



Imperfect information and the housing finance crisis: A descriptive overview

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ABSTRACT

We now know that the subprime market presented consumers with sub-optimal choices that they took, and that it contained many market imperfections. The interesting question, then, is what were the sources of imperfections. In the spirit of providing an introduction for this special issue of the Journal of Housing Economics, this paper discusses possible sources of market failure. Market imperfections in the Mortgage Finance System are classic: asymmetric information and agency problems. But we argue that the asymmetries and agency problems were not one-sided, but rather involved a multiple set of problems that need to be addressed.

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1. Introduction

Economists have traditionally found choice to be unambiguously good. The idea is simple: as the choice set gets larger, consumers cannot be worse off, because at worst extra choices become irrelevant. Better yet if the choices are produced without benefit of government subsidies. Because of this, economists tend to look at such innovations as subprime mortgages as welfare improving. Many commentators have expressed this view, including former Federal Reserve Chair Alan Greenspan, who noted in testimony:

“where once marginal applicants would have simply been denied credit, lenders are now able to quite efficiently judge the risk posed by individuals and price that risk appropriately...

...Improved access to credit for consumers, and especially these more-recent developments, has had significant benefits. Unquestionably, innovation and deregulation

have vastly expanded credit availability to virtually all income classes. Access to credit has enabled families to purchase homes, deal with emergencies, and obtain goods and services. Home ownership is at a record high, and the number of home mortgage loans to low- and moderate-income and minority families has risen rapidly over the past five years. Credit cards and installment loans are also available to the vast majority of households².”

More recently, however, behavioral economics has been exploring the fact that agents do have limited capacity to process information, and can therefore wind up worse off when confronted with too many choices.³ Market failure, moreover, is not controversial within economics for existence, but rather for the appropriate policy response to it. We now know that the subprime market presented consum-

¹ I would like to thank Yan Chang, Ed Golding, Doug McManus, and Bob Visini for their comments and assistance. For this analysis, data from First American Core Logic's Loan Performance was used under license.

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² See Remarks by Chairman Alan Greenspan at the Federal Reserve System's Fourth Annual Community Affairs Research Conference, Washington, D.C., April 8, 2005. The ellipse is used for brevity: the remarks within the ellipse emphasize that consumer worries about the use of technology for underwriting are largely misplaced. Available at <http://www.federalreserve.gov/boarddocs/speeches/2005/20050408/default.htm>.

³ See, e.g., Gabaix and Laibson (2004).

ers with suboptimal choices that they took, and that it contained many market imperfections. The interesting question, then, is what were the sources of imperfections. In the spirit of providing an introduction for this special issue of the Journal of Housing Economics. Market imperfections in the Mortgage Finance System are classic: asymmetric information and agency problems. But we argue that the asymmetries and agency problems were not one-sided, but rather involved a multiple set of problems that need to be addressed.

The asymmetric information problems flow between borrowers and brokers, aggregators and rating agencies, and investors and issuers. Along with these classic market failure issues, increasing competitiveness in the mortgage market may have aggravated these problems. All this said, it remains possible that the subprime market increased homeownership on net in the United States, at least for the consensus default rates expected. But it is not necessarily the case that the expansion of homeownership implies that the subprime market was welfare improving.

This paper has two parts. First, we look at the various agents involved in the mortgage transaction—including borrowers, brokers, originators, and investors—and their incentives. These incentives may help reveal how the subprime crisis became so large, and inform the appropriate policy responses going forward.

2. Agents and their incentives

2.1. Borrowers—Heterogeneous

Within the realm of the traditional conventional-conforming market, borrowers are relatively homogenous in terms of down-payments and credit scores as measured by FICO. Any variations tend to result in modest differences in default and prepayment probabilities that are reasonably well understood by the market. This is why traditional conforming mortgages may be placed into pools that sell as commodities in a very liquid securities market. In contrast, jumbo loans are tranching for credit. The Government Sponsored Enterprises' (i.e., Fannie Mae and Freddie Mac) ability to provide a corporate guarantee replaces this credit tranching to provide liquidity for the conforming market. The market performs fairly close to a market with com-

plete information. The reason for this is that conforming, prime mortgages are highly standardized: borrowers fill out a standardized loan application, appraisers use a standardized appraisal form, and borrowers provided standardized documentation for income and assets. Because Fannie Mae and Freddie Mac hold or guarantee millions of loans, they effectively have a large data set with which to calibrate models of mortgage default.

The GSEs use econometric models to estimate a probability functions; a general form of this function is $P(d|X, \Theta)$, where X is a set of explanatory variables and Θ is a set of parameters that maps the X s to delinquency and default probabilities. If the model is well specified, and the X s have large explanatory power, it is difficult for borrowers to have an information advantage over lenders: the distribution of unobserved characteristics of borrowers will wither be small or irrelevant. One of the things that allowed the GSEs to specify their models well is that they rationed loans: only borrowers whose measured X s were above a certain standard were given loans, which also created homogeneity among the borrower pool. From the perspective of Holmstrom's (1979) classic model of informational asymmetry, even uninformed agents could borrow in the prime market and investors could invest in the prime market with confidence: there was a sufficient flow of information to produce something close to a full information equilibrium.

By contrast, borrowers in the subprime market are highly heterogeneous and the differences are not fully transparent. The subprime market originally served as a market for those who had equity in their house, but because of unemployment, hardship, or even over-use of credit found themselves shut out of the traditional mortgage market. For example, Weicher (1997) concludes, "These data [on the characteristics of subprime borrowers] suggest that subprime home equity borrowers are basically the same sort of people as other homeowners and are able to make informed judgments about what is in their own best interest." Because of the higher default risk, heterogeneity in this group of borrowers is likely higher.

