

United States: Selected Issues

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International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

UNITED STATES

Selected Issues

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Approved by the Western Hemisphere Department

July 2, 2008

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I. WHAT GOES UP MUST COME DOWN? HOUSE PRICES IN THE UNITED STATES

Summary of IMF Working Paper, WP/08/187, by Vladimir Klyuev

1. **After several decades of uninterrupted growth, home prices have been declining on a national basis in the United States.** Drops in real estate prices have a key role in the current macroeconomic slowdown, thus making it important to ascertain the potential extent of future price declines. It is widely recognized that the observed declines are serving to align home prices with their fundamentals, leaving open the question of how far prices still are from their equilibrium levels.
2. **This note summarizes estimates of the gap between current home prices and their equilibrium levels, and examines short-run dynamics of price adjustment.** The preferred price measure is the real OFHEO purchase-only index, which adjusts for quality changes and seasonal factors and has wide geographic coverage, and is deflated by the CPI.
3. **Reflecting uncertainties about how to analyze underlying house price trends, two approaches are used to estimate the extent of home-price overvaluation.** First, following earlier staff work, equations for the supply and demand of housing were estimated, in which real home price is a function of the number of homes sold and variables that represent fundamental drivers of housing supply and demand: household size and construction costs on the supply side and real disposable income, the unemployment rate, and the real mortgage rate on the demand side. The model was estimated on annual regional data. Second, to provide an alternative asset-market perspective, a cointegrating relationship between home prices, rents, and interest rates (all in real terms) was estimated on quarterly national data.
4. **Both techniques yield similar results, revealing considerable overvaluation in the last few years, which has not been fully corrected yet.** As Figure 1 illustrates, after stagnating below equilibrium for most of the 1990s, home prices took off in 1997. After catching up with their fair value around 2001, prices accelerated, overshooting equilibrium by a wide margin. Despite real house prices declining by 7 percent subsequently, the two methods suggest they were still 11–12 percent above equilibrium in the first quarter of this year, with a 95 percent confidence interval of about 5–20 percent. At the sub-national level, the picture is qualitatively similar, but the extent of overvaluation differs across regions, with largest overvaluations in the northeast and west, which also have the greatest land constraints.
5. **Turning to house-price dynamics, short-term movements appear to be driven by inventory overhangs and new foreclosures.** Table 1 shows a dynamic equation in which the change in real home prices is regressed on its own lags, the inventory-sales ratio, and foreclosure starts. The results indicate that a 20 percent increase in the inventory-sales ratio leads to a quarter percentage point slowing of house price inflation in the short run. Starts in foreclosures, which obviously add to future inventory, seem to also exert additional

Figure 1. Actual and Equilibrium Real Home Prices; Actual 2000 = 100

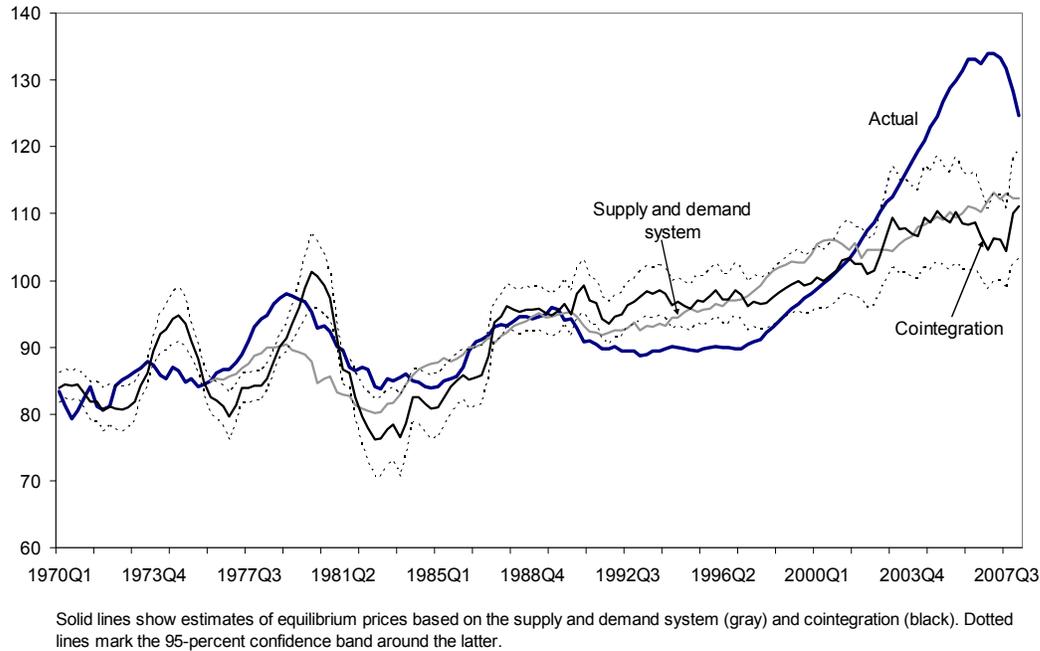


Table 1. Short-Run Determinants of Real Home-Price Appreciation

	Coefficient	Standard error	t-statistic	Probability
Constant	0.005	0.003	1.61	0.11
Lagged dependent variable	0.429	0.124	3.45	0.00
Lagged log (inventory-sales ratio)	-0.013	0.004	-3.42	0.00
Second lag of foreclosure starts	-0.030	0.009	-3.48	0.00
R-squared	0.46			
Durbin-Watson stat	1.98			

Ordinary least squares. Dependent variable: change in the log of real home price on previous quarter. Foreclosure starts enter as a percentage of total mortgages outstanding at quarter-end. Newey-West standard errors. Sample: 1982Q3 - 2008Q1.

downward pressure on prices. This result, which is consistent with microeconomic analysis suggesting foreclosures lower the value of surrounding houses, is particularly pertinent given the rapid recent rise in foreclosures. Home-price dynamics also exhibit some inertia, as attested by the coefficient of 0.43 on the lagged dependent variable. Strikingly, however, the regressions fail to identify any direct impact from the gap between current and equilibrium house prices on short-term house-price inflation.

