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Subprime Outcomes: Turmoil in the Mortgage Market

Until 2007, few Americans had probably heard the word “subprime” – including many homeowners who would come to learn that their own mortgage was a subprime mortgage. Today, subprime mortgages are much discussed because they lie at the center of the turmoil that roiled credit markets in 2007 and 2008. Analysis conducted by economists at the Federal Reserve Bank of Boston provides insight into how subprime mortgages became as popular as they did, and why they have

caused the problems that they have.¹ The analysis also suggests policy considerations for subprime lending in the future.

There is no standard definition of a “subprime” mortgage. In essence this term describes a loan that carries a relatively high interest rate because it is deemed to have a higher risk of default. If a borrower qualified for a mortgage on the basis of relaxed standards regard-

ing creditworthiness (such as borrower credit score, debt-to-income ratio, loan-to-value ratio, and/or loan documentation status), the mortgage is generally considered a subprime mortgage. As would be expected, such mortgages carry higher interest rates than prime mortgages, due to their higher probability of default.²

The most common type of subprime mortgage is a “hybrid” adjustable-rate mortgage. This type of loan is a 30-year mortgage with a fixed interest rate for the first two or three years. After this initial period, the interest rate “resets” to some fixed margin over a fluctuating benchmark market rate.³ Hybrid subprime mortgages are commonly called “2/28s” or “3/27s,” depending on the length of the initial fixed-rate period.

Subprime mortgages have been in use for many years, traditionally serving a small number of borrowers with blemished credit histories. As late as 1994, they constituted less than 5 percent of total mortgage originations. By 2005, however, they had climbed to 20 percent of originations. Soon after this peak market share was reached, foreclosures in many regional housing markets began to rise significantly. Given their greater risk, it is not surprising that subprime loans have accounted for a disproportionate share of these defaults. Some commentators have gone further and blamed current housing-market problems almost

exclusively on subprime lending. But closer analysis of these claims shows that they often mischaracterize the role of subprime lending in current housing-market problems.

Interest Rate Reset

Much of the initial concern about subprime mortgages centered on the interest-rate resets of subprime hybrids. Because the interest rate on hybrids generally rises after the initial two- or three-year period, many people believed that subprime mortgages were defaulting *because* subprime borrowers were no longer able to afford their loans after they reset. A look at some data helps quantify the “reset shock” faced by subprime borrowers. For 2/28 subprime loans originated nationwide from 2004 to 2007, the initial interest rate ranged from 7.3 percent in 2004 to 8.6 percent in 2007. (See Table 1.) For a typical 2/28 originated in mid-2004, which reset in mid-2006, the interest rate rose from 7.3 percent to 11.5 percent, increasing the payments on a \$200,000 loan by more than \$600 per month. Clearly, a reset shock increase of this magnitude could place considerable strain on many subprime borrowers.

Yet the data show that reset shocks have played a minor role in subprime defaults so far. Subprime borrowers who defaulted on their mortgages tended to do

Table I: Average Interest Rates on 2/28 Subprime Mortgages

(annual averages; all data in percentage points)

	Initial (pre-reset) interest rate	1-year prime ARM ¹ rate	Margin of post-reset rate over LIBOR ²	6-month LIBOR 2 years after origination	Adjusted (post-reset) interest rate
2004	7.3	3.9	6.1	5.4	11.5
2005	7.5	4.5	5.9	4.6	10.5
2006	8.5	5.5	6.1	3.0 ³	9.1
2007	8.6	5.7	6.1	3.0 ³	9.1

¹ Adjustable rate mortgage.