Fig. 1 shows that it the one measured characteristics that is available of all borrowers, subprime borrowers have a greater variation in FICO scores, in part, of course, be-

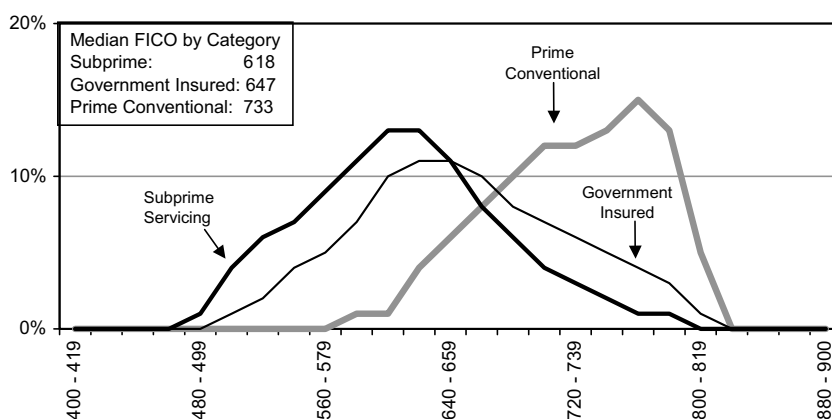


Fig. 1. Distribution of borrower FICO scores in outstanding loans as of December 2006.

cause the prime market truncates the distribution by preventing low-FICO borrowers into that market.

However, over the last 10 years, the market's volume expanded dramatically. The subprime market became a source of funds for first time homebuyers who otherwise would have had to wait to develop a positive credit history before buying a house. With less equity and no established history of making mortgage payments, both the heterogeneity of the pool and the lack of market knowledge about how these loans would perform over a cycle increased. The subprime market also expanded rapidly into investor loans as web-sites such as "condoflip.com" became prevalent. Investors could use subprime loans subprime mortgages as a *de facto* call option for investing in a house. And often, we suspect, mortgage lenders could not accurately distinguish between investor properties and homeowners. This category includes victims of the housing finance system, but also exploiters of the housing finance system. We will take each of these categories of borrowers one at a time.

2.1.1. Borrowers tapping equity

Consumers have two ways of getting equity out of their houses: cash-out refinancing and home equity lines of credit.

A cash-out finance takes place when a borrower pays off one mortgage and replaces it with a larger mortgage. Cash-out refinances are a particularly large part of the refinance market when market interest rates are rising: under such conditions, consumers simply looking to reduce their monthly mortgage payments will not refinance. According to the most recent Freddie Mac refinance survey, 87% of all refinances in the third quarter of 2007 were cash-out refinances. It would be helpful to know how borrowers used the cash they took out (in some cases, it was just to finance closing costs), but Loan Performance does not contain this information.

Home equity lines of credit (HELOCs) allow borrowers to tap into home equity without going through the relatively lengthy, and often more costly, process of obtaining a first-lien mortgage. It also allows owners to borrow amounts they wish when they wish: there is not a fixed payment structure. On the other hand, HELOCs are usually tied to a short-term interest rates, such as LIBOR, and as such do not give borrowers the benefit of known mortgage payments from month-to-month. They also typically carry higher margins than first-lien adjustable rate mortgages, again partially offsetting the flexibility and less arduous origination process.

When homeowners need cash, they have a strong incentive to draw upon home equity: so long as the outstanding value of their mortgage balance is less than \$1.1 million or the purchase price of their home plus the cost of capital improvements, borrowers may deduct mortgage interest on home equity loans. We should note, however, that these tax benefits are unequally distributed because lower-income households that do not itemize and utilize cash-out refinances are trading tax-free equity for a mortgage that is effectively paid for on an after-tax basis. Borrowers can also benefit from the fact that because a mortgage is a secured loans its cost will generally be lower than revolving debt, credit card debt or a personal loan.

But consumers have very different motivations for why they take on home equity debt, and these different motiva-

tions may tell us something about likely future credit performance. Borrowers have four broad motivations for taking equity out of their homes: consumption of consumer durables (or non-durables) home improvements (which may be viewed as both a consumer good and an investment), portfolio rebalancings, and bill consolidations.

Those who do not have liquid wealth often optimize by using home equity to purchase a consumer durable, such as a car, because such a financing mechanism lowers the cost of capital and allows for consumption smoothing. As subprime mortgages have taken a beating in the media recently, commentators have forgotten that they allow households to obtain consumer finance far more cheaply than other methods of funding: in particular, a subprime fixed-rate mortgage may well be less expensive for consumers than for a subprime automobile loan.⁴ Tapping home equity to purchase a durable also has only a gradual effect on household balance sheets, as the asset one buys through home equity is a depreciating, rather than immediate, expense.

On the other hand, when consumers use home equity for non-durables, they are causing their household balance sheet to deteriorate immediately. Nevertheless, when people lose their jobs or become ill, home equity may allow not just consumption smoothing, but solvency.

Whether a household uses home equity to purchase consumer durables or non-durables could well be an important predictor of loan performance: those who use home equity to finance consumer durables are likely to be in a different financial position from those who use it to finance immediate consumption. Unfortunately, it is difficult, if not impossible, to know whether this is the case because borrowers are not always required to identify the purpose for which they accessed their home equity, especially when using HELOCs.

The use of home equity to fund home improvements is another matter. While home improvements do not necessarily add to house values on a dollar-for-dollar basis, some home improvements actually provide value in excess of costs (new roofs and windows might be examples of this). Consequently, home equity used to finance home improvements does not necessarily reduce the net equity position in the house, and as such not necessarily increase the possibility of default.

