowers, investors, and regulators.

Looking ahead, there are several key themes emerging. First and foremost, the credit crunch of 2008 is by no means in its final act. The level of loan delinquencies and foreclosures, and the number of mortgage-backed security downgrades will continue to worsen for some time. This means more market volatility lies ahead, as repricing and downward valuation of higher risk assets occurs and as financial institutions deleverage and downsize to improve their capital positions. The cost of that capital will likely be higher for some time, and higher liquidity cushions will be sought and maintained. These are challenging times. We have an unprecedented chance, with everyone's attention clearly focused, to rethink how the current credit system and financial markets should work, and what can be done to improve them. We must all work in unison to seize that opportunity now. Our ability to successfully work our way out of the current crisis and avoid future ones hangs in the balance.

The pathway to improving the current credit system rests on a bed-rock of comprehensive and solid context. It rests on improved information, and it is illuminated by proper data sourcing and verification. We envision that the journey down that pathway will entail the integration of established credit principles, transparent and effective scientific methods, and common sense (for which there is no substitute).

## ■ NOTES

1. Several other large banks have been designated for government action under the Emergency Economic Stabilization Act of 2008.
2. C.A.E. Goodhart, "The Regulatory Response to the Financial Crisis," Financial Markets Group, London School of Economics, Working Paper Presented at CESIFO Conference "Financial Market Regulation In Europe," January 2008.
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7. Enterprise Community Partners, "Statement from Enterprise Community Partners President and CEO Doris W. Koo Regarding the Community Reinvestment Act," PRNewswire, October 15, 2008.
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9. William B. Gwinner and Anthony Sanders, "The Sub Prime Crisis: Implications for Emerging Markets," World Bank Working Paper, September 2008.
10. See Regulation B 12 C.F.R. §202.2(p) (1978). For further discussion of the requirements, see David C. Hsia, "Credit Scoring and the Equal Credit Opportunity Act," *Hastings Law Journal* 30, No. 2 (November 1978).
11. *Ibid.*, p. 402, note 106, in reference to C. Abrahams, "A Statistical Assessment of Model Performance Upon Validation," April 14, 1977 (publication of Fair, Isaac & Co., Inc.).
12. 73 Fed. Reg. No. 147/Wednesday, July 30, 2008/Proposed Rules, pp. 44,189–44,197.
13. Originated loans subject to Regulation Z, 12 C.F.R. part 226 and Reported under Regulation C 12 C.F.R. Part 20. For details about recent development in HOEPA, see Martin Neil Bailly, Douglas W. Elmendorf, and Robert E. Litan, "The Great Credit Squeeze: How It Happened, How to Prevent Another," Discussion Paper, Brookings Institution, May 21, 2008, pp. 104–107.
14. *Average prime offer rate* means an annual percentage rate that is derived from average interest rates, points, and other loan pricing terms currently offered to



- consumers by a representative sample of creditors for mortgage loans that have low-risk pricing characteristics.
15. The *rate spread reporting requirement* applies to a rate that exceeds, by the specified margin, the average prime offer rate for a comparable transaction as of the date the interest rate is set.
  16. The relevant date to use to determine the average prime offer rate for a comparable transaction is the date on which the loan's interest rate was set by the financial institution for the final time before closing.
  17. See "Real Estate Settlement Procedures Act (RESPA): Rule To Simplify and Improve the Process of Obtaining Mortgages and Reduce Consumer Settlement Costs," 24 C.F.R. § 203.1 and 203.27 and §3500.7, Docket No. FR-5180-F-03, RIN 2502-AI61, 73 Fed. Reg. No. 222, November 17, 2008. Currently there is also an ongoing discussion between lenders and lawmakers regarding how the rulemaking effort will impact the whole mortgage market. See *Inside Mortgage Finance News*, December 17, 2008, on ABA Compliance Solutions Telephone Briefing.
  18. *Ibid.*, p. 68,238.
  19. See Clark Abrahams and Mingyuan Zhang, *Fair Lending Compliance Intelligence and Implications for Credit Risk Management* (Hoboken, NJ: John Wiley & Sons, 2008), p. 85, note 4.
  20. At an estimated \$7.5 trillion, the government bailout program will be the most costly one in history even surpassing the entire cost of World War II. See Russell Goldman, "Financial Bailout Balloons to the Trillions—More Than Just TARP, the Bailout Is the Costliest U.S. Expenditure Ever," ABC News, November 25, 2008.
  21. David Ellis, "House takes Paulson to task on bailout—Treasury chief responds to criticism of the progress of \$700B bank rescue plan; lawmakers push for additional help for homeowners," CNNMoney.com, November 20, 2008.
  22. Some have suggested capital insurance aiming to reduce the adverse consequences of a crisis at the cost of the private sectors. See Anil K. Kashyap, Raghuram G. Rajan, and Jeremy C. Stein, "Rethinking Capital Regulation," Working Paper, University of Chicago and NBER, September 2008.
  23. See Financial Stability Forum (FSF), *Report of the Financial Stability Forum on enhancing market and institutional resilience*, Basel, April 7, 2008. Included in the FSF working group on market and institutional resilience are Chairman Christopher Cox of the SEC, Treasury Secretary Timothy Geithner (former president of the Federal Reserve Bank of New York), and Comptroller of the Currency John Dugan.
  24. See Institute of International Finance, Report of the IIF Committee on Market Best Practices, July 2008, and Counterparty Risk Management Policy Group III, *Containing systemic risk: The road to reform*, August 6, 2008.
  25. See U.S. Department of the Treasury, *Blueprint for a modernized financial regulatory structure*, March 31, 2008, and Bank of England, HM Treasury and FSA, *Financial stability and depositor protection: further consultation*, July 2008.

26. Both Warren Buffett and his vice chairman Charlie Munger agreed that not every business or investment bank should be rescued, because failure is an important part of capitalism, according to *Financial Post*, Trading Desk, May 6, 2008, by Jonathan Ratner.
27. According to the Joint Economic Committee (JEC) Economic report, about \$71 billion in housing wealth will be directly destroyed by the process of foreclosures and \$32 billion indirectly, due to the spillover effect to the value of neighboring properties.
28. Ben S. Bernanke, "Reducing Preventable Mortgage Foreclosures," Speech at the Independent Community Bankers of America Annual Convention, Orlando, FL (March 4, 2008).
29. The American Housing Rescue and Foreclosure Prevention Act of 2008 was passed by Congress on July 26, 2008, and signed into law on July 30, 2008.
30. Associated Press, "U.S. to Streamline Homeowner Assistance," *New York Times*, November 11, 2008.
31. Bernanke, "Reducing Preventable Mortgage Foreclosures."
32. This program is part of the larger Housing and Economic Recovery Act of 2008 that was signed into law by President Bush on July 30, 2008.
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