

# Explaining the September 2008 – June 2009 U.S. Macroeconomic Crisis\*

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## Abstract

Over a nine-month span beginning in September 2008, U.S. labor and goods markets suffered tremendous declines. In this paper, I describe empirical evidence and construct an economic model to support the hypothesis that this episode was primarily driven by a pessimistic news shock in expectations about the future economy. This news shock began in September 2008 and was rooted in public discourse by political leaders surrounding the debate over the TARP proposal, which proffered a view of how close the U.S. was to economic catastrophe. I explain that other causes, such as wealth effects through house price declines and credit supply shocks, likely had relatively minor causal roles during the episode. In addition to narrative evidence from media sources, I draw on surveys of both business and households, traditional macroeconomic time series, cross-county house price and vehicle sales data, interest rate spreads and other financial market data, as well as internet search counts.

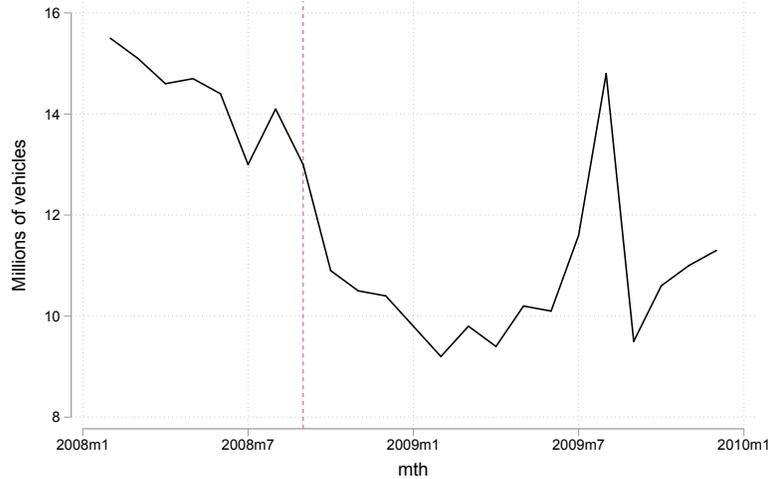
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\*The analysis set forth does not reflect the views of the Federal Reserve Bank of St. Louis or the Federal Reserve System. The authors thanks Rodrigo Guerrero for excellent research assistance and Adrienne Brennecke for help acquiring the data. First draft: December 2017.

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Figure 1: Monthly new vehicle sales



Source: Bureau of Economic Analysis.

## 1 Introduction: Deconstructing the Conventional Narrative

The U.S. lost 5.7 million net jobs between September 2008 and June 2009. Over the same time interval, new vehicle sales fell by roughly 4 million units (or 30 percent) at a monthly rate (see Figure 1). Both the employment and new vehicle declines were unprecedented for the post Great Depression U.S.

The conventional explanation for the causes of the 2007—2009 Recession centers on two events: the housing market downturn, which began in January of 2007, and the financial market turmoil that reached a melting point in September of 2008. The NBER dates the start of the recession as December of 2007. Although the economy began to lose jobs then, the recession’s effect on the labor market was relatively mild for many months to come. From the start to the end of 2007, the prime age employment-population ratio fell only 1 percentage point (see Figure 2).

It is useful to parse the 2007-2009 recession into three distinct phases. This is done in Figure 3, which plots the month-over-month change in the nonfarm payroll. Phase 1 constituted a mild downturn. During this phase, the economy lost roughly 1.1 million jobs. Note that the timing of the Phase 1 does not align well with the decline in house prices, which had been falling for nearly a year before the start of the recession.

According to my delineation, Phase 2 begins in September 2008 and lasts through June 2009. This was the Economic Crisis, in which the economy lost over 5.7 million jobs in this 10 month period, over five times the decline in employment during Phase 1. Providing a new explanation for this second phase of the recession is the purpose of this paper. The end of Phase 2 and beginning

Figure 2: Prime age employment-to-population ratio

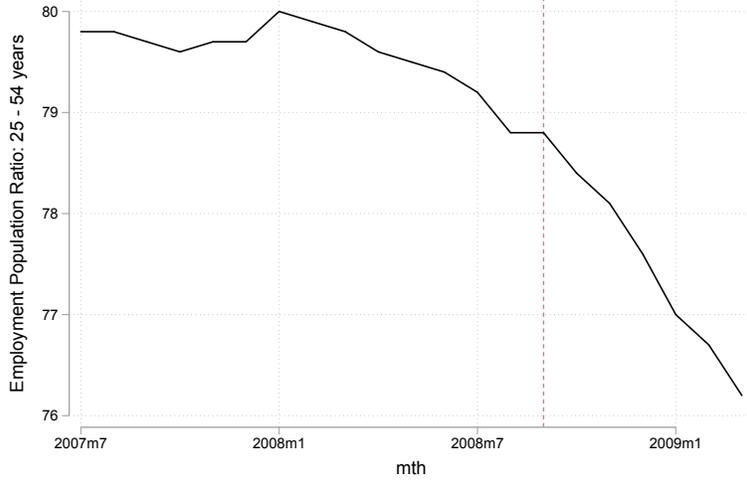


Figure 3: Changes in the nonfarm payroll

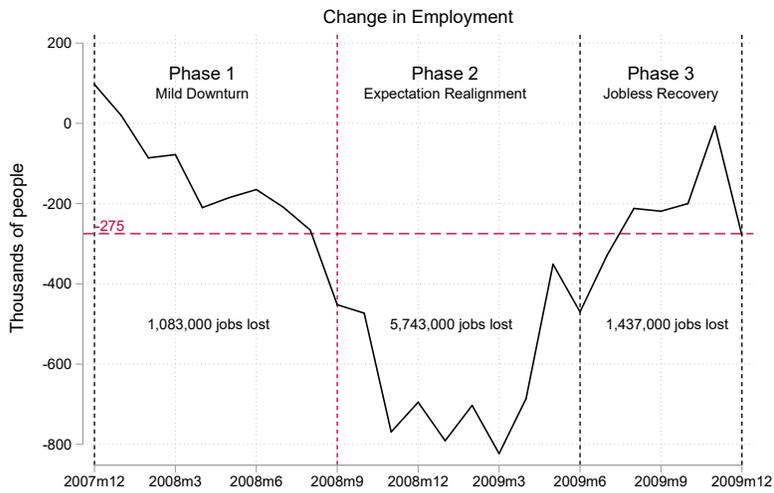
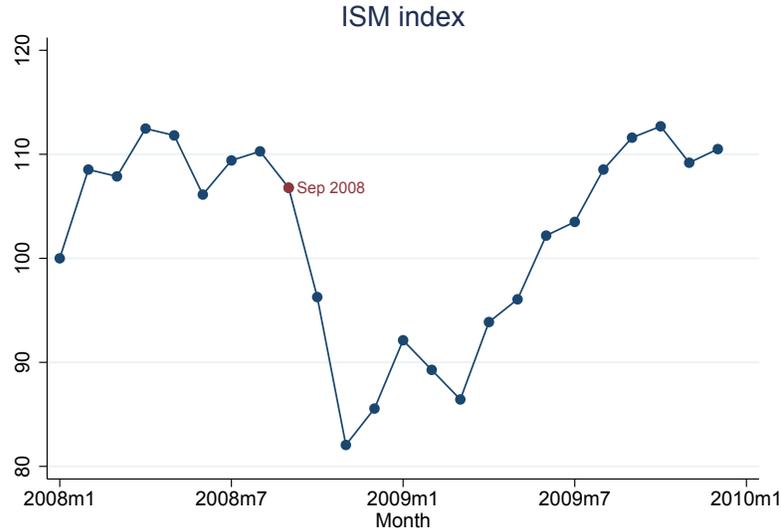


Figure 4: ISM Manufacturing Index



of Phase 3 lines up with the NBER-dated ending of the recession. Note that during Phase 3, there were still substantial employment losses, totaling almost 1.4 million jobs.