6. The gap between actual and equilibrium home prices seems to matter only through its medium-term impact on the inventory-to-sales ratio. As shown in Table 2, the gap helps to explain the subsequent path of the inventory-sales ratio. However, the short-run impact of the price gap is relatively small (0.22) and the coefficient on the lagged dependent

variable is very large (0.91), suggesting that the gap influences the inventory-sales ratio extremely gradually. This may explain why it was not possible to find a direct impact from the price gap onto house inflation.

Table 2. Evolution of Inventory-to-Sales Ratio

	Coefficient	Standard error	t-statistic	Probability
Constant	-0.059	0.018	-3.36	0.00
Lagged dependent variable	0.912	0.027	33.94	0.00
Lagged price gap	0.225	0.101	2.22	0.03
R-squared	0.86			
Durbin-Watson stat	2.44			

Ordinary least squares. Dependent variable: log of inventory to sales ratio for existing single-family home. Price gap is log of the ratio of actual to equilibrium real home prices, as identified in the cointegrating equation. Newey-West standard errors. Sample: 1982Q3 - 2008Q1.

7. **Although the recent boom and bust in housing is often viewed in *regional* terms, it has had a stronger *national* component than in previous episodes.** While price movements continue to show significant regional variation, the dispersion of growth rates has been significantly smaller since the early 1990s than over the preceding period. In particular, while it used to be common for regional home prices to head in different directions, quarter-on-quarter home-price appreciation was positive in each of the nine Census divisions from 1996 through 2005, and it was negative in every division in the first quarter of this year.

Conclusions and policy implications

8. **Despite marked price declines across the country in the last few quarters, single-family homes still seem substantially overvalued.** Home prices, as measured by the OFHEO purchase-only index, were 5–20 percent above equilibrium in the first quarter of 2008. While CPI inflation will eliminate gradually some of the overvaluation, the bulk of the adjustment is expected to come through continued nominal home-price declines. Moreover, the most important determinant of home-price dynamics—the inventory-to-sales ratio—is near historic highs, while foreclosures are adding to the inventory and to market pessimism.

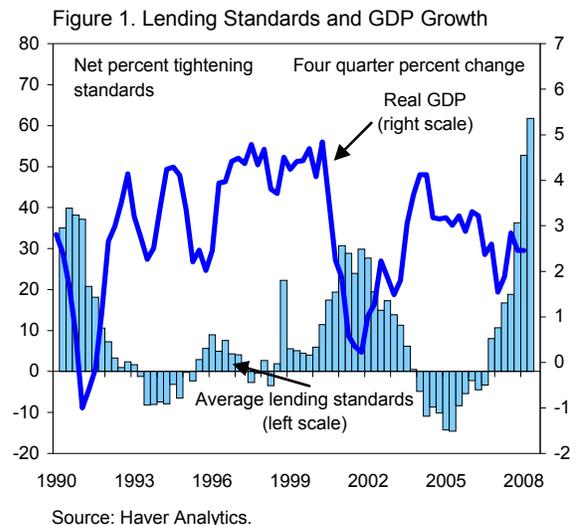
9. **Going forward, the strong downward momentum could push home prices well below equilibrium.** With the gap between actual and equilibrium prices playing only a weak anchoring role, house-price declines will likely persist even after overvaluation is eliminated. The risk that home prices swing below their equilibrium level provides some rationale for government policies directed at relieving pressure on inventories and improving market sentiment by limiting house-price declines as a result of preventable foreclosures.

II. A U.S. FINANCIAL CONDITIONS INDEX: PUTTING CREDIT WHERE CREDIT IS DUE

Summary of IMF Working Paper, WP/08/161, by Andrew Swiston.

10. **The working paper constructs a measure of economy-wide financial conditions for the United States.** While interest in the effects of monetary policy on the economy is hardly new, the rapidly growing complexity of financial systems requires a broader view of how overall financial conditions affect the real economy, given their potential significance in aggregate economic fluctuations. Also, estimates of the monetary policy effects on economic activity and prices could be biased if monetary policy reactions to financial shocks are not taken into account. The paper also serves as an alternative way of looking at macro-financial linkages to that outlined in Chapter 3 of this document.

11. **The paper brings together an emphasis on prices of financial assets with a concern for capturing the role of credit availability in the business cycle.** Credit availability refers to the willingness of lenders to provide funds at the market interest rate, which encompasses a number of non-price elements. It is closely related to shifts in the supply of credit, and relatively independent of credit demand. Following the lead of other authors, the Federal Reserve's Senior Loan Officer Opinion Survey on Lending Practices (SLOOS) is used to proxy economy-wide credit availability. The SLOOS is highly correlated with real activity, with periods of sharp tightening in lending standards generally matching up with the onset of economic downturns (Figure 1).