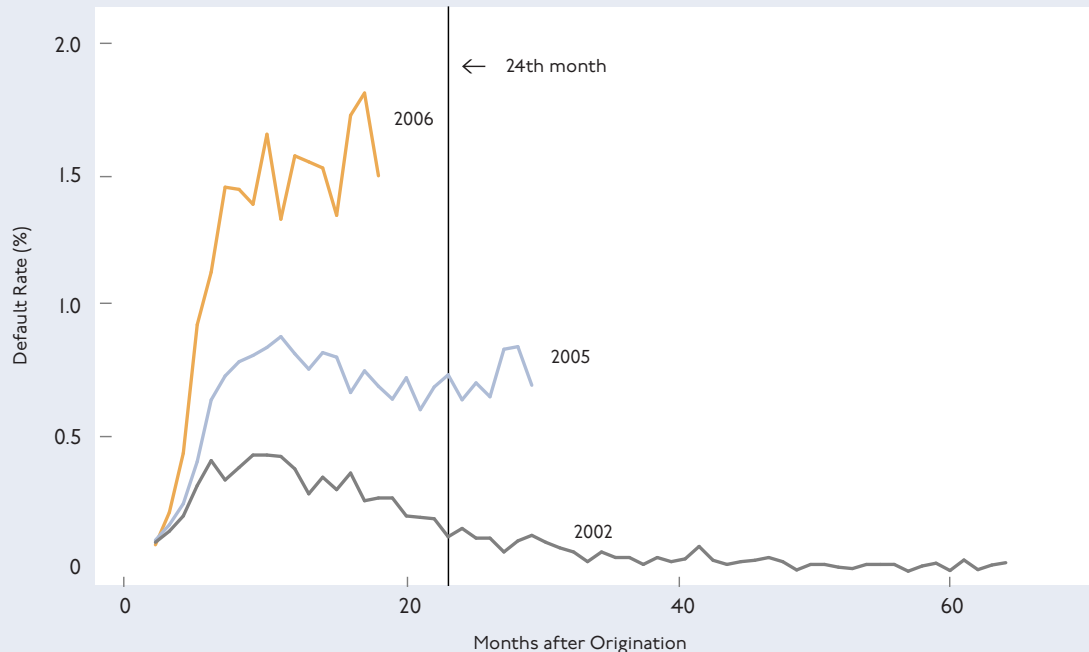
² London interbank offered rate.

³ The 2006 and 2007 vintages of mortgages reset in 2008 and 2009. For these mortgages, the 6-month LIBOR two years after origination is assumed to be 3.0 percent (the April 2008 value) to allow comparison with other vintages.

Source: National LP dataset.

Figure 1: Default Rates for 2/28 Subprime Mortgages

by Year of Origination



Source: LP dataset for southern New England.

so *before* their resets occurred. This tendency emerges clearly in a dataset of subprime 2/28s originated in Connecticut, Massachusetts, and Rhode Island. From this pool, the default rate for mortgages originated in 2005 and 2006 is indeed much higher than the default rate for 2002 mortgages. But for the more recent loans, the big jump in likelihood of default comes before the reset occurs. (See Figure 1.) No significant increase in defaults is seen near the actual reset date of 24 months.

If resets are not the problem in the subprime market, then why are so many of these loans defaulting? When answering this question, the first thing to note is that interest rates on subprime hybrids are generally high even in the initial fixed-rate period. The initial rate is sometimes called a “teaser” rate because it is often lower than the fully indexed rate that the borrower pays after the reset occurs. But “teaser” or no, initial interest rates have been about three percentage points higher than rates on one-year *prime* adjustable-rate mortgages. Moreover, the interest burdens faced by many subprime borrowers are even greater than what is indicated by the initial and post-reset rates on sub-

prime hybrids. Many subprime purchasers did not have enough savings to make sizeable downpayments when they bought their homes. To cover the gap between the price of the home and the value of the first-lien subprime mortgage, they often relied on second mortgages, sometimes called “piggyback” loans. These second mortgages were generally fixed-rate, ten-year loans with higher interest rates than even the initial interest rates on first-lien subprime mortgages. A subprime borrower with a high initial interest rate and a costly second mortgage faces a substantial interest burden even before his reset takes place.

The high interest rates paid by subprime borrowers allowed the subprime lending model to be profitable for lenders, even though most subprime borrowers never spent much time paying the post-reset rates. Instead, subprime borrowers generally refinanced their mortgages in advance of, or shortly after, the resets occurred. Of the 2/28 subprime loans originated in southern New England between 2001 and 2004, more than half had been prepaid by the reset date.⁴ (See Figure 2.)