Using home equity to rebalance a portfolio can also reflect optimizing behavior. When households have a substantial share of their wealth in home equity, taking money out of the house and putting it in the stock and bond markets creates substantial diversification benefits. Nevertheless, the increase in leverage makes the position in housing in and of it more risky, and if the household moves from a home equity position of 20% to 10%, it is doubling its leverage ratio, and consequently, is doubling its risk with respect to housing. In short, it is not clear whether households that are already highly leveraged reduce their overall risk position by borrowing against their house to purchase other assets. To give an example, suppose a local housing market has a standard deviation of

⁴ The website bankrate.com shows that auto loans are generally more expensive than comparable home loans.

5% in its returns, while an index fund has a 10% return. The correlation between the two markets is 0.5. Suppose all of a household's wealth is in home equity, and its loan-to-value (LTV) ratio is 20%. If it takes half the home equity and places it in the index fund, the LTV is now 90%. The standard deviation of the household portfolio has now increased from 25% to 28%, because the leverage effect offsets the diversification effect.

Finally using home equity to consolidate bills indicates perhaps two offsetting characteristics of a household: on the one hand, it may be using home equity to reduce its total cost of debt, in which case it reduces the overall credit risk of the household. On the other hand, it can also indicate that a household got itself into trouble by taking on too much debt. If a household is in the subprime market because it has a low FICO score, the need to consolidate debt reaffirms the evaluation of a household's credit worthiness.

2.1.2. First time homebuyers

The United States government has long encouraged homeownership. As such, it has had a series of tax preferences for owner-occupied housing, as well as specialized housing finance institutions, including Savings and Loans, the Federal Housing Administration, the Federal Home Loan Bank System, Fannie Mae and Freddie Mac. At the same time, advocates have noted the difference in homeownership rates across race and income class. Some commentators, such as Melvin Oliver and Michael Sherraden, have shown that housing equity has been the principal method by which middle-class and lower-middle class Americans have accumulated wealth.⁵ The disparate rates of homeownership may, therefore, prevent minorities and low-income households from accumulating wealth. Oliver and Sherraden are hardly alone in sharing this view—politicians in particular seem to think that both wealth and good social behavior arise from homeownership. It would be helpful to know borrowers used the cash they took out (in some cases, it was just to finance closing costs), but Loan Performance does not contain this information. Consequently, government policy has encouraged lenders to advance loans to lower-income and minority households; the levers they have used for doing this are the Community Reinvestment Act and the GSEs' Affordable Housing Goals.

The message to low-income renters was clear: homeownership was a good thing with little concern to the location of the house, expected tenure, and long-term mortgage costs. Consequently, minorities and low-income households with poor FICO scores and little cash for a down-payment were encouraged to use subprime loans to purchase houses even in those markets in which opportunities for appreciation were limited.

We should make clear that when we say opportunities for appreciation were limited, we do not necessarily mean inner cities: some of them experienced substantial increases in value between the late 1990s and 2005, and even with the declines of the past few years, are substantially higher in value than they were ten years ago. For example, even in rust-belt

metropolitan areas, such as Detroit, Cleveland, Buffalo and Pittsburgh nominal values increased by 40 to 60 percent over the period 1997–2007.⁶ In contrast, in areas where housing supply was very elastic, such as on the fringes of a metropolitan area, the growth in housing prices was likely tied to the cost of new construction. For example, George Bush's White House put out the following statement in a press release⁷: The president believes that homeownership is the cornerstone of America's vibrant communities and benefits individual families by building stability and long-term financial security. In June 2002, President Bush issued *America's Homeownership Challenge* to the real estate and mortgage finance industries to encourage them to join the effort to close the gap that exists between the homeownership rates of minorities and non-minorities. The President also announced the goal of increasing the number of minority homeowners by at least 5.5 million families before the end of the decade. Under his leadership, the overall U.S. homeownership rate in the second quarter of 2004 was at an all time high of 69.2 percent, minority homeownership set a new record of 51 percent in the second quarter, up 0.2 percentage point from the first quarter and up 2.1 percentage points from a year ago.

Nevertheless, with loan products that allowed borrowers to become owners with little or no equity, the prospect of being a homeowner was surely irresistible to many families who never thought they would be able to become homeowners. Subprime lending allowed borrowers to buy a house without any equity—and according to First American LoanPerformance data, the percent of purchase money subprime mortgages having LTVs in excess of 100% increased from 1.6% in 2000 to 28.6% in 2006. Having no home equity, these households more resemble renters than owners with respect to incentives to maintain, mobility, etc. To the extent buyers with little or no money down also had little in the way of financial resources, any major housing expense, such as the need to replace a roof or a furnace, could lead to foreclosure. This also means that when such households face a trigger event, such as job loss, illness or divorce, they have might very well be in a position where the wise financial action is to foreclose.

It is a worthwhile question to ask whether on net the subprime market has increased or decreased the homeownership rate. The Center for Responsible Lending maintains that the subprime market has reduced homeownership, because the number of subprime foreclosures exceeded the number of subprime mortgages originated for first time homebuyers for each year between 1998 and 2006.⁸ But as Jack Guttentag points out, this comparison stacks up originations for first time homeowners against foreclosures for all subprime mortgages.⁹ It is entirely possible that borrowers that refinanced from a prime into a subprime mortgage would have defaulted regardless of the refinance,

⁶ This growth is based on the increase in the Freddie Mac's CMHPI MSA-level repeat sales house price index from 1997Q3 to 2007Q3.

⁷ See <http://www.whitehouse.gov/news/releases/2004/08/20040809-9.html>.

