Lessons from the Great Recession: Household Debt in Macroeconomic Models

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Elevated levels of household debt combined with the dramatic decline in house prices have been the major factors explaining the severity of the 2007 to 2009 recession and the weakness of the subsequent recovery. My goal is to describe the underlying macroeconomic framework I believe is most consistent with these facts, and to provide evidence in support of this framework. The framework implies three lessons for policy-makers that I explain further in the final section:

1. In the short-run, policies aimed at reducing household debt burdens are likely to have the biggest positive effect on the economy
2. Macroeconomic models used for policy analysis and regulation should take into account household heterogeneity as it relates to aggressive borrowing behavior
3. Policy-makers should investigate the use of flexible mortgage contracts in which principal amounts automatically adjust downward when aggregate house prices collapse

I. Background

As Figure 1 shows, the recession of 2007 to 2009 in the United States was preceded by a historic rise in household debt. My co-author Atif Mian and I have done extensive research on this topic (Mian and Sufi (2009, 2011a)). Here is the basic narrative: Following the 2001 recession, there was an expansion in the supply of mortgage credit especially toward households that traditionally had difficulty obtaining mortgage finance, a group I refer to as marginal.

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1 This essay has been prepared for the May 2012 academic consultants' meeting of the Federal Reserve Board of Governors. It is based in large part on research I have conducted with Atif Mian. I thank Randall Kroszner, Atif Mian, and Raghuram Rajan for comments. Contact information: amir.sufi@chicagobooth.edu, 773 702 6148.
borrowers. This expansion in supply was unrelated to fundamental improvements in productivity or income prospects of marginal borrowers. Further, the expansion in mortgage credit fed house price appreciation by increasing demand for housing.

Figure 1: U.S. Household Debt to Income Ratio

Existing homeowners responded to increased house price appreciation by aggressively borrowing against the rise in home equity. Our research suggests that households on average borrowed $0.25 against each dollar rise in home equity; households traditionally described as "constrained" borrowed extremely aggressively—as much as $0.75 for every dollar rise in home equity. Consistent with survey evidence (Canner, Dynan, and Passmore (2002)), our findings suggest that a substantial amount of home equity withdrawal was used for consumption and home improvement.

Our research implies that most of the rise in household debt prior to the recession was due to these two effects: marginal borrowers using debt to purchase new properties and existing homeowners borrowing heavily against the increase in home equity value.

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2 Our research does not take a stand on the specific forces that led to the expansion in mortgage credit supply, and I do not believe a consensus has been reached among researchers. The global savings glut, expansionary monetary policy, inherent problems with the securitization process, and government programs designed to expand credit to marginal borrowers have all been blamed.
II. Household Debt in a Macroeconomic Framework

The argument that high household debt levels affect the macro-economy has been made since at least Fisher (1933) and was strongly put forth by Mervyn King (before he became Governor of the Bank of England) in his 1994 European Financial Association Presidential Address (King (1994)). However, household debt played a relatively minor role in mainstream macroeconomic models prior to the recession of 2007 to 2009.

Recently, three models argue that elevated levels of household debt play a central role in generating a severe recession (Eggertsson and Krugman (2011), Guerrieri and Lorenzoni (2011), and Midrigan and Philippon (2011)). In my view, these three models—which, despite having unique features, are similar—together provide the most empirically relevant framework for understanding the recession of 2007 to 2009 and the subsequent weak recovery.

The models have three main ingredients. First, they involve heterogeneity in the household sector with a significant fraction of spending constrained agents in the economy, where I use the term spending constrained (or just constrained) to reflect a very large elasticity of spending with respect to credit availability. For these households, changes in borrowing constraints and credit availability play a very important role in spending decisions. This assumption on household heterogeneity generates variation across households in debt levels before the recession, with spending constrained agents having the highest household leverage.

3 In more technical terms, the consumption behavior of spending constrained agents in these models is not governed by a standard Euler equation as in the Permanent Income Hypothesis. Instead, the consumption of spending constrained agents moves strongly with fluctuations in credit availability. Eggertsson and Krugman (2011) and Guerrieri and Lorenzoni (2011) introduce this constraint using a binding limit on debt capacity, whereas Midrigan and Philippon (2011) use a “collateral” cash in advance constraint based on Lucas and Stokey (1987) in which home equity is critical for household liquidity. I avoid using the term “borrowing constraints” or “liquidity constraints” because they imply that these households borrow aggressively because they expect higher income growth in the future, and I am not convinced this is the case.
The second ingredient is a shock to the economy that results in a severe pullback in spending by households with the highest leverage ratios. This shock is modeled as a tightened leverage constraint in Eggertsson and Krugman (2011) and Guerrieri and Lorenzoni (2011) that leads to deleveraging by levered households. Midrigan and Philippon (2011) model the shock as a drop in liquidity services from housing, which affects the spending of levered households given that during the boom they used home equity most aggressively to facilitate spending. The empirical counter-part to these shocks is the collapse in house prices in 2007 and the financial crisis in 2008.