Declining Home Prices

High pre-reset interest rates explain why the subprime lending model was profitable during the housing boom. But they do not explain why default rates for subprime loans have risen, because subprime interest rates have always been high. To understand the reason for the rise in subprime defaults, we must first understand why homeowners default in the first place. Defaults typically occur when homeowners experience life events that prevent them from making timely mortgage payments. Such a life event can include the loss of a job, illness, or divorce. Each of these events can adversely affect the borrower's cash flow and disrupt his ability to keep current on a mortgage. Whether a bad life event leads to foreclosure depends on whether there is positive or negative equity in the home. With positive equity, foreclosure is unlikely. A homeowner is always better off selling the home and pocketing the difference between the proceeds of the sale and the outstanding balance of the mortgage. Similarly, if a life event causes only a temporary cash-flow problem (as would result, for example, from a temporary spell of unemployment), a

homeowner with positive equity can often take out a cash-out refinance to tide him over the difficult period.

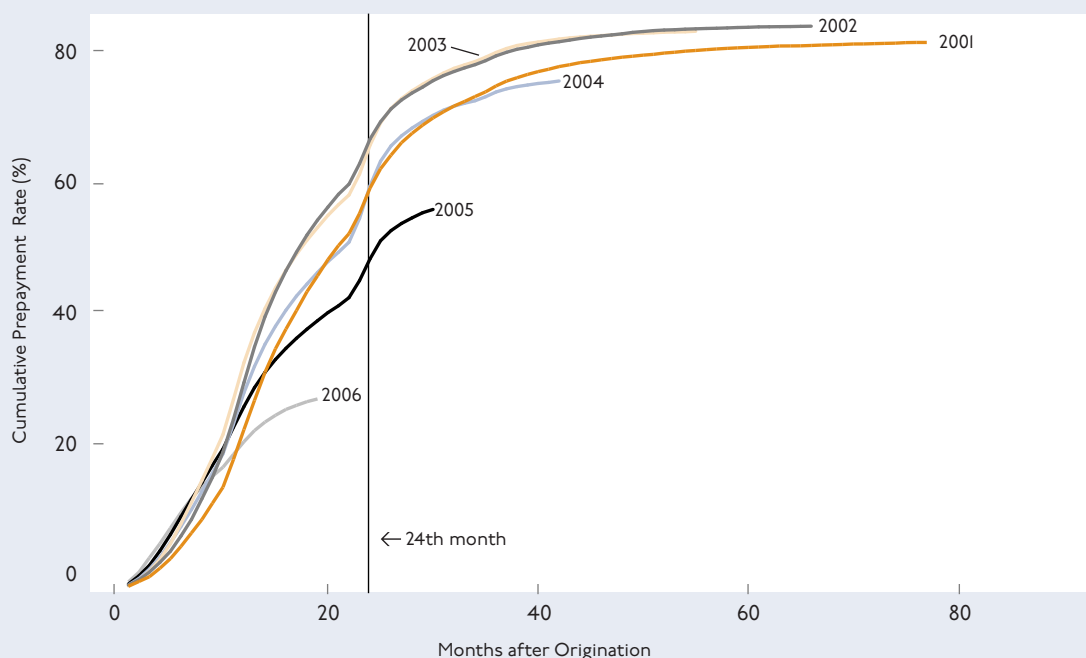
During the first half of the 2000s, house prices rose rapidly, so relatively few borrowers – subprime or prime – ever found themselves with negative equity. Therefore, few borrowers defaulted on their loans and foreclosures were rare, even among borrowers undergoing adverse life events. The picture changed when house prices began to level off and then decline. Owners who had purchased their homes when prices were at their peak often found themselves with negative equity as prices fell. If an adverse life event occurred to an owner with negative equity, foreclosure generally followed. For subprime borrowers, such a life event can occur before the interest rates on their loans reset. Thus, it is the recent decline in house prices that explains why so many recent subprime loans are defaulting even before reset occurs.

