

**THE SUB-PRIME MESS**  
**(What We Should Have Known, or Learned, From Behavioral Economics)**

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**Introduction**

The collapse of the credit market has been linked to many catalysts. The bursting of the housing “bubble” is one. The proliferation of sub-prime mortgages is another. The inability of the market to measure the risks of complex securitized investment products, such as mortgage-backed securities (MBOs), is a third. All are good places to start in any historical analysis.

Like in many bubbles, however, people’s behavior contributed to and amplified the current credit crisis – and it is on the “behavioral component” of the crisis this paper will focus. Specifically, it will focus on the impact of two important changes that significantly influenced behavior:

- **Increase in Securitization:** the development of derivative securities, such as MBOs, allowed mortgages to be pooled, repackaged and sold to investors who did not understand them well. The creation of these securities changed the incentives of:
  - the home buyer
  - the initial originators of the mortgage (often called mortgage brokers) who worked for the financial institutions (usually commercial banks) that initially funded the mortgage
  - the initial appraisers of the house underlying the mortgage
  - the commercial banks that provided the initial funding of the mortgages and then sold the mortgage to the financial institutions (typically investment banks) that created the derivative securities
  - the financial institutions that created the derivative securities
  
- **A long period of rising home prices:** this slowly changed both the beliefs and incentives of:
  - the home buyer,
  - the final rating agencies (the three most prominent being Moody’s, Standard & Poor’s and Fitch, which in turn influenced the beliefs of
  - the final buyers of the derivative securities, such as MBOs.

In a more general sense, the creation of mortgage-backed and other related securities amplified an asymmetrical information problem by adding a third layer of participants on top of home buyers and their lenders – packagers (creators) of MBOs and investors in MBOs. This led to predictable, yet significant behavior changes by all sides in the latter stages of the housing boom, without which the crisis would not have been nearly as severe.

## Background – Definitions of Sub-prime Loans and Securitization

References to sub-prime mortgages and securitization are common throughout the credit crisis literature, and both will be referenced heavily in this paper. Definitions for both terms are therefore given below.

**Sub-prime** – refers to a borrower that is less likely to repay a loan. Sub-prime borrowers may be classified as “sub-prime” because of many things, including bad credit or lack of credit history, low income or high debt to income ratios, and/or large loans relative to the value of the securing property.

Source: About.com: <http://banking.about.com/od/loans/g/subprime.htm>

The critical aspect of sub-prime borrowers is that their credit history is not sufficient to qualify for a conventional mortgage. As a result, they often have limited options in terms what institutions they can borrow from, are more often the target of predatory lending practices and they are charged a higher interest rate on their loans as a result.

**Securitization** – the process of pooling, in this case, various types of debt-mortgages and packaging them as bonds, which are then sold to investors. These bonds may also be known as mortgage-backed securities or obligations (MBOs) because the interest and return of principal they promise are based on the value of the underlying assets, in this case homes purchased with the original loans.

Source: Morgan Stanley: <http://www.morganstanleyindividual.com/customerservice/dictionary/default.asp?letter=S#IDAZ1YBB>

Securitization is significant because it has enabled non-traditional lenders to invest in, and assume the risk of mortgages. It is this last point – the creation and expansion of securitization – we will focus on for the rest of this paper. Securitization created a gap between borrower and ultimate investor that gave lenders and borrowers predictable incentives to change their behavior that, in retrospect, led to predictable results – assuming one understands some basic principles of behavioral economics.

