The Subprime Crisis:
Can problems in a small part of the mortgage market disrupt the entire economy?

Paul Willen
Federal Reserve Bank of Boston

REFA Meeting, December 6, 2007

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or the Federal Reserve System

When I say “we”, I mean members of the research department.

Caveat

Everything I’m about to say could be wrong:

Example:

*Until [the depression], mortgages were not fully amortized, as they are now..., but were balloon instruments in which the principal was not amortized, or only partially amortized at maturity, leaving the debtor with the problem of refinancing the balance.*

Fabozzi and Modigliani (1992)

Is this true?
Essentially no.

<table>
<thead>
<tr>
<th></th>
<th>Mutual banks</th>
<th>Life Insurers</th>
<th>Savings and Loans</th>
<th>Commercial Banks</th>
<th>Individuals and Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>By type of loan (1925-1929)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully Amortized</td>
<td>14.3</td>
<td>94.6</td>
<td>10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partially Amortized</td>
<td>61.5</td>
<td>0</td>
<td>38.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-amortized</td>
<td>24.1</td>
<td>5.1</td>
<td>50.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of market (1929)</td>
<td>10.5</td>
<td>11.8</td>
<td>40.3</td>
<td>12.1</td>
<td>25.2</td>
</tr>
<tr>
<td>As % of dollar value of all loans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Economists find a new theory...
Old theory is “wrong”, new theory is “right”
New theory will be old some day!

Figure: Theodoric of York, Medieval Barber (and intellectual)

Why, just fifty years ago, they thought a disease like your daughter’s was caused by demonic possession or witchcraft. But nowadays we know that Isabelle is suffering from an imbalance of bodily humors, perhaps caused by a toad or a small dwarf living in her stomach.
Short answer

- Can problems in a small part of the mortgage market disrupt the entire economy?
- Answer: No.
- Because we have tools to address problems in the mortgage market. (Point 1)
- But...
  - Problems in mortgage market are symptom of more serious problem: House prices (Point 2)
  - House prices could derail the economy
  - But we believe they probably won’t. (Point 3)

Forecast

- From Macro Advisors (ours isn’t ready yet)
- Percentage change at annual rates.

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>Real GDP</td>
<td>4.9</td>
<td>0.1</td>
</tr>
<tr>
<td>Consumption</td>
<td>2.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Nonres. investment</td>
<td>9.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Residential inv.</td>
<td>-19.7</td>
<td>-24.7</td>
</tr>
<tr>
<td>Change in inventories</td>
<td>32.9</td>
<td>22.9</td>
</tr>
<tr>
<td>Exports</td>
<td>18.9</td>
<td>3.2</td>
</tr>
<tr>
<td>Imports</td>
<td>4.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Gov’t spending</td>
<td>3.9</td>
<td>3.2</td>
</tr>
<tr>
<td>Unemployment (%)</td>
<td>4.7</td>
<td>4.8</td>
</tr>
<tr>
<td>Core CPI</td>
<td>2.5</td>
<td>2.2</td>
</tr>
</tbody>
</table>
Reckless lenders, new products, mortgage resets
Problems spread
Source of problems is stagnant or falling house prices

We will focus on:

- Addressing the credit crunch
- It’s the house prices...
- The housing wealth-consumption link

Paul Krugman (NYT, 9/20/2007)

*It makes more funds available to depository institutions, a.k.a. old-fashioned banks but old-fashioned banks aren't where the crisis is centered. And the Fed doesn't have any clear way to deal with bank runs on institutions that aren't called banks.*
Introduction

1. Credit Crunch
2. It’s the house prices
3. Housing wealth and consumption

Fed response

- "New Housing Finance System"
  - No banks necessary

- Banks still at the center of it all!

Paul Willen (Boston Fed)
The Subprime Crisis: December 6, 2007

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 2007</td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Sept. 2007</td>
<td>2.3</td>
<td>1.7</td>
<td>1.5</td>
<td>1.8</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Forecasters have historically overestimated the impact of financial crises.