Risk Characteristics of Subprime Loans


Default rates on all types of loans have risen as house prices have fallen, but subprime loans have proven par-

Figure 2: Cumulative Prepayment Rates for 2/28 Subprime Mortgages

by Year of Origination



Source: LP dataset for southern New England.



The average debt-to-income ratio for high-score borrowers rose from 36.9 percent in 2000 to **41.9%** in 2005.

ticularly vulnerable to price declines. An analysis of the risk characteristics of subprime loans made during the housing boom shows why. One reason that borrowers take out subprime mortgages is that they do not have sizeable downpayments. Borrowers with low downpayments are more likely to find themselves with negative equity when house prices fall, so they are more likely to suffer a foreclosure in response to a bad life event. During the housing boom, the average loan-to-value ratio for subprime mortgages in southern New England rose rapidly, from 82.6 percent in 2000 to 92.8 percent by 2005. (See Table 2.) A second risk characteristic of subprime loans is documentation status. Borrowers who are unable or unwilling to supply documentation for their loan applications typically default more often than borrowers who do supply documentation. The fraction of fully documented subprime loans in the southern New England subprime pool fell from 69.6 percent in 2000 to 50.2 percent in 2005. A third factor affecting the risk of a mortgage is the borrower's debt-to-income ratio. The average for this ratio in the subprime pool rose

from 37.1 percent in 2000 to 42.0 percent in 2005. All three of these factors moved in the direction that would make a subprime loan made in 2005 more sensitive to a house-price decline than one made in 2000.

One risk statistic that did improve in the southern New England subprime pool is the average credit score of subprime borrowers. Typically, a borrower with a FICO score of 620 or higher is considered a "prime borrower," because such a borrower would generally be able to obtain a prime loan.⁵ As the housing boom progressed, more and more prime borrowers took out subprime loans. In 2000, only 44.5 percent of subprime loans were held by prime borrowers. By 2004, this fraction had risen to about 71.0 percent, an increase that is qualitatively similar to those found in nationally representative datasets.

Why is this particular risk characteristic suggesting less risk while the other three characteristics are flashing the opposite signal? While a credit score of 620 or above might qualify a borrower for a prime loan, it would not

qualify him for *any* prime loan. If a borrower wanted to take out a mortgage with a high loan-to-value ratio, or one that implied a high debt-to-income ratio, or if this borrower did not want to document his income, he would likely be turned down by a prime lender. A subprime lender, on the other hand, might be willing to make this loan – as long as this lender was compensated with a higher interest rate.

When we look deeper into the pool of Connecticut, Massachusetts, and Rhode Island subprime loans, we find that more and more prime borrowers were entering the subprime pool because they were taking out increasingly risky loans. For high-score subprime borrowers, the average loan-to-value ratio rose from 83.8 percent in 2000 to 93.8 percent in 2005, an increase that is similar to the increase for the subprime pool as a whole. Changes in documentation status are even more pronounced. The share of prime borrowers with full documentation fell from 67.0 percent in 2000 to only 40.8 percent in 2005. Finally, the average debt-to-income ratio for high-score borrowers rose from 36.9 percent in 2000 to 41.9 percent in 2005.

In short, the subprime market has evolved during the past several years. As noted above, this market started out by providing loans to risky *borrowers*. But as the

housing boom gathered steam, this market began to provide risky *loans* to a variety of borrowers. The pool of subprime borrowers is often portrayed as a monolithic group of borrowers with low credit scores. But the reality is that subprime borrowers are a heterogeneous group with a wide range of FICO scores and a variety of reasons for using this market. What they have in common is a high vulnerability to the decline in home prices. By 2005, the share of subprime mortgages that had a risky level of at least one of the four risk characteristics (FICO score, loan-to-value ratio, debt-to-income ratio, and documentation status) had topped 95 percent.

