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Beyond Leveraged Losses: The Balance Sheet Effects of the Home Price Downturn

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Beyond Leveraged Losses:
The Balance Sheet Effects of the Home Price Downturn

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Abstract

This paper aims to quantify the impact of the decline in US home prices, the increase in mortgage credit losses, and the associated reduction in credit supply on real GDP growth. Using a state-level panel analysis, we first estimate the link between home prices and foreclosures. We estimate that an additional 10% home price decline from mid-2008 levels would be consistent with total residential mortgage credit losses over the years 2007-2012 of $636 billion, although the uncertainty is high. We then try to gauge the impact of the credit losses on the supply of credit from banks, asset-backed security markets, and the government-sponsored enterprises (GSEs), and the knock-on effect on real GDP growth. In our central scenario, we estimate that the crisis could lower real GDP growth in 2008 and 2009 by an average of 1.8 percentage points per year. This assumes that the GSEs continue to expand their mortgage book of business aggressively, an outcome that has become more likely following the measures announced by the U.S. Treasury on September 7, 2008. If instead the GSEs stopped expanding, the estimated GDP hit would rise to 3.2 points per year.

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1. Introduction

The current US housing market downturn weighs on the economy in four main ways. First, it involves a sharp decline in residential construction activity. From the fourth quarter of 2005 to the second quarter of 2008, declining real residential investment subtracted a cumulative total of 2.4 percentage points from real GDP growth.

Second, declining income in the housing sector has knock-on effects on other parts of the economy. For example, laid-off construction workers and real estate agents cut back on consumer spending, homebuilders (and their subcontractors) invest less in construction equipment, and nonresidential construction firms see less demand for commercial development in newly built suburbs. These second-round effects are harder to quantify because they are so spread out throughout the economy but are likely to be significant as well.

Third, declining house prices weigh on personal consumption via a negative wealth and/or mortgage liquidity effect. Households who spent more than they earned during the boom by borrowing against the rising value of their home may be forced to cut back. Moreover, even households who didn't outspend their income might reduce their consumption in response to a decline in their wealth and permanent income. Most studies analyzing this issue find evidence for a housing wealth effect, but its size varies widely depending the time period and empirical design (for an overview see Muellbauer, 2007).

Fourth, mortgage credit losses deplete the equity capital of leveraged financial institutions and persuade them to reduce their financial leverage. This reduces the supply of credit to households and nonfinancial businesses. Greenlaw, Hatzius, Kashyap, and

Shin (2008, henceforth GHKS) aim to quantify this effect and find that an assumed $500 billion aggregate mortgage credit loss could cut real GDP growth by 1.5 percentage points over a year's time.

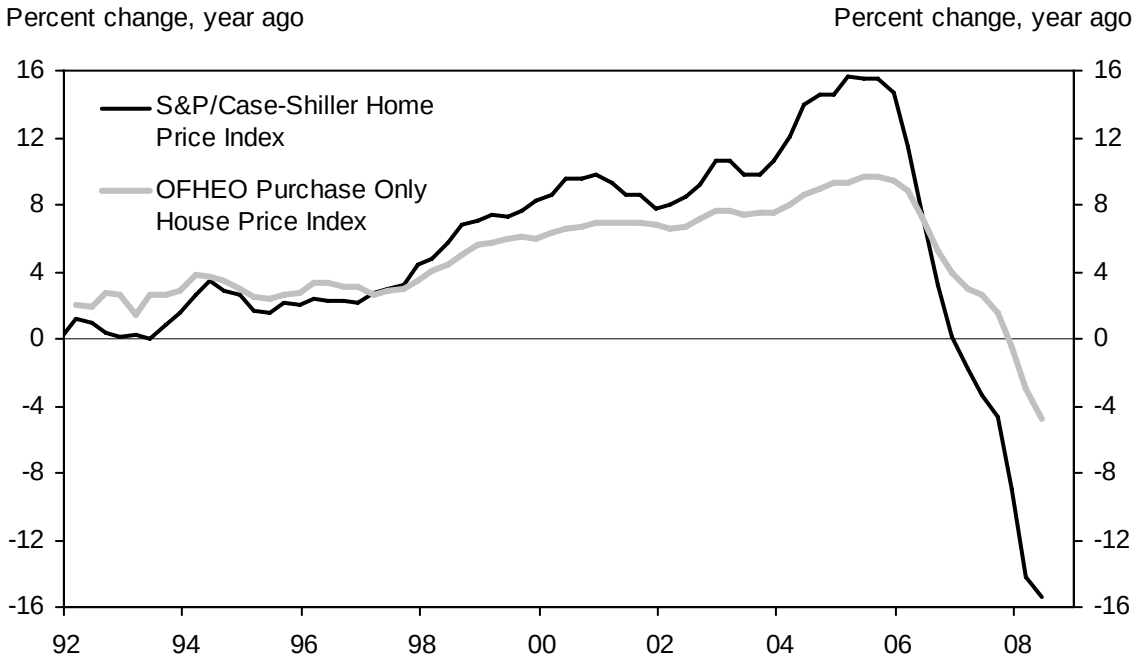
This paper takes an in-depth look at the fourth channel. Building on GHKS (2008), its main contributions are a more detailed empirical analysis of the link between home price declines and mortgage credit losses and a more systematic look at the role of the asset-backed security (ABS) markets. Section II analyzes the link between home prices, foreclosures, and mortgage credit losses, using a state-level panel dataset for the period 1998 to 2008 to predict foreclosures. Section III discusses the impact of the losses on the supply of credit to private nonfinancial borrowers, with a particular focus on (1) on-balance-sheet lending by banks and other leveraged financial institutions, (2) off-balance sheet lending via the ABS markets, and (3) lending backed by government-sponsored enterprises (GSEs) such as Fannie Mae and Freddie Mac. Section IV discusses the potential impact on economic activity, using an instrumental-variables approach to estimate the link between credit supply and real GDP growth. Section V concludes.

II. The Link Between Home Prices and Credit Losses

The underlying reason for the recent financial crisis is the decline in US home prices and the associated increase in foreclosures and credit losses. Exhibit 1 shows the current pace of decline in home prices as measured by the two most widely used measures, the S&P Case-Shiller index and the purchase-only OFHEO index. As of the

second quarter of 2008, home prices on a year-on-year basis were down 15.4% according to the Case-Shiller and 4.8% according to the OFHEO index.[1]

Exhibit 1. Two Measures of the Home Price Decline



Source: OFHEO. S&P, Fiserv, and MacroMarkets.

Existing Approaches to Measuring Mortgage Credit Losses

The key question for our purposes is how large an aggregate mortgage credit loss will result from the decline in house prices. Analysts have attempted to provide an answer to this question in three main ways. First, some have estimated "market-implied" losses from indexes such as the ABX.HE subprime credit derivatives (e.g. Blundell-

[1] The large difference between the two home price indexes is due to three main factors. First, the Case-Shiller index is weighted by market capitalization whereas the OFHEO index is weighted by the number of households. This means that the Case-Shiller index gives more weight to high-value regions on the coasts, which generally have seen larger home price swings. Second, the Case-Shiller index includes all home transactions, whereas the OFHEO index only includes transactions involving conforming mortgages. This means that the OFHEO index has missed the direct effects of the subprime mortgage boom and likely understates the rate of home price decline in the broad housing market. Third, the Case-Shiller index only covers 70% of the United States (by market value), whereas the OFHEO index has near-complete geographic coverage. Since the regions excluded by the Case-Shiller index are generally rural and relatively stable, this means that the Case-Shiller index likely overstates the rate of home price decline in the broad housing market.

Wignall (2008), GHKS (2008), and Bank of England (2008)). However, while such an estimate of market-implied losses is useful for gauging how much principal financial institutions that mark to market will need to write down in the near term, there is no particular reason to think that it will prove to be an accurate gauge of the ultimate credit losses. Indeed, if we use market prices to forecast credit losses and the market then relies on these forecasts to price assets, the cat chases its own tail.

Second, many applied mortgage credit analysts use detailed vintage-by-vintage data to estimate credit losses by "walking forward" historical delinquency, default, and loss curves. The key assumption in this type of analysis is that while different mortgage vintages have different default trajectories, the relative progression through time is stable, or at least highly predictable. For example, suppose that the cumulative default rate of the 2006 subprime vintage is 3% at the end of 2007. Suppose further that the 2004 vintage showed a cumulative default rate of 1% after 1 year and 4% after 3 years, i.e. a fourfold increase in 2 additional years. In that case, the model implies that the 2006 vintage should show a 12% default rate by 2009. The problem with this approach should be readily apparent, namely that within-vintage patterns are unlikely to remain stable as one goes from a rising to a falling house price environment. At a minimum, one should adjust the curves for falling home prices, but this is difficult to do because the detailed data required for building these vintage-by-vintage models are only available back to the late 1990s, a period without a national housing downturn until very recently.

Third, one can use historical relationships between defaults, house prices, and perhaps other economic variables to estimate future default rates. For example, Blundell-Wignall (2008) estimates an equation that explains the subprime delinquency rate by

GDP, house prices, and unemployment using data from 1998 to 2007. The study then uses the resulting equation along with assumptions about the relationship between delinquencies, defaults, and losses and the evolution of the explanatory variables to forecast credit losses. The problem with this approach is that the underlying data set is confined to 40 aggregate observations during which there was no housing downturn (except at the very end).

A State-Level Approach

Given these limitations, it is more promising to use disaggregated region-by-region information that includes at least some periods of declining home prices to estimate the relationship between home prices and mortgage credit performance. For example, GHKS (2008) look at foreclosure data from the Texas, California, and Massachusetts housing downturns of the 1980s and 1990s to gauge what a significant nominal home price downturn can mean for foreclosures. The 10%-15% nominal home price declines observed in these episodes resulted in a tripling of the rate of foreclosure starts over a 3-5 year period, with only a gradual decline thereafter. Extrapolating this observation to the post-2007 national U.S. housing market and given assumptions about the percentage of foreclosure starts that result in repossessions and the average "severity" (loss given default), GHKS (2008) argue that the regional precedents may be consistent with total losses of around $500 billion in the current episode.