- Will we do that again?
Some financial crises in the past

1. 1970 Q2: Penn Central bankruptcy.
2. 1982 Q3: Latin American defaults (e.g., Mexico) and crises in commercial banks and thrift institutions.
3. 1987 Q4: Stock market crash (Black Monday).
5. 1998 Q3: Russian default and LTCM crisis.
6. 2001 Q3: September 11th attacks in NYC and Washington DC.
**Figure**: Forecasting experience with the Russia Crisis in 1998.

![Graph showing quarterly percentage change in GDP forecasts and actuals during the Russia Crisis in 1998.](image)

**Figure**: Forecasting experience with the 1987 stock market crash.

![Graph showing quarterly percentage change in GNP forecasts and actuals during the 1987 stock market crash.](image)
Fed response

- Banks still matter!
- Fed policy tools still matter!
A theory (more of a story)

- Conventional wisdom right now:
  - Lenders threw out 100 years of best practice and did stupid things:
    - Reduced documentation
    - “Exploding ARMs”
  - Our theory:
    - It’s house prices
    - even if they had followed reasonable guidelines, we’d still have a problem, even if not as big as the problem that we now face.

Some points

- Defining a subprime mortgage
- Resets aren’t the problem
- Profile of foreclosees
- Subprime outcomes
- It’s the house prices
Introducing a subprime mortgage

- What is a subprime mortgage?
- Good question:
- A “subprime borrower”
  - Has missed a mortgage payment in the last year or two years
  - Has filed for bankruptcy in the last few years
  - Has a “FICO score” less than 620

A “subprime lender”
- is the only type of lender who lends to subprime borrowers.
- but also lends to other borrowers who want to stretch
  - High LTV
  - High DTI
  - Low Doc
  - All of the above plus subprime borrower
- has a reputation as honest, trustworthy. Puts interest of borrower first.
A “subprime mortgage” is either
- a loan made to a subprime borrower
- or a loan made by a subprime lender to any borrower.
- or some ill-defined combination of both.

Bottom line: Even defining subprime is a mess.

- LoanPerformance data
  - Mortgage sold in MBS
  - Labelled “Subprime”, “Alt-A” or “Prime”
- HMDA
  - “High cost” loans
  - 300 basis points over treasury of equivalent maturity
- Warren Data
  - Use HUD list of “Subprime Lenders”
  - For small sample, we can see ARM rates
  - 93% of HUD-list loans had either
    - margin > 350 basis points
    - initial rate > 200 basis points over equivalent prime
**Table:** Subprime Lenders in Massachusetts, 1998-2007. HUD List.

<table>
<thead>
<tr>
<th>Subprime Lenders</th>
<th># loans</th>
<th>% of subprime purchase mortgages</th>
<th>status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option One Mtg. Corp.</td>
<td>11,243</td>
<td>18.6</td>
<td>operating</td>
</tr>
<tr>
<td>New Century Financial Corp.</td>
<td>5,951</td>
<td>9.9</td>
<td>shutdown</td>
</tr>
<tr>
<td>Freemont Investment &amp; Loan</td>
<td>5,550</td>
<td>9.2</td>
<td>shutdown</td>
</tr>
<tr>
<td>Argent Mtg. Co.</td>
<td>3,599</td>
<td>6.0</td>
<td>shutdown</td>
</tr>
<tr>
<td>Summit Mtg. Co.</td>
<td>3,067</td>
<td>5.1</td>
<td>shutdown</td>
</tr>
<tr>
<td>Mortgage Lender Net</td>
<td>2,798</td>
<td>4.6</td>
<td>shutdown</td>
</tr>
<tr>
<td>Long Beach Mtg. Co.</td>
<td>2,520</td>
<td>4.2</td>
<td>shutdown</td>
</tr>
<tr>
<td>WMC Mtg. Corp.</td>
<td>2,316</td>
<td>3.8</td>
<td>shutdown</td>
</tr>
<tr>
<td>Accredited Home Lenders</td>
<td>2,174</td>
<td>3.6</td>
<td>shutdown</td>
</tr>
<tr>
<td>First Franklin Financial</td>
<td>1,896</td>
<td>3.1</td>
<td>operating</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>41,114</td>
<td>68.1</td>
<td></td>
</tr>
</tbody>
</table>

