Consumer and Corporate Credit Ratings

and the Subprime Crisis in the U.S.

with Some Lessons for Germany

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Contents

Abstract

Both consumer and corporate credit ratings played a role in the U.S. subprime mortgage crisis. The consumer credit score, once it became the main and often the only measure of creditworthiness, could not effectively predict consumer default. We identify reactivity or "gaming the system," the omitted variable problem, correlated defaults, and endogeneity as the weaknesses that resulted in the deterioration of the FICO® score and subsequent decline of the quality of consumer credit assessment. Corporate rating agencies which assessed the securitized mortgage credit pools and that use a less formalized methodology were hampered by data problems created by bad scores, and suffered from correlated defaults and conflicts of interest. We also briefly compare the German and the U.S. situation.

1. Introduction

The subprime mortgage crisis developed in the U.S. and became a full-blown crisis in 2007 and its effects have been rippling through the entire world economy. Its causes are many and some of its consequences are still not well understood. Analysts are still grappling with how this crisis with provincial origins in the U.S. could have such a devastating impact on the entire global financial system. This paper will focus on a single aspect of this multifaceted problem: the role of consumer and corporate rating in the subprime disaster. We will pay special attention to the role of consumer credit scoring and will identify some of the weaknesses of the FICO® score and the problems created by a mechanized and exclusive reliance on credit scores. We also briefly compare American practices with those in Germany.

2. Short History of the Subprime Crisis

By 2005, home ownership in the U.S. reached an all time high of 69 percent (Census Bureau 2007).[1] The largest increase was experienced by minority groups. U.S. mortgage debt in 2007 stood at $11 trillion, of which 65 percent were securitized making the U.S. secondary mortgage market the largest fixed income market in the world (Keys et al. 2008).[2] Subprime mortgages in 2007 were estimated to be worth around $1.5 trillion (Agarwal and Ho 2007). A subprime mortgage is one that does not meet the underwriting guidelines of Freddie Mac and Fannie Mae, the two federally chartered mortgage giants. These criteria include a good credit score, proper employment and low loan-to-income ratio. For the borrowers, subprime mortgages are more expensive, they carry higher interest rates, origination fees, penalties, mortgage insurance etc. For lenders, these mortgages are riskier. In fact, the overall default rate for subprime mortgages rose to 13 percent by October 2007, double what the

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[1]   The comparable numbers in some European countries: Germany 42 percent, France 55 percent, UK 69 percent, Ireland 77 percent, Spain 85 percent.

[2]   The size of corporate debt in the U.S. by comparison is $5.7 trillion.

rate was two years earlier. This figure was 19 percent for adjustable rate subprime mortgages; triple the mid-2005 level (Federal Register 2008, p.1674).

The precursor to the crisis was a long and steep increase in housing prices. Between 1997 and 2006, when they reached their peak, real home prices for the U.S. as a whole increased 85 percent (Shiller 2008, p.32). This rapid boom coupled with low interest rates resulted in aggressive lending on the expectation that future price increases will act as quasi-collateral: even if the owners default on their mortgages lenders' losses will still be covered by the appreciation of the real estate (Figure 1). A wide subprime market developed for people whose credit indicators were below safe (or prime) levels. In 1995, $65 billion worth of subprime mortgages were originated, unadjusted for inflation this figure quintupled by 2003, and was $625 billion by 2005 leveling off at $600 billion in 2006 (Chomsisengphet and Pennington-Cross 2006, Decker 2007, Ashcraft and Schuermann 2008). While the absolute size of the subprime market grew its relative size within the entire mortgage market shrunk until 2003 as the non-subprime segment grew even faster. From 2003, its relative size too grew from 9 to 24 percent (Figure 2).

The market quickly consolidated itself. Over 90 percent of subprime mortgages were issued by the top 25 players led by lenders such as Countrywide Financial, HSBC, Washington Mutual, Citi Group, Wells Fargo and Ameriquest Mortgage (Ashcraft and Schuermann 2008). As the volume of subprime mortgages increased their rate of securitization increased as well. In 1995, it was still under 30 percent, by 2003, it reached almost 60 percent (Chomsisengphet and Pennington-Cross 2006) and it climbed further to 75 percent by 2006 (Demyanyk and Van Hemert 2008, p.6).

The growth of the subprime lending market was made possible by federal actions aimed at deregulating banking. In 1980, the Depository Institutions Deregulation and Monetary Control Act pre-empted state anti-usury laws that set a ceiling on interest rates on mortgages, and the

Alternative Mortgage Transaction Parity Act of 1982 permitted variable interest rates, balloon payments and interest-only and minimum payment loans.[3] Four years later, the Tax Reform Act abolished all tax deductions on consumer loan interests except for mortgage interest, which made even expensive mortgage loans cheaper than consumer loans. This pushed demand for mortgages up as people started to finance their purchases through home equity loans. During the last decade, with property values rising and interest rates staying relatively low cash-out refinancing became very popular (Figure 3).

2.1 Subprime Mortgage Crisis and Germany

The U.S. subprime crisis spread to other countries. It also reached Europe and Germany in particular and affected the German banking system. A similar crisis in Germany, however, is unlikely, as there is no extensive subprime lending mortgage market in the country. The German real estate market is structured differently. In contrast to the U.S. and to other European countries, such as the UK and Spain, there has not been a house price bubble in Germany in the last few years. Similarly, the German mortgage credit market grew only by 5.9 percent for the period between the beginning of 2003 and the end of 2006, while the rest of the Euro area expanded by 77 percent with the largest increases registered in Ireland (153 percent), Greece (148 percent) and Spain (132 percent) (Hess and Holzhausen 2008, p.15). In general, consumer culture in Germany is still less developed than in the U.S. and, therefore, the importance of consumer credit is far lower with 11 percent in Germany compared to 14.4 percent in the U.S. between 1990 and 1997. For outstanding mortgage credit the figures were 34.4 (Germany) and 48.5 (U.S.) (Guardia 2002, p.11-12). This might also be due to historical-cultural differences between the U.S. and the U.K. on the one hand and continental Europe on the other (Balaguy 1996), as both U.S. and UK

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[3]   Interest only loans leaves the principal unchanged while minimum payment loans with even smaller payments actually increases the loan balance and results in "negative amortization."

have a long history of being more open to credit. Traditionally, continental countries have "demonized" the use of credit to finance purchases, in particular consumer credit, as opposed to other essential credit such as mortgage (Jentzsch and Riestra 2003, pp.5f.).

2.2 Ratings and the Subprime Mortgages

Both consumer and corporate ratings played important roles in the subprime mortgage crisis. To originate a mortgage, lenders must first assess the creditworthiness of the applicant. The chief indicator used in judging applicants has been for years the credit score calculated by the credit bureaus from the credit histories of applicants. The three largest credit bureaus in the U.S., Equifax, Experian and TransUnion, each with files on about 210 million people and 1.5 billion credit accounts, cover over 90 percent of the adult population. Each provides a credit score with the detailed credit history for an additional charge. The score for all three bureaus originally was devised by Fair Isaac Co. (FICO) and the score, therefore, is known as the FICO® score. The score runs from 300 to 850 with the median score a little under 700. Fannie Mae and Freddie Mac made FICO the *de facto* industry standard in mortgage lending in 1995 (Straka 2000), and defines borrowers with FICO® scores below 620 as "subprime."