⁸ See Center for Responsible Lending, *Subprime Lending, A Net Drain on Homeownership*, <http://www.responsiblelending.org/pdfs/Net-Drain-in-Home-Ownership.pdf>. Access October 7, 2007.

⁹ See http://www.mtgprofessor.com/A%20-%20Public%20Policy%20Issues/does_the_sub-prime_market_reduce_home_ownership.htm, Accessed October 7, 2007.

⁵ For evidence on this, see Bucks et al., 2006, Sherraden (1991, and Oliver and Shapiro (1997).

Table 1

Percentage of no/low documentation loans by occupancy status.

Origination year	Percent no/low documentation loans		
	Owner occupied (%)	Second home (%)	Investor property (%)
2003	44.0	60.1	51.0
2004	48.6	57.1	53.5
2005	42.2	65.5	60.3
2006	32.4	58.2	46.3

Source: First American LoanPerformance data.

because default usually arises from circumstances, such as job loss, divorce and illness, which have nothing to do with the financial characteristics of the mortgage (see Galster and Santiago, 2007).

2.1.3. Investor properties

Some of the more exotic subprime mortgage products resembled call options, and as such should have been attractive to speculators in a hot housing market. Two products in particular stand out: the 2–28 adjustable rate mortgage, which carried lower interest rates for two years, and then reset to a rate with a high margin over LIBOR or one-year treasury securities, and the so-called “option-ARM,” where borrowers had a negative amortization option. Investors could purchase a house in a market with high levels of appreciation and have low carrying costs for a few years. In the event that house prices rose substantially, the investor could sell at a very high internal rate of return (because down-payments and monthly payments would be low). In the event house prices fell (which, of course, they did), the investor could default at low cost. Consequently, some of the subprime products attracted speculators. As we shall discuss later, it is a bit of a surprise that investors in mortgage-backed securities didn’t understand the kind of adverse selection that were an inevitable consequence of these products.

Beyond the fact that they had an incentive to get exotic subprime products, investors in houses may not have qualified for prime loans and use no/low documentation loans to get around credit policies. According to Loan Performance data, shares of no/low documentation loans for subprime home-purchase originations are higher with investor properties and second homes (see Table 1).¹⁰

In short, while different types of borrowers had very different motivations for borrowing, many of them—those doing bill consolidation. High LTV, low FICO first time homebuyers, and investors, were *per se* default risks.

To this point, however, we have described borrowers as if they were fully informed about their mortgage decisions. Because of the nature of mortgage disclosures, this is almost certainly not the case. Green and Wachter (2008) set forth the nature of the problem:

Asymmetric information also arises because it is likely that mortgage originators understand mortgage pricing

and risk better than borrowers. To make this concrete, consider the nature of mortgage disclosures. The Truth in Lending Act requires that borrowers be informed of the Annual Percentage Rate (APR) on their mortgage. The APR rate is the internal rate of return on a mortgage based on its coupon rate, discount points, [some fees] amortization and term. The APR calculation assumes that borrowers never refinance, and makes no provision for certain fees [such as prepayment penalties that expire before the loan matures]. As such, it does not give an accurate picture of mortgage cost.

Both borrowers and investors in mortgages are interested in yield, which is the internal rate of return on a mortgage. But of course, the yield is not the same thing as the mortgage coupon rate (the basis on which the mortgage amortizes) or the Annual Percentage Rate (APR) (a rate that amortizes the cost of discount points over the amortization period of the mortgage). The yield is rather the true return/cost of a mortgage. Even in the context of a fixed-rate mortgage, disclosing effective cost is not straightforward.¹¹

Inadequate disclosures create market failure. As Federal Reserve Board Governor Randall Kroszner notes, “Information is critical to the effective functioning of markets...[a] core principle of economics is that markets are more competitive, and therefore more efficient, when accurate information is available to both consumers and suppliers...pages and pages of fine print may provide comprehensive descriptions that lawyers might love, but consumers find it confusing, or, worse, useless. We need to translate legalese into something consumers can use.”¹²

2.2. Intermediaries

2.2.1. Channels between consumers and the mortgage market

A number of channels connect consumers to the mortgage market. We focus on one: the wholesale channel. Apgar et al. (1997) provide a good characterization of this channel:

Most wholesale lending operations include two distinct components: mortgage brokerage, and correspondent lending. Typically, correspondent lenders are smaller mortgage banks, thrifts, or community banks that operate much like retail lenders in that they take applications, underwrite and fund mortgages, and then sell these “whole loans” to a wholesale lender under prearranged pricing and delivery terms. In contrast, brokers are independent agents who identify customers and match them to mortgage products. The broker’s role is to help the borrower submit the mortgage application to the wholesale lender, who then makes the decision to accept or reject the application and fund the mortgage.

¹⁰ In addition, there can be misrepresentation of investor properties as owner-occupied. For example, FitchRatings (2007) “The Impact of Poor Underwriting Practices and Fraud in Subprime RMBS Performance,” conducted a file review of early defaults and finds that 66% of these loans were misrepresented as owner-occupied.

¹¹ A referee pointed out that Green and Wachter (2008) was not quite correct on this point. The changes in brackets give a more accurate depiction of APR.

¹² See remarks by Governor Randall Kroszner, “Creating More Effective Disclosures” at the George Washington University Financial Services Research Program Conference on subprime lending, May 23, 2007. Available at <http://www.federalreserve.gov/newsevents/speech/kroszner20070523a.htm>.

Table 2

Loan characteristics by channel.