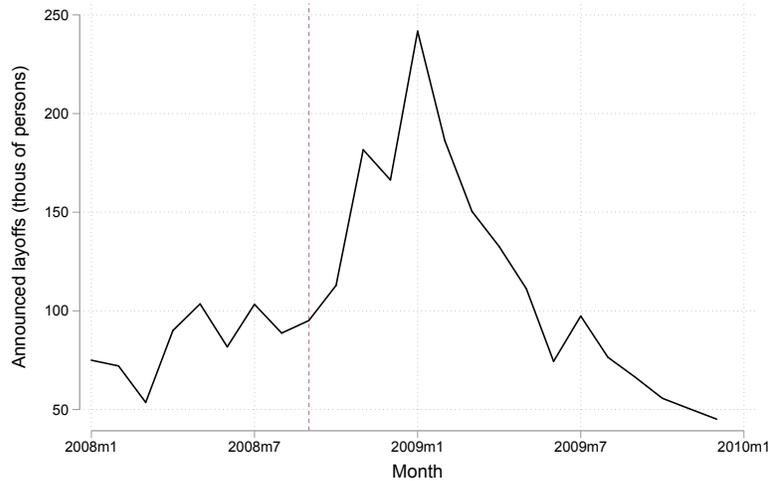
New vehicle sales also fell dramatically. Similarly, Figure 4 shows a substantial decline in manufacturing, as measured by Institute of Supply Management index. The index fell about 25% in a two-month span and then remained low throughout Phase 2. Figure 5 plots monthly announced layoffs as measured using survey data of businesses from Challenger, Gray and Christmas, an outplacement firm. This increase occurred in the months immediately following September 2008.

In the following 9 months, the unemployment rate spiked by 3.4 percentage points. No doubt the coincidence of the September 2008 financial market upheaval, which included the bankruptcy of Lehman Brothers, and the labor market collapse generated much research interest in the importance of financial frictions and shocks in explaining the poor economic performance during this episode.

Any causal transmission from financial market shocks to the labor and goods market, perhaps through a reduced credit supply channel, must reckon with following observations. Following Federal Reserve and U.S. Treasury Department interventions very early on in the crisis, financial markets largely stabilized. Within the first few weeks of the crisis, the Federal Reserve slashed the federal funds rate and introduced special lending facilities for both banks and non-banks. Within the first six weeks of the crisis, an act of Congress established the \$700 billion Troubled Asset Relief Program (TARP). Very quickly, interest rate spreads that had spiked in September had largely stabilized by January.<sup>1</sup>

<sup>1</sup>These include the LIBOR-OIS spread and the asset-backed commercial paper rate minus the 3-month Treasury

Figure 5: Announced layoffs



Source: Challenger, Gray and Christmas.

These observations beg the question: if quick federal and central bank interventions “did their jobs” in the last third of 2008, then how could financial market shocks explain the tremendous output and employment declines that occurred in the nine months following the Lehman collapse?

I contend that this “negative credit supply” shock explanation, which might certainly have played some role, does not hold together as the overriding influence. Instead, I offer that there was a strong negative news shock about the future economic conditions that reduced demand for goods and services. It is no coincidence that the negative news shock and associated decline in demand occurred in September 2008. This is precisely when the proposal of and debate over TARP begin a months-long period of negative commentary by national political leaders—and the media—about the closeness of the U.S. to a tremendous downturn. Beginning in mid-September 2008, the phrases “economic crisis” and “depression” were regularly used in the national press.

Why did this language become so commonplace so quickly? Democrats in Congress along with President George W. Bush viewed (and may have been correct about) the need for such dire pronouncements in order to win passage of the expensive and politically unpopular TARP legislation. Thus, the negative commentary may have been critical in achieving passage of the law. However, the collateral damage of this debate was the consumers and businesses expectations about the future economy worsened substantially. The bailout initially failed passage in the U.S. House of Representatives (falling short by 13 votes). This was followed by a immediate 7 percent one-day decline in the Dow Jones Industrial average. Four days later the bailout package passed  
bill rate.

with relatively broad bipartisan support.

In addition to the negative credit supply shock view, the house price decline itself has been posited as a critical factor in explaining the recession. According to one explanation (e.g., Mian, Rao and Sufi (2013) and Mian and Sufi (2014)), the decline in employment and auto sales was a direct result of a negative “net worth shock” due to falling house prices in between 2007 and 2009.

As evidence, several papers run disaggregate region-level regressions of consumption and employment measures on net worth, driven mainly by house price declines, and establish a statistically significant relationship between each measure and net worth. Unlike the credit supply shock historical record, there were no successful government interventions that stabilized housing markets. The decline in house prices over this episode was dramatic and persistent.

There are two difficulties, however, with this explanation. First, quantitatively house prices can only explain a small fraction of the overall decline in economic activity. First, I study new vehicle sales during this nine month period. I show that, during this period, despite the statistical relationship between house prices and vehicles sales, the quantitative significance of the relationship is not sufficiently strong to explain most of the aggregate decline in sales.

Specifically, only 20 percent of the average auto sales decline across U.S. counties could be explained by declining house prices. The remainder is due to the intercept term: new vehicle sales fell almost everywhere, including regions with stable house prices and declining house price and regions with on average poor credit and on average good credit. In short, the entire country stopped buying cars.

Given that house prices cannot explain the bulk of the auto sales crash, I return to the alternative aggregate explanation. Again, there was a broad-based, dramatic decline in household and business expectations about the economy’s future that occurred simultaneously with the government officials public discourse in the fall of 2008. From the perspective of the fall of 2008, this news shock about the economy’s future drove down auto and other goods purchases. In response, businesses fired workers.

In the language of the permanent income model, current consumption is determined by the current value of financial wealth plus non-financial wealth (i.e., the properly discounted sum of expected future income). Whereas some authors stress the contribution of shocks to the current financial wealth, I argue that the news shock drove down the expected value of future income.

The news shock explanation has an added benefit that it can explain the decline in financial wealth, whereas in the house price explanation, the change in net worth is treated as an exogenous shock. Of course, current net worth is an endogenous variable.

The contribution of an asset to total net worth is determined by the quantity of the asset (e.g., housing) times the asset’s price. In 2007, the total value of housing fell because of a price decline, not a quantity decline as might result from a natural disaster. Of course the price of housing is an endogenous variable as well. A negative revision to expectations about the economy’s future drives

down the current price of housing, as long as the supply of housing is somewhat inelastic in the short-run.

Next, I build an equilibrium model that demonstrates how a negative news shock about the future can drive down employment and consumption in the present. The mechanism that generates procyclical news shocks is novel and works off of two assumptions.<sup>2</sup>

First, I assume real wages are fixed and above the equilibrium flexible wage. As such, the amount of labor in equilibrium is labor demand rather than labor supply determined. This makes the negative wealth effect on labor supply associated with the bad news inoperative.

Second, I assume a matching process between businesses and customers. When demand for goods falls as a result of the negative news customers spend less time searching. Reduced search effort lowers rate at which goods are matched with customers and therefore the amount of goods that businesses choose to produce and put on store shelves.

The natural question is what happened in September 2008 that drove down expectations about future income. To address this, I examine public remarks of U.S. political leaders at the time. The impetus for these extremely negative statements was the desire to pass the financial sector bailout, later known as the Treasury Asset Relief Program (TARP). Coincident with these discussions, there is a decline in survey measures of confidence about the future economy by both households and businesses, internet searches of terms like “economic crisis,” and of course sales of durable goods such as autos.

One conventional wisdom surrounding September 2008 is that this period experienced a negative credit supply shock. According to this view, businesses lacked funding to conduct normal operations and households were denied access to credit markets. I will call into question that quantitative importance of this channel by examining survey evidence of households and businesses. Survey questions that relate to credit availability are nearly unchanged in this nine month period.