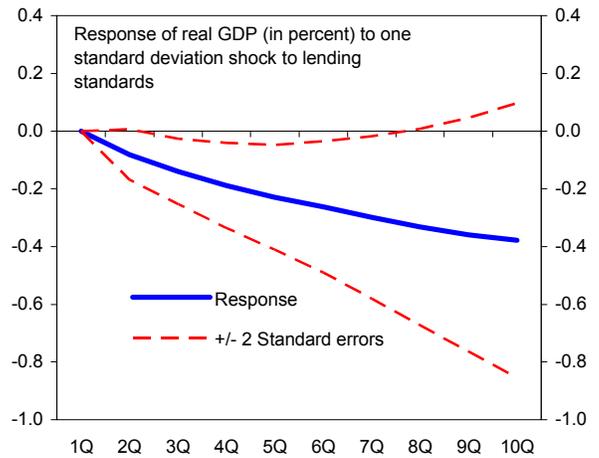


12. **The financial conditions index (FCI) constructed in the paper includes a range of variables covering major financial markets and channels of transmission.** The estimation uses vector autoregressions (VARs), which incorporate endogenous responses of financial variables to economic activity—as well as to each other—into estimates of macro-financial linkages. The FCI is calculated by weighting together impulse-response functions of the impact of shocks to each variable on growth over the next eight quarters. Defined in this way, the “index” is not an abstract number but intuitively conveys the impact of current and past financial conditions on GDP growth prospects.

13. **In the calculation credit availability (as measured by lending standards, and not found in most FCIs) is found to be an important driver of the business cycle.** It accounts for over 20 percent of the typical contribution of financial factors to growth. A one standard deviation shock to lending standards (a tightening of net responses by 6.8 percentage points)

reduces GDP growth by more than $\frac{1}{3}$ percentage point over two years (Figure 2). Financial accelerator effects account for some of the impact, as the effects of a credit squeeze on growth are followed by significant rises in corporate risk spreads and declines in equity returns. The estimated impact of monetary policy on growth is also influenced by the inclusion of lending standards. Monetary policy seems to move to offset credit tightening (which is a good predictor of future activity) as well as current shocks to real GDP growth, while the effects of changes in policy rates seem to feed through loan standards, supporting the existence of a credit channel of monetary policy.

Figure 2. Credit Supply Shocks and Growth

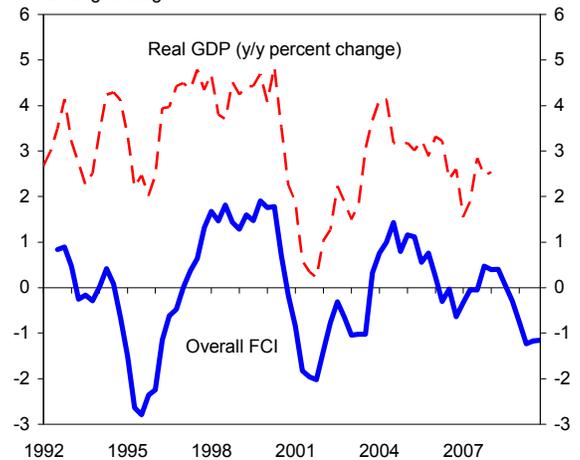


Source: IMF staff calculations.

14. **The overall FCI also contains statistically significant effects on GDP growth from shocks to corporate bond yields, equity prices, and real exchange rates.** As can be seen in Figure 3, movements in the FCI appear to closely track the U.S. economic cycle (the FCI is expressed in terms of its annualized contribution to real GDP, so Figure 3 compares the four-quarter moving average FCI with the four-quarter percent change in real GDP).

The FCI accurately tracks both the timing and magnitude of major business-cycle movements since the early 1990s. Because it incorporates information from financial shocks over a period of eight quarters preceding the quarter in which GDP is measured, the FCI contains a substantial amount of leading information about economic activity. It anticipates turning points in activity some six to nine months ahead, and seems to be a better predictor of future growth than the index of Leading Economic Indicators.

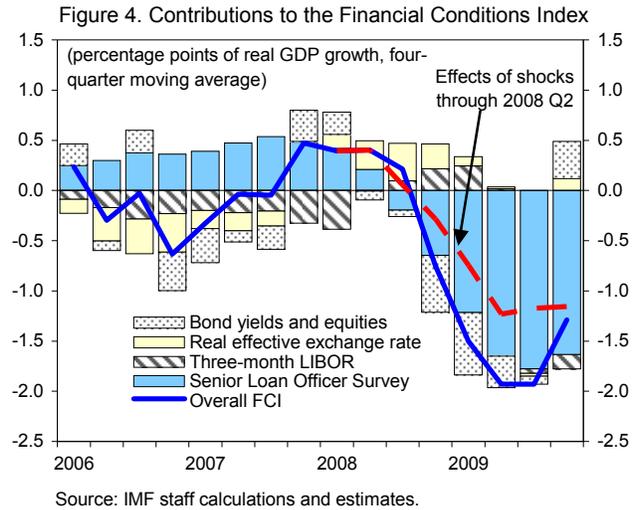
Figure 3. Financial Conditions Index
In percentage points of annualized GDP growth, four-quarter moving average



Sources: Haver Analytics; and IMF staff calculations.