However, this case-study approach is also subject to several limitations. One could argue that it is too pessimistic because the rise in foreclosures in the three regional downturns was undoubtedly partly due to the massive labor market deterioration recorded

in all three cases. From the start of the downturn, the unemployment rate rose by a cumulative 3.3 percentage points in Texas, 4.8 percentage points in California, and as much as 6.0 percentage points in Massachusetts. For comparison, the biggest national increase in the postwar period totaled 4.4 points, seen in the 1973-1975 recession. While the national labor market is clearly deteriorating at present, using such a large decline as the baseline assumption is probably too extreme.

Conversely, one could also argue that the case study approach delivers overly optimistic results because it cannot take account of the far-reaching structural changes in the housing and mortgage markets seen over the past two decades. In particular, the subprime mortgage market barely existed prior to the mid-1990s. Since a large share of the current problem is concentrated in the subprime market, this might suggest the current downturn may be more severe. The behavior of U.S. mortgage borrowers may also have changed. As recently as in the early 1990s, it seems that only a relatively small share of homeowners in "negative equity" ended up defaulting on their mortgage debt. For example, Foote et al. (2008b) show that only 6.4% of Massachusetts homeowners who were estimated to be in negative equity at the end of 1991 defaulted over the next three years. Now, however, at least the anecdotal reports suggest that a significant number of borrowers "walk away" from their home once they are in negative equity. This could imply that the impact of home price declines on defaults will be larger in the current national episode than in the three regional downturns.

We have therefore built a model that uses more recent state-level information to estimate the link between home prices and foreclosures, and ultimately credit losses. We use quarterly panel data from the Mortgage Bankers Association (MBA) for all 50 states

and the District of Columbia over the period 1998Q1-2008Q2 to estimate the relationship between the logarithm of the state foreclosure rate and changes in nominal state house prices as measured by the purchase-only OFHEO index.[2] We estimate separate equations for prime adjustable-rate, prime fixed-rate, subprime adjustable-rate, and subprime fixed-rate loans and include state and time fixed effects as well as three lags of the dependent variable.[3]

We then use these equations to project state-level foreclosure rates for each type of mortgage for a given house price path. We combine these projections with assumptions about the estimated foreclosure completion rate and mortgage loss severities to calculate a path for total mortgage credit losses. Finally, by summing up these period-by-period losses over the years 2007-2012, we can obtain a rough estimate of total credit losses on the currently outstanding stock of residential mortgage debt.

Our approach has some important advantages compared with previous analyses. First, when combined with assumptions about foreclosure completions and severities, it allows us to estimate the implications of a given change in the home price outlook for foreclosures using a very simple and transparent method. Other approaches including the case studies in GHKS (2008) do not allow such a calculation.

Second, we bring a large amount of state-by-state information to bear on the problem. Depending on the exact specification, we have almost 2000 observations on the link between moves in house prices and foreclosures at the state level. This is especially noteworthy because the panel structure of our dataset implies that our large sample does

[2] Unfortunately, the Case-Shiller home price index is not available at the state level. The purchase-only OFHEO index is generally viewed as the most reliable state-level home price measures.
[3] It is well known that a simple fixed effects estimator leads to downwardly biased coefficient estimates on the lagged dependent variable. However, the results in Judson and Owen (1997) suggest that the bias should be very small given the dimensions of our panel, with N=51 and T=42.

not come from using old data from periods when the behavior of borrowers and lenders may have been very different, such as the early 1990s downturn or prior periods.

Third, we model foreclosures for different types of mortgages and are therefore able to take into account potential differences in the performance of subprime vs. prime and adjustable-rate vs. fixed-rate loans. [4] Subprime borrowers are more vulnerable to default than prime borrowers, both because they are financially weaker and because they have, in recent years, often taken out mortgages with higher loan-to-value ratios in particularly "frothy" parts of the country.

Our analysis also has some clear limitations. First, and most importantly, it extrapolates a fairly recent event -- namely the unprecedented downturn in mortgage credit quality that started in late 2006/early 2007 -- into uncharted territory. Although we have a large number of observations, it is optimistic to believe that we will be able to uncover stable (let alone "structural") relationships between home prices and foreclosures. At best, we can hope to provide an order-of-magnitude estimate of the likely amount of mortgage credit losses assuming a particular outcome for home prices.

Second, our analysis is reduced-form in nature, and we cannot be sure about the causal relationship between home prices and foreclosures. Although Foote et al. (2008a) argue persuasively that home prices have a bigger impact on foreclosures than foreclosures have on home prices, the arrows of causation surely run in both directions. We do not have a good instrument for state-level home prices that would allow us to

[4] The distinction between prime and subprime isn't entirely clean. The MBA classifies a lender as either prime or subprime and then allocates all of its loans to the prime or subprime sample. This implies that the prime sample contains some subprime loans and the subprime sample some prime loans. Also, there is no separate category for so-called alt-A mortgages, loans to borrowers with high credit scores that are lower quality on other metrics such as income documentation or loan-to-value ratios. Our understanding is that alt-A loans are largely included in the "prime" sample.

settle this issue. However, we do not view this as a big problem because much of the interest in the link between home prices and mortgage credit losses is of a "reduced-form" variety. That is, we would like to know which mortgage credit loss estimate is consistent with a given path for home prices, and our analysis provides an answer to this question.

Third, because our foreclosure data do not pertain to specific mortgage vintages, we cannot control directly for the effects of good vs. bad underwriting standards in particular vintages, and we also cannot precisely estimate foreclosures on the currently outstanding stock of mortgages. Our approach could lead to a higher or a lower number than a true "lifetime loss" analysis, depending on whether the losses on mortgages that have yet to be originated but will be realized in the 2008-2012 period are greater or smaller than the losses on mortgages that have already been originated but will not be realized until after 2012. We suspect that the difference between these two numbers -- whether it is positive or negative -- is small relative to the range of potential estimates, but we have no way to be sure.

Our Estimation Results

Exhibit 2 shows our baseline estimates for subprime ARMs, subprime FRMs, prime ARMs, and prime FRMs. The equations include both state and time dummies. Although time dummies pose some problems for projection purposes as it is difficult to be sure what number to use for future periods (see the discussion below), we found that equations without time dummies resulted in a significant overprediction of foreclosures in some of the boom-bust states toward the very end of the sample period. This problem

was particularly severe for subprime ARMs. If we do include time dummies, the size of the overprediction problem declines significantly. One potential explanation is that part of the deterioration in the 2006-2007 period reflects poor underwriting standards and mortgage fraud in the 2006 and 2007 vintages rather than the impact of house price declines *per se*. A specification without time dummies will miss such vintage effects. It will attribute all of the deterioration to the home price declines and therefore predict a closer relationship between home price declines and foreclosures than is appropriate if there are indeed important vintage effects.

Exhibit 2: Panel Estimation Results (Baseline)

Dependent Variable	Prime ARMs	Prime FRMs	Subprime ARMs	Subprime FRMs
constant	-0.15 (0.02)	-0.36 (0.05)	0.50 (0.03)	0.30 (0.02)
log(foreclosures started) (-1)	0.41 (0.04)	0.38 (0.05)	0.40 (0.04)	0.30 (0.04)
log(foreclosures started) (-2)	0.18 (0.04)	0.17 (0.04)	0.15 (0.04)	0.17 (0.04)
log(foreclosures started) (-3)	0.10 (0.03)	0.21 (0.05)	0.04 (0.02)	0.02 (0.03)
d log(home prices)	-3.60 (0.73)	-1.09 (0.92)	-2.08 (0.67)	-0.90 (0.94)
d log(home prices) (-1)	-2.74 (0.66)	-3.57 (0.97)	-2.39 (0.57)	-1.70 (0.92)
d log(home prices) (-2)	-2.56 (0.74)	-2.56 (0.86)	-3.80 (0.76)	-3.84 (0.97)
d log(home prices) (-3)	-1.88 (0.84)	-1.23 (0.96)	-1.67 (0.71)	-2.23 (0.98)
state dummies	yes	yes	yes	yes
time dummies	yes	yes	yes	yes
sample	1998Q4 - 2008Q2	1998Q4 - 2008Q2	1998Q4 - 2008Q2	1998Q4 - 2008Q2
number of observations	1981	1942	1952	1919
R-squared	0.87	0.84	0.82	0.74
D-W	2.02	1.96	2.04	1.90

Note: The dependent variable is the log ratio of foreclosure starts in percent of mortgages serviced. White standard errors are given in parentheses under the coefficients.
Source: Our calculations.

The upshot of our estimation results is that the link between home prices and foreclosures is very close. For all four types of mortgages, the relationship between house price changes and foreclosures is highly significant, with coefficients that sum to between -8.5 and -10.8. Ignoring the lagged dependent variables, this means that a 1% home price drop is associated with an 8.5% to 10.8% increase in foreclosures. Moreover,

there is substantial persistence in all four equations, with coefficients on the lagged dependent variables that sum to between 0.49 and 0.76. In general, the equations show that prime and subprime mortgage foreclosures are quite similar in terms of their links with home prices. The level of foreclosure starts is much higher for subprime loans -- and particularly for subprime ARMs -- but the elasticity with respect to home prices is not too different. In fact, if anything the elasticity of foreclosure starts to home price declines is slightly larger in the prime market than in the subprime market.

Our baseline estimates do not include state-specific economic variables such as the state unemployment rate.[5] The reason is that we did not find much evidence that state unemployment rates have significant predictive power with respect to foreclosures, at least once we include the home price and lagged dependent variable terms in our model. This is illustrated in Exhibit 3, which adds the current state unemployment rate and three lags to our baseline specifications. In all four cases, the coefficients sum to around zero, with negative coefficients on the current unemployment rate and positive coefficients on the thrice-lagged unemployment rate. If we took this result seriously, it would imply that a rising unemployment rate was associated with *fewer* foreclosures. However, note that the size of the effect is extremely small. For example, the equation for subprime ARMs implies that a 1-percentage-point increase in the unemployment rate -- a very large move on a quarter-to-quarter basis -- lowers foreclosure starts by just 3% (logarithmically). Hence, we ignore the unemployment rate in our projections.