As explained above, I model the information arising in the autumn of 2008 as affecting the economy through a news shock. The crucial aspect of the model is not a news shock, but rather *an expectations* mechanism. Using a news shock is particularly appealing since there is a great deal of evidence of a productivity slowdown following the 2007-2009 recession, often referred to as *secular stagnation*.<sup>3</sup>

Other expectations mechanism could be used. For example, one could model the economy as being subject to sunspot fluctuations (i.e., coordination failure or multiple self-fulfilling equilibrium). In this type of environment, the model has an ingredient, such as increasing returns to scale, that leads extrinsically-based changes in expectations to be validated. Examples include Azariadis and Guesnerie (1986), Farmer and Guo (1994), Benhabib, Meng and Nishimura (2000). It is natural to consider that extreme pessimism from political leaders in public discourse would serve as a focal

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<sup>2</sup>A few of the contributions to the macroeconomic news shock literature include Beaudry and Portier (2014), Jaimovich and Rebelo (2009) and Schmitt-Grohe and Uribe (2012).

<sup>3</sup>See for example Summers (2015) and Gordon (2015)

point mechanism upon which agents may coordinate.

Another potential expectations mechanism is generated by sentiments, in which decisions about production and/or consumption must be made under imperfect information. Examples include Angeletos and La'O (2013), Benhabib, Wang and Yen (2015) and Lorenzoni (2009).<sup>4</sup>

The outline of the paper is as follows. In the next section, I develop a simple model of news shocks and consumption demand in order to frame the issue. In Section 3, I describe the public discourse surrounding the financial bailout legislation in September and October of 2008 and document the corresponding, synchronous decline in consumer and business expectations. The next two sections compare the news shock explanations to a pair of popular alternative causes for the economic downturn: the house price channel and credit supply channel. The final section concludes.

## 2 A Simple Model of Expectations and Consumption Demand

This section provides a simple model of expectations and consumption demand. Its key ingredients are sticky real wages and a goods market matching process.

### The Model

There is a continuum of identical households. Each household consumes  $x^d$  in period 1 and  $c^d$  in period 2. Its utility function is:

$$U = \log(x^d) + \beta \log(c^d)$$

The household is endowed with labor in period 1 and goods in the amount  $i$  in period 2. Each household hires labor from other households for production and sells its own labor to other households.

The household supplies labor  $n^s$  and demands labor  $n^d$  in the first period. The real wage equals  $w$ , is paid in the period 1 good and is exogenously fixed. I assume the real wage is sufficiently high that is determined by labor demand. As such, there is no need to specify a particular labor supply function (i.e., put labor supply in the utility function). The household can produce goods using a one-for-one production function in period 1,  $y^s = n^d$ . The good can be stored across periods at net interest rate  $r$ .

Once goods are produced, they are sent to market where some of the goods are sold. The amount of goods sold depends upon the amount sent to the market:

$$x^s = q(\bar{y}, \bar{z}) y^s \tag{1}$$

Here  $\bar{y}$  is the economy-wide average number of goods sent to market, and  $\bar{z}$  is the average economy-

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<sup>4</sup>Benhabib and Spiegel (2017) investigate whether sentiments drive economic activity by examining state-level data, and instrumenting for local sentiments with political outcomes.

wide resources that households spend searching for period 1 consumption (which I describe below). The function  $q$  is positive, decreasing in  $\bar{y}$  and increasing in  $\bar{z}$ . In equilibrium, it may be the case that not all output is sold.

In order to acquire the period 1 consumption good, the household expends  $\phi$  units of period 1 resources per unit of search, which is given by  $z^s$ . Households on the production side of the market match with other households' demanded goods according to:

$$x^d = m(\bar{y}, \bar{z}) z^s \quad (2)$$

In addition, I assume

$$m = (y/z)^{1/2} \quad \text{and} \quad q = (z/y)^{1/2} \quad (3)$$

Finally, the household has market power over the good it sells according to the following inverse demand curve:  $p(x^s) = \bar{p} \cdot (x^s/\bar{x})^{-1/\theta}$ , where  $\theta > 1$ . One could derive this demand curve from an underlying monopolistic competition Dixit-Stiglitz framework.

The household's intertemporal budget constraint is:

$$p(x^s) x^s + wn^s + \frac{i}{1+r} = \bar{p}x^d + wy^s + \frac{c^d}{1+r} + \phi z^d \quad (4)$$

Equation (4) states that income (on the left hand side) obtains from selling the good and supplying labor in period 1 and the endowment of the good in period 2. Income is used to buy the good in periods 1 and 2, pay wages to other households and finance the search costs.

The household maximizes  $U$  subject to (1), (2) and (4) by choice of  $\{x^s, x^d, y^s, z^d, c^d\}$ , taking as given the wage and economy-wide average variables. Let the numeraire be the average price of period 1 consumption, i.e.  $\bar{p} = 1$ .

I next present the first-order condition for optimization in a symmetric equilibrium where each household behaves identically. The first condition equates the return on selling an additional unit of  $x$  on the left-hand side with the cost of selling the additional unit of  $x$  on the right-hand side.

$$\mu = \frac{q(y, z)}{w} \quad (5)$$

where  $\mu = \theta/(\theta - 1)$  is the gross markup. The former is the markup rate and latter is the rate at which producing output generates sales, divided by the marginal cost of production.

The next expression is the household intertemporal Euler equation:

$$\frac{\beta(1+r)}{c} = \frac{1}{x} - \left[ \frac{\phi}{m(y, z)} \right] \frac{1}{c} \quad (6)$$

The second term on the right-hand side above reflects the forgone consumption at period 2 resulting from the search cost of acquiring consumption at period 1.

In equilibrium, the budget constraint becomes:

$$\frac{i}{1+r} = \phi z + \frac{c}{1+r} \quad (7)$$

The solution for the equilibrium is four unknowns  $(c, x, z, y)$  in four equations (2), (5), (6) and (7).<sup>5</sup> For simplicity, assume  $\beta = 1/(1+r)$ .

I solve for the equilibrium quantity of period 1 consumption, which equals

$$x = \frac{i}{1 + \phi\mu w + \phi\mu w(1+r)} \quad (8)$$

Period 2 consumption is given by:

$$c = \left[ 1 - \frac{(1+r)\phi\mu w}{1 + \phi\mu w + \phi\mu w(1+r)} \right]$$

Consumption in both periods falls upon a negative news shock about future income (i.e., a decline in  $i$  that is anticipated in period 1).

### Features of the Equilibrium

A change in period 2 income  $i$  that becomes known to households in period 1 constitutes the news shock. In particular, if  $i$  falls this will induce a one-for-one percentage drop in period 1 consumption. According to (1), this also generates a decline in labor input. The model set-up therefore overcomes a traditional difficulty with generating procyclical news shocks. In the standard real business cycle model, bad news about future income reduces households' permanent income. The decline in permanent income drives down current labor input because of a negative wealth effect.<sup>6</sup>

Here, the real wage is rigid and sufficiently high such that labor demand determines labor input rather than the intersection of labor demand and labor supply. In addition to real wage rigidity, the result depends on the presence of the matching friction. On the production side, households hire labor up to the point that the marginal revenue product of labor equals the marginal cost of producing a unit of sales. While the real wage is fixed, the marginal cost of producing a unit of sales depends on total demand for goods because higher demand implies that it is easier to turn a unit of production into a sale. This is seen in equation (5).

The comparative statics implied by (8) are straightforward. An increase in  $\phi$  raises the search cost, which reduces demand for goods. An increase in the wage  $w$  lowers the households demand for labor, which in turn reduces income and thus period 1 consumption. An increase in the markup raises the returns to hiring, which raises labor input and profits. With greater income, households

<sup>5</sup>The second matching constraint (1) is redundant when  $x^s = x^d$  under the assumption in equation (3).

<sup>6</sup>Some researchers appeal to non-standard preference, such as Jaimovich and Rebelo (2009), that dampen the wealth effect of labor supply.

increase their demand for goods.