Lending to subprime borrowers is risky not just because borrowers come with checkered pasts and shaky finances, but also because of self-fulfilling prophecy: the terms low-score borrowers receive are worse which makes them even more likely to fail. Moreover, borrowers with already low credit scores have less to lose if they walk away from their mortgages because their scores are already low and another black mark on their records will make little difference. This increased risk is counterbalanced not just by higher interest rates[4] but also by securitization that allows lenders to sell the debt to others thus taking them off their books and sharing the risk with outside investors.

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[4] The interest premium on subprime mortgages is about 2 percent on average (Chomsisengphet and Pennington-Cross 2006).

Securitization begins with lenders bundling their residential mortgages into packages and putting them in a trust fund which then serves as collateral against which securities are issued. These securities are then sold all over the world to investors. Before they were offered for sale, each bundle of loans is rated by one of the corporate rating agencies. For that, the agency needs data from the lender that includes most importantly the credit or FICO® score of the borrower, but also other information such as the loan amount, the geographic location of the property, the ratio of the loan to the value of the house, whether it is used as primary residence, first and second lien etc. To construct what is called Residential Mortgage Backed Securities (RMBS) the pool of mortgages is structured into tranches. This is called subordination and it is designed to create different levels of risk (tranches) where the lower levels absorb most of the risk protecting higher ones. If there are ten tranches, the first defaults or payment delays go to the lowest tranche. Once the lowest tranche lost all its principal, losses are assigned to the next lowest tranche and so on. The top tranche, therefore is protected by nine subordinate ones, the one below it by eight etc. Each tranche must have a rating that expresses its riskiness and drives the fixed interest (coupon) each pays. Lower tranches pay higher interest reflecting their higher risks. The rating agency's job is to rate each tranche by running various models to test, how many defaults can be expected under various assumptions and how it will affect each tranche. The rating results in a collection of loans that *in toto* could be too risky to be rated as "investment grade," – a designation necessary by law for certain investors, such as pension funds, to buy them, – but now has parts (tranches) which are designated as safe investment.

An even more complex form of investment is called Collateralized Debt Obligations (CDOs). CDOs are structured like RMBS but they can manage their obligations actively, that is they can buy and sell them. While a RMBS has a static pool of debts, CDOs can have an ever changing set of obligations (residential mortgages, car loans, credit card debts etc.)

in their portfolios. These loans, regardless of their type, are also to a large extent judged on their FICO® scores. Transactions by the CDOs are limited by a set of complex rules that are designed to keep the rating of each tranche constant. These rules of debt management are also set by the rating agencies. If estimating default probabilities for RMBS is intricate requiring various assumptions and robust data, the assessment of CDOs make even higher demands on rating models.

The rating of RMBS or CDOs is more formalized than rating securities issued by companies. Most importantly, rating corporate bonds offered by companies requires the separation of the durable qualities of the corporation from short term effects of the business cycle, which involves a series of judgment calls about the future of products, competitors, the quality of the management, corporate structure etc. When RMBS or CDOs are rated, it is not an organization that is assessed but a set of debt obligations where the overriding issue is the likelihood of the default in the pool. If a company encounters difficulties, good management can rescue it by bringing in more capital or steering the company in a different direction. If a pool of debtors stop paying it is unlikely that the issuer is going to do much because now the debt and the risk belong to the investors. This allows for a more formal assessment, because there are no "human factors" to contemplate – except, of course, the thousands of humans who ultimately responsible for paying their own debts – but it does not necessarily mean that absent a motivated management to rescue an RMBS in trouble, it is necessarily more risky than corporate bonds. After all, bad management can also easily bring down a successful company turning its bonds worthless. Moreover, corporate bonds all rise or fall with the fortunes of the company. RMBS on the other hand can be partitioned into better and worse parts, a quality tranching exploits.

In fact, before the crisis, RMBS had been considered especially safe for two reasons. It was believed that banks eager to take debts off their books to avoid setting aside legally mandated debt provisions were more

likely to securitize good debt than bad one, as securitization opened up the bank's lending practices to public scrutiny. It was also observed that people in financial difficulty abandoned mortgage debt last and kept up their monthly payments well after they had defaulted on their car loans or credit cards.

While rating debt obligations is more formalized than rating securities issued by companies, judgment comes into play in several ways. First, the analyst must assess the quality of the information provided by the issuer. Then she must adjust the model to the peculiarities of the given pool of obligations and figure out the proper ways of stress testing them. One of the agencies explains their process this way:

> "Comprehending the default scenario is perhaps the most challenging of loss-given-default analysis. In a limited number of situations, the default may be imminent, so the context is already set. But in most cases, it is necessary to make certain assumptions. The analyst must be creative, but avoid engaging in excessive conjecture or speculation." (Standard and Poors 2006, p.64)

Here a lot depends on what economic forecasts the analyst chooses. In the end, the ratings, as always, are decided by committee vote and in several cases, the results of the quantitative analysis are overridden (SEC 2008a). Moreover, for the CDOs, there is additional human judgment necessary. Analysts constantly have to adjust and readjust the rules of active asset management as the CDOs find ever more creative ways around the increasingly complex limitations imposed by the rating agencies. One of the key pillars of these models – and indeed mortgage securitization itself – is the FICO® score. If the scores are compromised, the complex models will be built on rotten foundations.

As the crisis devolved, the rating agencies had to revise their earlier, overly optimistic assessments. The three together took 9,496 so called 'rating actions' on U.S. subprime RMBS tranches in the first ten months of

2007, compared with 836 in 2006 and 240 in 2005, an unprecedented admission of failure. (Romey and Drut 2008, p.9)

Thus this crisis involves both consumer and corporate rating agencies in a two step process. Residential mortgages were issued to consumers who were typically rated by their FICO® scores. The bundled debts that were sold to investors were rated then mostly by the three big corporate rating agencies: Moody's, Standard and Poor's, and Fitch.[5] A by-and-large automated system of underwriting was used in originating the mortgages, and a judgmental system – albeit aided by formalized modeling – was deployed to securitize them.

2.2.1 FICO's Role in the Crisis

As the volume of subprime mortgages began to climb and more of it became securitized in recent years, questions were raised about possible adverse consequences. A 2006 study by two economists from the Federal Reserve reviewed the then available data and suggested that fears of a subprime meltdown should be alleviated by an encouraging improvement in FICO® scores. In fact, FICO® scores grew steadily from 2000 and the average in 2005 stood almost 50 points higher than five years earlier (Chomsisengphet and Pennington-Cross 2006). This overall increase has been a robust finding. Demyanyk and Van Hemert finds a 35 point increase between 2001 and 2006 (see also Moody's 2007, Ashcraft and Schuermann 2008). The improvement was even more pronounced in the Adjustable Rate Mortgage (ARM) category, the type of mortgage that weaker customers tend to get, than in the Fixed Rate category, a development started in 2000 (Figure 4) but continued after 2003 (Figure 5). Another study showed the same trend for subprime mortgages when

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[5] Moody's, Standard and Poor's, and Fitch "account for over 99% of all outstanding ratings for asset backed securities." From a total of 394,635 ratings for asset backed securities, Standard and Poor's accounts for 197,700, Moody's for 110,000, and Fitch for 72,278. (SEC 2008b, p.35).

they are compared with higher grade Alt-A mortgages (Figure 6).[6] When subprime borrowers began to default at rates much higher than predicted by the FICO® scores,[7] RMBS along with CDOs began to lose their value quickly[8] creating a global financial crisis.