In standard macroeconomic models without frictions, a large decline in consumption by highly levered households would not have aggregate effects. Wages, prices, and interest rates would adjust to induce more spending by unlevered households. One such channel would be a significant decline in the interest rate, as the pullback in spending by constrained households acts as a positive shock to savings. In turn, lower interest rates would induce more consumption by unlevered households.

Therefore, the third necessary ingredient is some friction that prevents the economy from adjusting. In Eggertsson and Krugman (2011), the zero lower bound on nominal interest rates plays a crucial role. The zero lower bound on nominal interest rates makes it difficult to get real interest rates into negative territory, where they would need to be to generate more consumption by unlevered agents. In fact, the only way to get real interest rates negative would be to push the current nominal price level down to generate high inflation expectations going forward. But if debt contracts are in nominal terms, pushing the current price level down will only worsen the spending pullback of levered agents, similar to the Fisherian debt-deflation argument of 1933.

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4 See Hall's (2011) AEA Presidential Address for an excellent description of this mechanism.
It is important to emphasize that the friction preventing adjustment need not be the zero lower bound on nominal interest rates. As Midrigan and Philippon (2011) show, frictions preventing nominal wage/price adjustment, household mobility, or labor re-allocation across sectors would have similar effects. Regardless of the precise friction, the conclusion is that the decline in consumption by levered households generates a severe aggregate decline in output.

Taken together, these three ingredients lead to the following crucial insight: the credit shock that hit the economy in 2007 and 2008 affected aggregate output because of the distributional consequences of a highly levered household sector. Or in other words, if the decline in house prices had occurred in an economy with low levels of household leverage, the consequences for the decline for aggregate output would have been much smaller.5

It is useful to contrast the conclusions of this framework to those of another framework that emphasizes the distribution of leverage: the bank lending channel literature (e.g., Bernanke and Gertler (1989)). The bank lending literature emphasizes how negative shocks to the highly levered banking sector can lead to sharp declines in lending by banks, especially to firms. Or in other words, these models emphasize the importance of financial sector leverage in transmitting shocks to the aggregate economy through firm investment. In these models, leverage in the household sector plays an insignificant role. As I will argue below, policies that alleviate financial sector shocks while ignoring problems stemming from household leverage will likely be ineffective at significantly improving the economy.

III. The Evidence Supporting the Household Debt Framework

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5 In other words, the net wealth distribution is a crucial state variable of the model. The severity of an economic downturn following asset price declines will be strongly amplified if leverage levels in the economy are high. This is because the marginal propensity to consume is much higher for levered relative to unlevered households, an argument put forth by Meryvn King (King (1994)).
In a series of research papers (Mian and Sufi (2010), Mian, Rao, and Sufi (2011), Mian and Sufi (2011b)), Atif Mian and I have utilized heterogeneity across U.S. counties in household leverage as of 2006 to provide empirical support for the framework discussed above. We empirically measure levered and unlevered households in the theoretical model using variation in leverage across counties. Or, in other words, high leverage counties are the levered households prior to the recession, and low leverage counties are the unlevered households.

We measure household leverage using the household debt to income ratio in the county as of 2006. There is a substantial amount of such variation. For example, Monterey County in California had a debt to income ratio as of 2006 of 3.9 whereas Woodbury County in Iowa had a debt to income ratio as of 2006 of 1.1.

A key question is: what is the underlying source of the variation across U.S. counties in household leverage? We address this question in detail in our research; to summarize, housing supply elasticity plays an important role. In areas with inelastic housing supply (such as California and Florida), the mortgage credit supply shock led to higher house prices (from increased demand for homes by marginal borrowers) which in turn led to aggressive home equity withdrawal. In areas of the country with very elastic housing supply (such as Iowa and Kansas), the mortgage credit supply shock did not affect house prices. While there are counter-examples to this pattern (most notably Las Vegas, Nevada and Phoenix, Arizona), housing supply elasticity is on average strongly negatively correlated with household leverage ratios as of 2006.