Origination year	Share of no/low doc loans		Share of hybrids	
	Retail (%)	Broker (%)	Retail (%)	Broker (%)
2003	28.1	34.8	54.6	62.7
2004	26.1	40.8	69.0	70.6
2005	22.6	41.4	62.8	68.1
2006	17.0	36.2	47.2	53.1

Source: First American LoanPerformance data.

In one sense, the mortgage brokerage market is highly competitive. As licensing requirements are in many places non-existent, there is free entry into the mortgage brokerage market. Brokers, moreover, do not have the capital requirements that portfolio lenders have. Consequently, we would expect economic profits for brokerage to be, at the margin, on average, zero, and for brokers to engage in what [Krueger \(1974\)](#) refers to as ‘rent seeking’. The methods of rent seeking take two forms: identifying borrowers who are particularly incapable of understanding mortgage pricing, and exploiting the implicit moral hazard arising from being able to initiate mortgages without capital, by shopping loan applications to various lenders.

While we do not have adequate controls, aggregate data suggest that the nature of the loans initiated by brokers is different from those originated through other channels. For example, the propensity of brokers to originate loans with low or no documentation is substantially higher than for retail channels. In fact, in 2005 and 2006, brokers were more than twice as likely to originate low/no doc loans than retail channels, and were more likely to originate hybrid ARMs ([Table 2](#)). Brokers also were more likely to originate controversial products such as 2–28 ARMs with prepayment penalties. Borrowers with FICO scores in excess of 660 were also more likely to obtain a 2–28 subprime loan from a broker than from a retail lender.

At the same time, lenders competed for the opportunity to fund borrowers through brokers. As one trade journal explains, “Brokers would fax application information to multiple lenders: 73% of brokers shopped identical Alt-A and subprime loan packages for prequalification to two or more lenders.”¹³ An originator maintaining high credit standards in an environment where brokers vigorously shop loan applications among a number of lenders, risks losing market presence.

We may then ask what the equilibrium is between the broker and retail lending channels. To simplify, let’s assume that the fundamental difference is capital: brokers needn’t hold it, while retail lenders do. Let us also say that the prime market is chiefly rationed through underwriting standards, while the subprime market is priced. In this stylized economy, the appropriate capital for a prime mortgage is lower than the appropriate capital for a subprime loan, because default losses on prime loans are lower than on subprime loans. Let us also say that it takes more effort to originate a subprime loan than a prime loan.

Expected profits before effort on subprime loans are identical to prime loans, but the variance of profits is greater in the subprime market. This should lead to a separating equilibrium whereby brokers take the subprime market and retailers take on the prime loans.

Retailers will want to avoid subprime loans, because capital is expensive, and because they will want to avoid costs associated with subprime loans. Brokers, on the other hand, will want to take on subprime loans, because if the loan fails, the broker suffers no costs. Consequently, from the standpoint of the broker, the distribution of profits is truncated at zero, and so the expected profit from subprime loans is greater than prime loans. Because the broker must engage in effort to originate the loan, it prefers loans whose realizations will be more profitable to it, and consequently will originate only subprime mortgages.

The actual marketplace is more complex than this example suggests. While many brokers specialize in either prime or subprime lending, many do both types of loans. Moreover, some correspondent lenders have become ‘super mortgage brokers’ with the ability either to originate loans or to serve as a wholesale broker. This arrangement allows a firm to channel subprime loans through the broker channel, and thus limiting both capital needs and legal liability.¹⁴ The important point is that, disproportionately, subprime loans are originated in an environment in which there will be strong incentives for the production of loan volume with limited offsetting exposure to the underlying financial and legal risk.¹⁵

The mystery in all of this is why investors did not understand this dynamic. That is an issue to which we will return later.

Ratings agencies have long borne criticisms for a compensation structure that encourages overstated ratings (see for example, [Smith and Walter, 2002](#)). Securities issuers themselves pay for ratings, and they do not pay the agency until the security is rated. The explosion of subprime MBS and collateralized debt obligation (CDO) issuance has, until recently, resulted in a large and growing share of the agency income generated through rating these structured products. Changes in ownership structure may have increased the pressure for short-term earnings growth, as well as acting to increase competition among agencies. Moreover, those who work for rating agencies can often move to higher paying positions working for the firms being rated. That rating agencies benefit from rating as many securities as possible comes from the stock price of Moody’s, which rose dramatically relative to the S&P 500 over the period in which subprime lending grew rapidly ([Fig. 2](#)).

It is clear *ex post* that ratings agencies substantially underestimated the risk in structured securities (especially CDOs). This is why they have needed to downgrade so many securities, especially those securities based on subprime collateral. On the other hand, this does not by itself indicate that the compensation structure of agencies led to high ratings; rather, it could have been driven by spurious assump-

¹⁴ Inside Mortgage Finance, 7/28/2006.¹⁵ For an practitioner’s perspective on this issue see Andrew Davidson’s essay “Six Degrees of Separation,” in *The Pipeline—Special Edition*, Andrew Davidson & Co.¹³ Inside Alternative Mortgages 1/13/2006; Inside B&C Lending 1/6/2006.