Since the onset of the crisis, FICO and its score have come under strong criticism. One study by Fitch shows that the difference between the average FICO® score of defaulting and non-defaulting loans in 2006 was only 10 points, a very small difference given the scale of the score (Figure 7).[9] As it soon got revealed, the overall predictions of the FICO® score became substantially more inaccurate (Demyanyk and Van Hemert 2008). The power of the FICO® score to predict delinquency or foreclosures dropped considerably between 2001 and 2006.

Responding to criticisms, FICO backtracked from its hard-line position that claimed the "past is the best predictor of the future" and that the score is tamper proof, and toned down its claims of predictive accuracy:

> "The point is that FICO® scores only give you part of the risk picture. Best practices suggest that lenders evaluate as many factors as possible — and understand the risk associated with all the factors when determining lending strategies and evaluating the performance of a portfolio of loans." (Foster 2007)

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[6]   Alt-A mortgages are loans to borrowers with good credit but include more aggressive underwriting than the standards set by Fannie Mae or Freddie Mac.

[7]   Lehman Brothers sold a subprime mortgage portfolio for 1.2 billion in 2006 with an average FICO® score of 631 and a predicted overall default rate of 5 percent. Eighteen months later the default rate was up to 15 percent (Maiello 2007).

[8]   Their value loss, in fact, was faster than was warranted by the actual level of defaults, due to various amplifying mechanisms of which the most important is the accounting rules that price the value of a lender's assets to their current market price together with a set of regulations that prescribe the amount of liquid assets banks must hold in relation to their losses. If the market devalues the bank's assets (say its RMBS) this creates an accounting loss even if the bank has no intention of selling the asset. To counter the loss on its books, the bank must sell some assets pushing asset prices down, leading to the next cycle in a downward spiral.

[9]   Ten points is less than one-eights of one standard deviation.

But FICO took proactive steps as well. In March 2008, it rolled out a new and improved FICO® score.[10] FICO's debacle points to four weaknesses of formalized rating and formalized models in general: increased vulnerability to "gaming the system," the "omitted variable" problem, the correlation among the outcomes and endogeneity.

2.2.2 Corporate Raters Role

It was not just FICO that failed, corporate rating agencies are also being blamed. The U.S. Congress is currently investigating the role the three played in the subprime crisis. The Securities and Exchange Commission (SEC) issued a detailed report faulting the performance of the rating agencies and proposing new regulations to shore up the ratings process and the agencies pledged to take "remedial measures to address the issues" (SEC 2008a, p.39).

3. Areas of Weaknesses of Ratings in the Subprime Mortgage Crisis

In this section we will discuss six issues to evaluate consumer scoring and corporate rating: "gaming the system," omitted variables, correlated errors, endogeneity, data quality and conflict of interest.

3.1 Reactivity or Gaming the System

No measurement is ever perfect. There is always a discrepancy between an indicator and the concept it intends to capture. The FICO® score is an indicator of creditworthiness but it is by no means a perfect one, even advocates of the score are quick to admit this. The data FICO uses is a peculiar one. The early versions of FICO were based on information provided by the borrower and the resulting score was called origination or generic score. Today, however, FICO is computed exclusively on the basis of one's credit history, that is information supplied by lenders. This score, called behavior score, cannot be manipulated

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[10]   The new score is probably also a response to the new VantageScore created by the credit bureaus.

directly by the borrower by misstating information. Data circulates in a closed, standardized system from lenders to credit bureaus to lenders without borrowers necessarily being aware even that it happens. With no access to the system, consumers must change the lenders' reports to improve their scores.

Formalization facilitates transparency. Transparency ties the hands of the lenders, which was the very reason why formalization emerged as a solution to combat discrimination in lending in the U.S. Transparency, however, also makes it easier for the borrowers to manipulate the system as the lender (or rater) is obliged to disclose its operation giving borrowers the opportunity to learn how to exploit the gap between indicator and concept by figuring out ways of increasing their score without improving their creditworthiness. FICO, mindful of this problem, – and to protect its proprietary interests[11] – has done everything it could to keep its algorithm secret. Until a few years ago, it was quite successful, and people did not even have the right to know their FICO® scores unless they were rejected for a loan on its basis. Since 2000, when California forced lenders to disclose scores regardless of the decision on the loan, FICO changed tactics and now anyone willing to pay can purchase her score. FICO now supplies a very general description of the various components of the score, but not its technical details. The start of the rise in average credit scores coincided with the lifting the veil of secrecy over the credit scores.

Improving scores in and of themselves are not signs of declining validity of the scores. FICO and the credit bureaus themselves have made efforts to help people understand their scores and improve them by addressing problems in their personal finances. Learning how to improve creditworthiness and – as a consequence – credit scores was for many the result of transparency. This was also very much in the spirit and letter of the Equal Credit Opportunity Act (ECOA) of 1974 that mandates that people should be informed about the credit decision in their case in a

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[11]   The FICO algorithm is patented.

manner that allows them to improve their creditworthiness in the future. The secrecy around the credit score had been a clear violation of the ECOA.

How could we tell if the overall improvement in FICO® scores were due to a real improvement of people taking a real interest in improving their finances rather than to gaming the system? We would see an increase in the overall average credit score, but no change in the average scores for performing and non-performing loans, just a decline in the general default rate. As Figure 7 illustrates, between 2003 and 2006, the average score for bad borrowers grew and the same figure for good ones stayed the same. As a result the difference between the two averages dropped from 31 to 10 points, which is one way of saying that the FICO® score became a worse predictor of default.

Is it possible that it is not that FICO changed but default became harder to avoid overall? After all, once the housing market begins to tumble, people who in previous years were able to keep up with their mortgages are pushed into default by the force of the crumbling market. First, we must observe that until the end of 2006 there was no crisis. In fact, interest rates declined since 2000 and so did default rates between 2002 and 2005 (Mian and Sufi 2008). Second, if somehow default were to become easier, we would see an increase in the average of the defaulting scores, which we do, but also an increase in the average of those who keep paying, which we don't. An overall increase in default rates would leave only the stronger borrowers in the non-defaulting group and that would result in higher scores in that group as well, but there is no evidence for that.

Is it possible that it is not borrowers who are gaming the system, but somehow predatory lending explains the decline of the predictive power of the FICO® score? A predatory loan does increase one's chances of default (albeit only after some time). Maybe there is a real increase in scores at the bottom end of the distribution but people get suckered into bad loans. The people who are defaulting have higher scores because they

are more creditworthy, but because they now face a harder mortgage they will still fail. This mechanism may play a role but a study by Demyanyk and Van Hemert (2008) shows that even after controlling for loan characteristics, the explanatory power of the FICO® score to predict delinquencies and foreclosures declined considerably (p.15).