[5] National-level variables such as mortgage rates cannot be included because of the fixed time effects.

Exhibit 3: Panel Estimation Results (with State Unemployment)

Dependent Variable	Prime ARMs	Prime FRMs	Subprime ARMs	Subprime FRMs
constant	-0.18	-0.44	0.46	0.32
	(0.08)	(0.15)	(0.07)	(0.09)
log(foreclosures started) (-1)	0.41	0.38	0.39	0.30
	(0.04)	(0.05)	(0.04)	(0.04)
log(foreclosures started) (-2)	0.19	0.17	0.15	0.17
	(0.04)	(0.04)	(0.04)	(0.04)
log(foreclosures started) (-3)	0.09	0.21	0.04	0.02
	(0.03)	(0.05)	(0.02)	(0.03)
d log(home prices)	-3.66	-1.15	-2.18	-1.03
	(0.71)	(0.92)	(0.67)	(0.94)
d log(home prices) (-1)	-2.88	-3.61	-2.47	-1.81
	(0.66)	(0.99)	(0.57)	(0.93)
d log(home prices) (-2)	-2.62	-2.58	-3.81	-4.00
	(0.72)	(0.84)	(0.76)	(0.98)
d log(home prices) (-3)	-1.79	-1.15	-1.59	-2.28
	(0.83)	(0.95)	(0.71)	(0.97)
unemployment rate	-0.07	-0.03	-0.03	-0.01
	(0.04)	(0.06)	(0.05)	(0.04)
unemployment rate (-1)	0.01	-0.03	-0.01	-0.10
	(0.04)	(0.04)	(0.04)	(0.04)
unemployment rate (-2)	0.10	0.06	0.03	0.06
	(0.05)	(0.07)	(0.05)	(0.05)
unemployment rate (-3)	-0.03	0.01	0.02	0.04
	(0.03)	(0.06)	(0.03)	(0.03)
state dummies	yes	yes	yes	yes
time dummies	yes	yes	yes	yes
sample	1998Q4 - 2008Q2	1998Q4 - 2008Q2	1998Q4 - 2008Q2	1998Q4 - 2008Q2
number of observations	1981	1942	1952	1919
R-squared	0.87	0.84	0.82	0.74
D-W	2.01	1.95	2.04	1.90

Note: The dependent variable is the log ratio of foreclosure starts in percent of mortgages serviced. White standard errors are given in parentheses under the coefficients.
Source: Our calculations.

In what follows, we use our baseline results from Exhibit 2 to project alternative paths for overall mortgage credit losses for given house price paths. To be able to do this, we need to make a number of assumptions, which we now discuss in turn.

Projecting Foreclosure Starts

To project foreclosure starts from our model, we need to choose assumptions for the explanatory variables, *i.e.* state home prices and the time dummies. Regarding state home prices, we choose three paths that are each statistically consistent with one of the following assumptions: (1) a stabilization in nominal prices at the second-quarter level,

(2) a further 10% (logarithmic) decline in nominal home prices, and (3) a further 20% (logarithmic) decline through the middle of 2009, all measured by the national Case-Shiller index. To translate these national-level home price assumptions to the state level, we use the predicted values from 51 simple regressions of the quarter-to-quarter change in the regional purchase-only OFHEO index on the change in the national Case-Shiller index (both seasonally adjusted using the Census X-12 algorithm). This allows us to translate alternative expectations for national home prices, expressed in terms of the Case-Shiller index, into corresponding assumptions about state-level prices, which are only available from OFHEO. As one might expect, the result is that states with volatile housing markets such as California and Florida show much greater sensitivities to national home price moves than states with more stable housing markets such as Iowa and Missouri.[6]

We also need to decide what value to choose for the time dummies in our equations. Under the assumption that the positive time dummies in the 2006-2007 period reflect vintage effects from poor underwriting and/or mortgage fraud, and that these poorly underwritten and/or fraudulent mortgages have now largely defaulted, we set the time dummies to zero for our projections. This is an important and relatively "optimistic" assumption since the time dummies have been mostly positive in recent quarters.[7] Finally, to estimate absolute foreclosure starts, we multiply all foreclosure rates

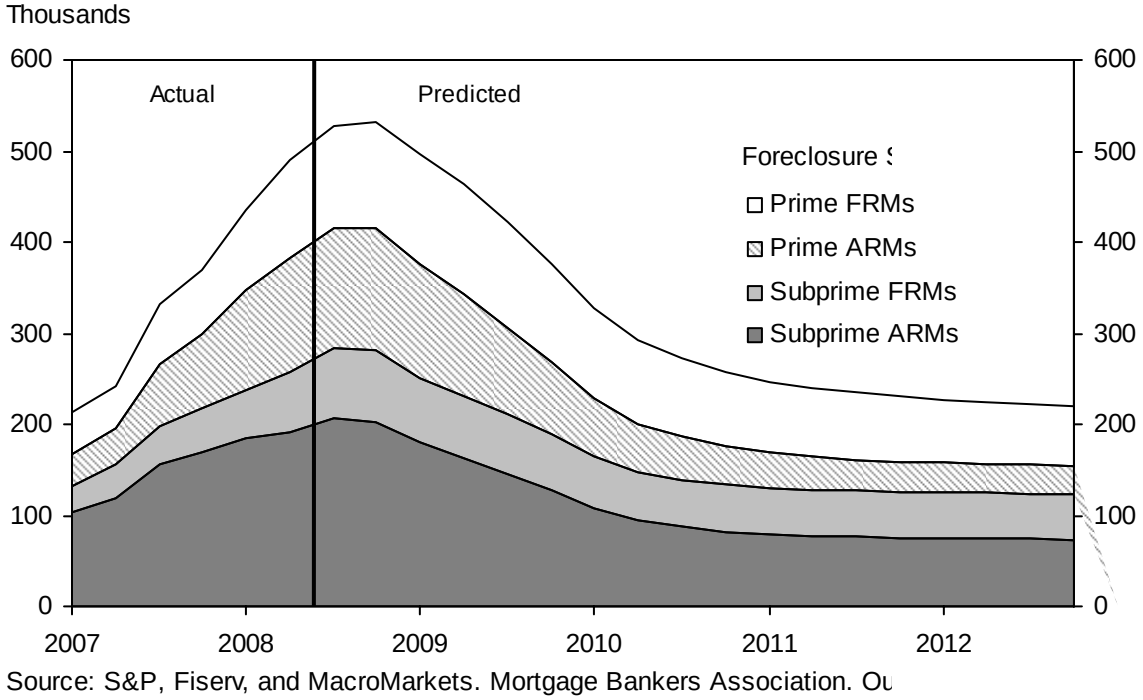
[6] Moreover, the predicted values for the national purchase-only OFHEO index that results from aggregating the 51 state predictions is very close to the actual national series, with an R^2 of 85%.

[7] If we instead set the time dummies equal to the values estimated for 2008 Q2, the projected foreclosure rates would be 15% higher for subprime ARMs, 21% higher for prime ARMs, 8% higher for subprime FRMs, and 15% higher for prime FRMs.

by the number of mortgages serviced for each state and mortgage type, adjusted for the rising coverage of the MBA sample.[8]

Exhibit 4 shows foreclosure starts since 2007 along with our projections through 2012, assuming a further 10% home price decline. Our model predicts that foreclosure starts will peak at around 530,000 (not annualized) in the fourth quarter of 2008, before gradually falling back toward the 200,000 levels seen in early 2007 in subsequent years. In total, the model predicts 7.8 million foreclosure starts from early 2007 to late 20012, with projected shares of 37% for subprime ARMs, 17% for subprime FRMs, 20% for prime ARMs, and 26% for prime FRMs.

Exhibit 4: Foreclosure Starts Peak in Late 2008 if Home Prices Fall Another 10%



Source: S&P, Fiserv, and MacroMarkets. Mortgage Bankers Association. Ou

[8] The total number of mortgages serviced in the MBA dataset as a share of all first-lien home mortgages outstanding according to the American Housing Survey has risen from 57% in 1998 to 88% in 2008.

Projecting Loss Incidence and Severities

The MBA data pertain to foreclosure starts rather than credit losses. Hence, we need to make assumptions about the share of foreclosure starts that result in the loss of a home (the "foreclosure completion rate") or another loss to the lender, and about the average size of that loss (the "severity," or loss given default).

Regarding the first issue, the question is what happens to borrowers against whom a foreclosure notice has been filed. In theory, there are a number of possibilities. They could again become current on their mortgage of their own volition (which implies no loss to the lender), lose their home in a sheriff's auction (a large loss to the lender), agree to a "short sale" in which the lender accepts a sales proceed that falls short of the mortgage balance (usually a somewhat smaller loss), or a repayment plan that may involve some debt forgiveness (an even smaller loss). Unfortunately, we have no hard data on the relative frequencies of these ultimate outcomes. However, there is good reason to believe that a large proportion of the foreclosures started over the next couple of years will result in a significant cost to the lender, in most cases a sheriff's auction. This is partly for *a priori* reasons. Presumably, negative equity sharply decreases a homeowner's incentive to become current on their mortgage, which would suggest that the percentage of foreclosure starts that result in a cost to the lender will increase as home prices decline. Indeed, this is largely confirmed by data from Hope Now -- a coalition of mortgage services and other market participants that have committed themselves to preventing foreclosures in cooperation with the Treasury Department -- on recent foreclosure starts and sales in states that have already seen large-scale home price declines for several quarters, and where the impact of negative equity on borrower

behavior should therefore be most readily apparent. In three of these states (California, Arizona, and Nevada), Exhibit 5 shows that the number of foreclosure *sales* is currently running about even with the number of foreclosure *starts* 1-2 quarters earlier. Given the usual foreclosure timeline, this suggests that the vast majority of foreclosure starts currently result in sheriff's auctions in these states. The exception to this pattern is Florida, where foreclosure sales are running at only about one-third the level of foreclosure starts 1-2 quarters earlier. However, it should be noted that Florida is a "judicial" state where lenders need to obtain a court order to proceed with the foreclosure, and it has been widely reported that there is currently a serious "logjam" in processing foreclosures in the Florida court system. If so, most of the foreclosures currently started may still end up resulting in foreclosure sales, but the lag would be too long for this to show up in the foreclosure sales data in the near term.