## The Impact of Securitization on Asymmetric Information, Incentives, Moral Hazard and Adverse Selection

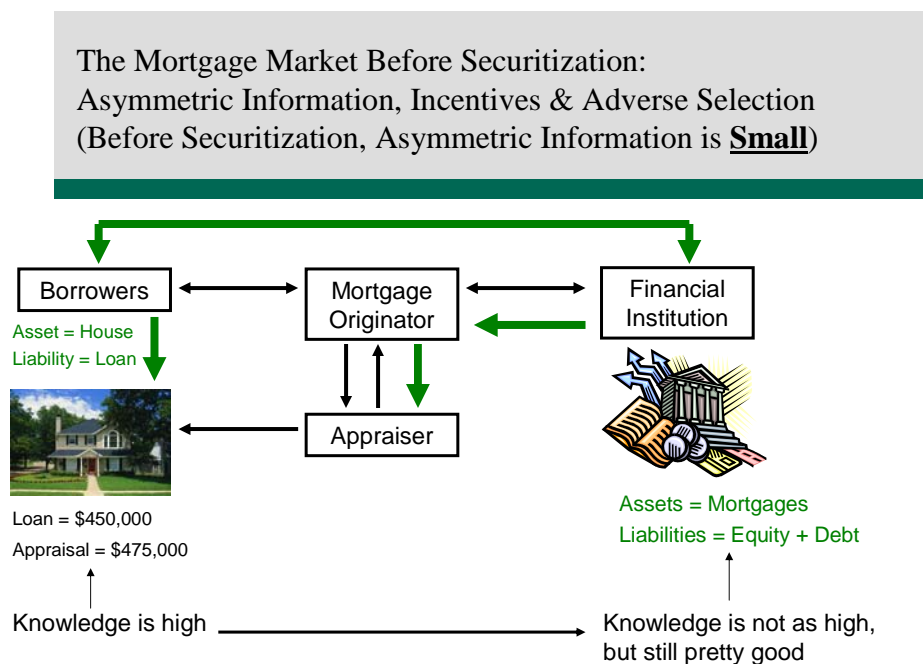
**Asymmetric Information** - One party to a possible transaction (purchase or sale) knows more about the underlying asset and/or liabilities

Source: Pearson Education: <http://wps.pearsoned.co.uk/wps/media/objects/2499/2559960/glossary/glossary.html>

Mortgages historically have been simple transactions. As seen in Figure 1, appraisers place a value on a house. A transaction takes place between buyer and seller, usually at a price close to the appraisal price. (In the days before securitization of mortgages, an intermediary mortgage originator or mortgage broker may not even have been involved – the prospective buyer simply walked down to the local bank and asked for a mortgage.) The process is sufficiently transparent

that lenders can assess the risk relatively quickly and easily. Nevertheless, there is an asymmetric information problem even in this simple financial transaction – the borrower knows more about his/her ability to meet the mortgage payment than the lender, but not much more. In Figures 1 and 2, large green arrows trace the flow of money; smaller, black arrows trace the flow of information.)

**Figure 1**



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Note that in this case, the asset (the mortgage) remains on the balance sheet of the bank or financial institution. Thus, the bank has a strong incentive to learn as much about the borrower’s ability to pay as possible.

As seen in Figure 2, with the advent of securitization, assessing risk becomes much more complicated for the ultimate holders of the loans – third party investors such as hedge funds and even the investment banks that created the derivative MBO, -- as well as for the rating agencies such as Moodys, Standard & Poors, and Fitch, etc. The direct line of communication between borrower and lender is broken. Borrowers still have all the information (of their own credit worthiness, of the approximate value of the home they seek to purchase, etc.). Banks still have reasonably strong information, but less strong because their incentives to know this information are reduced because they won’t be the ultimate holder of the mortgage.

By comparison, the ultimate lenders, in this case hedge funds and other third parties (including Fannie Mae and Freddie Mac), have very little information about the underlying individuals and homes in the portfolio of mortgages they have purchased via an MBO.