One of the central predictions of the framework discussed in Section II is that the decline in aggregate demand is driven by levered households responding to house price declines and the

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6 In much of our research, we use housing supply elasticity as an instrument for household leverage ratios as of 2006. One of the main advantages of this approach is that housing supply elasticity is uncorrelated with residential investment growth and population growth during the housing boom. Or, in other words, this approach allows us to isolate the effect coming uniquely from household debt levels as opposed to alternative channels related to booming markets.
financial crisis. We find very strong evidence supporting this prediction: drops in household spending by high leverage counties can quantitatively explain the lion’s share of the drop in household spending in the aggregate U.S. economy during and after the recession.

**Figure 2: Household Spending by High and Low Leverage Counties**

- **Auto sales**
  - High leverage/inelastic counties, 2006
  - Low leverage/elastic counties, 2006

- **Other durables**

- **Non-durables, non-grocery**

- **Groceries**

Figure 2 shows the basic result by plotting household spending for U.S. counties in the top and bottom decile of the household leverage distribution as of 2006. The results are striking: all measures of spending declined much more significantly in high household leverage counties. Our counter-factual estimates suggest that in the absence of problems related to high household leverage, auto sales would have declined by only 15% instead of the observed 36% from 2007 to 2009, and non-auto sales retail spending would have actually grown by 2% instead of the observed 12% decline in 2007 to 2009.

We provide a number of results showing that high debt levels are crucial to understanding this pattern. In high leverage counties, mortgage defaults and foreclosures are significantly
higher. Further, in these areas, home equity credit availability declined much more sharply and households have been unable to refinance into lower mortgage rates. Finally, within high leverage counties, the negative effect of house prices on household spending was concentrated in zip codes where households owned fewer financial assets. This latter result suggests that house price declines mattered for household spending because of low household net worth and high debt levels.  

How did this negative demand shock affect unemployment? This question is harder to address because a decline in household spending in high leverage counties will affect employment throughout the country. Or in other words, one cannot simply examine job losses in high leverage counties to measure the total effect of the negative demand shock coming from excessive household debt levels.

We overcome this obstacle by splitting employment in every county into predetermined tradable and non-tradable sectors. If the negative demand shock coming from household debt is driving unemployment, we expect to see job losses in the non-tradable sector concentrated in high leverage counties. In contrast, job losses in the tradable sector should be evenly spread across the economy. As Figure 3 shows, this is exactly what we find. Job losses in non-tradable sectors such as retail employment have been concentrated in high leverage areas, whereas job losses in tradable sectors such as manufacturing were spread throughout the country. Using this methodology, we estimate that 65% of the jobs lost from 2007 to 2009 in the U.S. economy were directly due to the negative demand shock induced by excessive household debt.

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7 Several commentators and policy-makers have argued that house price declines alone, even in the absence of debt and collateral considerations, can explain sharp declines in household spending. This argument is contradicted by both theory and evidence. From a theoretical perspective, in the absence of debt or collateral considerations, a decline in house prices does not represent a loss of wealth given that households must purchase housing going forward. In terms of the empirical evidence, the decline in household spending in high leverage counties is far too large to be explained by a pure housing wealth effect.
Our results are most consistent with the macroeconomic models discussed above in which household debt plays a central role. They are less consistent with other prevailing views of the recession. First, our results cast doubt on the role of policy and regulatory uncertainty as a primary driver of the recession. Aggregate uncertainty cannot explain the differences we find across U.S. counties, and it cannot explain why economic problems are so closely related to household debt. Uncertainty may amplify the negative effect of household debt on the economy, but it should not be viewed as the primary driver of economic weakness.

Second, our results cast doubt on the traditional bank lending channel through firm investment explanation for the severity of the recession. In this view, the severity of the recession is due to banks refusing to extend credit to firms that have good investment opportunities. In fact, we find evidence contradicting this view: Job losses in non-tradable industries in high leverage counties were concentrated within large firms that generally have the best access to credit. Job losses at small firms were less severe. This pattern suggests that job losses were due to a lack of demand rather than an inability to access credit. These findings are in line with anecdotal evidence that lack of demand was the chief problem facing firms during the recession, not
difficulties raising finance.\textsuperscript{8} To the degree that the bank credit channel played an important role in the recession, it is likely due to reduced lending to households, not businesses.