**Conventional wisdom**

- Story goes something like this:
  - Borrower lured in by “below-market teaser”
  - Can afford the payments
  - Reset hits
  - Payment “explodes”
  - Delinquency

- Not accurate picture.
There is no such thing as a low teaser on subprime loan

Focus on 2/28s because
- More than half of all subprime loans
- Almost all the subprime ARMs
- Disproportionate delinquencies

Whole country
Subprime 2/28's
Source: LP (Prepared by the BOG)

<table>
<thead>
<tr>
<th>Year</th>
<th>Initial rate</th>
<th>1-year prime arm</th>
<th>Margin at reset</th>
<th>Fully Indexed Rate at origination</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>9.7</td>
<td>5.8</td>
<td>6.2</td>
<td>7.5</td>
</tr>
<tr>
<td>2002</td>
<td>8.7</td>
<td>4.6</td>
<td>6.6</td>
<td>8.3</td>
</tr>
<tr>
<td>2003</td>
<td>7.8</td>
<td>3.8</td>
<td>6.3</td>
<td>10.0</td>
</tr>
<tr>
<td>2004</td>
<td>7.3</td>
<td>3.9</td>
<td>6.1</td>
<td>11.3</td>
</tr>
<tr>
<td>2005</td>
<td>7.5</td>
<td>4.5</td>
<td>5.9</td>
<td>10.7</td>
</tr>
<tr>
<td>2006</td>
<td>8.5</td>
<td>5.5</td>
<td>6.1</td>
<td>10.9</td>
</tr>
<tr>
<td>2007</td>
<td>8.6</td>
<td>5.7</td>
<td>6.1</td>
<td>10.8</td>
</tr>
</tbody>
</table>
Subprime Business Model

- Extract high fees
- High interest rates prior to reset
- Borrowers refinance (or defaults) prior to reset.
- NOT the same as credit cards.

Cumulative terminations of Subprime 2/28’s

Source: LP (prepared by BOG)

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Still active</td>
<td>4.5</td>
<td>2.4</td>
<td>6.0</td>
<td>14.0</td>
<td>47.9</td>
<td>77.3</td>
</tr>
<tr>
<td>6 months or less</td>
<td>6.2</td>
<td>5.4</td>
<td>6.3</td>
<td>8.6</td>
<td>9.0</td>
<td>9.3</td>
</tr>
<tr>
<td>7 to 12 months</td>
<td>21.0</td>
<td>20.4</td>
<td>24.3</td>
<td>26.8</td>
<td>25.2</td>
<td>20.3</td>
</tr>
<tr>
<td>13 to 18 months</td>
<td>37.1</td>
<td>37.4</td>
<td>40.1</td>
<td>41.8</td>
<td>38.0</td>
<td>22.7</td>
</tr>
<tr>
<td>19 to 24 months</td>
<td>56.8</td>
<td>59.6</td>
<td>64.9</td>
<td>67.3</td>
<td>50.1</td>
<td></td>
</tr>
<tr>
<td>25 to 30 months</td>
<td>69.8</td>
<td>73.5</td>
<td>80.6</td>
<td>81.6</td>
<td>52.1</td>
<td></td>
</tr>
<tr>
<td>31 to 36 months</td>
<td>77.5</td>
<td>81.9</td>
<td>87.5</td>
<td>85.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
You may have heard about exotic mortgages

- Interest only and Neg-AM
- Do have exploding payments

Are NOT the problem right now.