Indeed, an entire industry emerged advising people on how to improve their scores regardless whether they can improve their creditworthiness (Foust and Pressman 2008). Today, one can find countless web sites offering credit score simulation whereby people can run what-if scenarios to find out how their FICO® score would be affected by changing one or more things about their credit history.[12] The internet is full of advice – some savvy, some erroneous – on how people can improve their credit scores in just a few days. This cannot be done by lying but only by doing things that would then be reported by the lender.

The tricks are by now widely known. Because FICO calculates credit usage against available credit, one should not close unused credit accounts. One can also pay off debt from a personal loan because a sudden short-term dip in indebtedness boosts the score. Getting rid of a few thousand dollars of loans can qualify one to take out tens of thousands (at lower interest rates), and then pay back the personal loan from the new, larger one. It is wise to make purchases using a credit card but one must pay it off immediately. Not using credit counts against you but not using credit but acting as if you did helps your score. One method of credit repair that anyone could purchase through the internet is getting added as an "authorized user" to a stranger's credit card with excellent payment history. Originally designed for teenagers who could get a card by being added to their parents' credit card, or for spouses who want to use jointly a single card, authorized use of someone else's card with exemplary payment record could boost FICO® scores by about 35 points.

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[12]   E.g. http://www.providian.com/cmc/fico_simulator.htm ,
http://www.creditsourceonline.com/credit-score-simulator.html ,
http://www.bankrate.com/brm/fico/calc.asp , or
http://www.creditxpert.com/Products/wis.asp .

The new FICO® score is said to ignore "authorized user" accounts (short changing legitimate authorized users). Now a new way to game the system is buying "seasoned accounts," where one, just before it is closed, can add one's name to an account which was paid off by someone else with a perfect record. The account enters one's credit history inflating the score by 35-40 points (Morrissey 2008). None of these strategies actually improve one's financial situation[13] or decreases one's likelihood of default yet improves her scores.

Most gaming involves taking advantage of a hole in the system and do not entail anything illegal. There are tricks that clearly violate the law and deployed not by the clients but by the brokers and even the lenders themselves. Some mortgage brokers allegedly hacked into credit reports sent by the bureaus to lenders to up scores by using PDF Password Remover 2.5, a free software available from the web to override password protection. Some lenders would also issue "proprietary credit accounts" to customers which they pay for but cannot use yet improves their credit record. (Foust and Pressman 2008)

Most of these tricks may not catapult someone from the bottom of the distribution to the top but can give enough points to move above the cut off point making the difference between a yes or a no decision or getting better or worse terms.

Judgmental decisions are not exempt from the perils of system gaming, but formalization together with transparency makes gaming more "democratic," that is, available to a much wider circle. Corporate rating agencies work with data supplied by clients. While financial data are highly standardized, other information must be extracted from the borrower interested in skewing the measures in its favor. For corporate ratings, data is often a matter of interpretation. How one assesses the future of products and competitors, or judges the quality of the management and its strategy is highly 'qualitative,' complex and judgmental. Data used to assess consumers, in contrast, is fairly straightforward. Arguments about

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[13]   Because a seasoned account sets you back by $1399 it actually worsens your finances.

accuracy are rarely arguments of interpretation and judgment but rather they are disputes about what happened and who is responsible. Corporate data, on the other hand, leaves wider room for interpretation. This is why 'conversations' and even site visits are necessary when a corporation is rated. Rating RMBS requires a good knowledge of the lender and the reliability of its reports. Judgment, in principle, allows for a reflexive processing of data. Corporate raters can always stop and evaluate data quality in every case. Consumer raters cannot do that because of the enormous volume and the relatively small amount of funds involved.

Reactivity, however, did pose a different problem for corporate rating agencies in the case of CDOs. As the assets of CDOs would constantly shift, the durability of their ratings depended on a set of conversion rules that defined risk equivalencies. The novelty of CDOs and the complexity of these rules created a situation, where CDO managers would constantly try to find ways around the limitations imposed on them to keep their ratings intact. The agencies had to go back to each case over and over to tighten rules just to find new holes in the system. While the rating agencies were not always able to keep a step ahead of smart managers, the only reason they could keep up as well as they did was because they could use judgment in adjusting rules and formulas.

Gaming the system is a form of reactivity (Espeland and Sauder 2007) that belongs to the category of the self-frustrating mechanism. Self-frustrating mechanisms occur when the consequence of making a prediction is that the prediction becomes less likely to hold (Buck 1963). Credit scores are predictions about the future behavior of borrowers. In the long run, system gaming, a result of the way predictions are made, makes those predictions worse as is obvious from the example of the subprime crisis.

3.2 The Omitted Variable Problem

Another weakness of formalized scoring is that the algorithm depends on a pre-specified set of variables and therefore it is capable of only very limited learning. Scoring models give different weights to each

factor, and models learn when the weights are updated from time to time with the help of new data to reflect shifts in the relative importance of the factors. A factor that loses its relevance may end up with a weight close to zero. Yet factors that are omitted from the model (and thus assumed to have a zero weight) will never appear. The model assumes that we know upfront what the relevant variables are and their list can change only by subtraction. There is no such constraint on judgmental decision making. Experts can always decide to add new factors, if they think that it is necessary, when they mull over a particular case.

Omitted variables are a serious concern for the FICO® score. Avery et al. (2000) show that omission of variables related to local economic conditions seriously bias and weaken scoring models. In the subprime meltdown, one missing variable was income. Because the FICO® does not include it, income is usually checked separately by mortgage lenders. The addition of income to the decision process is mostly done using a simple formula where the maximum loan payment is set as a percentage of the applicant's income. Loans with low documentation in most cases imply that the applicant's income was not verified. Another missing variable is assets. Although not directly measured in Figure 7, first time buyers, who tend to be younger with less accumulated wealth, are more likely to default.[14] The FICO® score does not include any information about one's "capacity" or "capital."

Nor does the credit score consider the Loan-to-Value (LTV) of the mortgage. Corrected Loan-to-Value (CLTV) that includes second mortgages and home equity loans increased between 2003 and 2006 by six percent. Not surprisingly, the amount of equity one has in a home is a very strong predictor of default, and unlike credit scores, it became a stronger predictor over time (Demyanyk and Van Hemert 2008). In fact, not only did CLTV become central to predicting who will not pay, it also influences the effect of the credit score: a low FICO® score matters less if

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[14]   Those who purchased their residence include both first and non-first time buyers (see % of Purchase Loans column). Those who refinance already own property.

the CLTV is high and matters more if the owner has little, no or negative equity in his home.

This is how Don Truslow, the Chief Risk Officer of Wachovia, one of the largest U.S. banks, put it in a DeutscheBank Securities conference call:

> "The FICOs are kind of interesting. I know there's been a lot of press about this, and we've experienced it in our book as well. In this cycle, we're seeing that loan to value and the outlook around – and the perception, maybe, amongst consumers around the trend in housing prices – so, for instance, when somebody feels like they've lost their equity and it's not going to get any better soon, or it could get a lot worse – tends to be a much bigger driver of, it seems, whether people will choose to stop paying, or will default on their loans, as opposed to just pure FICO.
>
> So we're still very much in a learning environment here as we're experiencing what's happening in the market. But FICO is still some – is a predictor, but it appears that a person or a borrower feeling like they have lost equity in their home seems to be an even bigger driver of whether they actually default and walk away from their house or their mortgage, or the like." (Wachovia, March 12, 2008)

Because CLTV is unavailable for the calculation of the credit score the quality of the score will suffer. Yet the decline in the predictive powers of the FICO® score cannot be entirely due to the fact that negative equity overrides the scores. As we have seen, the decline in the value of the FICO® score in predicting defaults began much earlier, at a time when the real estate market was still booming and people had reasons to believe their equity in the house and their CLTV would rise further. The overriding power of negative equity should not come into play until the end of 2006.