As a final note, it is important to emphasize that our results are not unique to U.S. counties. For example, Glick and Lansing (2010) show that the strong effect of household leverage levels on recession severity also holds across European countries during the 2007 to 2009 recession (see also IMF (2012)). King (1994) shows the exact same pattern in the 1989 to 1992 recession: countries with higher household leverage as of 1988 experienced the most severe subsequent recessions. Olney (1999) and Mishkin (1978) assign an important role for household debt in explaining the severity of the consumption collapse during the Great Depression.

\textbf{IV. Lessons for Policy-Makers}

Macroeconomic models in which household debt plays a central role have been the most successful at explaining the severity of the recession and the weak economic recovery. What are the central lessons for policy-makers? I emphasize three. The first focuses on the near term policy implications, whereas the second and third are lessons for the longer term.

\textit{Lesson 1: Policies aimed at reducing household debt burdens are likely to have the biggest positive effect on the economy}

All three of the models discussed above have this immediate implication. The logic is clear. In the models, weak aggregate demand driven by an over-levered household sector is the

\textsuperscript{8} As Izzo (2011): "The main reason U.S. companies are reluctant to step up hiring is scant demand, rather than uncertainty over government policies, according to a majority of economists in a new Wall Street Journal Survey." In the very first bullet point of Dennis (2010) of the National Federation of Independent Businesses, he notes that "the principal immediate economic problem for 51 percent of small employers remains slow or decline sales ... even among owners who report they cannot get credit, twice as many cite poor sales as cite credit access." The NFIB has consistently argued that weak demand, and not difficulties accessing credit, is the primary problem facing small businesses.
source of economic weakness. Levered households have a much higher marginal propensity to consume out of income given high debt burdens. As a result, any policy that targets household debt will lead to a significant boost in economic activity.

There are many such policies. In terms of the least controversial, efforts to allow borrowers with little or negative home equity to access historically low interest rates are likely to have a positive effect on economic activity. It has been well documented that homeowners with negative equity have been unable to access lower rates, even if they have been solvent on payments for the life of the mortgage (Boyce, Hubbard, and Mayer (2011)). Figure 4 shows the state level correlation between the fraction of homeowners underwater and the growth in refinancing activity from 2006 to 2010. There is indeed a very strong negative correlation.

**Figure 4: Refinancing and Underwater Homeowners, by State**

Research suggests that the inability of homeowners to access low interest rates has introduced a large wedge between interest rates that the Federal Reserve can affect and the actual interest rates faced by borrowers. This large wedge substantially weakens the efficacy of monetary policy, and in my view must be targeted directly (Feroli, Harris, Sufi, and West (2012)). These conclusions have also been reached by members of the Federal Reserve (see for
example the white paper on housing by the Federal Reserve Staff (2012) and Dudley (2012)).

Previous efforts by the Obama Administration to facilitate refinancing by underwater homeowners have been largely unsuccessful, but there is some evidence that the most recent November 2011 revamp of the program is working (Woellert (2012), MBA (2012)).

The more controversial policy option is government involvement in forgiving principal amounts of mortgages. The macroeconomic framework discussed in Section II implies that forgiving principal on mortgages, which acts as a transfer from unlevered to levered households, would have an immediate positive effect on economic output.

Obviously, there are important issues that need to be discussed before such a policy could be implemented on a large scale: Is there a way to implement principal forgiveness without triggering strategic defaults? How would forgiveness be financed? What would be the implications for confidence in contracts going forward? What are the moral hazard implications for borrowers and lenders?

These are all legitimate questions, and I do not have the space here to discuss them at length. However, I want to emphasize two points. First, there is strong historical precedent for large-scale principal forgiveness, and history suggests that such policies positively affect the economy. Bolton and Rosenthal (2000) discuss debt moratoria imposed by state governments in response to commodity price collapses in the 18th and 19th centuries, and during the Great Depression. Kroszner (1998) provides evidence that the abrogation of gold clauses in debt contracts during the Great Depression improved the value of both equity and debt. The strong relation between abandoning the Gold Standard and escaping the Great Depression has been typically attributed to expanding money supply (Eichengreen (1996)); but abandoning the Gold Standard also effectively transferred wealth from creditors to borrowers through inflation.
The IMF has put forth a compelling argument for household debt restructuring in Chapter 3 of their 2012 Economic Outlook (IMF 2012). As they note: "...bold household debt restructuring programs such as those implemented in the United States in the 1930s and in Iceland today can significantly reduce debt repayment burdens and the number of household defaults and foreclosures. Such policies can therefore help to avert self-reinforcing cycles of household defaults, further house price declines, and additional contractions in output." Their careful cross-country study reinforces the argument that excessive household debt is a main driver of severe recessions, and makes a compelling case for principal reduction efforts.