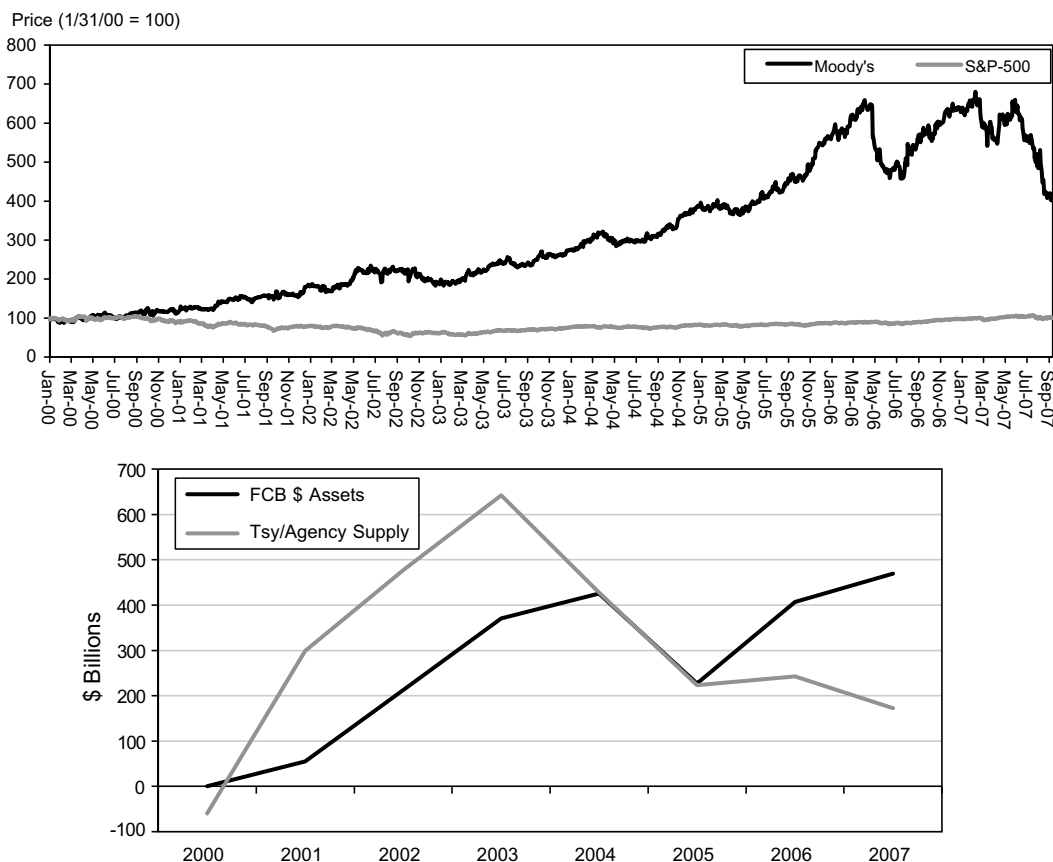


Fig. 2. Moody's stock performance relative to the market.

Table 3

Ratings change by collateral type.

	Prime/jumbo	Alt-A	Subprime
Number of upgrades	1379	374	1,180
Number of downgrades	416	73	5,111
% Downgrades relative to all ratings changes	23.18	16.33	81.24

Source: Bear Stearns 'Across the Curve' includes Moody's, S&P, and Fitch rating changes from 1/3/06 to 9/7/07.

tions about continued house price growth, or flaws in the modeling. Indeed, the ratings downgrades have been especially concentrated in the subprime market (see Table 3).¹⁶

Instead, the agencies may well have predicted performance poorly because their empirically based models of subprime loans did not predict substantial losses. This was understandable considering that nominal house prices throughout the United States rose from the middle-1990s through the year 2004. Under these house prices conditions, borrowers that got into financial trouble had strong incentives to sell their house (and therefore keep some

equity) rather than default. This may have led analysts to believe that a large portion of the credit risk in subprime securities was idiosyncratic, and hence diversifiable. Given the favorable loss experience over this period, some critics argued that the agencies were overestimating the credit risk in subprime MBS (see, for example, Engel and McCoy, 2007, p. 2055). The decline in underwriting quality over this period can also impact the risk associated with a given factor, rendering models based on historical relationships outdated. For example, the incremental risk associated with low documentation loans has greatly increased in recent years (see Table 4).

Housing market conditions began changing in 2005. Deteriorating economic conditions in the rust-belt led house prices to plateau and then fall in some cities—notably Cleveland and Detroit. One hundred percent LTV loans no longer developed a cushion; more important, flat aver-

Table 4

Delinquency rates by documentation level.

Documentation level	Ever 90-days delinquent by origination year					
	2001	2002	2003	2004	2005	2006
Low (%)	23	19	15	16	20	20
Full (%)	22	17	13	13	14	11
Risk Ratio	1.04	1.06	1.13	1.24	1.47	1.85

Source: First American LoanPerformance data on ARMs with 590–660 FICO scores and 80–90 LTV.

¹⁶ It is also interesting to note that over the 1/3/06 to 9/7/07 period there were material differences in the downgrade rates across the agencies. The rates of downgrades to total ratings changes were 69% for Moody's, 79% for Fitch, and 90% for S&P.

age house prices in a metropolitan area meant that some neighborhoods had deteriorating values. As a result of slowing house price growth, defaults on subprime loans started rising sharply. As defaults increased, in submarkets with high subprime concentrations, a glut of REO houses caused market values to fall, which in turn led to increasing losses conditional on default. To the extent that the agencies adopted overly optimistic views of future house price performance and were slow to adapt to changing market conditions, this alone could lead to a substantial difference between the ratings and the actual risk in structured products based on subprime loans.

The failure by the agencies to properly assess the risk of pooled subprime tranches in collateralized debt obligations (CDOs) had particularly important implications for the subprime market. Typically, the largest challenge in securitizing a pool of subprime loans is marketing the lower rated tranches of the structure. CDOs had been providing such a market but only because ratings agencies (and investors) had overstated the diversification gains available through pooling, effectively viewing the lower rated subprime tranche risk as largely idiosyncratic. This resulted in a substantial under pricing of the credit risk in these tranches, and consequently, an excessive demand for subprime issuance. It is now clear that to a large degree this risk was systematic. Consequently, the market demand for lower rated subprime tranches is unlikely to return to the levels seen over the last few years.