Moreover, the conditions of the loans (interest rate, actual value of the item purchased, other collateral etc.) are also missing from the credit history and therefore from the FICO® score. It is important to remember

that the FICO® score is a universal score. It fails to distinguish not just among particular loans but even among various types of loans and the same score is used for credit cards, car loans and residential mortgages.[15] Credit scores, therefore, omit a lot of important information.

Corporate rating agencies discussing their rating criteria use general descriptions and explain by example rather than by stating a fixed list of factors and measurements. This allows them to include new factors within their general outline and to deploy alternative measurement for established factors.

3.3 Correlated Defaults

Scoring algorithms assume that each borrower is statistically independent of all others. This amounts to assuming that one's default depends only on one's own characteristics (or history) and it is unaffected by defaults of others. However, defaults are often strongly correlated (Calem and LaCour-Little 2001, Löffler 2003). Cowan and Cowan (2004) demonstrated that correlated errors are of special concerns on the subprime mortgage market. The mechanisms of default correlation in real estate markets are quite clear. Foreclosure affects housing values in the entire neighborhood, depressing real estate values making the neighborhood *de facto* poorer which, in turn, increases the probability of further foreclosures. Defaulting mortgages also dampen the demand for construction and that can lead to further defaults as those working in and around the construction industry lose their jobs. In local labor markets, a borrower's loss of job can increase the likelihood of another person becoming unemployed, if their jobs are linked in some way.

Default correlation can also emerge through imitation. Seeing that others walk away from their loans makes it more acceptable to do so resulting in a cascade of defaults. In fact, once defaults reach a critical mass, the problem becomes redefined as a collective, political problem

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[15]   The one-size-fits-all approach to credit scoring creates an additional problem for CDOs where the debts can be of various types.

that requires government intervention.[16] That further increases the temptation for bailing out.

In the consumer market, where the link between two loans is less direct, default correlation can be thought of as a special case of the omitted variable problem. Real estate prices or local unemployment could be included as additional variable but they will not fully account for the volatility created by the domino effect.

In corporate lending, the relationships are more direct. If a bank lends both to a flour mill and the bakery that buys its flour, the default of the bakery has a direct effect on the miller's ability to pay his debts. There need not be any more general factor that underlies the two defaults. To model correlated defaults makes predicting behavior extremely complicated, and becomes impossible unless simple, general assumptions can be made about the correlations.

The solution to this problem in corporate rating, including the rating of RMBS and CDOs, is simulation. Simulations posit certain arbitrary levels and/or patterns of correlations among cases. These correlations are informed by historical data on macro-economic conditions. These simulations are very sensitive to measurement error and they require expert judgment to interpret their results.

3.4 Endogeneity of Creditworthiness

Another important assumption of consumer credit scoring models is that a person's riskiness as borrower or creditworthiness determines her credit score and not the other way around. To put it differently: her creditworthiness is not simply the artifact of her credit score, or in statistical parlance: her creditworthiness is exogenous with respect to her score. We have already mentioned that to some extent this in obviously untrue. Low scores result in worse loan conditions that in turn increase the riskiness of the borrower. Here the score is, at least partially, the cause and not just the consequence of creditworthiness. This is inevitable

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[16] The Bush administration already offered measures to help people whose low, introductory interest rates are about to reset to their actual, higher level.

and in many circumstances it plays a role small enough to think it is negligible. Yet there are three reasons why here the endogeneity problem is of significant concern.

First, poor performance on a particular loan and a subsequent drop in credit score can have an effect on the terms of other *existing* loans. Most importantly, the terms of one's credit card debts can be at danger of an interest hike if one's credit score goes down, say, as a result of missing payment on a mortgage. As credit card lenders can change the term on their cards with a 15 day notice, nothing keeps them from raising interest on an unrelated debt already accumulated, demanding higher payment from the cardholder, making it even more difficult for her to meet her mortgage obligations, driving her score further down.

Second, in the U.S. credit scores are used not just by lenders to evaluate creditworthiness but also by many others. Credit scores are used routinely by landlords to decide whether to rent an apartment. People with low credit scores are more likely to be turned down or to be required a large deposit. Employers use credit scores in making hiring decisions. People with low credit scores are less likely to get certain jobs. It is easy to see how a spell of unemployment can lead to missed payments, then to lower scores and finally to losing job opportunities, which, in turn, results in more missed payments. Ninety-five percent of American car insurance premiums are based on credit scores and people in financial difficulty will have to pay more to drive their cars making it harder to climb out of those difficulties.

Third, subprime lending targets vulnerable social groups. These tend to be lower middle and working class people, often minorities, who have little savings, few assets, limited skills and restricted geographic mobility to follow the best job opportunities. They lead a precarious existence and are often just a paycheck away from financial ruin. That is why they are risky borrowers and have low credit scores. For them, a small change in credit scores can have momentous consequences. Not having the financial buffers, they can quickly find themselves in a vicious cycle of financial

difficulty begetting low scores begetting even worse financial difficulty, a process where the score is as much the cause as the consequence of their economic ruin.

The expansive role of credit scoring in the U.S. may mean brisk business for FICO and the credit bureaus opening up new markets where they can sell their score. Banks also may find it helpful that non-lenders too punish their bad clients increasing the cost of non-payment and making credit scores the tool of a wider social disciplining. In normal times, it may even improve the predictive power of credit scores, as following the Matthew principle (giving more to those who already have more and taking from those who already have little) [17] helps low scores to default and high scores to stay current. Yet because it amplifies the effect of external shocks, predictive power suffers because default rates will increase much faster than scoring models would predict. In the U.S., the leading cause of bankruptcy is job loss, divorce and medical problems (Sullivan et al. 2000), shocks that are mostly beyond the control of people. The dramatic downturn in the mortgage market is another external shock that gets acerbated by the endogeneity problem.

Consumer scoring will not be the main cause of the momentum of the crisis, but it can contribute to it, putting people in a debt trap and there is plenty of journalistic evidence that it does. The same problem afflicts corporate ratings, as well, but while it is not clear if anything can be done about the endogeneity problem in the corporate world, there are ways to contain it for consumers by limiting the permitted use of credit scores to areas of lending.

3.5 Measurement: Data Issues

The accuracy of rating depends fundamentally on the quality of the data used. While scoring data is supplied by the lenders following a standardized protocol, studies report that credit bureau records are far

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[17]   'For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath.' Matthew 25:29.

from completely accurate (Cassady and Mierzwinski 2004, Avery et al. 2004, GAO 2005). Lenders have their own interests that can distort the data. Some, for instance, are reluctant to report skipped payments as a favor to the customer. Others do the opposite and report even minor lapses that are under dispute to keep customer scores down making them ineligible for better terms or less likely to move to another lender. The annual free credit report credit bureaus must provide since 2004 as a result of the Fair and Accurate Credit Transactions Act (FACTA), an amendment to the Fair Credit Reporting Act (FCRA), is designed to correct some of the inaccuracies. As providing data is voluntary by the lenders, there is little leverage that credit bureaus have over data quality but as lenders are both the suppliers and consumers of the information, they have an interest in keeping the information fairly accurate.