Lesson 2: Macroeconomic models used for policy analysis and regulation should take into account household heterogeneity as it relates to aggressive borrowing behavior

There is a large body of evidence that a significant fraction of the population borrows very heavily out of increases in credit availability.9 Yet most quantitative macroeconomic models based in the dynamic stochastic general equilibrium framework continue to rely heavily on an unconstrained Euler equation in determining household consumption behavior.10 Or in other words, households in these models follow the permanent income hypothesis and smooth their consumption response to credit supply shocks. As a result, these models are ill-equipped at explaining large fluctuations in economic output that come from changes in credit supply to households. Simple consumption function estimations based on aggregate data may pick up

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9 The microeconomic evidence overwhelmingly supports this statement. Zeldes (1989) supports "the hypothesis that an inability to borrow against future labor income affects the consumption of a significant portion of the population." A very high sensitivity of borrowing and consumption with respect to changes in credit availability has been shown for credit cards (Gross and Souleles (2002)), auto loans (Einav, Jenkins, and Levin (2011)), and home equity withdrawal (Mian and Sufi (2011a)).

10 There is a rich history of models incorporate financial accelerator effects from the production side of the economy (Bernanke, Gertler, and Gilchrist (1999)).
some of these effects through a housing wealth effect, but they will likely fail to see the importance of leverage and debt constraints.

Heterogeneity in debt constraints across U.S. counties also introduces complications to the conduct of monetary policy. A shared currency diminishes the power of monetary policy to target areas most affected by excessive debt burdens. Monetary expansion at the national level will have uneven effects, and may even spur inflation in areas of the country where the recovery is quite strong. The uneven weakness across the country may require fiscal policy actions that can implement transfers directly to over-levered households, as proposed in Bernanke (1999).

Further, as I have outlined in Sufi (2011), an under-appreciation of the importance of aggressive borrowing behavior also hindered the ability of regulators to understand the impact of the credit housing boom on the economy. As I argue there, an analysis of microeconomic data during the 2002 to 2006 period would have made it clear that an expansion in credit supply to marginal borrowers was driving the increase in household leverage and house prices, and this credit expansion was unrelated to fundamental improvements in income or productivity.

Building a quantitative macroeconomic model that incorporates household heterogeneity and aggressive borrowing behavior is without doubt a challenge. In the short-run, there is a vast amount of microeconomic data on debt, credit scores, household spending, house prices, and income that would allow policy-makers to track households that tend to borrow aggressively. Measuring the behavior of these households has been the basis of much of my research, and I am convinced that such measurement could improve our understanding of trends in the economy.

Lesson 3: Policy-makers should investigate the use of flexible mortgage contracts in which principal amounts automatically adjust downward when aggregate house prices collapse.
As the framework above implies, the inflexibility of debt contracts has negative aggregate effects when asset prices collapse. This is because debt contracts concentrate losses among levered households—precisely the households that cut spending by the most when faced with a negative credit shock.

In the optimal contracting literature, the justification for the use of non-contingent debt contracts is borrower moral hazard or information asymmetry (e.g., Townsend (1977), Diamond (1984), Aghion and Bolton (1992), Hart and Moore (1994)). However, it is hard to understand these benefits in states where aggregate asset prices collapse. Borrowers presumably have no control over and no private information about aggregate asset price movements.

An obvious question is: why don’t private mortgage markets offer flexible mortgage contracts where principal automatically adjusts downward if house prices drop sharply? One likely explanation is the adverse selection problem in introducing such contracts by a private seller. Households that take these contracts are likely to be those with incomes that are most sensitive to aggregate house price changes. If this information is asymmetric, the private seller is likely to face severe adverse selection. Another likely explanation is the mortgage interest tax deduction that heavily favors the use of non-contingent debt contracts.

There are important questions regarding the use of flexible principal mortgage contracts. But we know that real estate crashes are associated with severe economic downturns in large part because of the uneven distribution of losses across levered and unlevered households. I would encourage policy-makers and regulators to investigate the feasibility of such contracts, and to further explore why such contracts are not more prevalent in the market. I would further encourage policy-makers to reconsider policies in place—such as the mortgage interest tax deduction—that strongly encourage the use of non-contingent debt by households.
Works Cited