Source: McDash

<table>
<thead>
<tr>
<th></th>
<th>1 mo.</th>
<th>2 mo.</th>
<th>3+ mo.</th>
<th>Total</th>
<th>FICO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option ARM</td>
<td>3.2%</td>
<td>1.2%</td>
<td>1.2%</td>
<td>5.7%</td>
<td>707</td>
</tr>
<tr>
<td>2/28</td>
<td>10.0%</td>
<td>5.2%</td>
<td>6.7%</td>
<td>21.9%</td>
<td>624</td>
</tr>
<tr>
<td>3/1</td>
<td>5.1%</td>
<td>2.1%</td>
<td>2.6%</td>
<td>9.9%</td>
<td>684</td>
</tr>
<tr>
<td>5/1</td>
<td>1.5%</td>
<td>0.5%</td>
<td>0.5%</td>
<td>2.5%</td>
<td>729</td>
</tr>
<tr>
<td>7/1</td>
<td>1.1%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>1.7%</td>
<td>732</td>
</tr>
<tr>
<td>10/1</td>
<td>1.0%</td>
<td>0.3%</td>
<td>0.2%</td>
<td>1.5%</td>
<td>738</td>
</tr>
<tr>
<td>All IO ARMS</td>
<td>2.0%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>3.6%</td>
<td>726</td>
</tr>
<tr>
<td>All Non-IO ARMs</td>
<td>4.1%</td>
<td>1.7%</td>
<td>2.1%</td>
<td>7.9%</td>
<td>696</td>
</tr>
</tbody>
</table>

Reset Freeze

- Freeze rates at initial level for borrowers who:
  - can afford the initial rate.
  - cannot afford the fully indexed rate.

- Two problems:
  - not many people
    - Reset is small – raises payment by 20%.
    - Presence of second liens means that effect on total mortgage payment is even smaller.
    - Equivalent to a < 10% fall in income even for highly indebted borrowers.
  - very difficult to identify these people
    - especially if loan was low-doc to begin with...

- To me, it’s useful because it shifts the debate.
  - Even if we could implement it, it wouldn’t help much.
  - Forces people to accept that resets aren’t the problem!
A profile of foreclosees

- Actual foreclosures (not petitions)
- Three facts
  1. Many put nothing down.
  2. Many owned the house for a short time.
  3. Concentrated in LMI communities, not new construction.
Disproportionately LMI
- Minority
- More so than last time

<table>
<thead>
<tr>
<th></th>
<th>LMI % of Foreclosure</th>
<th>LMI % of Ownerships</th>
<th>Minority % of Foreclosure</th>
<th>Minority % of Ownerships</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>43.8</td>
<td>16.8</td>
<td>25</td>
<td>14.2</td>
</tr>
<tr>
<td>2007</td>
<td>44.2</td>
<td>17</td>
<td>25.6</td>
<td>14.3</td>
</tr>
<tr>
<td>1991</td>
<td>34.1</td>
<td>17.7</td>
<td>21.8</td>
<td>14.8</td>
</tr>
<tr>
<td>1992</td>
<td>38.8</td>
<td>17.6</td>
<td>23.3</td>
<td>14.7</td>
</tr>
</tbody>
</table>
Tenure

- Percentage of foreclosees with who owned the house for...

<table>
<thead>
<tr>
<th></th>
<th>&lt;1 year</th>
<th>&lt;2 years</th>
<th>&lt;3 years</th>
<th>&gt;3 years</th>
<th>≥5 years</th>
<th>≥10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>4.0</td>
<td>26.9</td>
<td>42.4</td>
<td>57.5</td>
<td>42.3</td>
<td>21.8</td>
</tr>
<tr>
<td>2007</td>
<td>3.1</td>
<td>25.8</td>
<td>45.1</td>
<td>54.9</td>
<td>38.8</td>
<td>21.1</td>
</tr>
<tr>
<td>1991</td>
<td>5.8</td>
<td>11.7</td>
<td>24.8</td>
<td>75.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>3.2</td>
<td>6.6</td>
<td>15.3</td>
<td>84.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Purchase equity

- Percentage of foreclosees with LTV at purchase of...