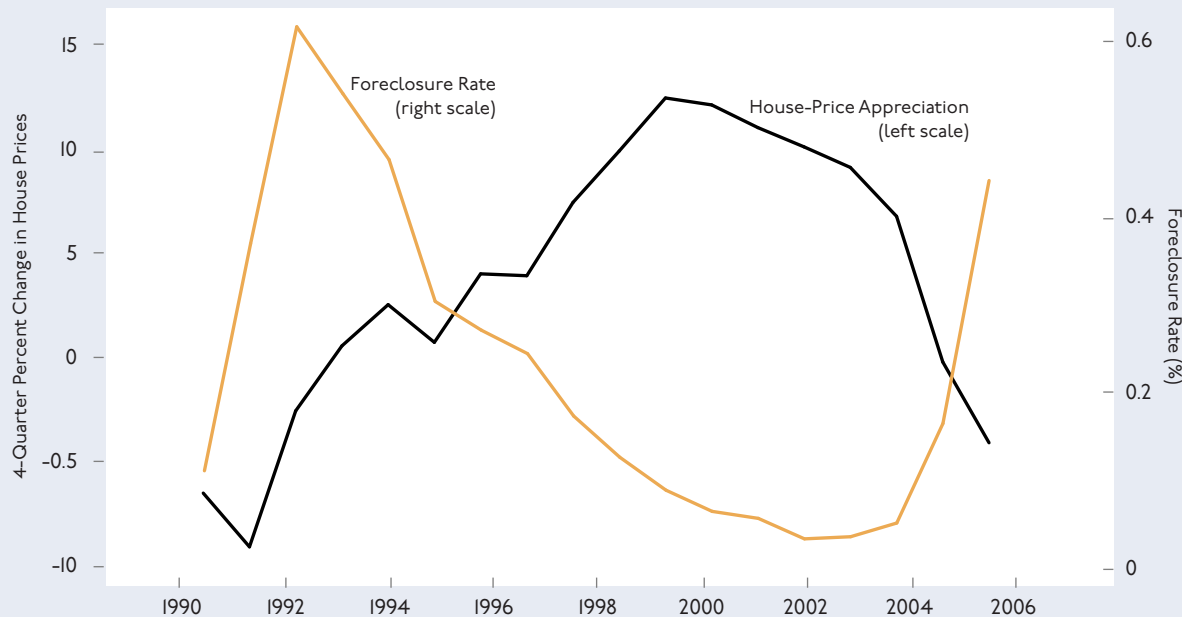
An important policy question is why this transformation took place. There are many reasons why prime borrowers may have found themselves holding risky subprime mortgages as the housing boom progressed. They may have been “steered” to the subprime mortgage market by real estate professionals who encouraged them to take out inappropriately risky loans. Alternatively, the high-score borrowers may have found their own way to the subprime market, because these borrowers wanted to buy houses that prime lenders were unwilling to finance. For whatever reason, these borrowers turned to the subprime mortgage market for loans that they could not have obtained in the prime mortgage market.

Table 2: Risk Characteristics of Subprime Loans in Southern New England

All borrowers	2000	2003	2005
Number of loans originated	3,171	13,486	30,219
Average loan-to-value ratio	82.6	88.6	92.8
Share of loans fully documented	69.6	55.5	50.2
Average debt-to-income ratio	37.1	38.9	42.0
Fraction of borrowers with FICO score of 620 or more	44.5	68.2	71.0
Borrowers with FICO score of 620 or more			
Number of loans originated	1,411	9,203	21,442
Average loan-to-value ratio	83.8	89.8	93.8
Share of loans fully documented	67.0	48.6	40.8
Average debt-to-income ratio	36.9	38.6	41.9

Source: LP dataset for southern New England.

Figure 3: Foreclosure Rate and House-Price Appreciation in Massachusetts



Source: Warren Group dataset. Federal Reserve Bank of Boston calculations.

Late 1980s and Early 1990s versus Now

Massachusetts has suffered from falling home prices and rising foreclosures before. The most notable example was the economic recession of the late 1980s and early 1990s. When the trough of this cycle was reached in 1992, house prices were down by more than 10 percent from their previous peak, while the foreclosure rate was more than 5 times its 1990 level. (See Figure 3.) While there are some parallels, there are also important differences between today's foreclosures and those of the earlier period. To begin with, borrowers losing their homes in the early 1990s tended to have lived in their homes longer and to have put down sizable downpayments.