### 3 Public Discussions, News and the Economic Crisis

On September 15, 2008, Lehman Brothers filed for Chapter 11 bankruptcy. Over the next few days, the Federal Reserve and the U.S. Treasury Department took significant actions to mitigate the effects of the financial market turmoil. The Federal Reserve cut the federal funds rate, made \$85 billion in loans to AIG under Section 13(3) of the Federal Reserve Act and established special lending facilities to depository institutions and bank holding companies. The U.S. Treasury established a guarantee program to guarantee investments of participating money market mutual funds.

On September 20, the U.S. Treasury Department submitted draft legislation to Congress that would authorize the federal government to buy troubled assets. Before the submission of this legislation, on September 18, then-Treasury Secretary Hank Paulson and then-Federal Reserve Board of Governors chair Ben Bernanke met with Congressional leaders to brief them on financial markets and lay out the need for what would later be called TARP.

While this meeting was held in private, the substance of the meeting almost immediately became public through interviews of some of those present with the media. This began months of unprecedented negative commentary on the U.S. economy.

One day after the meeting, then-Chair of the Banking, Housing and Urban Affairs Committee, Senator Christopher Dodd stated “We’re literally maybe days away from a complete meltdown of our financial system, with all the implications here at home and globally.”

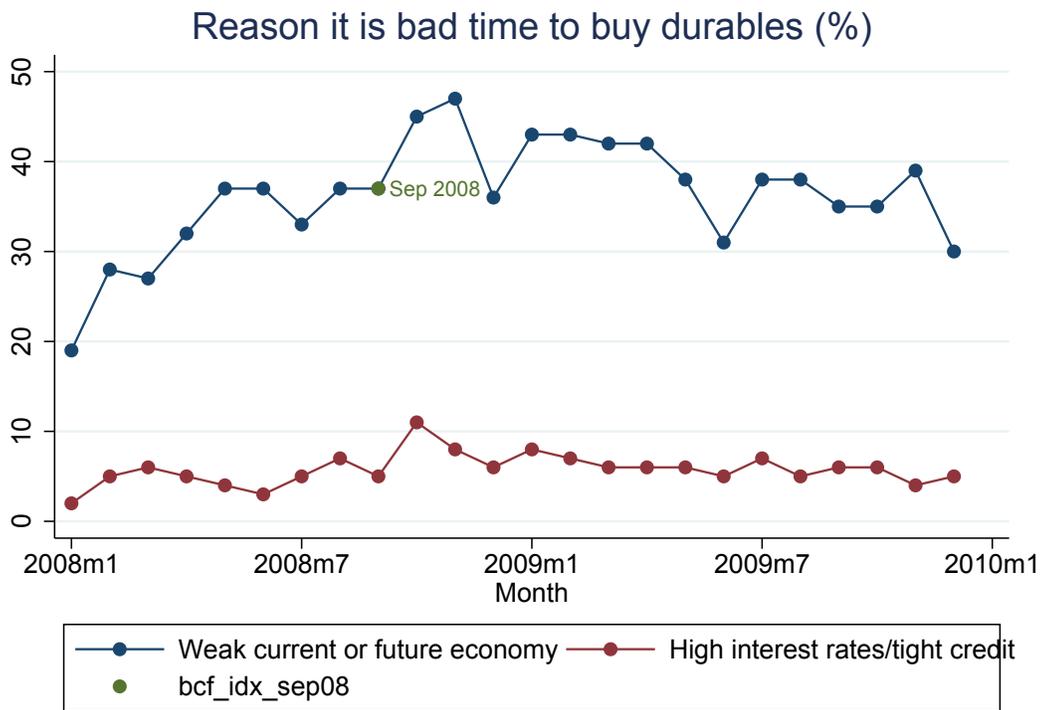
An *Economist* article from September 25, wrote (of the meeting) that: “[Bernanke] told us that our American economy’s arteries, our financial system, is clogged, and if we don’t act, the patient will surely suffer a heart attack, maybe next week, maybe in six months, but it will happen,” according to Charles Schumer, a Democratic senator from New York. Mr Schumer’s interpretation: failure to act would cause ‘a depression’.”

An article in *The Guardian* from September 26 presented then-President George W. Bush’s view of the situation: “ ‘This sucker could go down,’ Bush is said to have told the group - referring to the teetering US economy.”

Then-House Speaker Nancy Pelosi was quoted on September 29 as follows: “And we heard the secretary and the chairman tell us that this was a once in a hundred year phenomenon, this fiscal crisis was so drastic. Certainly once in 50 years, probably once in a hundred years.”

The TARP legislation passed on October 3. Nonetheless, the damage to consumer and business confidence had been done. For example, the Michigan Survey of Consumer, in its monthly survey, asks respondents whether it is a bad time to buy durables. There was a substantial spike in the percentage that answered yes in September and remained in the following several months. More tellingly, the Michigan Survey goes on to ask those who said it is a bad time to buy durable for the respondents’ reasons. Figure 6 plots the time series for two of the possible reasons. There

Figure 6: Reason given that it is a bad time to buy durables, percent



Source: Michigan Survey of Consumers.