Exhibit 5: Foreclosure Starts and Sales

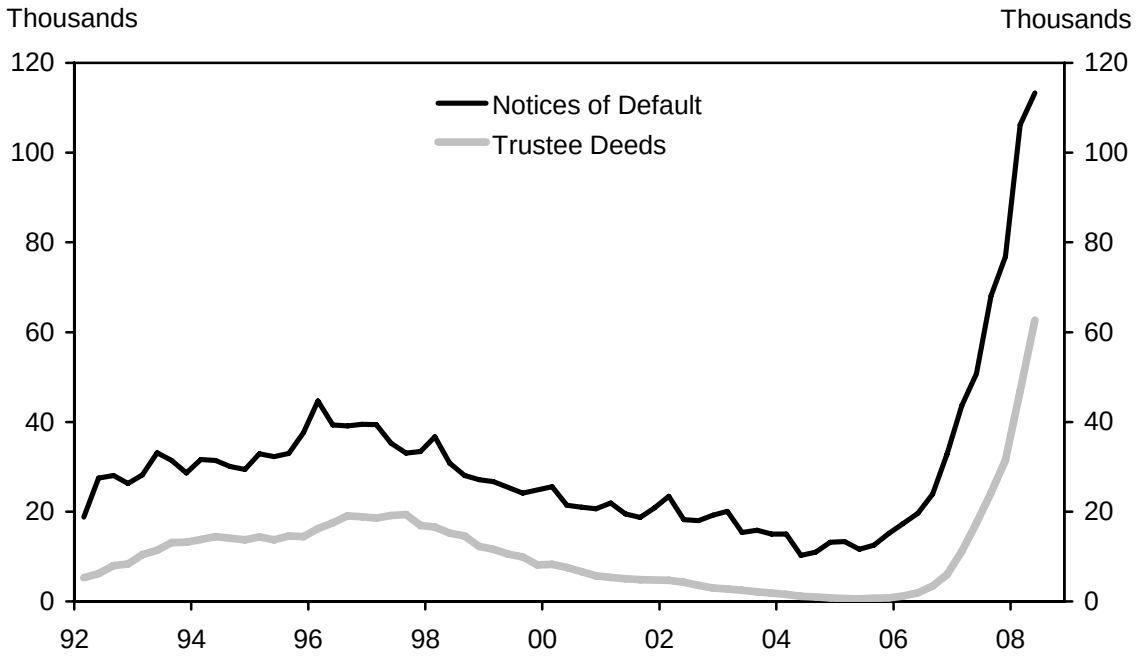
	California		Florida		Arizona		Nevada	
	Starts	Sales	Starts	Sales	Starts	Sales	Starts	Sales
2007Q1	28,656	7,417	18,690	2,528	4,342	1,035	3,499	979
2007Q2	32,572	10,967	21,735	3,435	5,364	1,396	4,257	1,394
2007Q3	47,119	15,533	32,285	5,110	6,993	2,362	4,708	1,782
2007Q4	52,347	22,347	42,639	6,200	9,260	3,493	6,808	2,740
2008Q1	81,684	36,581	58,496	9,780	14,646	6,290	9,434	4,489
2008Q2	99,125	56,953	72,418	14,788	19,164	10,273	12,241	7,163

Source: Hope Now.

Moreover, a longer perspective for the state of California confirms that the percentage of foreclosure starts that results in sales closely tracks overall housing and mortgage market developments. The real estate information company Dataquick, Inc., has produced a quarterly time series on foreclosure starts (notices of default) and

foreclosure sales (trustee deeds) for California since 1992, which is shown in Exhibit 6.[9] In the downturn of the early/mid-1990s, when nominal home prices fell moderately, a sizable proportion of foreclosure starts turned into foreclosure sales. During the subsequent California real estate boom that started in the late 1990s, hardly any foreclosure starts turned into sales. Finally, in the home price plunge of the past 12-18 months, foreclosure sales have climbed essentially in lockstep with foreclosure starts 1-2 quarters earlier, confirming that a very large proportion of all new foreclosure starts result in sales at this point.

Exhibit 6: CA Foreclosure Starts (Notices of Default) and Sales (Trustee Deeds)



Source: DataQuick Information Systems.

These observations suggest that a very large proportion of the foreclosure starts in the current cycle will involve a significant loss to the lender, in most cases because a

[9] The absolute numbers are higher than those in Exhibit 4 because the Data Quick figures are a universe count while the Hope Now figures are based on a sample of servicers. However, the moves over time are quite similar for the (short) period during which both series overlap.

foreclosure start is followed by an eventual sheriff's auction. Moreover, the data suggest that loss incidence shows a strong inverse relationship with changes in home prices.

This relationship suggests that we should let our assumptions about foreclosure completion rates vary inversely with the decline in home prices. Unfortunately, we do not have enough data to estimate this relationship empirically. Instead, we assume a foreclosure completion rate of 70% if home prices stay at current levels, 80% if prices drop another 10%, and 90% if prices drop another 20%.[10]

We also need to convert our predictions for the number of foreclosures into a number for dollar losses. Since the MBA foreclosure data are based on the number rather than the dollar value of loans, this means that we need to make an assumption about the average mortgage balance by state. To do this, we use data from the Federal Reserve Bank of New York on the average balances of subprime and alt-A loans by state. We assume that the typical foreclosure in the MBA categories "subprime ARMs" and "subprime FRMs" is an average-sized subprime loan, and the typical foreclosure in the MBA categories "prime ARMs" and "prime FRMs" is an average-sized alt-A loan.[11]

The only remaining issue is what to assume for average severities. Severities depend inversely on home prices because a larger home price decline implies that the typical foreclosed home is more deeply in negative equity. As with the foreclosure

[10] We can loosely justify these assumptions by cross-sectionally correlating the 2008 Q2 foreclosure completion rate from the Hope Now data (estimated using the ratio of foreclosure sales to foreclosure starts two quarters earlier) with the cumulative home price change from 2006 Q2 to 2008Q2. An OLS regression with 51 observations yields a slope coefficient of -1.35 (with a t-statistic of -5.6), meaning that an incremental 10-percentage-point home price drop implies an incremental 13.5-percentage-point rise in the foreclosure completion rate.

[11] This is a relatively "conservative" assumption. The MBA subprime sample includes at least a small number of alt-A loans (which are generally larger than subprime), and the MBA prime sample includes most jumbo loans (which are generally larger than alt-A). Moreover, it is likely that the average foreclosure involves bigger-than-average mortgage balances, since an excessive amount of debt presumably is a key reason for why the borrower experienced problems in the first place.

completion rate, however, we do not have enough data to estimate the relationship between home prices and severities statistically. Instead, we assume that -- depending on the home price outcome -- severities vary between 55% and 65% for subprime mortgages and between 37% and 43% for prime/alt-A mortgages.[12]

Our Credit Loss Projections

Exhibit 7: Our Mortgage Credit Loss Projections

	Total Losses (Billions of Dollars)		
	Prices Flat at mid-2008 Level	**Prices Fall 10% from mid-2008 Level**	**Prices Fall 20% from mid-2008 Level**
2007Q1	5	5	5
2007Q2	8	8	8
2007Q3	13	13	13
2007Q4	19	19	19
2008Q1	27	27	27
2008Q2	37	37	37
2008Q3	39	46	51
2008Q4	36	52	66
2009Q1	30	48	74
2009Q2	25	45	82
2009Q3	23	40	74
2009Q4	20	35	62
2010Q1	19	30	47
2010Q2	18	26	38
2010Q3	17	24	34
2010Q4	16	22	30
2011Q1	16	21	28
2011Q2	16	21	27
2011Q3	15	20	26
2011Q4	15	20	25
2012Q1	15	19	24
2012Q2	15	19	24
2012Q3	15	19	23
2012Q4	15	19	23
07Q1-12Q4	**473**	**636**	**868**

Source: Our calculations.

[12] This assumption is qualitatively consistent with the methodology of Standard and Poor's (2008), whose severity assumptions depend directly on the decline in home prices. A sampling of recent severity estimates for different mortgage types shows that Standard and Poor's (2008) assumes prime, alt-A, and subprime severities of 30%, 40%, and 50%, respectively, Freddie Mac (2008) assumes alt-A severities of 45%, and Goldman Sachs (2007) assumes subprime severities of 60%.

We use these assumptions to project total credit losses for three alternative price scenarios, as shown in Exhibit 7. If nominal home prices remain at their 2008 Q2 level until mid-2009, before reverting to a +3% annualized trend, our model implies that mortgage credit losses realized in the 2007-2012 period will total $473 billion. If nominal home prices fall another 10% through the middle of 2009, the model projects losses of $636 billion. Finally, if prices drop another 20%, predicted losses increase to $868 billion. Moreover, the table suggests that losses peak in the third quarter of 2008 if home prices are flat going forward; in the fourth quarter of 2008 if prices drop another 10%; and in the second quarter of 2009 if prices drop another 20%.[13]

Exhibit 8 breaks down the overall losses in our three home price scenarios into the four types of mortgages. In our central -10% scenario for house prices, the model implies losses of $347 billion or just over half of all losses are projected to occur in the subprime sector. As it happens, this corresponds roughly to the subprime losses that are currently implied by the ABX.HE family of subprime credit derivatives.[14] One could interpret this as saying that the market is currently discounting an implicit further home price decline of about 10%. However, note that this statement is highly approximate because the ABX analysis is based on the stock of mortgages currently outstanding while our analysis of the MBA foreclosure data is based on cumulative foreclosures over the 2007-2012 period.

[13] Note that we date losses as of the foreclosure start since this usually coincides roughly with the booking of a loss by the lender. If we chose the foreclosure sale instead, the peaks would occur roughly 2 quarters later.

[14] According to the model developed in Goldman Sachs (2007), the ABX.HE market was discounting total subprime losses of $382.8 billion as of September 9, 2008.