About 80 percent of the early group had lived in their home for more than three years; this contrasts with a little more than half of owners suffering foreclosure in the current period. (See Table 3.) The difference in downpayments at the time of purchase is also striking. More than 30 percent of foreclosees in the earlier period made a down payment of at least 20 percent at the time of purchase. But fewer than 10 percent of foreclosees in the current period did so, and more than one third of the current foreclosees made no down payment at all.

These differences stem from the different macroeconomic environments of the two foreclosure waves.

Table 3: Characteristics of Massachusetts Foreclosures, 1991-1992 and 2006-2007

	1991	1992	2006	2007
Share of foreclosees living in home...				
for 2 years or less	11.7	6.6	26.9	25.8
for more than 3 years	75.1	84.6	57.5	54.9
Share of foreclosees who put down...				
no downpayment	8.2	8.8	34.5	40.0
20% or more at purchase	35.9	30.4	8.6	8.0

Source: Warren Group dataset.

The early 1990s was a period of exceptionally high unemployment, with the state's unemployment rate peaking at 8.8 percent in 1991 and 1992. Additionally, the mid-1980s saw an explosion of residential construction in Massachusetts. High unemployment and a legacy of previous overbuilding put significant downward pressure on housing prices in the early 1990s, so that even people who moved into their homes with large equity cushions were in danger of having negative equity as prices fell. At the same time, the state's poor labor market caused many Massachusetts residents to lose their jobs, thereby supplying the negative life events needed to trigger foreclosures when negative equity is present. During the current foreclosure wave, the macroeconomic environment has not been nearly so bad.

Another difference between the earlier crisis and the current one involves the presence of the subprime market. Indeed, the current crisis is often described as a "subprime mortgage crisis," as if prime mortgages were not a significant factor. As we have seen, subprime mortgages are more sensitive to price declines for a number of reasons. Somewhat less than half (45.5 percent) of all defaulted mortgages in Massachusetts have been subprime loans, though this fraction varies across different types of houses (single-family, condominium, and multi-family). (See Table 4.) It is important to note, however, that many of these defaulted subprime loans were refinances on houses that were originally purchased with prime loans. About 30 percent of all foreclosures have come on houses originally purchased with subprime mortgages, though here again there is some variation



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Table 4: Subprime Shares Among Defaulted Massachusetts Ownership Experiences and Mortgages in 2006-07


	Fraction of defaulted ownerships purchased with subprime mortgages	Subprime fraction of defaulted mortgages
Single-family residences	24.2	42.7
Condominiums	27.5	40.7
Multi-family residences	42.6	53.3
All Residences	30.0	45.5

Source: Warren Group dataset.

based on the type of house. These statistics point to the quantitative importance of subprime lending in the current foreclosure wave. But they also show that this crisis extends beyond the subprime market. The fact that 30 percent of all foreclosures have come on houses purchased with subprime mortgages suggests that the other 70 percent of foreclosed properties were originally purchased with prime loans.

Policy Considerations

Current problems in the subprime market have led many to ask what role this market should play in the future. Proponents of subprime lending argue that this market encourages homeownership by extending credit to people who may have blemished credit records but who are now capable of handling the financial obligations of homeownership. Other candidates for successful subprime lending include people who do not earn



...**70%** of foreclosed properties were originally purchased with prime loans.

enough to borrow a given amount from a prime lender, but who do have other, stable resources to call upon if conditions change. Finally, subprime lending can encourage homeownership by providing refinance loans to people undergoing adverse life events, such as the loss of a job. A prime lender may be nervous about extending credit to a borrower who has just lost a job, but a subprime lender may be willing to extend such a loan if he is compensated for the extra risk. Opponents of subprime lending counter that such lending causes more problems than it solves. To the extent that subprime borrowers are less financially sophisticated than other borrowers, they are more likely to fall victim to predatory lending schemes or be steered into loans that are inappropriate for them but profitable for their lenders.