Figure 7: Bloomberg Weekly Consumer Confidence Index

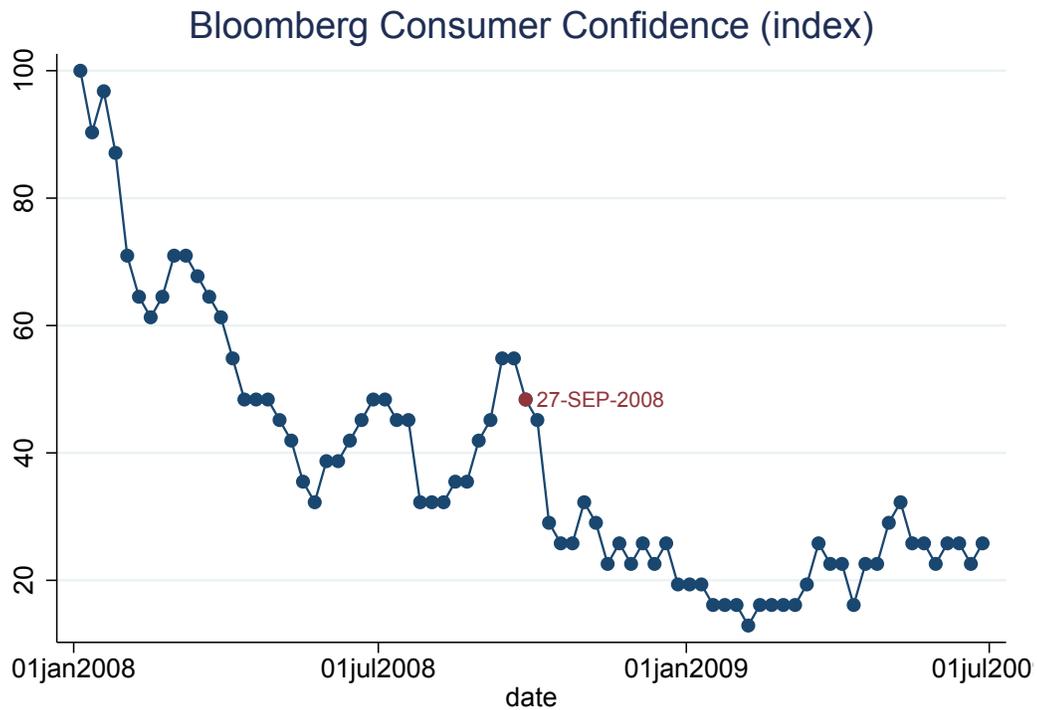


Figure 8: Google Searches for “Economic Crisis,” index

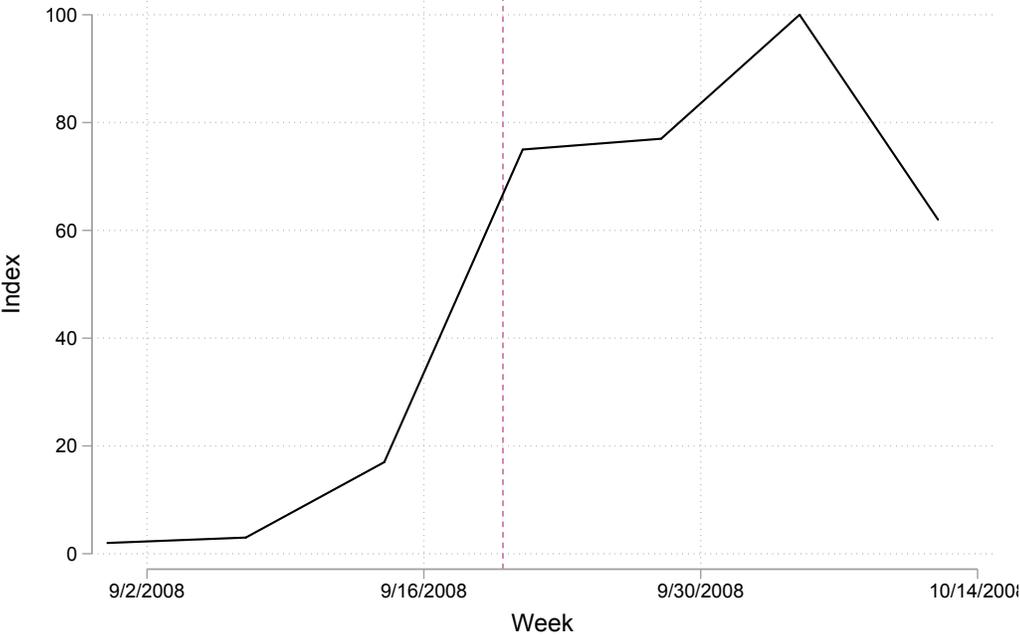
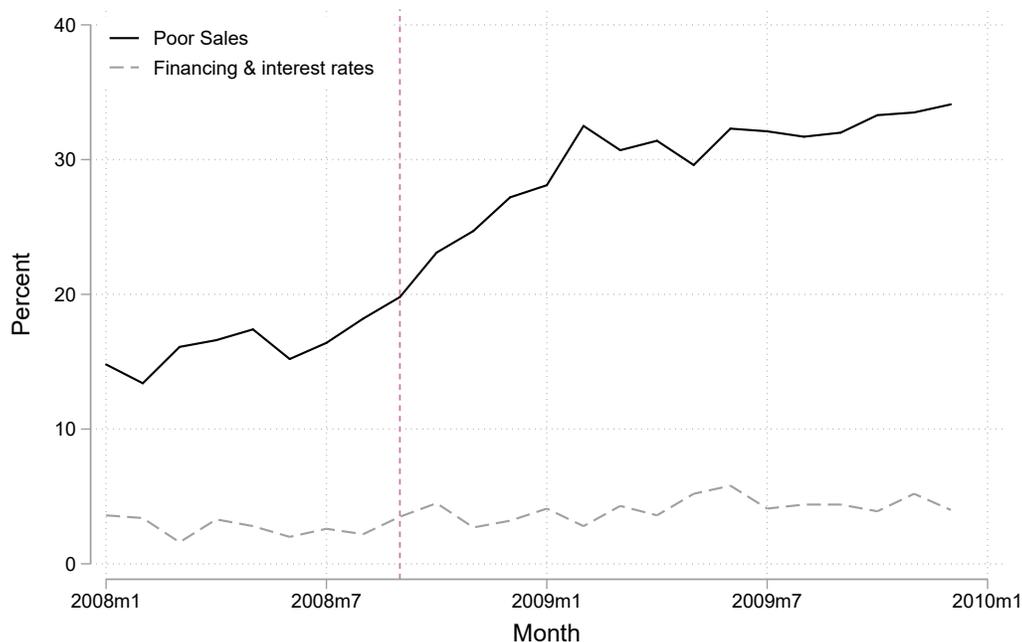


Figure 9: Single Most Important Problem Associated with Weak Economic Conditions, As Reported by Small Businesses



Notes: Source is National Federation of Independent Businesses. Percentages for two of the available answers reported above.

in its monthly survey for the "Single Most Important Problem Associated with Weak Economic Conditions." Figure 9 plots the fraction of businesses giving two of the potential answers. Following the meeting, the fraction of respondents citing poor sales increases 50 percentage points. In contrast, the fraction citing "financing and interest rates" is nearly unchanged from its already low level.

## 4 The House Price Channel and the Economic Crisis

In this section, I study the quantitative importance of one mechanism, the house price channel, in explaining the Phase 2 decline in economic activity. According to this mechanism, the house price decline in 2007-2009 led homeowners to reduce consumption as they saw an important component of their wealth fall. Moreover, this effect may have been amplified for households that were borrowing constrained at the time.

### New Vehicle Sales Evidence

The consumption category hit hardest during Phase 2 was new vehicle sales, which fell by about 37 percent in one year and remained low throughout the Phase 2. To explore the importance of

the wealth effect, I will examine how new vehicle sales responded to the decline in house prices at the county level. As with previous analysis by other authors, I find a statistically significant relationship between house prices and auto sales. My analysis differs from previous studies in that I examine Phase 2 in particular and also that I emphasize the quantitative effect of house prices relative to the overall aggregate decline in vehicle sales.

Define  $a_{j,t}$  to be the natural log of total new vehicle sales in quarter  $t$  in county  $j$ . This data was constructed by R.L. Polk and Co., which has since been acquired by IHS Markit. Next, define  $u_{j,t}$  to equal the quarter  $t$  natural log of the Core Logic house price index for county  $j$ . I have this data for 1,341 counties. Let  $S_d$  be the time series operator such that  $S_d x_t = x_t - x_{t-d}$ .

I estimate a regression of the one-year growth rate of new vehicle sales against the three year growth rate of house prices in the second quarter of 2009.

$$S_4 a_{j,t} = -0.34 + 0.26 S_{12} u_{j,t} + \varepsilon_{j,t} \text{ for } t = 2009Q2$$

(0.005)      (0.024)

There are two important takeaways from the regression coefficients. First, there is a statistically significant relationship between house price growth and new vehicle sales. The point estimates, for example, imply that a county with a 10 percent decline in average home prices is expected to reduce its new vehicle purchases by 2.6 percent.

The second observation is that, relative to the total vehicle sales decline during Phase 2, the home price effect is small. For example, the best linear predictor of the change in vehicle sales for a county that saw no home price change would equal -34 percent (i.e., simply the intercept of the regression). The average change over the year was 37 percent. Most of the decline in auto sales—at the aggregate level—is explained by the intercept rather than house prices.