Exhibit 8: Mortgage Credit Loss Projections by Type of Mortgages

	Total Losses (Billions of Dollars, 07Q1-12Q4)		
	Prices Flat at mid-2008 Level	Prices Fall 10% from mid-2008 Level	Prices Fall 20% from mid-2008 Level
Subprime ARMs	189	250	335
Subprime FRMs	76	97	120
Prime ARMs	100	143	213
Prime FRMs	107	146	199

Source: Our calculations.

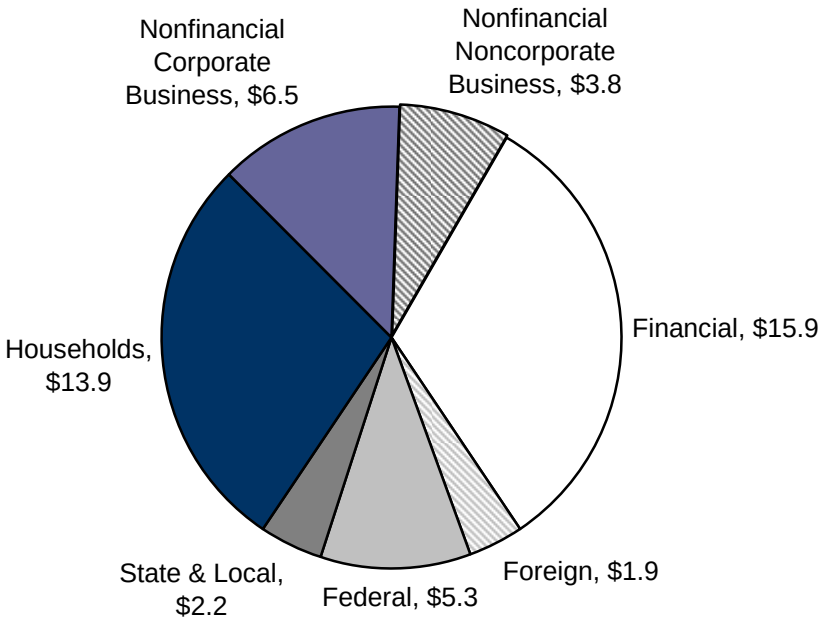
III. The Link Between Credit Losses and Lending

The main reason why credit losses are important from a macroeconomic perspective is that they weigh on the supply of credit to nonfinancial borrowers. We now use the mortgage credit loss estimates of the previous section to quantify these links.

We start by documenting the facts about credit extension. Exhibit 9 provides a breakdown of the total credit extended by U.S.-based entities. About half of the nearly $50 trillion total consists of liabilities by domestic nonfinancial private borrowers; the rest is mainly financial and government debt. We focus on the availability of credit to private nonfinancial borrowers because it is likely to have the most direct effect on overall economic activity.[15]

[15] Reduced availability of financial credit may be important indirectly, but such an effect would usually work via a tightening of nonfinancial lending conditions. A reduction in credit availability to government borrowers is unlikely except in extreme cases.

Exhibit 9: Breakdown of Total Debt Outstanding (Q1 2008, Trillions of Dollars)



Source: Federal Reserve Board.

Using information contained in the Federal Reserve Board's flow of funds accounts as well as our own assumptions and interpolations, we can divide this debt into five main categories:

1. On-balance-sheet lending by leveraged private entities such as banks, broker-dealers, savings institutions, and finance companies ($10.6 trillion as of the first quarter of 2008). The largest categories are residential and commercial mortgages held on balance sheet, followed by other bank loans and consumer credit held on balance sheet. (Note that our measure of on-balance-sheet lending does not include GSE-backed MBS, for which the credit risk ultimately resides with a government agency.)

2. Lending via the asset-backed securities markets ($2.5 trillion). This category mostly consists of nonconforming mortgage-backed securities, but it also includes

securities backed by consumer credit and corporate loans (CLOs). We exclude ABS held on the balance sheets of leveraged institutions.

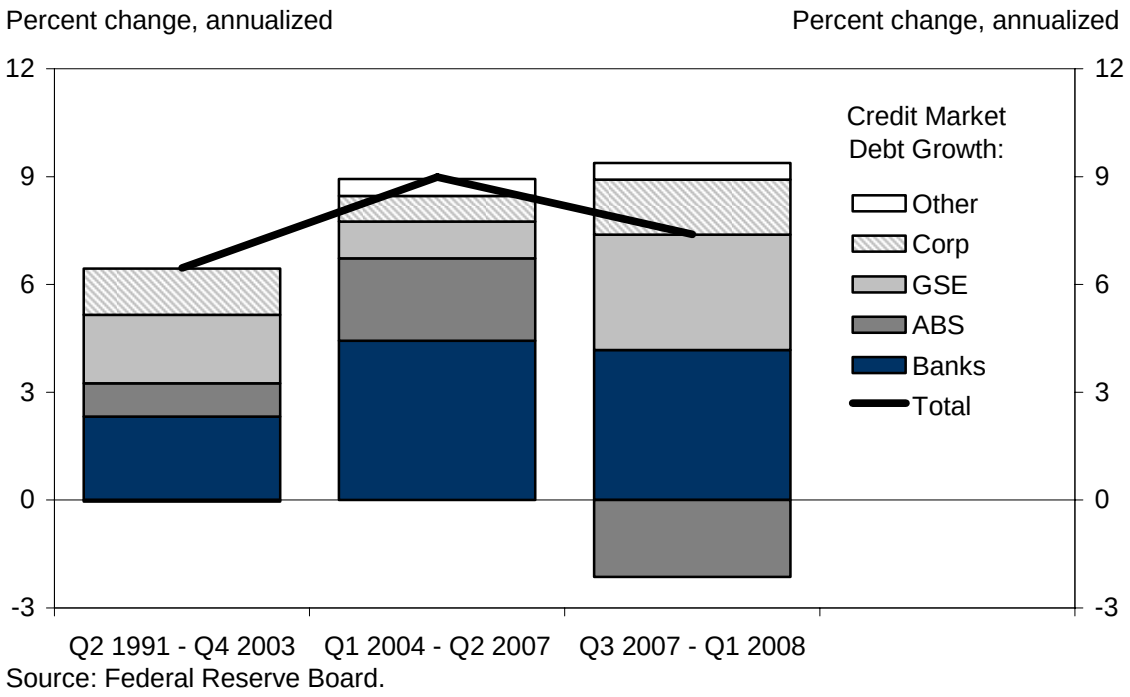
3. Debt owned or guaranteed by a government-sponsored enterprise ($5.3 trillion). This category consists almost entirely of the mortgage book of business of Fannie Mae and Freddie Mac, which includes mortgages or MBS on their balance sheets as well as MBS for which the agencies bear the credit risk. Note that we include mortgages even when they are held on a private-sector balance sheet so long as the GSEs bear the credit risk.

4. Lending via the corporate bond and commercial paper markets ($3.8 trillion), again excluding assets held on leveraged-sector balance sheets.

5. Direct lending and holdings of securities by unleveraged entities such as insurance companies, pension funds, and the government ($1.7 trillion).

Exhibit 10 shows total private nonfinancial credit (or simply "credit") growth and its five components since 1991. Overall credit has grown at a compound annual rate of 7.0%, significantly faster than the 5.3% growth rate of nominal GDP over that period. By far the biggest contributor has been on-balance-sheet credit growth, which has contributed 2.8 percentage points, followed by GSE lending with 1.8 percentage points, corporate bonds with 1.2 percentage points, and the ABS markets with 1.1 percentage points.

Exhibit 10: Accounting for Nonfinancial Private Credit Growth



Source: Federal Reserve Board.

However, there have been sharp changes over time in the relative contribution of different sectors. During the credit boom of the 2004-2007 period, the surge in the private-label securitization markets contributed as much as 2.3 percentage points to overall credit growth. Since the start of the bust in mid-2008, however, this picture has changed dramatically as the private-label ABS market has subtracted 2.1 percentage points from overall credit growth. In contrast, GSE-backed lending has accelerated sharply over the past year. During the boom, GSE-backed lending contributed 1.0 percentage points to credit growth, but since the bust started this number has increased to 3.2 percentage points. This acceleration has come despite the deterioration in the finances of Fannie Mae and Freddie Mac over that period.

To assess the impact of the credit crisis, we are particularly interested in the first three sectors -- leveraged institutions, private-label ABS markets, and the GSEs. In what follows, we discuss the likely behavior of each of these three sectors in turn.

The Behavior of Leveraged Financial Institutions

The first hit to the supply of credit occurs via declining equity capital and declining leverage among financial institutions, including commercial banks, broker-dealers, savings institutions, credit unions, and finance companies. In what follows, we simply call our group of leveraged institutions "banks."

There are three key ingredients in our story, which follows GHKS (2008) in several important respects. First, the losses and writedowns cut into banks' equity capital base, although there are offsets to these losses from recapitalization as well as lower corporate income taxes. Second, the impact is magnified because banks appear to target a procyclical leverage ratio over the cycle. This can be explained in terms of value-at-risk (VaR) models that measure the "approximate" maximum daily loss, in the sense that anything worse than this loss can only happen with some benchmark probability. Third, however, the impact of the first two factors on end-user credit -- i.e., households and nonfinancial businesses -- is dampened because some of the lost credit supply consists of claims on other banks.

To get an estimate of the hit to credit supply, note that we can summarize this story by means of the equations:

(1) $dA = -C \times (1-k-t) \times L + dL \times A$,

(2) $dY = dA\ Y/A$.

In equations (1) and (2), A is total bank assets (i.e. the total size of the unconsolidated balance sheet), Y is end-user credit (i.e. lending to private nonfinancial entities), C is the pretax credit loss suffered by banks, k is the percentage of pretax credit losses that is replaced via capital raising, t is the effective marginal corporate income tax rate, and L is leverage.

To derive a benchmark for the contraction in total assets and nonfinancial private credit, we use the following numbers for each of the variables in equations (1) and (2).