15. **This framework can also be applied to assess the impact of financial conditions on growth over the forecast horizon.** Figure 4 projects the FCI forward by combining estimates of the lagged impact of shocks that have already occurred with a measure of future shocks implicit in the staff's financial sector assumptions. The solid line shows the overall impulse of financial conditions to year-over-year real GDP growth, with the columns decomposing the impact into the various components and the dashed line indicating the effects of shocks through the second quarter of 2008. Financial conditions remained relatively accommodative into early 2008 as the lagged impact of easy credit availability

offset the more recent tightening associated with the credit market turmoil. However, financial conditions are projected to shave about two percentage points off growth by mid-2009, as the effects of monetary policy easing and dollar depreciation will be more than outweighed by credit supply constriction, equity price declines, and rises in corporate risk spreads. About 1¼ percentage points of the tightening results from the lagged transmission of shocks that have already occurred, while the staff's financial forecast, which envisages some further tightening of loan standards, implies a further ¾ percentage point slowdown.



Conclusions and Policy Implications

16. To summarize:

- **Credit supply shifts, as proxied by lending standards, are a primary factor in U.S. business-cycle fluctuations.** A tightening of 20 percentage points in standards reduces GDP by ¾ percent over 1 year and 1¼ percent over 2 years, in line with other estimates using this variable (see also Chapter 3). The importance of lending standards is robust even when accounting for the forward-looking information contained in other financial markets. This provides strong evidence of a causal relationship between credit availability and economic activity, and questions the alternative view that financial institutions merely tighten lending standards to guard against future losses when an economic slowdown is already foreseen.
- **Monetary policy, corporate bond yields, equity returns, and the real exchange rate also affect output.** These results underline the need to incorporate a range of financial market information when evaluating financial conditions.

17. **This analysis suggests that financial conditions will weigh heavily on growth over the next year.** Some segments of the financial market have returned to a more normal state of functioning, and the risks of a systemic crisis have receded. Monetary policy easing and the depreciation of the dollar will support growth going forward. However, the lagged effects of previous shocks, plus ongoing tightness in credit supply as financial institutions unwind balance sheet strains, seem likely to place a continued drag on economic activity.

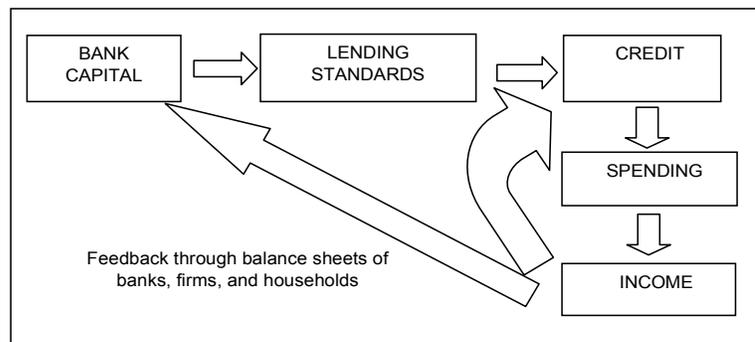
III. CREDIT MATTERS: EMPIRICAL EVIDENCE ON U.S. MACRO-FINANCIAL LINKAGES

Summary of IMF Working Paper, WP/08/169, by Tamim Bayoumi and Ola Melander

18. **How deep and protracted will the current U.S. economic slowdown be?** One of the main determinants will be how balance-sheet deterioration for banks and other leveraged lenders affects credit and spending. A particular concern is the possibility of an adverse feedback loop from economic activity to the financial system, with second-round effects on the economy through reduced credit availability.

19. **The paper develops a practical framework for policy analysis of macro-financial linkages.** It complements the reduced form Financial Conditions Index discussed in Chapter 2 with a more structural approach examining individual linkages between credit and spending. We start the process by assuming an exogenous negative shock to the bank capital-asset ratio, for example from a rise in bank loan losses. In response, banks tighten their lending standards, reducing credit availability. A credit tightening causes spending to fall, both directly through credit constraints and indirectly through the effects of an economic slowdown on balance sheets of banks, households, and firms (Figure 1).