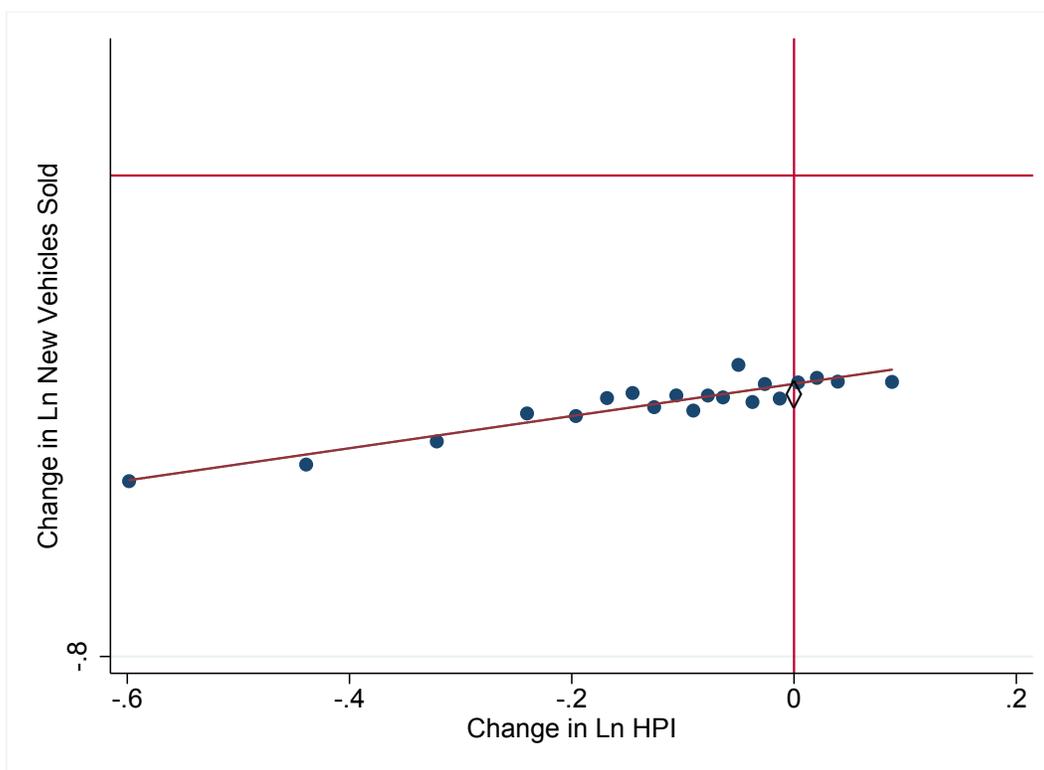
Figure 10 contains a binned scatter plot for the regression, with the solid line corresponding to the best fit line.

The best fit line intersects the vertical line at  $x = 0$ . The corresponding  $y$  value is the percentage change in vehicle sales for a county that saw no change in its average house price. The diamond marker indicates the average value of the dependent variable. The limited impact of house prices on the average decline in auto sales can be seen by how near the diamond mark is to the intersection of the best fit line with the  $x = 0$  vertical axis.

Most of the average decline in auto sales during this episode is not explained by house prices. Because the average decline is sopped up mainly by the intercept term, it becomes natural to look for an aggregate shock to the economy that affects all agents similarly, which is the broad-based shift in expectations. The empirical lesson from Figure 10 is that there can be limits to exploiting cross-sectional heterogeneity for the goal of understanding macroeconomic phenomenon.

In my discussion, I ignore another possible difficulty in developing an aggregate interpretation of this cross sectional evidence. The downside of cross-sectional approach is that it informs policymakers about the relative effects of house price changes across regions, but not necessarily its aggregate

Figure 10: Scatter plot of growth vehicle sales on house price growth



Notes: To make the plot more legible, we place x-axis variables into 20 equal sized bins. We plot, within each bin, the mean value of the x-axis variable against the mean value of the y-axis variable.

effects. If, for instance, a house price decline in one county induces households there to buy fewer goods from their own as well as other counties. If the reduces sales in the other counties reduced incomes in these counties, it could in turn reduce auto sales there. In this case, the cross-sectionally based estimate would be understate the true negative aggregate effect of house prices because it fails to account for the positive sales spillover across regions.<sup>7</sup>

Note that even if house prices declines are correlated with auto sales, this does not establish a causal relationship. Because house prices and therefore net worth are endogenous variables, it may be the case as I show in the paper's theory section that an expectations realignment (specifically, an exogenous decline in future income realized in the present) can cause both house prices and vehicle sales to decline.

### **Auto Loan Evidence**

Next, I examine the response of auto loans during the Economic Crisis. Auto loan data are available at a quarterly frequency from the New York Fed CCP/Equifax data set, which consists of a panel of consumer credit data. These include the number, size and delinquency status of home, auto and consumer loans as well as their residence zip code and credit scores, in addition to other information. For each individual, I calculate the one-year change in their total auto loan balance in 2009Q1. For many individuals this balance is zero, either because they do not own a car, they have paid off their car loan or else they did not finance their car purchase. I also assign each individual a house price change measure based on the county-level HPI in which they reside. The house price change is the 3-year log change in the county house price index ending in 2009Q2.

Next, I assign each individual into one of 25 bins, based on the quintile of their credit score and the quintile of their house price growth in their resident county.

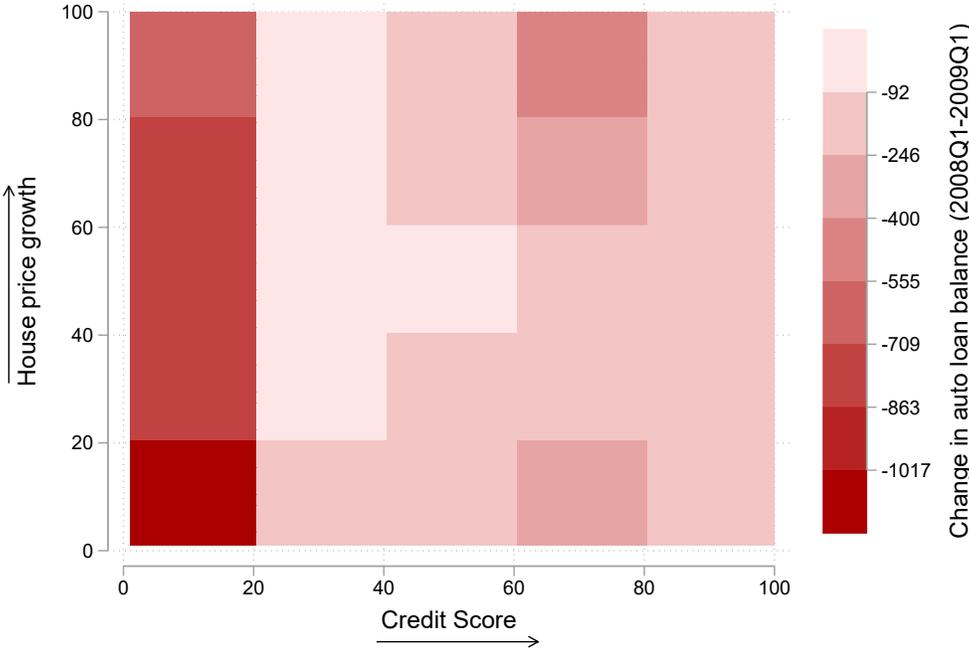
I assign each individual to a county of residence based on their zip code. Next, I take county-level averages of and average credit score in the county. Figure 11 provides a heat map of the average change in auto loan balances. It relates the size of auto loan balance change to past house price changes and credit scores. Increasing along the vertical axis, I vary the growth rate of house prices. Increasing along the horizontal axis, I vary the average credit score. The color of each bin reflects the change in auto loan balances averaged within the bin. A darker shade reflects a more dramatic decline in auto loan balances. That is, people are deleveraging with respect to their positions in auto loans.

This would occur if individuals were paying down auto balances over time but not financing new autos cars. Two things stand out immediately from the figure. First, the largest decline in auto loan balances occurs for those with the lowest credit scores and the largest house price declines. This evidence supports the contention of a negative wealth effect of house price declines, which is particularly important for low credit score households.

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<sup>7</sup>Papers that discuss and also present strategies to overcome this issue, in the context of fiscal policy, are Dupor and Guerrero (2017a), Dupor and Guerrero (2017) and Nakamura and Steinsson (2014).

Figure 11: Relationship between change in auto loan balance, past house price growth and credit scores



Second, and more importantly, there was deleveraging in auto loans *across the board*. That is, the auto loan balance adjustment was an economy-wide phenomenon and not just one that was limited to low-credit score and large HPI decline areas.<sup>8</sup>

Third, ignoring the lowest credit score quintile, there seems to be little relation between house prices and auto loan balances. That is, the house price channel seems to be an important factor, apart from the aggregate shock, for low credit households.

Next, I present regression evidence that documents the same fact: house prices declines explain only a small fraction of the change in auto loan balances during the Economic Crisis. Let  $a_i$  be the one-year change in the per capita auto loan balance (ALB) in 2009Q2 for county  $i$ . Let  $h_i$  equal the three-year change in log home price index (HPI) in 2009Q2 for county  $i$ .