Lenders, the immediate sources of information, are not disinterested accountants and they do have interests in distorting information about their clients. For instance, supplying good information to the credit bureaus benefits the lender less. It raises the client's score making her more desirable to other lenders and eligible for terms more advantageous for the consumer and thus less profitable for the lender. Nothing is more profitable than a low risk client who can be charged high risk rates. This margin disappears with rising scores. Yet, at the same time, banks also can build loyalty by not reporting skipped payments and small infractions to the credit bureau. The direction of the distortion is not obvious and the result is probably just a more noisy but not a particularly biased credit score. The annual free access for everyone to their own records should further improve the accuracy of the data.

Therefore in consumer rating, data is several steps removed from the actual assessment. The client's behavior is measured by the lender, the lender hands over (a version) of this information to the credit bureau which further shapes it to fit its standardized recording system. And then the data is further processed by FICO's statistical algorithm. The nature of the data used to assess consumers is fairly straightforward. Arguments

about accuracy are rarely arguments of interpretation and judgment but rather they are disputes about what happened and who is responsible.

Corporate raters face a different situation. They have to get the information directly from the borrowers (except when their rating is unsolicited). Rating agencies are not auditors but they must do due diligence.[18] Gathering corporate data, therefore, is an interactive process, more a discussion than simple data reporting. Corporate raters depend on their clients for the interpretation of the data and they must make various judgments about the information they then process. This, in turn, introduces new elements of discretion and potential for bias and error.

One question in the investigation of the subprime crisis is whether the agencies did have a proper understanding of the securities they rated. Yet an equally important question was whether the agencies understood the serious flaws in the data lenders provided on borrowers, including the limitations of the FICO® score.

3.6 Conflict of Interest

Because corporate ratings are "opinions" raters have discretion.[19] One question U.S. legislators are examining is whether this discretion had been exercised in a self-serving manner. Rating agencies are paid by issuers and issuers want good ratings who naturally want to influence the ratings to be more favorable. The allegations that are being investigated is whether the rating agencies short-changed investors and gave better ratings to mortgage backed securities than those deserved just because they wanted the business. Critics call for more formalization,

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[18]   When rating agencies were grilled on their conduct in the Enron scandal – as Enron's stocks were judged investment grade just four days before its bankruptcy was announced – the agencies responded that they were lied to and they cannot vouch for the veracity of the information they receive from companies.

[19]   The U.S. courts ruled in the case Jefferson County School District, Colorado vs. Moodys that the corporate rating agencies are protected under the First Amendment of the U.S. Constitution, because their ratings should be considered as their exercise of free speech rights. Their ratings are their opinions (Fight 2001).

transparency, a standardized methodology and more regulation and external oversight.

No one blames FICO for any such moral failings. While the corporate rating agencies are accused of corruption, FICO is accused either at best of overselling its score and at worst peddling a product of low quality. To put it sharply: corporate raters are charged with corruption, FICO is charged with incompetence.

4. Conclusion

To sum up, formalized scoring models being more transparent are more prone to wide-scale gaming, because models are inflexible, they cannot easily handle the omitted variable problem especially when changing circumstances alter the underlying causal dynamics of the prediction, and they have to make simplifying model assumptions such as statistical independence that may work within a certain range of conditions but upend the formal model in crises.

While the volume of consumer lending makes statistical credit assessment virtually inevitable, lenders have been more wary recently of mechanized credit assessment. In an earnings call, Bank of America's CEO, Ken Lewis was grilled about the use of the FICO® score in their mortgage underwriting by an analyst from UBS:

> Analyst: Well, I think the concern was that if home prices continues [sic] to decline from here a lot of home equity for the industry overall is based on FICO's, which is proven [not] to be that great [of] an indicator [….]
>
> Lewis: Well, you do have the phenomenon, people [walking] away because [the value of the] house declines. But that's not the general nature of most people and so the assets are a function. What you think employment's going to do much more so, and what you think of housing prices are going to do, and as long as we get some reasonable job growth, I think we are okay.

Analyst: Okay. And just in general, are you guys thinking differently about using FICO® scores as you evaluate it just all your consumer lending especially relate[d] to real estate?

Lewis**:** I don't know if you remember Matt, we talked about that before, when we merged with MBNA, we picked up quite a bit of expertise on the judgmental or underwriting side. And so, we actually have a blend, where with certain attributes will kind of kick out us all of our major scoring into judgmental scoring and versus team and our risk team. So, we have a pretty good robust process there. So, that is in place, and it is something that we had as part of the arsenal and clearly use. (Bank of America, October 18, 2007)

Bank of America, the largest U.S. bank has realized the dangers of relying exclusively on mechanized scoring and it is now supplementing scores with expert judgment.

The subprime mortgage crisis cannot be blamed solely or even primarily on consumer and corporate rating, but each played its own part and shoulders some of the responsibility. Fair Isaac, Co. and the big credit bureaus should have been more alert to the limitations of its score and should not have become captive of its own public relations rhetoric. They should have spotted earlier the declining predictive power of its score and should have closed the loopholes earlier. They should have stressed the importance of using the score with other information and should have toned down their marketing claims about its forecast ability. They should have abandoned the "one-person-one-FICO®-score" model built on the assumption that the score measures character. "One-person-one-character": yes. "One-person-one-likelihood-of-loan-default": no. The single FICO® model amounts to ignoring (or omitting) important variables that describe the nature or type of the loan. FICO should have stress tested its models taking advantage of geographic information and the peculiarities of the various markets relevant to various types of loans. They should also resist the spread of the score beyond lending. It is not

just that the endogeneity problem poses a threat to validity but it also exposes the score to popular resentment and resistance.

Corporate rating agencies should have paid more attention to the quality of the data they were receiving including the quality of the credit scores. In general, lenders and rating agencies should not have relied so heavily on the score. Finally, the conflict of interest is an area where corporate rating agencies will have to make drastic changes.

In Germany, the situation is different. First, in contrast to the U.S. where mortgage brokers function as coordinators of lenders and borrowers without bearing any of the financial risks themselves, German banks deal directly with the borrowers in a less intermediated credit market structure.

Second, in comparison to the U.S. German banks rely much less on securitization as a sheltering effect for taking the risks off their books. In the last years, however, this was about to change and banks were increasingly switching "from "originate and hold" to "originate, repackage and sell"." (ECB 2008, p.81). Yet, despite its size and its long tradition of a secondary mortgage market, Germany is still behind in asset-backed securitization (Peterson 2008, p.15, also Deutsche Bank Research 2007, p.11). [20]

Third, as banks do not dump the consequences of irresponsible lending onto others, they are motivated to lend more carefully. They do not rely solely on scoring and take additional information into consideration in their lending decision. Each bank (or at least each banking group) has its own scoring system that mostly includes the Schufa score as one input variable among a range of other variables, such as income or assets. Because of that, the Schufa score in Germany does not play the same focal role as the Fico® score in U.S. mortgage lending, a cut-off rate similar to the "620" for subprime borrowers is not known.