Bank Credit Loss = $504 billion

For our illustrative calculation, we assume that home prices fall by another 10% (logarithmically) from mid-2008 to mid-2009, which according to the model developed in Section 2 should result in a total residential mortgage credit loss of $636 billion. We assume that 50% of this loss, or $318 billion, hits US banks. The 50% estimate is similar to the assumption in GHKS (2008). It can also be justified on the basis of the losses that have already been recognized by global financial institutions. Exhibit 11 provides a tally of credit losses and recapitalizations since the crisis began in the summer of 2007. Over the past year, financial institutions globally have written down or provisioned for a total of $552.4 billion because of the credit crisis. The vast majority of these losses relate to residential mortgages. US banks and investment banks account for $270.6 billion (49%) of this total. Our assumption that US banks will bear 50% of the ultimate mortgage credit loss simply assumes that their share in total actual losses will be similar to their share in losses recognized to date.

Exhibit 11: A Tally of Credit Losses and Recapitalizations

Summary of Global Financials Write-downs and Capital Raising
(US$ in billions; since mid-2007)

Gross Write-downs

	US	Europe	Rest of the world	Total
Brokers	83.0	76.3	0.9	160.2
Banks*	187.6	108.6	13.2	309.4
Specialty Finance	37.4	--	--	37.4
Insurance & Asset Mgr	38.8	6.6	--	45.4
Total	346.8	191.4	14.1	552.4

*The US banks figure includes writedowns and above-trend credit provisions.

Capital Raised

	US	Europe	Rest of the world	Total
Brokers	48.7	41.6	--	90.3
Banks	144.0	63.7	5.4	213.1
Specialty Finance	48.3	--	--	48.3
Insurance & Asset Mgr	25.5	12.5	--	37.9
Total	266.5	117.7	5.4	389.6

Note: Specialty Finance include Financial Gurantors; Banks include C & JPM.
Source: Company releases. Goldman Sachs Research.

In addition to the assumed $318 billion in residential mortgage credit losses, banks are also starting to see larger credit losses on other types of loans and asset-backed securities, including commercial mortgages and consumer credit. To incorporate these in our analysis, we use the Goldman Sachs (2008) estimate that losses on other claims will total $186 billion, for a total bank credit loss of $504 billion.

Tax rate = 25%

The after-tax credit loss is likely to be lower than the pre-tax loss because most banks will be able to use their credit losses to lower their corporate income tax liabilities. However, the offset is likely to be below the statutory 35% corporate income tax rate. Banks that make losses for many years -- or end up going out of business -- will be unable to obtain this offset. Taking this into account, we assume that the average effective marginal tax rate offset is 25%.

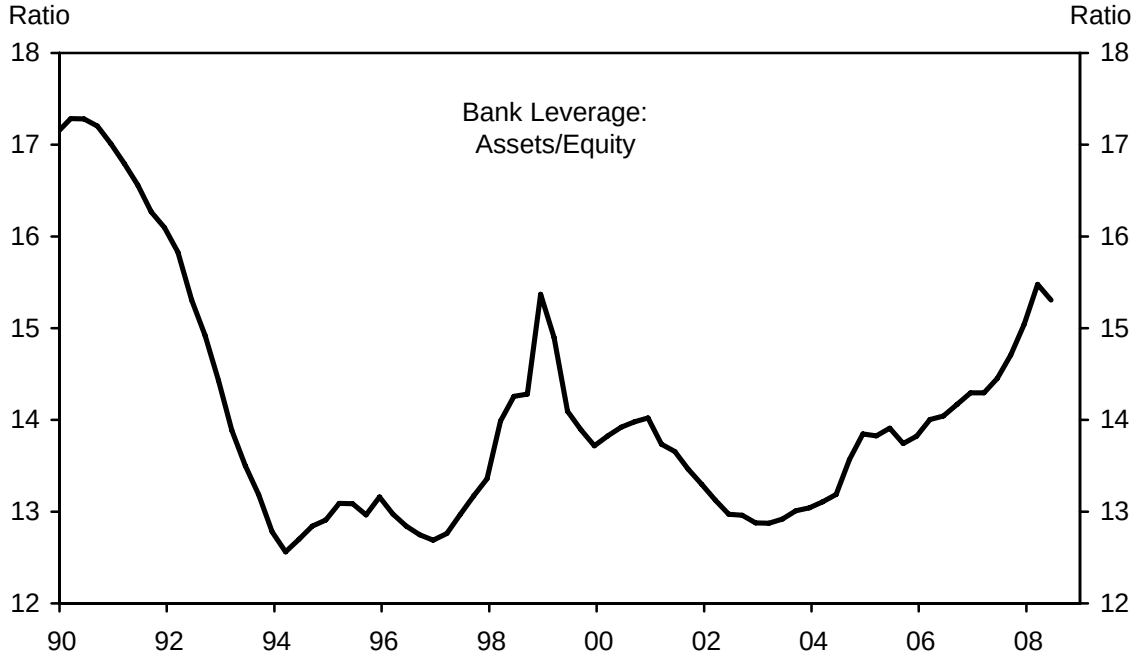
Recapitalization rate = 50%

So far through the crisis, US banks have been remarkably successful in raising capital to offset a large share of the impact of the credit losses on their equity capital, to the tune of about 70% of the total pretax credit loss. If this continued, it would imply that the after-tax credit losses will be largely offset by corporate income tax credits and capital raising. However, this assumption may be too aggressive because it would imply additional capital raising of another $150-$200 billion, about as much again as what has already been seen to date. Such large further capital raises could prove difficult given that the majority of first-round capital raises are currently trading below their offer prices and lower bank stock prices are making capital raising more dilutive and expensive for existing shareholders. We therefore assume a somewhat smaller ultimate recapitalization ratio of 50%, in line with the central assumption in GHKS (2008). However, we emphasize that the uncertainty around this estimate remains high.

Change in leverage = -10%

GHKS (2008) show that the leverage of commercial and investment bank is procyclical, rising in booms and declining in slumps. However, their paper does not provide much guidance with respect to the size of the potential leverage decline during the current crisis. To get a more quantitative estimate, we therefore look at two other pieces of evidence -- the history of the early 1990s and recent disclosures by US banks about changes in their balance sheet targets.

Exhibit 12: Trends in Bank Leverage



Source: Standard & Poor's. Our calculations.

Exhibit 12 plots the leverage ratio of US commercial banks and investment banks.[16] The chart shows that leverage declined by 28% (from 17.0 to 12.3) in the four years from 1990 to 1994. If this were to be the template for the current crisis, it would imply a very large amount of deleveraging. However, the chart also shows that leverage in the banking system is now considerably lower than it was in 1990. This suggests that the decline in leverage could also be more muted.

Exhibit 13 takes a different tack and looks at the disclosures of financial institutions about their plans in the current downturn for clues as what might happen to aggregate leverage. It shows that several large banks have recently indicated a desire to reduce their leverage substantially. The table shows the amount of "theoretical" new

[16] We define leverage as total assets divided by equity capital. The series is calculated from quarterly financial reports on the assets and equity capital on firms included in the S&P 500 sectors diversified banks (GICS code 40101010), regional banks (40101015), other diversified financial services (40201020), and investment banking and brokerage (40203020). The series is adjusted for two series breaks in June 2003 and April 2005.

balance sheet capacity associated with recent increases in equity capital, as well as the banks' professed targets for actual balance sheet size. The upshot of the table is that combined target leverage in these six large banks has fallen by about 18% since late 2007. These institutions hold combined assets of $3.5 trillion, or 20% of total bank assets of $17.3 trillion. Hence, their balance sheet adjustment alone implies a 3.6% drop in aggregate bank leverage, before considering any changes in other banks. If other banks on average saw a 5% drop in leverage -- a less aggressive reduction -- this would imply an overall decline of 7.6%.

Exhibit 13: Some Banks Aim to Reduce Leverage

					Theoretical capacity creation			*Actual capacity creation*	
	2007YE Tier 1	**Amount raised**	**2Q08 Tier 1**	**Long Term Tier 1 Target**	**Theoretical "excess" capital**	**Theoretical new loan capacity**	**New capacity - % of balance sheet**	**Goal for Growth / Shrinkage**	**Actual New Loan Capacity**
Citigroup	7.1%	$41 bn	8.6%	8.0%	$8 bn	$96 bn	5%	-19%	-$400 bn
Wachovia	7.4%	$19 bn	8.0%	8.0%	$0 bn	$0 bn	0%	-2%	-$20 bn
WaMu	8.6%	$11 bn	8.2%	8.0%	$1 bn	$7 bn	2%	-6%	-$20 bn
National City	6.5%	$10 bn	11.1%	8.0%	$4 bn	$53 bn	34%	-10%	-$16 bn
KeyCorp	7.4%	$1.7 bn	8.5%	8.0%	$1 bn	$7 bn	7%	-2%	-$2 bn
First Horizon	8.1%	$0.6 bn	10.4%	8.0%	$1 bn	$9 bn	23%	-10%	-$4 bn
Total	--	**$83 bn**	--	--	$14 bn	$172 bn	5%	-13%	**-$461 bn**

These five banks have raised ~$80bn of capital and now have 8.5% to 11.5% Tier 1 ratios.

In normal times (i.e. if these banks weren't facing big losses to come) these banks would have $15bn of excess capital and would be able to write $172bn+ of new loans - 5% of their weighted average balance sheet.

In fact, these banks are aiming to shrink their balance sheets by ~$460bn. Consequently, $80bn of capital injections still results in a net loss of capacity for the system.

Note: Theoretical excess capital = excess capital that would be in place if these companies weren't facing further losses. Theorietical new loan capacity uses 12.5X leverage across all for simplicity. Goal for balance sheet shrinkage are our estimates based on each companies stated intentions with respect to asset sales, run-off portfolios, etc. Balance sheet size = total earning assets (loans+securities).
Amount raised includes dividend cuts.