I regress the change in ALB on house prices growth.

$$a_i = -310 + 338.8 \times h_i + \epsilon_i$$

(13.1)      (53.6)

with  $R^2 = 0.13$  and  $N = 770$ . The first thing that jumps out is that house price growth has a statistically significant effect on ALB. As an example, the point estimate implies that a 10% house price decline would reduce auto loan balances by \$34 dollars. While statistically significant, it is also true that most of the decline in auto sales is not explained by house prices. Examining the intercept, one sees that a county with no HPI change would see ALB fall by \$310, according to the best linear predictor. A county with the median HPI decline (10%), would be expected to differ only mildly, with ALB falling by \$348.

Another way to see this is to compare the intercept term in the regression with the average value of the dependent variable. First, the average change in ALB is  $-\$360$ . The coefficient on the constant equals  $-\$310$ . The constant corresponds to the best linear prediction of the ALB change for a county that had no HPI change. This implies that, for a county that experienced no change in the house price index, its average ALB would decline by 86 percent of the average ALB decline. Stated differently, the house price decline explains very little of the average decline in ALB, even though there is a statistically significant effect of house price changes on the dependent variable.

The limited effect of house prices on ALB is even more stark if I restrict attention to counties that have moderate or high average credit scores. Running the same regression but excluding the lowest quantile of counties with respect to the credit score, the average change in ALB is  $-\$354$  and the constant coefficient equals  $-\$315$ . Excluding those with low credit scores, one would predict that a county with no change in house prices would experience a decline in ALB equal to 89 percent of the average decline within the group.

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<sup>8</sup>This observations about autos and house prices is somewhat similar to the case made in Foote, Gerardi and Willen (2012), that the mortgage crisis was driven by many borrowers and investors making bad decisions rather than a ill-informed borrowers that made up only a small section of the market. As I make in Section 2, those authors argue that a widespread change in *expectations* drove individuals to make ex post poor decisions.

Figure 12: Binned scatter plot of change in auto loan balance versus log change in house price index



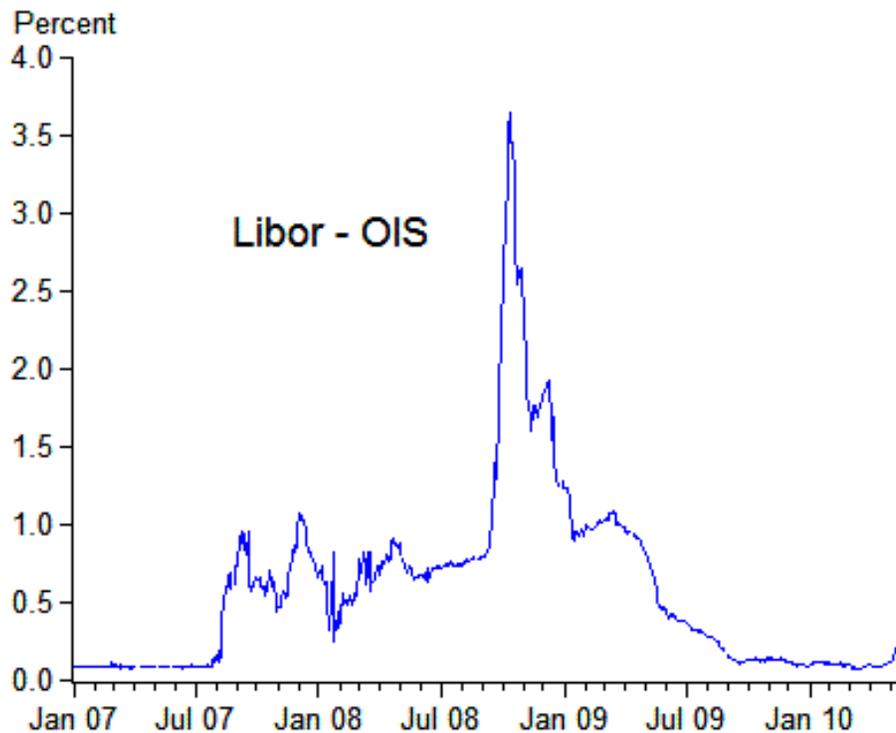
Figure 12 visualizes the limited explanatory power that house prices have for explaining the aggregate decline in ALB during Phase 2 of the period. The figure contains a binned scatter plot of log house price index changes against the average loan balance change by county. The best fit line is also plotted.

The best fit line intersects the vertical line at  $x = 0$ . The corresponding  $y$  value is the change in ALB for county that saw no change in its house price. The diamond marker indicates the average value of the dependent variable. The limited impact of house prices on the average decline in auto sales can be seen by how near the diamond mark is to the intersection of the best fit line with the  $x = 0$  vertical axis.

## 5 The Credit Supply Channel and the Economic Crisis

Whereas the evidence suggests that household and business expectations deteriorated dramatically and remained low, some measures of financial stress saw marked improvements quickly following the Federal Reserve and Treasury interventions. Figure 13 plots the LIBOR-OIS spread, typically

Figure 13: LIBOR-OIS spread



taken as an indicator of financial stress. Although it spikes in the Fall of 2008, it falls dramatically by January of 2009.

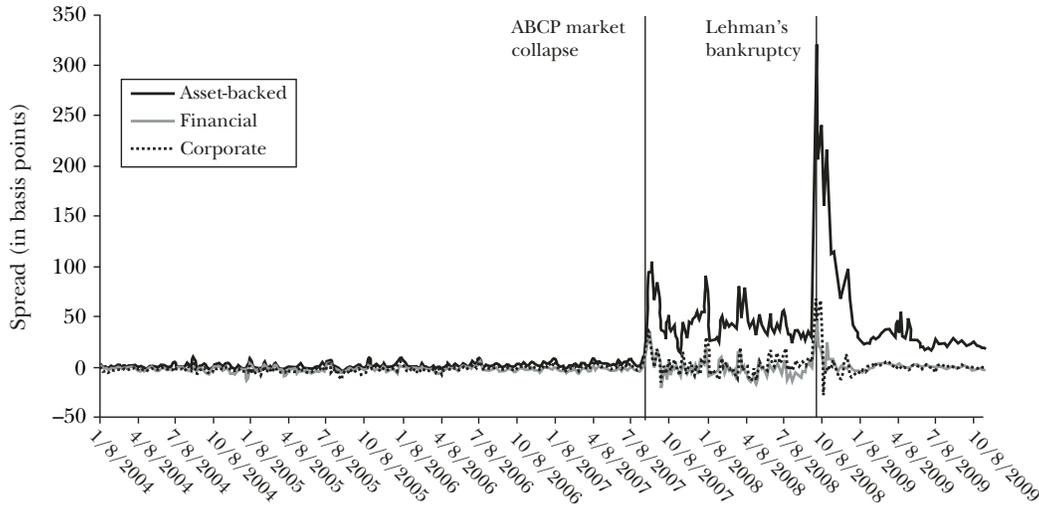
Figure 14 plots the overnight commercial paper rates minus the federal funds rates during this period.<sup>9</sup> While asset-backed commercial paper spreads spiked following the Lehman bankruptcy, they stabilized substantially following government interventions. Notably, the financial and corporate commercial paper spreads did not move significantly during this episode.

In addition, there has been some recent research on the recession

For example, Kudlyak and Sánchez (2017) study whether credit constraints were a primary cause of the recession following the financial crisis. Following the approach of Gertler and Gilchrist (1994), they examine the response of large and small firms' debt and sales during the credit disruption. According to the prevailing view, small firms should respond more than large firms to credit disruptions because they are more likely to be credit constrained. Kudlyak and Sánchez (2017) find that the opposite was the case following the financial crisis.

<sup>9</sup>Reproduced from Kacperczyk and Schnabl (2010).