Figure 3  
Changes in Types of Loans Over Time

	2001	2002	2003	2004	2005	2006
	<i>Size</i>					
Number of Loans (*1000)	624	974	1676	2743	3440	2646
Average Loan Size (*1000)	151	168	180	201	234	259
	<i>Mortgage Type</i>					
FRM (%)	41.4	39.9	43.3	28.2	25.1	26.1
ARM (%)	0.9	1.9	1.3	4.3	10.3	12.8
Hybrid (%)	52.2	55.9	54.7	67.3	62	46.2
Balloon (%)	5.5	2.2	0.8	0.2	2.6	14.9

Source: Demyank, Yuliya and Van Hemmert, Otto. "Understanding the Sub-prime Mortgage Crisis," Working Paper, Federal Reserve Bank of St. Louis. February 2008.

Other types of ARMs have also been created or more heavily utilized by banks recently, pushing the aggregate risk profile even further. These include such appropriately named loans as:

- Ninja loans ("no income, no job, no assets – no problem")
- Liar loans (no proof of income or assets required)
- Teaser loans (2% interest rate for first two years, > 20% thereafter)
- Stretch loans (require > 50% of gross income toward mortgage payments)

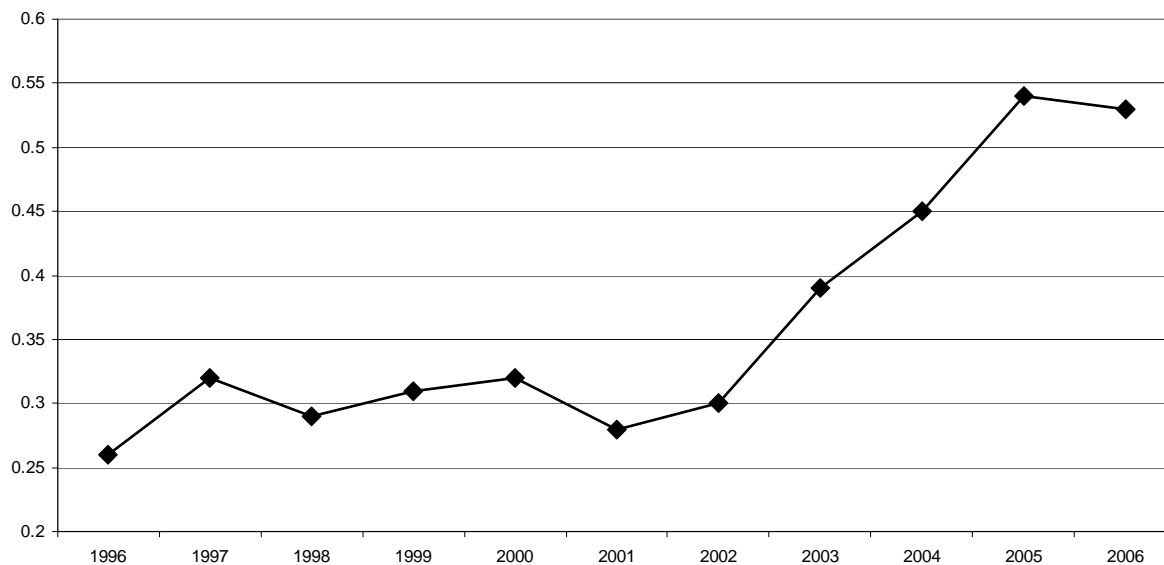
New types of mortgages made it possible for banks to accept a higher percentage of mortgage applications in general. The decline rate among higher-risk borrowers dropped significantly between 1996 and 2005.<sup>4</sup>

#### *Securitization of Mortgages – Fuel for More Bad Behavior*

The percentage of sub-prime loans packaged into securitized forms increased from 54% in 2001 to 75% in 2006.<sup>5</sup> Perhaps more importantly, as shown in the chart below, the percentage of these securitized loans sold to non-mortgage agency institutions (those with less understanding/ability to assess the risk involved than traditional mortgage holders) increased from less than 30% in 1996 to more than 50% in 2005.