Perhaps as important as the spuriousness of the models that underlay credit ratings was the fact that the meaning of credit ratings changed across time and varied across industry type. Nomura Fixed Income Research (2006) argued that both Moody's and Standard and Poor's lost their moorings over the course of the last ten years.¹⁷ Nomura argues:

...a rating system is most useful when each rating symbol has a constant meaning over time, geography, currency, and type of instrument. A rating system works best when a given symbol (e.g., BBB) denotes the same measure of credit risk for a German corporate bond in 1985, a US municipal bond in 1995, and a Korean mortgage-backed security in 2005.

Yet Nomura produces evidence that the performance of securities with the same rating varied across time, industry sector, and security type. Consequently, a BBB+ rating on a CDO meant something different from a BBB+ rating on a MBS, which in turn meant something different from a BBB+ rating on a corporate bond. Bond ratings are an important ingredient for regulating financial institutions and, more generally, for articulating investment guidelines for asset managers. If they are not consistent across security types, institutions and asset managers can have an incentive to shop for securities that have the highest rating per unit of risk.

Beyond the general issue of the inconsistency with which rating agencies evaluated securities, and the fact that the agencies underestimated subprime risk, the agen-

cies also appeared to be behind the market in their procedures for evaluating CDOs, especially those backed by subprime mortgages. One factor contributing to this gap was that other market players, such as hedge funds, would often recruit the agencies' strongest analytical talent.¹⁸ It should also be noted, however, that CDO risk analysis is an emerging area of finance and there were market-wide weaknesses in the methodologies used to value CDOs and their risks over this period. One interesting aspect of reports of CDO-related losses at financial institutions active in creating these instruments was that they retained significant positions in these structures suggesting (by revealed preference) that they also overestimated the diversification gains.

2.3. Investors

One of the great mysteries of the subprime crisis is why investors failed to understand the risk they were taking on when they bought securities backed by subprime mortgages. We speculate that investors were lulled into a false sense of security by the boom period for the housing market that lasted from around 1993 (when markets on the East Coast and California pretty much hit bottom) to 2005. A similar malfunction in financial markets took place in 1993, when after a remarkably extended worldwide bond market rally, rising interest rates caused leveraged investors with positions in long-duration fixed income securities to experience large losses.¹⁹

Another contributing factor is the structure of fund manager compensation. Hedge fund managers tend to be compensated by the "2–20" rule: they get two percent of the value of the fund they are managing, and 20% of any yield the fund earns above a designated index. This compensation scheme is like an option: the payoffs are asymmetric. If the fund does better than the index, the manager gains a lot; if it does worse, the manager in the short run is no worse off than if the index matches the market (although in the longer run, underperforming funds will lose assets). This will create incentives for fund managers to take on greater risk.

A third possibility is that subprime based CDOs were sufficiently complex to analyze that investors relied heavily on ratings agency risk assessments, and consequently higher rated tranches commanded a liquidity premium: many investors face ratings-driven restrictions on investments that result in highly rated tranches benefiting from greater liquidity.²⁰ At the same time, CDOs were not very transparent, and many investors, it seems, relied solely on rating agencies to properly evaluate risk.

¹⁸ "If the ratings agency ends up coming up with a really, really good pricing model, the individual responsible for developing those models will very quickly be hired by the hedge funds," MIT Finance Professor Andrew Lo quoted in the Reuters article "Can Wall Street be Trusted to Value Risky CDOs?" July 13, 2007

¹⁹ Orange County, California, was probably the best-known example of an institution that took a highly leveraged position in long-duration fixed income securities. The outcome was that the bonds of one of the richest counties in the United States went into default. Also, at the same time a number of money market funds managed by large financial institutions suffered major losses.

²⁰ See Fender and Mitchell (2005) for a discussion of the heightened role of ratings agencies in guiding investors in structured financial instruments.

¹⁷ Mark Adelson, "Bond Ratings Confusion" June 14, 2006, revised June 29, 2006, Nomura Fixed Income Research.

All this said, we must finally acknowledge the possibility that some investors may have made decisions with their eyes wide open, fully understanding the nature of the product they were buying. Just because investors take risks that *ex post* do not pay off doesn't mean that they were ill-informed when they made their decision.

Finally, many commentators have noted that world financial markets have recently been swimming in liquidity. The foreign central banks demand for high quality assets outstripped the supply of US Treasury and Agency assets by about \$300 billion in 2007. Outside of the United States, the world saved so much that yield spreads narrowed on almost all types of investments.

Policymakers are suggesting a variety of actions to avoid repeating the events characterizing the mortgage markets over the past year. Many of these actions are regulatory, and include such things as the development of "suitability rules" and assignee liability. We would like to suggest practical alternatives for reducing externalities arising from the crisis. We also would hope that new regulation would focus on aligning incentives to mitigate against the adverse selection and moral hazard issues that led to the current crisis. To be more specific, changes in policy should accomplish three things:

- (1) It should make sure that more parties in the lending chain have "skin in the game." While reputational risk mitigates against bad behavior, there is not a substitute for financial incentives
- (2) It should make sure that parties in the lending chain are subject to federal supervision. This will both reduce regulatory arbitrage and investor monitoring costs, facilitating the flow of capital into this sector
- (3) It should do what it can to improve disclosures throughout the lending chain. Borrowers must be better informed as to the consequences of their lending choices (although this will be difficult); ratings must be more consistent, and securities must be more transparent

These types of reforms will only help the market going forward. The coming wave of defaults could be dramatic: some analysts have suggested that the default rate among all subprime mortgages could reach as high as 20–25 percent. To put this in context, the mortgage default rate during the Great Depression was around 10% (Green and Wachter, 2005). While the subprime market never made up more than 20% of origination volume in a particular year, there are neighborhoods that relied heavily on subprime financing, and so this magnitude of defaults could have depression like effects on these neighborhoods.