Figure 14: Commercial papers spreads (net of federal funds rate)



Notes: Reproduced from Kacperczyk and Schnabl (2010).

Sahin et. al. (2011) address the same question, although they focus on the employment of varying size firms. They conclude “Although a tightened credit supply constrained some small firms, weak consumer demand for the firms’ products and services was a more pressing factor, reducing revenues and dampening new investment spending.” A few papers find a credit supply channel to real economic activity during the 2007 - 2009 Recession.

One paper that finds evidence of a negative credit supply shocks, during the period, on real economic activity is Benmelech, Meisenzahl and Ramcharan (2017). They focus in particular on the auto market and financing of auto purchases done by so-called captive leasing companies. These companies largely financed operations in the asset-backed commercial paper market, which collapsed during the financial crisis. Examining cross-county data, the authors find that auto sales fell by more in counties that had historically relied more on captive leasing financing (as opposed to, for example, cash purchases or bank financed loans). While the paper provides important evidence of a finance channel, the aggregate importance of this mechanism is limited. The authors state that, moving a county at the 25th percentile to the 75th percentile of the captive leasing measure results in a 2.5 percent drop in overall car sales. Recall that the aggregate drop in total new car sales during this period was approximately 40 percent.<sup>10</sup>

One reason that the collapse of the asset-backed commercial paper market had quantitatively limited effects on auto sales may be the quick action taken by the Federal Reserve and the U.S. Treasury. This echoes what I have said above. For example, the Ford Motor Credit Company used

<sup>10</sup>See also Chodorow-Reich (2014) for another paper on the real effects of credit supply shocks during this period.

the Term Asset-Backed Securities Loan Facility (TALF), established in response to the financial crisis, raise funds and help car buyers obtain loans.<sup>11</sup> Along similar lines, the U.S. Treasury Department extended loans to Chrysler Financial, the captive finance arm of Chrysler, as early as January 2009.

## 6 Conclusion

The coincidence of timing of the financial crisis with this decline has quite sensibly resulted in financial economists exploring how credit supply frictions caused or intensified the downturn. The (somewhat weaker) coincidence of timing of the house price decline has also quite sensibly lead economists to study the importance of this channel.

Given the steepness and severity of the decline in economic activity during the Economic Crisis, the episode stands out as different than other post-WWII recessions. It may not be meaningful to examine other post-WWII recessions to learn about the Economic Crisis. In other words, there is only so much that can be learned solely by looking at one aggregate observation.

Empirically-oriented researchers studying the period (because they only have one such episode) been forced to work in the cross-section. They have studied differential responses across states, counties or zip code areas during the episode. Perhaps obviously, cross-sectional comparisons can easily miss aggregate effects because the average change may get subsumed into the intercept of a regression.

Finally, two more broad lessons for macroeconomics can be drawn from the September 2008 – June 2009 Economic Crisis. First, the call from the 1970s by Lucas and Sargent (e.g. Lucas (1972), Lucas and Sargent (1981) and Sargent (1976)) and others to place expectations at the center stage of empirical and theory in macroeconomics has been unarguably validated by this era.

Second, when one observes large shifts in economic aggregates, there will often be similar behavior across economic unit in which case there may be insufficient cross-sectional variation to make precise causal statements about the macroeconomic phenomenon. In this case, economists and policy makers will need to place more trust in models in order to inform important policy questions.

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<sup>11</sup>“Factbox: No Bailoutm but Ford Sees Government Benefits,” *Reuters*, August 5, 2010.

## References

- Angeletos, G. and J. La'O (2013), "Sentiments," *Econometrica*, 81(2), 739-779.
- Azariadis, C. and R. Guesnerie (1986), "Sunspots and Cycles," *Review of Economic Studies*, 53(5), 725-737.
- Beaudry, P. and F. Portier (2014), "News-Driven Business Cycles: Insights and Challenges," *Journal of Economic Literature*, 52(4), 993-1074.
- Benhabib, J., Q. Meng and K. Nishimura (2000), "Indeterminacy Under Constant Returns to Scale in Multisector Economies," *Econometrica*, 68(6), 1541-1548.
- Benhabib, J., P. Wang and Y. Wen (2015), "Sentiments and Aggregate Demand Fluctuations," *Econometrica*, 83(2), 549-585.
- Benhabib, J. and M. Spiegel (2017), "Sentiments and Economic Activity: Evidence from U.S. States," Working Paper.
- Benmelech, E., R. Meisenzahl and R. Ramcharan (2017), "The Real Effects of Liquidity During the Financial Crisis: Evidence from Automobiles," *Quarterly Journal of Economics*, 132(1), 317-365.
- Chodorow-Reich, G. (2014), "The Employment Effects of Credit Market Disruptions: Firm-level Evidence from the 2008-09 Financial Crisis," *Quarterly Journal of Economics*, 129(1), 1-59.
- Dupor, B. and R. Guerrero (2017), "Local and Aggregate Fiscal Policy Multipliers," *Journal of Monetary Economics*, 92, 16-30.
- Dupor, B. and R. Guerrero (2017a), "The Aggregate and Relative Economic Effects of Medicaid and Medicare Expansions," Working Paper.
- Farmer, R. and J. Guo (1994), "Real Business Cycles and the Animal Spirits Hypothesis," *Journal of Economic Theory*, 63(1), 42-72.
- Foote, C., K. Gerardi and P. Willen (2012), "Why did so many people make so many ex-post bad decisions? The causes of the foreclosure crisis," Prepared for the conference *Rethinking Finance: New Perspectives on the Crisis*.
- Gertler, M. and S. Gilchrist (1994), "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms," *Quarterly Journal of Economics*, 109(2), 309-340.
- Gordon, R. (2015), "Secular Stagnation: A Supply-Side View," *American Economic Review*, 105(5), 54-59.

- Jaimovich, N. and S. Rebelo (2009), “Can News about the Future Drive the Business Cycle?,” *American Economic Review*, 99(4), 1097-1118.
- Kacperczyk, M. and P. Schnabl (2010), “When Safe Proved Risky: Commercial Paper during the Financial Crisis of 2007-2009,” *Journal of Economic Perspectives*, 24(1), 29-50.
- Kudlyak, M. and J. Sánchez (2017), “Revisiting the behavior of small and large firms during the 2008 financial crisis,” *Journal of Economic Dynamics and Control*, 77(C), 48-69.
- Lorenzoni, G. (2009), “A Theory of Demand Shocks,” *American Economic Review*, 99(5), 2050-84.
- Lucas, R. (1972), “Expectations and the neutrality of money,” *Journal of Economic Theory*, 4(2), 103-124.
- Lucas, R. and T. Sargent (1981), *Rational Expectations and Econometric Practice*, Minneapolis: University of Minnesota Press.
- Mian, A., K. Rao and A. Sufi (2013), “Household Balance Sheets, Consumption, and the Economic Slump,” *The Quarterly Journal of Economics*, 128(4), 1687-1726.
- Mian, A. and A. Sufi (2014), “What Explains the 2007-2009 Drop in Employment?,” *Econometrica*, 82(6), 2197-2223.
- Nakamura, E. and J. Steinsson (2014), “Fiscal Stimulus in a Monetary Union: Evidence from U.S. Regions,” *American Economic Review*, 104(3), 753-92.
- Sahin, A., S. Kitao, A. Cororaton and S. Laiu (2011), “Why small businesses were hit harder by the recent recession,” *Current Issues in Economics and Finance*, Federal Reserve Bank of New York, 17(4), 1-7.
- Sargent, T. (1976), “The Observational Equivalence of Natural and Unnatural Rate Theories of Macroeconomics,” *Journal of Political Economy*, 84(3), 631-640.
- Schmitt-Grohe, S. and M. Uribe (2012), “What’s News in Business Cycles,” *Econometrica*, 80(6), 2733-2764.
- Summers, L. (2015), “Demand Side Secular Stagnation,” *American Economic Review*, 105(5), 60-65.