### Fraction of Mortgages Sold to Non-Mortgage Agency Institutions

This figure presents the fraction of originated mortgages that are sold to non-mortgage agency institutions within one year of origination. Non-mortgage agency institutions include all third parties except for Fannie Mae, Freddie Mac, Ginnie Mae, and farmer Mac. Data are from HMDA.



Source: Mian, Atif and Sufi, Amir. "The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis.", Working Paper. University of Chicago, 2008.

A second, and highly correlated change incentives, was for banks was to increase the amount of mortgage lending in which they engaged. With the risk supposedly transferred to third-party investors, banks could more confidently meet the demand for mortgage-related investments and credit expanded dramatically as the number of mortgage applications accepted more than doubled between 1996 and 2005.<sup>6</sup>

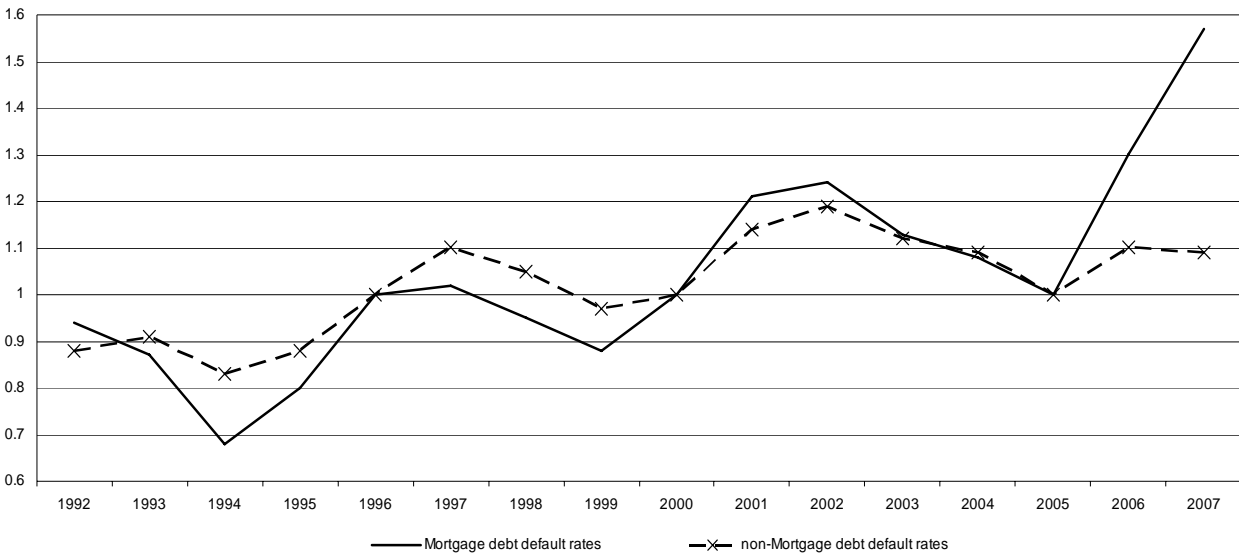
When the "game" ended (housing prices stop rising), the impact of the increase in these various types of loans – all targeting sub-prime borrowers – is obvious.

- More downward pressure on housing prices
- More pressure on credit throughout the financial system
- And more defaults

As seen in the chart below, the default rate on mortgage loans increased more than 50% between the fourth quarter of 2005 and the second quarter of 2007, from approximately 10% to 15%.

### Default Rates for Mortgage and non-Mortgage Debt, Indexed to 1996

This figure presents the default rate for consumer debt outstanding for the U.S. from 1992 to 2007, indexed to 1996. The total non-mortgage default rate is calculated using non-mortgage debt which includes student loans, auto loans, consumer loans, and outstanding credit card balances. Data are from Equifax Predictive Services.



Source: Mian, Atif and Sufi, Amir. "The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis." Working Paper. University of Chicago. 2008.