<table>
<thead>
<tr>
<th></th>
<th>≤80%</th>
<th>80%–95%</th>
<th>95%–100%</th>
<th>≥100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>8.6</td>
<td>41.1</td>
<td>15.7</td>
<td>34.5</td>
</tr>
<tr>
<td>2007</td>
<td>8.0</td>
<td>38.4</td>
<td>13.4</td>
<td>40.0</td>
</tr>
<tr>
<td>1991</td>
<td>35.9</td>
<td>53.9</td>
<td>1.9</td>
<td>8.2</td>
</tr>
<tr>
<td>1992</td>
<td>30.4</td>
<td>58.0</td>
<td>2.7</td>
<td>8.8</td>
</tr>
</tbody>
</table>
Role of subprime

- Almost half the foreclosures involved a subprime mortgage,
- But less than a third involved a house *purchased* with a subprime mortgage.
- I.e. 70% of foreclosed properties were purchased with prime mortgages.

<table>
<thead>
<tr>
<th>Subprime purchase</th>
<th>Subprime default</th>
<th>Default on purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006 28.7</td>
<td>45.6</td>
<td>38.6</td>
</tr>
<tr>
<td>2007 30.4</td>
<td>43.9</td>
<td>39.7</td>
</tr>
</tbody>
</table>

Gerardi, Shapiro and Willen (2007)

Do subprime loans lead to problems?

Look at delinquency rates on subprime loans.

Deceptive for two reasons

1. Most subprime loans are refinances – people are already in trouble when they get them. Causality goes the wrong way.
2. Subprime purchase loans? Most end with refinance

Look at whole *homeownership experience*

How often do borrowers who buy houses with subprime loans get into trouble?

We estimate that between 13% and 18% of subprime purchase experiences end in foreclosure.

Very sensitive to house prices
Our analysis shows that falling house prices are the driver of foreclosure activity.

Let me first present the evidence.
**Figure:** Foreclosures and house prices in Mass., 1989-present. Source: Boston Fed and The Warren Group.

![Graph of foreclosures and house prices]

**Figure:** Foreclosures and 30-day delinquency rates in Mass., 1989-present. Source: Boston Fed, the MBA and The Warren Group.

![Graph of foreclosures and delinquency rates]
What we are saying?

- Negative equity is necessary but not sufficient for foreclosures
- In other words:
  - If equity is positive, almost no one defaults (because they can sell at a profit).
  - If equity is negative, then default may make sense, but it depends on other things.
- Why should you hold on to a house when you have negative equity?
  - You will eventually make money
  - Depends on whether you can wait that long
  - Patience, financial resources

Figure: Cumulative appreciation for Massachusetts homeowner who bought in Q3, 1988.
Main difference with many others has to do with consumption.
How does a change in wealth affect consumption?
Some says $1 fall in housing wealth reduces spending by 5 cents
We think it’s closer to 2 cents.

Figure: Consumption to wealth relationship over time, based on NIPA data.
Figure: Consumption to housing wealth relationship over time, based on NIPA data.

- We attempted to put some numbers on it.
- Essentially, we estimated that the wealth effect after 1996 is about half what it was before.
- A one-dollar increase in net worth
  - led to a 5.4 cent long-run increase in consumption before 1/1/1996.
  - led to a 2.2 cent long-run increase in consumption after 1/1/1996.
- A one-dollar increase in housing equity
  - led to a 10 cent increase in consumption before 1/1/1996.
  - led to a 0 cent increase in consumption after 1/1/1996.
Financial Innovation and Credit Constraints

“Financial innovations” have made it easier to borrow against your house since the 1990s
- No paperwork!
- No fees!

So doesn’t this mean that spending should be more sensitive to house prices?
No, just the opposite.
- Level of borrowing will go up.
- Sensitivity of borrowing goes down.

Increased house prices relax a borrowing constraint
- Households have more debt...
- But the constraint matters to fewer consumers.
- For most consumers, borrowing self-limited.
Two key things to worry about:
- Can the Fed manage the liquidity squeeze?
- How much will house prices fall and how much will that affect consumption?