Figure 1. A Framework for Macro-Financial Linkages

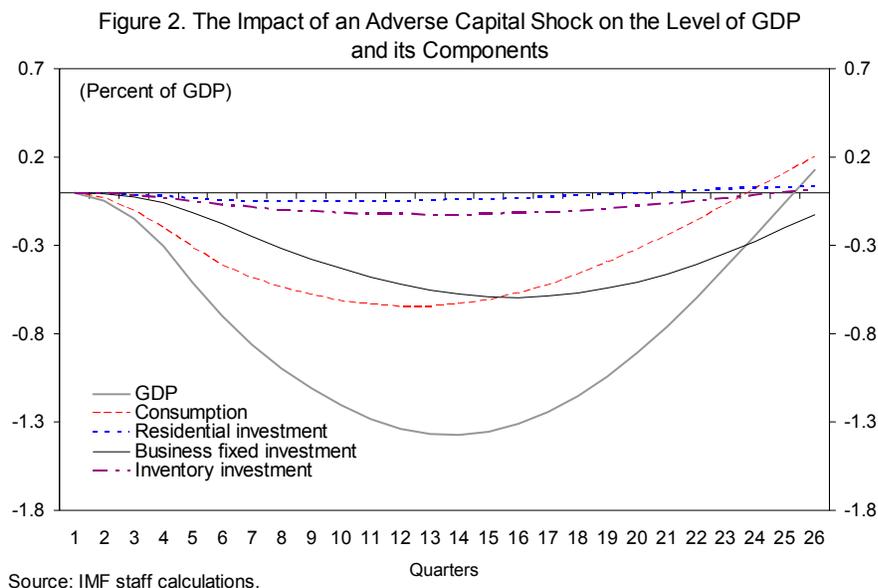


20. **The analysis traces the cycle for: (1) consumer credit and consumption; (2) home mortgages and residential investment; and (3) firms' credit market borrowing and business fixed and inventory investment.** The regression results indicate:

- Squeezes in bank capital gradually lead to a significant tightening in standards for all types of bank loans.
- Bank-lending standards, in turn, feed through into credit flow after a modest delay.
- Changes in credit lower real spending and GDP, with the fastest and largest effect coming from consumer credit onto consumption while effects of credit onto business investment are somewhat smaller and more elongated. Spending effects are particularly small for mortgage borrowing, as most mortgages finance existing homes rather than new ones (and, in any case, finance homes that have already been built).

- There are significant feedbacks from slower activity onto credit through loan losses, which worsen the bank capital-asset ratio, and through borrowers' income and collateral, which reduce the desire of banks to lend to individuals and firms.

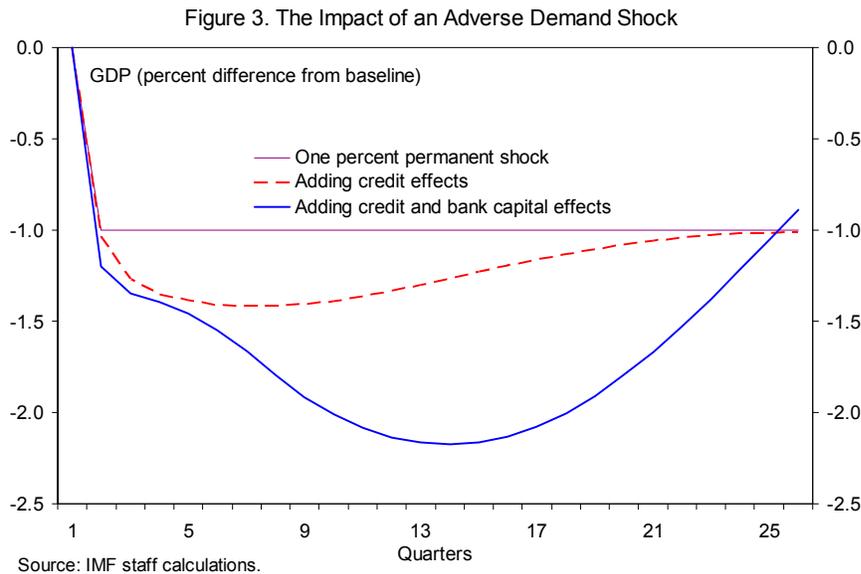
21. **An exogenous one percentage-point fall in the capital-asset ratio (close to what has been experienced since last August) ultimately reduces GDP by 1½ percent.** As shown in Figure 2, there is a gradual slowdown of economic activity as lending standards tighten over time, which results in further declines in the capital-asset ratio before lower lending gradually restore capital. The negative effect on GDP grows gradually over time, peaking at 1.4 percent of GDP three years after the initial capital-asset ratio shock and two years after the maximum impact on bank lending standards (the impact on growth peaks at ¾ percent slightly over a year after the initial shock to capital).



22. **Changes in consumption and business fixed investment are the main drivers of the fall in GDP.** Consumption responds more rapidly than business fixed investment to credit constraints, as would be expected given the longer planning horizons involved in investment decisions. The response of residential investment is very minor, reflecting the small estimated effects of mortgage credit on spending, and the contribution of inventory investment is only somewhat larger.

23. **The model can also be used in reserve gear—to examine how financial channels amplify and elongate a shock to real demand.** Figure 3 shows the response to a permanent negative decline in real consumption and investment totaling 1 percent of GDP. A weaker macroeconomic environment lowers the capital-asset ratio and tightens bank lending standards even as it reduces borrowers' credit worthiness. The resulting credit tightening has similar time lags and dynamics for sub-components of spending as a financial shock, with the impact on the level of GDP gradually growing from the initial shock of 1 percent to 2.2 percent after three years before falling subsequently. Thus, the initial demand shock is

about doubled through financial linkages. Similar overall patterns are evident when (possibly more realistic) temporary shocks to spending are used.



24. **The model can shed light on the split between the bank-lending and financial-accelerator (i.e. credit worthiness) channels.** When the bank-lending channel is eliminated by leaving the capital-asset ratio unchanged, the impact on GDP is reduced to 1.5 percent from 2.2 percent in the full model. This result implies that bank-lending and financial-accelerator effects have approximately the same quantitative importance. A striking difference in the model without the bank-lending channel is that the peak effect on GDP occurs much sooner than in the full model (after 6 quarters rather than 13 quarters). Thus, bank lending both deepens and lengthens the economy's response to shocks.