### Adverse Selection – More Borrowers Become Cheaters

A change in adverse selection is a phenomenon in which groups that, upon realizing they are not being monitored as closely as before, begin to “cheat” with more regularity. By supposedly passing along the risk to third-party investors, banks no longer had sufficient incentive to monitor the behavior of borrowers closely. And borrowers took advantage.

**Adverse Selection:** This is a transaction in which the seller has relevant information that the buyer does not have, or vice versa. It also refers to the tendency for buyers or sellers to exploit these asymmetries in information to their own advantage. For example, someone with a dangerous occupation or hobby may be more likely to apply for life insurance.

Source: Penn State University: [http://450.aers.psu.edu/glossary\\_search.cfm?letter=a](http://450.aers.psu.edu/glossary_search.cfm?letter=a)

A report by the US Department of the Treasury indicated that mortgage fraud increased by more than 1400% between 1997 and 2005.<sup>7</sup> The result of the increase in cheating by borrowers was similarly predictable – applications with fraudulent statements in them are five times as likely to go into default.<sup>8</sup>

### Rising Home Prices Temporarily Hide Increased Risk of Failure

Another factor causing the risk perceptions and incentives of all participants in this type of transaction, but particularly for the borrower, was the long period of rising home prices. Between 1996 and 2005, the average US home price increased by 200%,<sup>9</sup> enabling borrowers, even high-risk borrowers, to more easily refinance into more attractive loans.

From the borrowers' perspective, if they did not have to make a significant down payment, their perceptions of actually having to declare bankruptcy or deal with foreclosure was significantly less if they believed "home prices have always risen in the past and always will in the future." If home prices actually do continue to rise and the buyer simply can't continue to make the payments (particularly when the rate increases on an ARM loan), the buyer can simply sell the house at what they believe will be a higher price and use the proceeds to payoff the loan. Thus, the borrower's concern about the probability of foreclosure is reduced significantly and their assessment of the risk involved is reduced. (This change in the perception of risk probably affected all other parties involved in the transaction as well.)

This type of change in incentives and behavior should have been easily predicted by those familiar with behavioral economics and, in particular with "prospect theory" as developed by Kahneman and Tversky<sup>10</sup>, and the "representativeness heuristic."

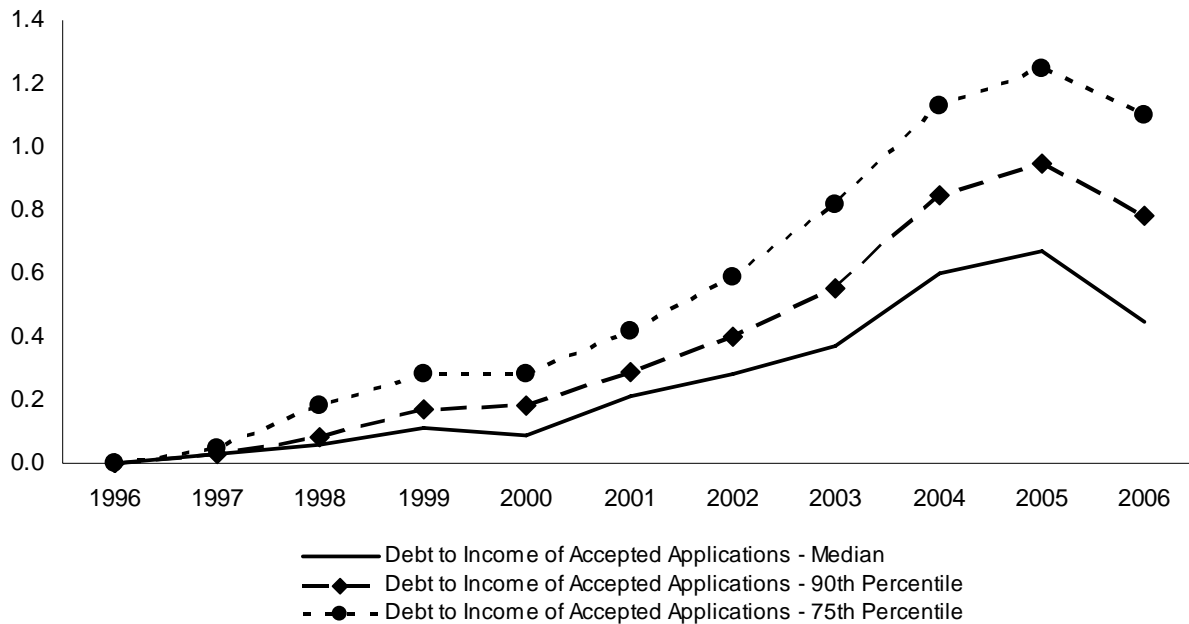
- Prospect theory predicts that when investors are in the domain of gains (as most involved in the housing market were after a long-run of rising home prices) they will tend to be less risk averse.
- The "representativeness heuristic" can be described by the old expression "if it looks like a duck, and quacks like a duck, it probably is a duck." This heuristic is one of the sources of the common cognitive errors known as stereotyping and the tendency to simply extrapolate a past time series (in this case, home prices) into the future – thus, the belief at the time that home prices will always continue rise.