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[20] The general culture is also against securitization of this kind: when it became public that several Sparkassen sold and securitized portfolios of performing and non-performing loans to the Lone Star Fund in 2006 and 2007 there was an uproar. Until then, the widespread belief in the German population had been that mortgage loans cannot be sold to third parties.

Fourth, not only does the Schufa score not play a focal role, its details of composition and processing are also not yet publicly known, which reduces the dangers of gaming the system. The German public in general still has a much lower awareness of credit scoring and people do not know what data are relevant for improving their scores. Public anxieties in Germany (and Europe) focus on data protection, a concern with a much lower profile in the U.S.

Fifth, the Schufa score is used much less extensively outside lending, which reduces the endogeneity effect.

And, finally, Schufa's score is not oblivious to the type of loan one applied for. This means that the score does not omit an important aspect of credit behavior.

Appendix

Figure 1.

A History of Home Values

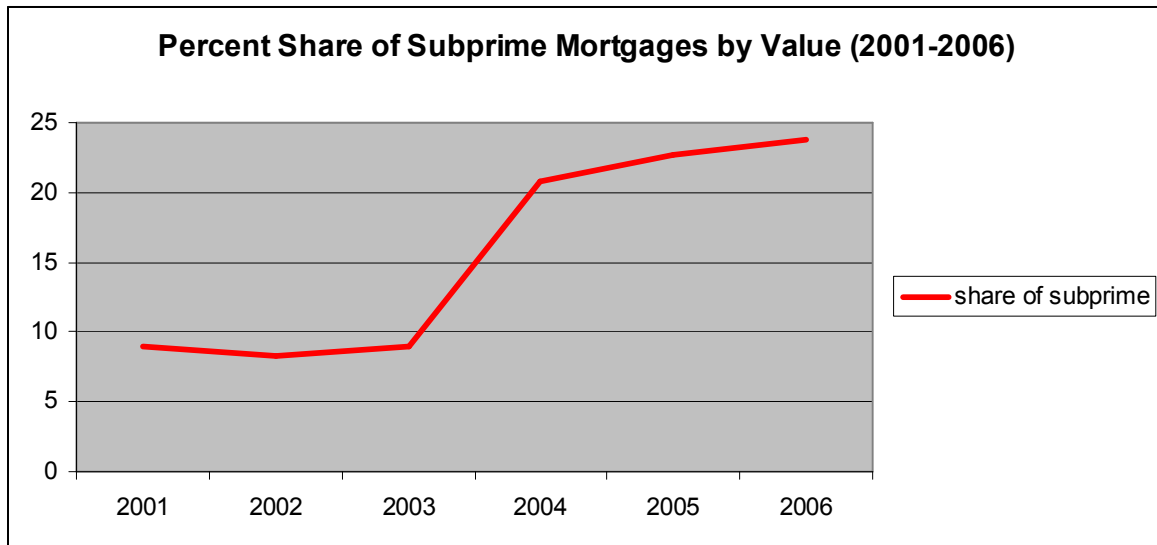The Yale economist Robert J. Shiller created an index of American housing prices going back to 1890. It is based on sale prices of standard existing houses, not new construction, to track the value of housing as an investment over time. It presents housing values in consistent terms over 116 years, factoring out the effects of inflation.

The 1890 benchmark is 100 on the chart. If a standard house sold in 1890 for $100,000 (inflation- adjusted to today's dollars), an equivalent standard house would have sold for $66,000 in 1920 (66 on the index scale) and $199,000 in 2006 (199 on the index scale, or 99 percent higher than 1890).

DECLINE AND RUN-UP Prices dropped as mass production techniques appeared early in the 20th century. Prices spiked with post-war housing demand.

BOOM TIMES Two gains in recent decades were followed by returns to levels consistent since the late 1950's. Since 1997, the index has risen about 83 percent.

Source: "Irrational Exuberance," 2nd Edition, 2006, by Robert J. Shiller

Bill Marsh/The New York Times

Source: Shiller 2006 Irrational Exuberance, 2nd Edition

Figure 2.

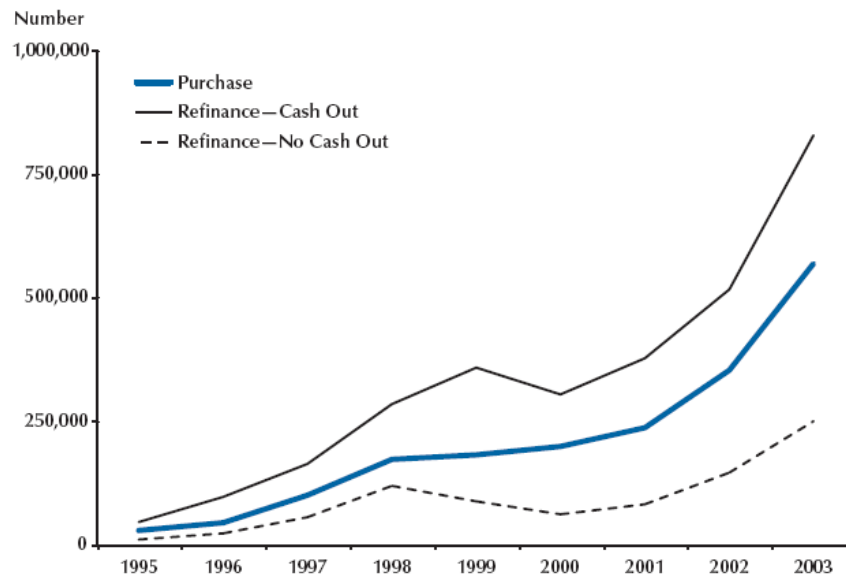**Percent Share of Subprime Mortgages by Value (2001-2006)**

Source: Calculated from Ashcraft and Schuerman 2008, p.2

Figure 3.

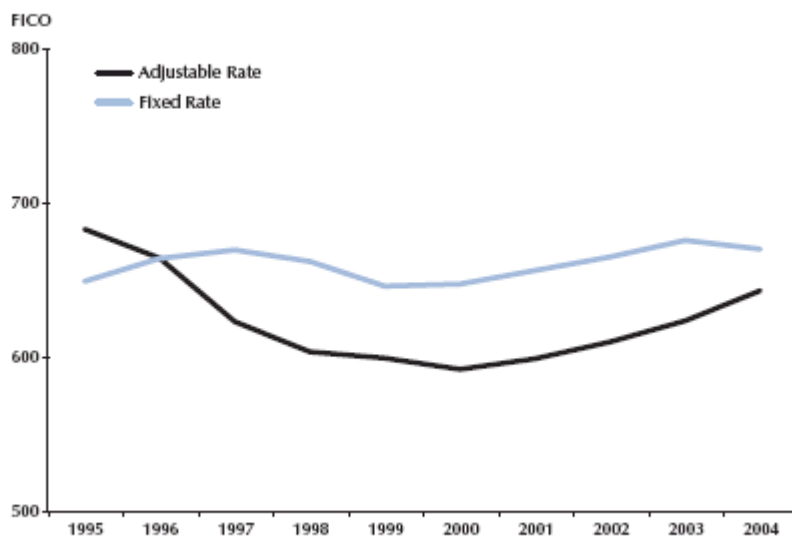**Number of Loans Originated by Purpose**

SOURCE: LoanPerformance ABS securities data base of subprime loans.