Conclusions and Policy Implications

25. **The analysis of macro-financial linkages implies that:**

- Bank strains have a relatively gradual impact on growth, peaking over a year after the initial shock to bank capital.
- These delays reflect lags in all links in the system, from bank capital to lending standards, standards to loans, loans to spending, and weaker GDP back to bank capital and borrower credit worthiness.

26. **Our results underline the risk that strains to banks' capital could continue to weigh on growth, notwithstanding the impressive amounts of capital already raised.** It also emphasizes the importance of continuing to encourage banks to improve their capital-asset ratio through raising more capital rather than a generalized shrinking in assets

IV. THE REAL EFFECTS OF THE SUBPRIME MORTGAGE CRISIS

Summary of IMF Working Paper, WP/08/186, by Hui Tong and Shang-Jin Wei

27. **This paper uses a different perspective—firms’ equity prices—to evaluate how the U.S. housing market crisis is affecting real activity.** Spillovers to firms could come through household balance sheet strains, hitting companies particularly dependent on discretionary consumer spending. But there is also a potential supply-side channel through tightened credit to firms.

28. **The importance of credit constraints in current circumstances is far from evident.** Non-financial firms held an abundance of cash prior to the crisis and the net debt ratio has exhibited a secular decline, suggesting there could be only limited liquidity tightening outside the financial sector. However, rather than taking comfort in these aggregate trends, the paper uses the fact that non-financial firms differ in their need for external funds to measure the impact of credit constraints. The idea is that tightening credit is likely to be more damaging to those firms that are initially relatively more credit constrained.

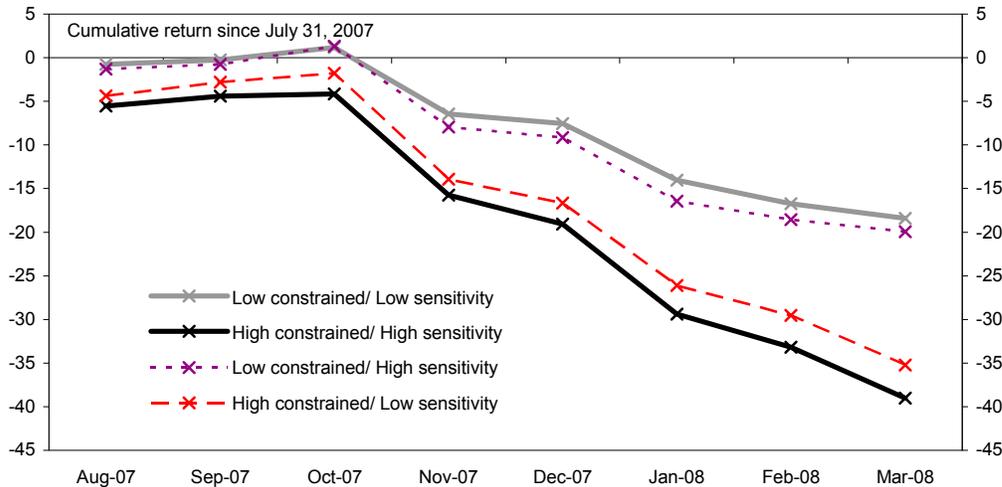
29. **The analysis uses equity price changes across firms to distinguish the impact of the demand shock and credit constraints.** The innovative approach uses cross-section regressions to compare the pattern of equity price changes since last August with those expected after a consumer demand shock and in response to credit constraints. The demand shock is identified using equity-price responses to the 9/11 attack, when consumer spending was expected to fall even after financial stability was rapidly restored by swift Fed action. A recently-developed measure of firms’ need for external financing captures sensitivity to credit constraints. The paper includes numerous robustness checks, including adding proxies for sensitivity to exchange rate movements and commodity prices, and alternative indices of external financing needs.

30. **While there were sporadic concerns about subprime losses in late 2006 and early 2007, their wider consequences only became broadly recognized in August 2007.** Based on a search of news articles that contain the words “subprime” and “crisis” in all U.S. newspapers, there was a sustained rise in news stories after early August 2007. Hence, the main results are for the period from July 31, 2007 to March 31, 2008.

31. **The results suggest that both shocks are at work, but the credit squeeze seems to explain more the cross-sector variation of stock returns than does lower demand.** A one standard deviation increase in a firm’s credit constraints is associated with an additional 12½ percent fall in its equity price from end-July 2007 through end-March 2008. In comparison, an equivalent increase in sensitivity to consumer discretionary spending is associated with a stock price contraction of 3½ percent during the same period.

32. **A stock-portfolio analysis also point to the larger importance of credit constraints.** A “portfolio approach” divides firms into equally-sized groups with different characteristics, in this case on credit constraints and sensitivity to consumer demand. Figure 1 shows that, since last July, declines in the “high credit constraint/high demand sensitivity” portfolio are double that of the “low credit constraint/low demand sensitivity” portfolio, while comparing “high constraint/low sensitivity” and “low constraint/high sensitivity” portfolios shows the greater importance of credit constraints in explaining overall patterns.