Based on a combination of the experience of the early 1990s and the recent indications that banks are reducing their leverage targets, we assume a decline in overall bank leverage of 10%. This is a more muted decline than that seen in the early 1990s, an assumption that can be justified by the lower starting point for leverage this time around. However, it would still imply significant moves in the direction of reduced leverage

targets, over and above what banks have already announced. Again, we acknowledge that the uncertainty about target leverage is very sizable.[17]

End user credit ratio = 63%

In our data set, the ratio of end-user credit to total bank assets is 63%, calculated simply as the ratio of our private nonfinancial credit measure to the total size of the unconsolidated bank balance sheet. This is larger than the 42.7% share used in GHKS (2008), which was estimated indirectly (and for a somewhat different set of institutions) from various accounting relationships in the US banking sector. However, our 63% measure is similar to the recent study by Deutsche Bank (2008), who estimate an end-user credit share of 67% for the European banking system.

Armed with these assumptions, we can calculate benchmark figures for dA and dY as follows:

(1) dA = -$504bn x (1-0.50-0.25) x 10.9 - 0.1 x $17.3trn = -$3.10trn

(2) dY = -$3.10trn x 0.63 = -$1.96trn.

Thus, our assumptions imply that banks could reduce the supply of credit to end users by $1.96 trillion in response to the credit losses and their desired leverage ratios. This number is twice as large as the $1 trillion estimate in GHKS (2008), for three main reasons. First, partly because of more adverse mortgage credit loss assumptions and partly because we also consider non-mortgage credit losses, we assume considerably larger total credit losses for banks, although this difference is partly offset by our

[17] In terms of the level of the leverage ratio, we rely on the estimates in Exhibit 4.5 in GHKS (2008), rather than the bottom-up data in Exhibit 12. While the bottom-up data are suitable for assessing changes over time, they only include S&P 500 firms and exclude both finance companies and most savings institutions, and are therefore considerably less comprehensive. When adjusted for the exclusion of the GSEs and imputed hedge fund figures from the leveraged sector, the GHKS data imply an aggregate leverage ratio of 10.9.

assumption that banks will be use 25% of the losses to reduce their income tax liabilities. Second, we consider a decline in leverage of 10% rather than 5%. Third, we are using a larger end user credit share.

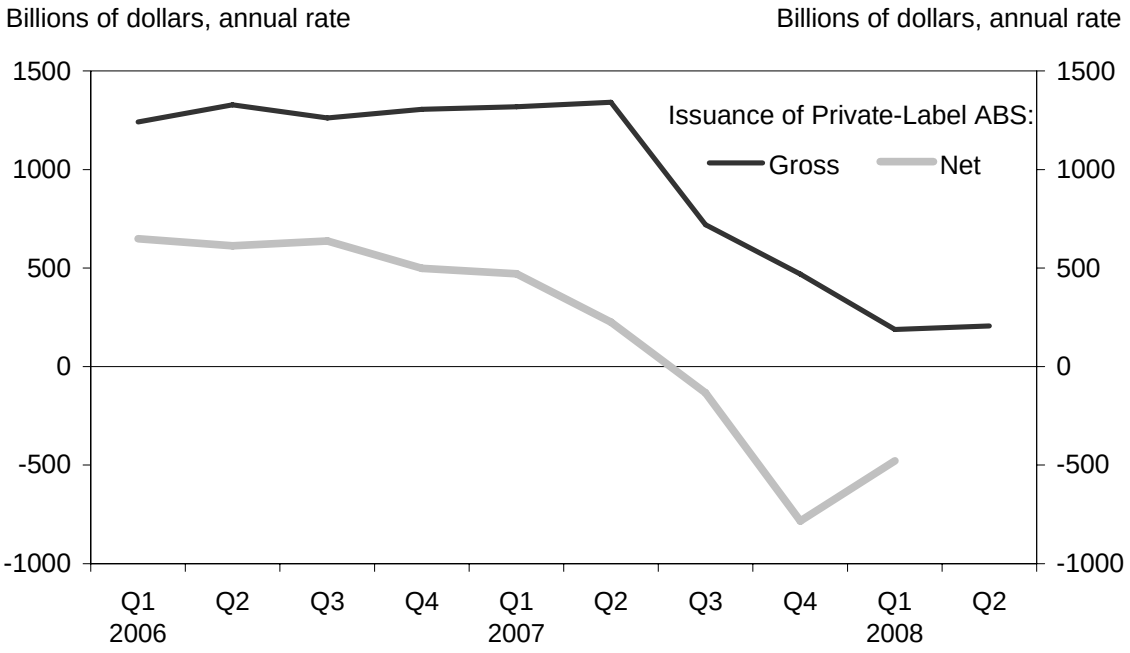
One very important question is the adjustment time horizon. For the purposes of quantifying the impact on real GDP growth, we assume that the hit will occur over a 2-year period. This is based on the assumption that banks started to respond to the credit crisis in mid/late 2007 and will have completed their response by mid/late 2009, when house prices are assumed to bottom. Under this assumption, the combined effects of the losses and the deleveraging would subtract just under $1 trillion from annualized bank lending, relative to a baseline scenario in which there is no housing and credit crisis. In this baseline scenario, the most natural assumption is continued bank lending growth that matches the trend growth rate of nominal GDP of about 5% (annualized). Since this implies baseline bank lending of about $500 billion per year (calculated as 5% x $10.9 trillion), our calculations imply an annualized shrinkage in the absolute level of end user bank credit of about $500 billion during the crisis. This shrinkage is not yet visible in the quarterly flow of funds accounts, but the Federal Reserve Board's weekly data on commercial bank balance sheets -- probably the best high-frequency proxy -- have recently shown a sharp slowdown in the growth rate of bank credit.

ABS Market Disruptions

The second hit to the supply of credit occurs via the ABS markets. The mortgage credit losses have brought the originate-and-distribute model underlying the ABS markets into serious disrepute. The model is based on the idea that the bundling and structuring of small loans -- most commonly residential or commercial mortgages, but also credit cards, student loans, and a host of others -- combined with an opinion from the major rating agencies could turn these securities into ones with risk characteristics more comparable to traditional corporate bonds. However, the much higher-than-expected losses especially on subprime mortgage securities have badly dented the reputation of the rating agencies and undermined the willingness of investors to purchase such securitized products from financial institutions that bundle them. Without a respected third-party source for assessing the credit quality of ABS, the model has broken down. As a result, gross issuance has fallen sharply.

Exhibit 14 shows the impact of this disruption on overall credit creation. It plots the gross issuance of securitized nonconforming residential mortgages, commercial mortgages, credit cards, auto, and student loans since early 2006 against our measure of net lending via the ABS markets. As gross issuance has fallen from around $1.3 trillion (annualized) in 2006 and the first half of 2007 to only around $200 billion (annualized) in the first half of 2008, net credit extension via off-balance-sheet ABS has swung from an average of around +$600 billion to -$478 billion in the first quarter of 2008. Hence, it appears that the drop in gross issuance has translated into an equal-sized drop in net credit extension.

Exhibit 14: Gross and Net ABS Issuance



Source: Federal Reserve Board. SIFMA. Bloomberg.

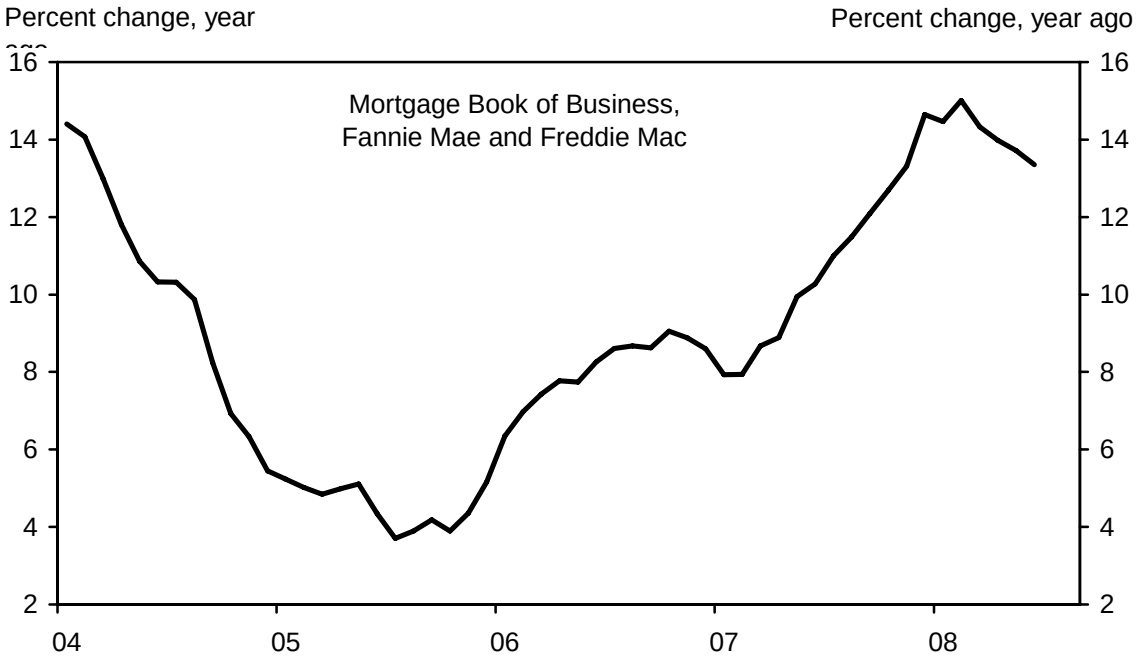
It is unlikely that ABS issuance will rebound until investors regain confidence in their ability to evaluate ABS credit quality. This could happen in one of two ways. Either the rating agencies regain the trust of investors despite their failure to foresee the massive mortgage credit losses or investors and/or issuers come up with alternative methods of monitoring credit quality in the ABS market. Neither development looks imminent, so it is likely that gross ABS issuance will remain extremely low, and net ABS issuance sharply negative. We therefore assume that the net credit extension via the ABS markets will remain at -$400 billion (annualized). Relative to a counterfactual trend of +$125 billion (or +5% of the outstanding stock of ABS), this implies an impact of -$525 billion.

The Behavior of Government-Sponsored Enterprises

The GHKS (2008) analysis includes the behavior of the government-sponsored enterprises Fannie Mae and Freddie Mac with that of other leveraged financial institutions. This seemed reasonable at the time because the GSEs are clearly among the most highly leveraged institutions in the US financial system, and because they are more directly exposed to the housing market than anyone else. Now that the GSEs have been taken into conservatorship by the US government, however, they clearly need to be analyzed separately.