As such, it may be appropriate to think of a housing triage program, particularly for those households who kept current on their payments before a rate reset. Two proposals are intriguing. One comes from Andrew Samwick, and Dean Baker:

There is a simple way to allow troubled homeowners to stay in their homes without also bailing out the mortgage issuers and speculators. Congress can pass legislation granting current homeowners the right to stay in their homes as long as they

like, simply by paying the fair-market rent. In other words, no one gets tossed out on the street, as long as they can pay the rental value of their house. The fair rent would be determined by an independent appraiser — exactly the same way that a lender is supposed to determine the size of a mortgage that can be issued on a home. Under this plan, homeowners would turn over their property to the mortgage holder. This would generally not be a loss since borrowers currently face crises precisely because they owe more than the value of their house. If the value of the home exceeded their debt, then they wouldn't have to sign up for the program.

As a renter with secure tenure, the former homeowner would have incentive to do necessary maintenance and keep the home from falling into disrepair. This would prevent the blight that is already hitting neighborhoods where foreclosures have become commonplace.

There are some issues here; among others are the facts that it might not be straightforward to determine market rent, and will require capital to be raised to fund acquisition of the homes. This capital will either need a subsidy or will entail higher expected returns. It will be difficult to sell a detached single family home if the renters in it have absolute tenure security, and hence this constraint will have to be reflected in a higher return on equity.

As for going forward, we begin with capital. A mortgage finance system in which more participants have some 'skin in the game' may help better align individual interest with social interest. The current 'originate to securitize' model of housing finance with participants having little stake in the performance on the loans they arrange has led to perverse incentives. Compensation could be tied to loan performance and deferred for a year or two.

The current compensation system for brokers also produces perverse incentives. Brokers benefit from two things: yield spread premiums (YSP), which are largely invisible to borrowers, and volume. Their compensation is not tied to loan performance. As such, brokers have an incentive to steer borrowers to high YSP loans that have low initial payments (the low initial payments allowed borrowers to qualify for larger loans). The probability that loans would repay had almost no impact on brokers' incentives. So long as house prices were rising, the poor quality of the loans was masked; as soon as house prices began to flatten, the poor quality revealed itself.

The best way to have brokers avoid this behavior in the future is for their compensation to be somehow tied to loan performance. It is possible that in the end this could only come about with a restructuring of the broker market that required some combination of bonding and capital.

Second, it is important to make mortgages and their costs more transparent to consumers. Consumers should be aware of the total compensation that brokers earn (including the yield spread premium). This would be analogous to the current practice wherein consumers see the wholesale cost to the dealer of an automobile, so they know the mark-up they are paying when they buy the car. Guttentag (2007) has an interesting proposal wherein consumers would get only two mortgage prices: a rate and points. All fees would have to be wrapped into either the

YSP or the rate. To continue to analog with automobiles, Guttentag argues that just as it is the case that car buyers do not get to choose whether the car has tires, borrowers do not get to determine whether the loan gets an appraisal.

Guttentag's proposal, however, does not deal with adjustable rate mortgages, where rates can change over time. It would almost certainly be a good thing to have clear disclosures about potential payment shocks, but it is not entirely clear that such disclosures would help the most vulnerable borrowers. Perry (2007) and others argue that borrowers are myopic, and have a hard time seeing beyond their first mortgage payment.

With respect to intermediaries, there are two points worth making. First, as Gramlich (2007) noted, we currently have two banking systems: one that is under federal supervision, and another "shadow" banking system. This not only means that there are institutions with inadequate capital making loans, but also that there is opportunity for regulatory arbitrage, which may well be more distortionary than a second best uniform regulatory regime. Placing all lenders under the Home Ownership and Equity Protection Act (HOEPA) would be a good first step.

Second, it is important to closely monitor the effectiveness of the recent changes to the regulatory regime under which rating agencies do business.

Finally, we must think carefully about how to define and punish predatory lending. Part of the definition of a predatory loan must involve its opaqueness: when lenders hide fees, when prepayment penalties are not clearly spelled out, when good faith estimates of closing costs are substantially different from those on the HUD-1 form at closing are all indicators of predatory lending. Note, the issue is more about disclosure than *per se*.

3. Conclusions

The subprime mortgage market in the first years of the 21st century was a natural experiment of a purely market-based financial system. The market was supplied by atomistic competitors, and was largely unregulated, with an unregulated sector performing both originations and securitizations. Investors were supposed to be informed by private ratings agencies and protected by the structuring of the securitization.

In the end, things fell apart because of market imperfections highlighting the lessons from the theory of the second best (in the sense of Lipsey and Lancaster, 1956). Some brokers exploited asymmetries in compensation and information to extract rents; some borrowers adversely selected into loan products with advance knowledge that they would ruthlessly default.

None of this would be of concern to policymakers if the losses involved were confined to investors in houses, mort-

gages and securities. But the losses are not so confined. Homeowners who did not understand the complicated documents they were signing wound up converting their home equity into fees for brokers. Neighborhoods with high concentrations of defaults saw wealth disappear even for households with no mortgage at all.

The question is how to move forward without unduly restricting the flow of mortgage capital. Targeted intervention into neighborhoods suffering from waves of defaults; developing incentives grounded in capital adequacy or bonding to discourage the making of unsuitable loans; and greater transparency throughout the mortgage process would help.

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