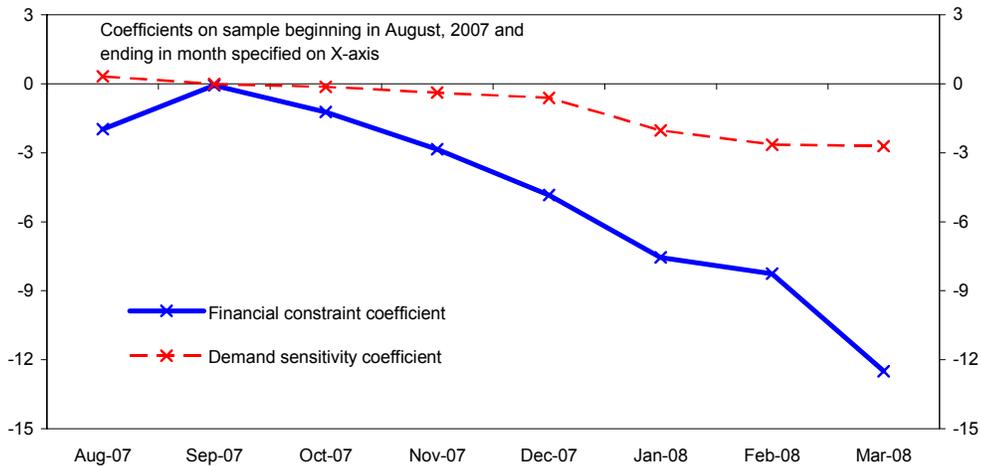
Figure 1. Stock Returns By Credit Constraint and Demand Sensitivity Group



Source: IMF staff calculations.

33. **The paper also traces the importance of demand sensitivity and financial constraints over time.** It conducts the baseline regression adding one month each time to the sample (Figure 2). Market reaction to the housing crisis has manifested itself in incrementally large negative coefficients on the proxies for credit constraints and, to a smaller extent, sensitivity to consumer spending. Indeed, the loss of consumer confidence does not appear to be perceived as a major factor for firms’ prospects until early 2008.

Figure 2. Key Regression Coefficients from Successively Expanding Regression Samples



Source: IMF staff calculations.

34. **The housing crisis was accompanied by other changes in the economic environment, including a depreciation of the dollar and a surge in commodity prices.**

The paper accounts for firm-level *ex post* exposure to these factors by interacting correlations between weekly stock price movements and both major exchange rates and commodity prices from 2004 to 2006 at the firm level with observed movements in exchange rates and commodity price movements in the sample period. Regressions including these series show that both liquidity constraints and demand sensitivity continue to have statistically significant effects, while the energy price hike shows a pronounced effect on equity returns across firms.

Conclusions and Policy Implications

35. **This paper quantifies the importance of tightening liquidity constraints and a deterioration of consumer confidence on equity prices as a result of the housing crisis.** It finds that both channels are at work, but that, even though many firms are in good financial shape, credit constraints appear more significant in explaining cross-firm differences in equity-price declines. Indeed, credit constraints seem to explain at least half of the drop in equity prices for firms that were initially highly liquidity constrained.

36. **While the nonfinancial sector started with strong balance sheet conditions, the analysis suggests credit constraints are shaping market views of firms' prospects.**

Hence, the impact of a potential credit squeeze on the corporate sector should not be ignored. The fact that markets are differentiating between firms with different credit needs suggests that at least some of the improvement in firms' balance sheets in recent years may have reflected a defensive response to rising uncertainties "precautionary saving", rather than a fundamental improvement in financial resilience.

V. HOUSE PRICES AND REGIONAL CYCLES IN THE UNITED STATES

For More Detailed Results Contact: Marcello Estevão and Natalia Barrera

37. **House-price busts create severe imbalances that may contribute to longer and deeper recessions.** Pure demand shocks (e.g., a drop in consumer confidence or lower government spending) tend to reverse faster than housing-price shocks and, it is generally believed, can be more easily counteracted by policy moves. By contrast, house prices affect household balance sheets and the health of financial system, possibly resulting in longer-term strains, while some of the ancillary effects of housing-price busts, e.g. wider credit spreads, may limit the potency of monetary policy actions.

38. **International evidence suggests that housing-price busts have been associated with longer recessions but there is no systematic study for the United States.** Using data for 14 industrial countries from 1970 to 2000, the IMF's Spring 2003 *World Economic Outlook* suggested that house-price busts were associated with longer and deeper recessions. However, the study does not show causal effects and does not include U.S. episodes because the country did not have a national housing crisis in the sample period. Moreover, greater U.S. economic flexibility compared to other industrial economies implies that the link between house-price busts and recessions could be weaker in United States.

39. **This summary presents evidence that regional housing-price busts lengthen U.S. regional recessions.** The analysis uses data for the 9 U.S. Census divisions, using unemployment rates as the business-cycle measures (because regional GDP is only available at an annual frequency). The following were used to define housing busts and recessions:

- *House-price downturns* occur when real housing prices (OFHEO housing-price index divided by regional CPI) decline for at least 5 consecutive quarters. Judgment was used when interruptions of only one or two quarters occurred.
- *Housing busts* are the most severe house-price downturns, defined as the episodes in the top quartile of the distribution of busts.
- *Regional recessions* are defined as periods of unemployment consistently above the regional natural rate as determined by a Hodrick-Prescott filter (a definition is needed as the NBER only dates national recessions). The recession *length* is the number of months between the time when the unemployment rate rises above its natural rate and the time it returns to it. The *contraction* phase goes up to peak unemployment rate and the *recovery* phase goes from peak unemployment rate to when it equals its natural rate.