An important point is that in this "game" that housing prices only have to stop rising – they don't have to actually fall – for the "game to be over. This is because, if the borrower has to sell the house at the same price he/she paid for it, the borrower loses both whatever down payment was made and the transaction costs associated with selling the house. This increases the risk of foreclosure and foreclosure is expensive for all parties, as a home in foreclosure will sell for significantly less than one that is sold in the more ordinary course of events.

### *Fall of housing market – Catalyst for Sub-prime Defaults*

While steadily rising housing prices during the past decade managed to temporarily stall the impact of the increase in risky loans, the seeds of the collapse were planted long before August 2007. As seen in the chart below, the quality of mortgage loans being approved started to decline long before the credit market began to crumble.

**Figure 2A**  
**Debt to Income Ratios for Accepted Mortgage Applications, Relative to 1996**



Source: Mian, Atif and Sufi, Amir. “The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis.” Working Paper. University of Chicago. 2008.

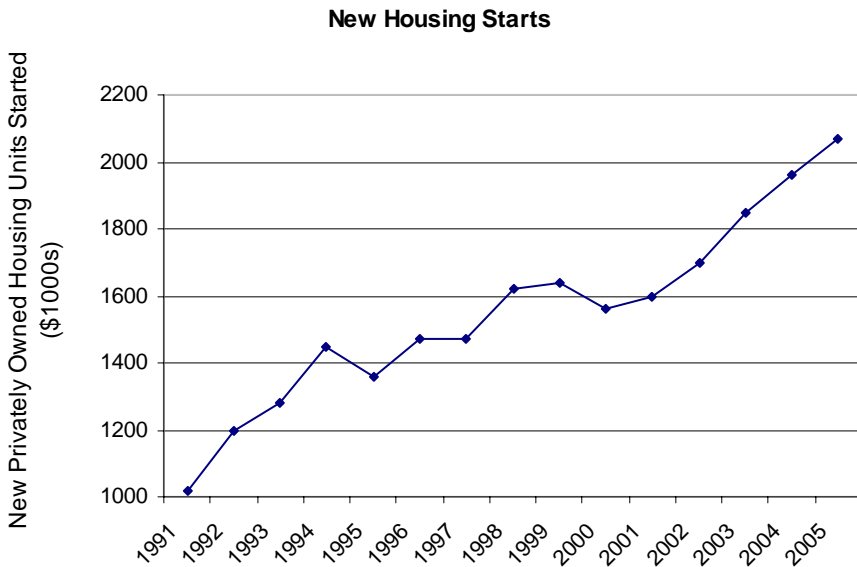
The entire crisis needed to take hold was a turn in the housing market to make refinancing more difficult for sub-prime borrowers and subsequently increases the default rate. When the break in the housing bubble arrived – between mid 2006 and mid 2008, the average price declined 18%<sup>11</sup> – the results were, in retrospect, very predictable.