Source: Chomsisengphet and Pennington-Cross 2006, p.42

Figure 4.

Average Credit Score (FICO)

SOURCE: LoanPerformance ABS securities data base of subprime loans.

Source: Chomsisengphet and Pennington-Cross 2006, p.44

Figure 5.

Securitized Products' Credit Trends by Product Type[1]

FRM	2003	2004	2005	2006
Loan Size	$145,000	$162,155	$173,401	$164,369
Coupon	7.38%	7.03%	7.09%	8.01%
FICO	637	642	636	636
LTV	78%	77%	77%	78%
CLTV			79%	80%
% Simultaneous Seconds			12%	12%
Purchase	15%	17%	19%	16%
Full Documentation	71%	69%	68%	70%

ARM	2003	2004	2005	2006
Loan Size	$166,235	$181,424	$206,631	$224,805
Coupon	7.61%	7.17%	7.22%	8.06%
Margin		5.92%	5.89%	5.99%
Average 6-Month LIBOR		1.79%	3.76%	5.28%
Rate Discount[2]		0.55%	2.43%	3.21%
FICO	607	615	622	624
LTV	81%	82%	81%	79%
CLTV			87%	87%
% Simultaneous Seconds		25%	31%	39%
Purchase	30%	35%	41%	47%
Full Documentation	66%	60%	53%	51%

Notes:
1. Annual statistics are an average of the year's quaterly weighted average statistics
2. A discount rate is calculated as the fully indexed rate minus the coupon. Largely all of the sub-prime adjustable rate mortgage loans are indexed to 6-month LIBOR.

Source: Moody's, 2006 Review and 2007 Outlook: Home Equity ABS
(Asset Backed Securities), January 2007

FRM= Fixed Rate Mortgages

ARM= Adjustable Rate Mortgages

LTV= Loan to Value

CLTV= Combined Loan to Value (including second mortgages etc.)

Simultaneous Seconds= second lien loans that are originated in conjunction with the first lien loans as part of a low- or no-equity loan program, e.g., 80/20 combo 80% first and 20% second lien loan =100% LTV

LIBOR = London Interbank Offered Rate, interest rate offered on unsecured loans by one bank to another

Figure 6.

Average FICO Score for Alt-A and Subprime Mortgages in RMBS Pools (1999-2006)
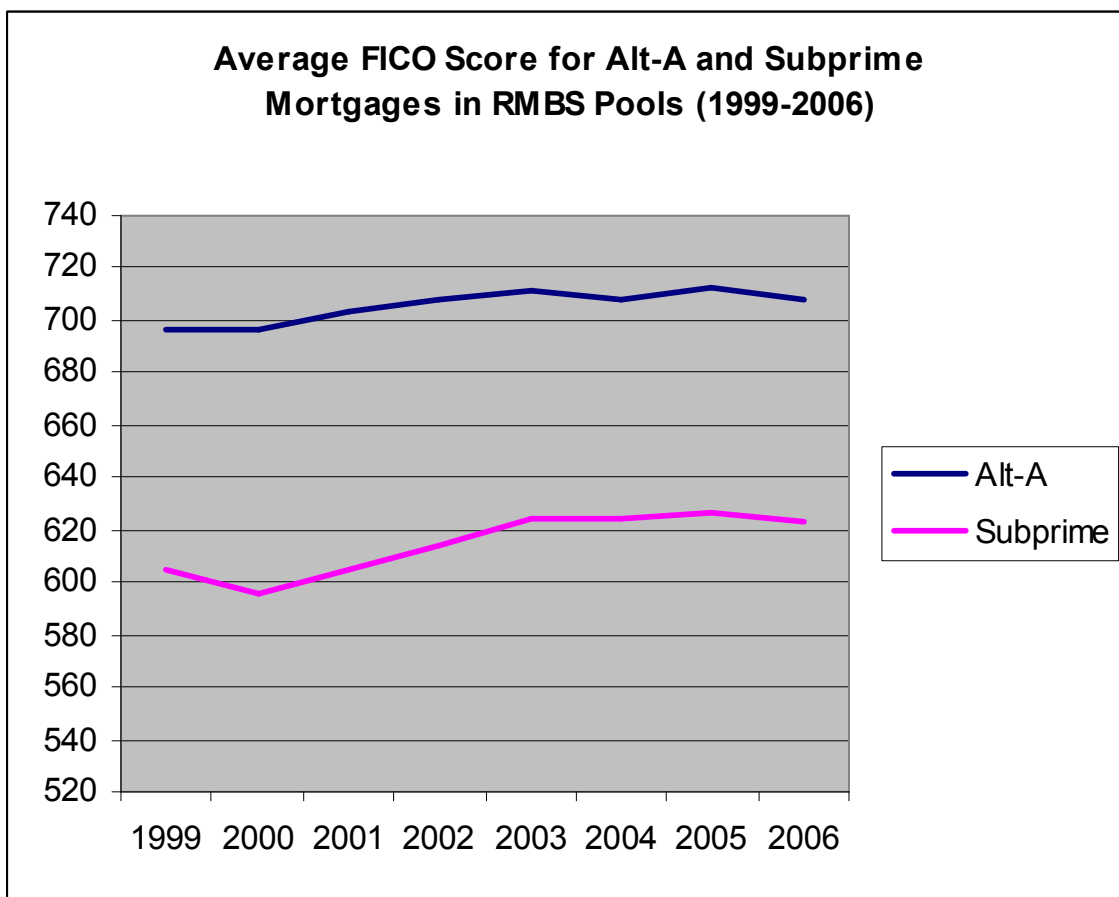
Source: Ashcraft and Schuermann 2008, p.16

Figure 7.

Vintage	Average Balance ($)	FICO	LTV (%)	CLTV (%)	% of Low Docs	% With Piggybacks	% of Purchase Loans	% in Calif.	WAC (%)
Mortgages That Defaulted by Month 12 (90+ Days Delinquent)									
2003	146,219	589	82	83	41	19	33	20	8.44
2004	157,827	593	82	85	43	22	40	19	7.82
2005	180,730	604	82	88	48	36	50	22	7.78
2006	221,148	615	82	89	54	46	56	31	8.40
Mortgages That Performed Through Month 12 (Never 90+ Days Delinquent)									
2003	155,236	620	80	81	34	14	27	32	7.59
2004	174,634	624	81	83	38	20	34	34	7.07
2005	194,163	627	81	85	40	28	39	31	7.13
2006	205,773	625	80	85	43	33	42	27	7.94

LTV – Loan to value. CLTV – Combined loan to value. WAC – Weighted average coupon.

Source: Fitch, Subprime Collateral trends and Early Payment Defaults, April 2007

FICO = Fair Isaac Co. score

LTV = Loan to Value

CLTV = Combined Loan to Value (including second mortgages etc.)

Low Docs = Low Documentation

% With Piggybacks = % of people with second liens on their house

% Purchase = % of loans for purchase a new home rather than refinance an existing one

% in Calif. = % in California

WAC (%) = Weighted average coupon. It is the weighted-average gross interest rates of the pool of mortgages that underlie a mortgage-backed security (MBS) at the time the securities were issued

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