The only thing we can say for certain about these claims is that to some extent, all of them are true. Subprime lending has helped many borrowers into homeownership; it is worth remembering that even with all of the

problems in the subprime market, four out of five Massachusetts homeownerships that began with a subprime mortgage have avoided foreclosure. And, undoubtedly, some examples of inappropriate steering took place. Going forward, the challenge for policy makers will be to quantify the offsetting effects of subprime lending on the homeownership rate. How many people have been moved into homeownership with subprime lending, and what has been the impact of homeownership on other life outcomes, such as wealth accumulation? How much financial sophistication is needed to understand the typical subprime loan contract, and how much sophistication have previous subprime borrowers actually had in practice? Finally, how should financial markets be regulated to insure that credit is available to finance appropriate home purchases? Though subprime lending has only recently been on the policy agenda, it is likely to be at the center of housing policy research for some time to come.

Endnotes

¹ The research examines two types of datasets. The first consists of Registry of Deeds data for individual properties in the state of Massachusetts. The second is data on individual loans that have been packaged into non-agency mortgage-backed securities and sold to investors in the secondary market.

The Registry of Deeds dataset, which is available as far back as the late 1980s, permits the study of complete *ownership experiences*: For a single owner's time in a given house, all transactions can be traced, including the original purchase mortgage(s), refinance mortgages, home equity loans, and foreclosure deeds. This dataset was made available to the Federal Reserve Bank of Boston by the Warren Group, a private Boston firm that has been tracking real estate transactions in New England for more than a century. The Warren Group has published the data in its newspaper, *Banker and Tradesman*, since 1872. The Bank gratefully acknowledges the Warren Group's generosity in making this dataset available.

The second dataset – loans packaged and sold in the non-agency secondary market – provides interest rate information and the borrower's credit score, as well as other characteristics of the loan and the property. The Federal Reserve acquired this dataset from First American LoanPerformance, a subsidiary of First American CoreLogic, Inc., owned by First American Corporation.

² Certain lenders, typically mortgage banks, may specialize in subprime loans. Banks, especially smaller community banks, generally do not make subprime loans, although a few large banking organizations are active through mortgage banking subsidiaries. According to interagency regulatory guidance issued in 2001, "the term 'subprime' refers to the credit characteristics of individual borrowers. Subprime borrowers typically have weakened credit histories that include payment delinquencies and possibly more severe problems such as charge-offs, judgments, and bankruptcies. They may also display reduced repayment capacity as measured by credit scores, debt-to-income ratios, or other criteria that may encompass borrowers with incomplete credit histories. Subprime loans are loans to

borrowers displaying one or more of these characteristics at the time of origination or purchase. Such loans have a higher risk of default than loans to prime borrowers. Generally, subprime borrowers will display a range of credit risk characteristics that may include one or more of the following:

- two or more 30-day delinquencies in the last 12 months, or one or more 60-day delinquencies in the last 24 months;
- judgment, foreclosure, repossession, or charge-off in the prior 24 months;
- bankruptcy in the last 5 years;
- relatively high default probability as evidenced by, for example, a credit bureau risk score (FICO) of 660 or below (depending on the product/collateral), or other bureau or proprietary scores with an equivalent default probability likelihood; and/or
- debt service-to-income ratio of 50 percent or greater, or otherwise limited ability to cover family living expenses after deducting total monthly debt-service requirements from monthly income.

This list is illustrative rather than exhaustive and is not meant to define specific parameters for all subprime borrowers."

³ Most often, the market rate used as an index for the post-reset rate is the six-month LIBOR. LIBOR is an acronym for London Interbank Offered Rate, an international interbank lending rate similar to the federal funds rate in the United States. The typical post-reset interest rate exceeded LIBOR by about six percentage points.

⁴ Note that prepayment rates have fallen for subprime 2/28's originated in 2005 and 2006. This decline stems from the drop in housing prices over this period, a topic we return to below.

⁵ FICO, an acronym for Fair Isaac & Co., is a scoring system developed by Fair Isaac & Co. and widely used to evaluate the creditworthiness of borrowers. FICO scores range from 300 to 850, with about one-quarter of the U.S. population falling in the range of 750 to 799.