As seen in the chart below, during a period when housing prices start declining, and borrowers are unable to subsequently refinance their loans at a lower rate, the default rate on ARMs rises dramatically and credit throughout the financial system becomes tighter as a result<sup>12 13 14</sup>.

Period	12/2005	10/2007	1/2008	5/2008
% of ARMs 90 days delinquent or in foreclosure proceedings	6%	16%	21%	25%

***Building Boom Accentuates Credit Crisis***

As seen in the chart below, new home construction not surprisingly chased the rise in home prices. When the market turned, a glut of new homes suddenly was without buyers and existing homeowners refused to sell their houses at lower prices (also a very predictable behavior). The result of the increased inventory was a spiral of downward pressure on home prices, which made refinancing more difficult for borrowers and put downward pressure on the valuation of MBOs, initiating the collapse of the credit market last August.



Source: Census Bureau.

## Conclusions

It is impossible to say whether the collapse of the sub-prime mortgage market, and the subsequent credit crises, could have been avoided. In retrospect, however, it should have been easy to predict.

The increase in securitization of mortgages predictably changed the incentives of lenders and borrowers to take on more risk. With the less-informed, less skilled third-party investors unable to conduct the necessary due diligence to keep them in line, lenders approved more sub-prime loans. Borrowers sought out larger, riskier loans than they could reasonably afford, or cheated outright on their applications to get approval. And builders did their best to keep up with the increased demand.

In summary, it was an unsustainable situation. The stop in house prices increases followed by the downturn in housing prices simply made all parties involved pay for their ill-advised, yet predictable, change in behavior.

<sup>1</sup> Bankrate.com. "Warning signs of a bad home loan (page 2 of 2)," (2008).  
<http://www.bankrate.com/brm/news/mortgages/20040615a1.asp>

<sup>2</sup> National Public Radio. *All Things Considered*, "Economists Brace for Worsening Sub-prime Crisis," August 7, 2007.

<sup>3</sup> Federal Reserve Board: Speech – Ben Bernanke, "Fostering Sustainable Homeownership," March 14, 2008.

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<sup>4</sup> Mian, Atif and Sufi, Amir. “The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis,” Working Paper. University of Chicago. 2008. Please refer to Exhibit 4A.

<sup>5</sup> Wikipedia. “Sub-prime mortgage crisis.” [http://en.wikipedia.org/wiki/Subprime\\_mortgage\\_crisis](http://en.wikipedia.org/wiki/Subprime_mortgage_crisis).

<sup>6</sup> Mian, Atif and Sufi, Amir. “The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis,” Working Paper. University of Chicago. 2008.

<sup>7</sup> US Department of Treasury: Reported Suspicious Activities.

<sup>8</sup> New York Times. “So We Thought...But Then Again.” January 13, 2008, <http://www.nytimes.com/2008/01/13/business/13view.html?ref=business>.

<sup>9</sup> Mian, Atif and Sufi, Amir. “The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis,” Working Paper. University of Chicago. 2008.

<sup>10</sup> Kahneman, Daniel, and Amos Tversky (1979) "Prospect Theory: An Analysis of Decision under Risk", *Econometrica*, XLVII (1979), 263-291.

<sup>11</sup> The Economist. “Home Economics,” August 14, 2008.

<sup>12</sup> Ben S. Bernanke. “The Recent Financial Turmoil and its Economic and Policy Consequences.” October 17, 2007. New York, NY

<sup>13</sup> Ben S. Bernanke. “Financial Markets, the Economic Outlook and Monetary Policy.” January 10, 2008. Washington D.C.

<sup>14</sup> Ben S. Bernanke. “Mortgage Delinquencies and Foreclosures.” May 5, 2008. New York, NY