Over the past year, the behavior of the GSEs has been very different from that of private banks. Despite the sharp decline in the book and (especially) the market value of their equity capital, the GSEs sharply stepped up their contribution to overall credit growth. Exhibit 15 shows that they further accelerated the growth rate of their book of business from an already strong 10.3% in June 2007 to a peak of 15.0% in February 2008. The reason was that the federal government actively encouraged the GSEs to step into the breach left in the mortgage market by the disruption in the ABS markets and the deleveraging in the banking sector. Despite a modest slowdown since February, the GSEs have contributed almost $620 billion to total private nonfinancial lending in the year to June 2008, almost $400 billion more than what would be implied by a trend-like 5% growth rate in their book of business. In terms of total credit creation, this implies that the acceleration in GSE lending has so far offset most of the drag from the disruptions in the ABS markets.

Exhibit 15: GSEs Grow Their Book of Business Rapidly



Source: Federal Home Loan Mortgage Corporation. Fannie Mae.

Prior to the government's decision to take the GSEs into conservatorship, the risk had increased that increasing capital scarcity would cause the enterprises to focus on capital preservation and bring the growth in their book of business to a halt. However, while the measures announced on September 7, 2008, put fairly tight limits on the GSEs' retained portfolio growth, they do not constrain the enterprises' ability to grow their guarantee business. Hence, the enterprises will likely be able to continue growing their overall book of business significantly, and in our analysis we assume an annualized contribution of $750 billion, or almost 15%.

Implications for Overall Credit Supply

We sum up our discussion by providing rough estimates of the net impact from our three sectors on the supply of nonfinancial private credit. In doing so, we add up a)

the estimated annualized hit to the supply of bank credit, b) the annualized change in off-balance-sheet private-label ABS, relative to a counterfactual assumption of 5% growth, and c) the annualized change in GSE-backed debt, also relative to a counterfactual assumption of 5% growth.

Exhibit 16 shows our estimates. There are two cases. First, under our baseline assumption that the GSEs continue to expand their book of business by $750 billion (annualized), we estimate a total drag on nonfinancial private lending of $997 billion, i.e. a 4.1-percentage-point drag on the growth rate of private nonfinancial debt. This is almost entirely due to the restraint on bank balance sheet growth from credit losses net of recapitalization and falling leverage. In this scenario the increased supply of GSE-backed lending would continue to offset the drag from the private-label ABS markets.

Exhibit 16: Two Scenarios for the Hit to Credit Growth

	If GSEs Keep Expanding			If GSEs Stop Expanding		
	Actual (Bil.$)	Trend (Bil.$)	Impact (Bil.$)	Actual (Bil.$)	Trend (Bil.$)	Impact (Bil.$)
Banks			-978			-978
ABS	-400	+125	-525	-400	+125	-525
GSEs	+750	+250	+500	0	+250	-250
Total			**-997**			**-1753**
(% of total)			**-4.1**			**-7.2**

Source: Our calculations.

Second, if the GSEs were to "hunker down" and stop the expansion in their book of business, the drag rises to $1.75 trillion (annualized), or about 7.2% of private nonfinancial debt, as the GSEs would go from being a net contributor to lending to a net drag on lending. The fact that stagnation in the GSEs' book of business would almost double the overall hit to credit supply shows just how important these institutions are for offsetting some of the hit to the economy from the fully private forms of credit provision.

We believe the second scenario has become less likely now that the GSEs have essentially been taken over by the government.

IV. The Link Between Lending and Aggregate Economic Activity

To close our analysis, we turn to the link between the supply of credit and aggregate economic activity. The effects of the credit losses on banks and off-balance-sheet ABS markets have led to a reduction in overall balance sheet capacity and therefore in the supply of credit to the real economy. A simple way to measure the importance of this effect is to relate the volume of credit outstanding to a measure of cyclical fluctuations in overall economic activity, such as the growth rate of real GDP. However, since the causality between credit and economic activity clearly runs in both directions, it is important to look for instrumental variables that can be used to isolate the impact of an exogenous change in credit on activity. We use two survey measures of credit availability as our instruments. The first is the perceived availability of credit to small businesses as measured in the monthly survey of the National Federation of Independent Business (NFIB), and the second is the willingness of banks to extend consumer installment loans as measured in the Fed's Senior Loan Officers' (SLO) survey.

While an instrumental variables approach should reduce the endogeneity problem, we are mindful of the risk that a tightening of credit availability may be due to a deterioration in the economy, which would render our instruments invalid (Mishkin, 2008). In our first-stage equation, we therefore only use instruments lagged by two quarters or more. Even this does not entirely rule out endogeneity problems if banks are systematically able to predict a deterioration in the economy two quarters or more in the

future and adjust their credit standards accordingly. However, whether banks indeed have this degree of forecasting ability is open to question. The fact that many banks were apparently caught by surprise by the housing and credit crisis may raise some serious about the ability of banks to forecast broader economic and market developments, reducing the worries about endogeneity in our analysis.

We start by presenting a simple OLS regression of real GDP growth on real private domestic nonfinancial debt (PDNFD) growth:

$$\underset{}{d\ GDP} = \underset{(1.93)}{0.0114} + \underset{(4.17)}{0.39309}\ d\ PDNFD$$

Sample 1974Q4-2008Q1, Adj. R^2 =0.16, SE=0.028, D-W=1.56,

where d GDP is the annualized log difference of real GDP, d PDNFD is the annualized log difference of real credit, and Newey-West t-statistics are given in parentheses underneath the coefficients. There clearly is a reasonably strong correlation between credit growth and GDP growth, very much as expected.

Turning to the IV results, we start by presenting the results from our auxiliary first-stage regression of credit on our lagged survey variables:

$$d\ PDNFD = \underset{(11.71)}{0.0752} - \underset{(4.83)}{0.005532}\ NFIB_{2\ to\ 4} + \underset{(1.70)}{0.00358}\ SLO_{2\ to\ 3}$$

Sample 1974Q4-2008Q1, Adj. R^2 =0.51, SE=0.0226, D-W=0.79.

where $NFIB_{2\ to\ 4}$ is the average percentage of small businesses indicating that credit was harder to get in NFIB survey from lags 2 to 4, and $SLO_{2\ to\ 3}$ is the average net percentage of banks reporting increased willingness to make consumer installment loans (seasonally adjusted using the Census X-12 algorithm) from lags 2 to 3. Our survey variables have substantial predictive power for future private credit growth.

Next, the second-stage IV regression is given by

d GDP = 0.002261 + 0.443059 d PDNFD
(1.10) (3.01)

Sample 1974Q4-2008Q1, Adj. R^2 =0.16, SE=0.0071, D-W=1.55.

where d GDP is the annualized log difference of real GDP. The equation implies that a supply-driven 1-percentage-point slowdown in real credit growth is associated with a 0.44-percentage-point slowdown in real GDP growth. This estimate is very similar to the results in GHKS (2008), who estimate that a 1-percentage-point slowdown in credit growth lowers real GDP growth by 0.34 percentage points in the short run and 0.47 percentage points in the long run.

We can combine our regression results with the calculations from the prior section to estimate the approximate impact of the credit supply deterioration on economic activity. Recall from Section III that we estimate a supply-driven drag on credit growth of 4.1 percentage points per year period if the GSEs continue to expand their book of business rapidly. According to our IV estimates, this implies a drag on real GDP growth of about 1.8 percentage points per year for a two-year period.

However, the impact rises considerably if we assume that the GSEs stop expanding their book of business. In that case, we estimate a supply-driven drag on credit growth of about 7.2 percentage points per year. This implies a drag on real GDP growth of 3.2 percentage points per year.

Our estimates should be viewed as the shock to aggregate demand from the balance sheet tightening that is brought about by the increase in mortgage credit losses. The ultimate deviation of real GDP growth from trend could be larger or smaller than our estimates. It could be larger if there are substantial multiplier effects that amplify the

initial shock. These multipliers could work through a deterioration in the labor market, a downturn in nonfinancial business investment in response to the original shock, or a US-induced global economic slowdown that washes back onto US shores via international trade and investment. But it could also be smaller if economic policymakers react to the shock in a timely manner by cutting interest rates and loosening fiscal policy.

V. Conclusion

Our analysis confirms that the decline in US home prices and the associated increase in mortgage credit losses could have a substantial impact on real GDP growth via the disruptions in the financial system. These disruptions occur not just via the impact of the losses on the lending capacity of banks, which were emphasized by GHKS (2008), but also via the sharp swing from positive into negative territory of net lending via the private-label ABS markets.

From a policy perspective, our analysis suggests that it matters a great deal whether the GSEs continue to expand their book of business rapidly. If so, the impact of the credit downturn may be confined to a couple of years of stagnation or mild recession in the broader economy. While a 1.8-percentage-point hit to real GDP growth is sizable, especially when combined with other ways in which the housing downturn is weighing on economic activity, these drags must be viewed in the context of a US economy which is already seeing a significant amount of stimulus from a weaker currency, a lower federal funds rate, and some fiscal stimulus.

However, if the GSEs were to stop growing their book of business, the outlook could deteriorate significantly. The 3.2-percentage-point hit to growth implied by our

analysis would not only directly imply a deeper recession, but it would also raise the risk of substantial adverse feedback effects between the real economy, the housing market, and the financial sector. Greater economic weakness might feed into bigger house price decline, which might trigger larger credit losses and in turn a greater amount of credit tightening and reduced economic activity. Hence, the ultimate impact on economic activity could be even larger than our "first round" estimates. The specter of such a feedback loop was likely an important reason for the Treasury's decision to take the GSEs into conservatorship on September 7.

More broadly, our analysis provides support to the view that macroeconomic policies may need to remain unusually expansionary during the adjustment of the financial system to the housing and credit market downturn. Especially if feedback effects are important, policymakers should attempt to lean against the decline in the financial system's ability to supply credit. This should not be viewed as an attempt to perpetuate the unsustainable, but as a way of keeping the housing and credit market retrenchment sufficiently gradual to reduce the probability of very unfavorable outcomes.

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