40. **U.S. regional recessions associated with house-price busts lasted on average 31 months longer than other episodes** (Figure 1). The methodology detected 29 regional recessions with six of them happening after a housing-price bust started (Table 1). On

average, recessions during housing-price busts lasted 76 months while in other episodes the average was 45 months. This gap was larger for recoveries than for contractions (19 months versus 10 months).

41. Any analysis must recognize that, even though housing busts and recession length are highly correlated, busts could just be the result of long recessions. To shed light on a possible causal effect from busts to recession length, we run regressions between year-over-year changes in real housing prices *before* a recession begins on the recession's duration (and, separately, on the duration of its contraction and recovery phases). By using information before the onset of a recession to explain its length, the reverse causality going from the length of a recession to changes in real housing prices is largely mitigated. An interactive term between real housing price changes and a dummy for recessions associated with housing-price busts is included to test for the effect of large housing-price declines on recession length.

42. Econometric evidence points to a causal relationship from house-price busts to longer recessions. The first column of Table 2 shows that housing-price busts lengthen recession spans mostly by lengthening the unemployment recovery period (column 4)—i.e. the coefficient for the interactive term is negative and significantly different from zero. The results for the contraction phase are weaker (not shown). The estimation suggests that there is something special about busts, as moderate changes in real housing prices do not affect recession length significantly, as the coefficient for the linear term is insignificantly different from zero. However, changes in housing prices could be capturing the severity of the recession shock rather than pure housing-price effects. Therefore, columns 3 and 6 control for year-over-year changes in real regional personal income before the onset of a recession (and an interactive term with the dummy for busts) to mitigate this criticism. Previous declines in real income are also found to lengthen recessions, but housing-price busts remain a highly significant factor. Other robustness checks yield similar results.

Conclusions and policy implications

43. Housing-price busts appear to lengthen U.S. regional recessions, most notably the recovery phase. This plausibly reflects the impact of house values on household and financial balance sheets. Lower house values reduce household wealth and collateral for borrowing, affecting medium-term consumption and savings behavior. Also, mortgages are an important part of financial sector assets. Falls in housing values thus have a strong impact on financial sector balance sheets (particularly as they are generally viewed as relatively safe assets), limiting medium-term credit availability and hence spending.

Housing busts and regional unemployment cycles

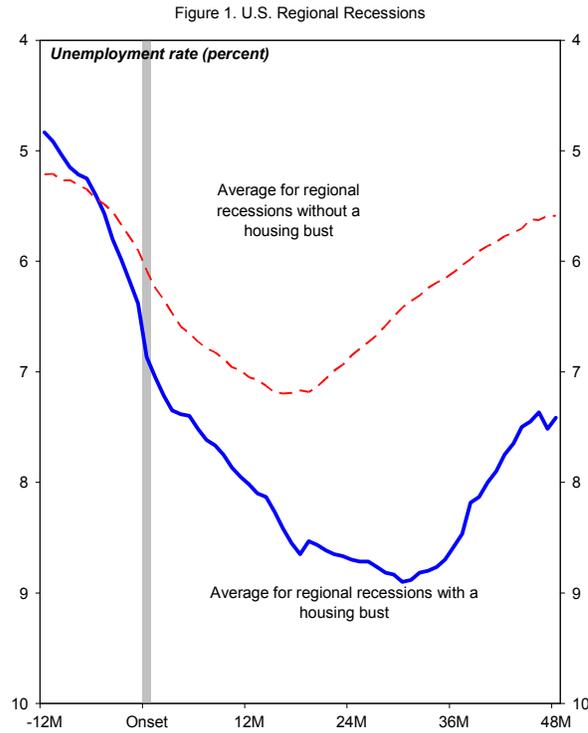


Table 1. Regional Unemployment Cycles.

<i>Excluding cycles occurring around housing busts</i>			
Census division	Start	Trough	End
New England	Jul-81	Jun-82	Jan-84
New England	Apr-02	Apr-03	Mar-07
Middle Atlantic	Sep-81	Jan-83	Dec-84
Middle Atlantic	Nov-01	Dec-02	Jan-05
East North Central	Feb-91	May-92	Apr-94
East North Central	Oct-01	Jul-03	May-06
West North Central	Oct-90	Feb-91	Mar-94
West North Central	Oct-01	Jul-03	May-06
South Atlantic	Feb-81	Dec-82	Jan-85
South Atlantic	Nov-90	Mar-92	Dec-94
South Atlantic	Aug-01	Jul-03	Sep-05
East South Central	Jul-80	Jan-83	Jun-87
East South Central	Feb-91	Jul-91	Jul-93
East South Central	Sep-01	Aug-03	Sep-06
West South Central	Mar-82	Jul-83	May-84
West South Central	Jul-91	Jun-92	Jul-94
West South Central	Nov-01	Jun-03	Apr-06
Mountain	Dec-81	Jan-83	Dec-83
Mountain	Jan-85	Jan-87	Jun-88
Mountain	Sep-91	May-92	Sep-93
Mountain	Aug-01	Mar-03	Dec-05
Pacific	Sep-81	Jan-83	May-85
Pacific	Oct-01	May-03	Feb-05

<i>Cycles occurring around housing busts</i>			
Census division	Start	Trough	End
New England	Apr-90	Nov-91	Mar-96
Middle Atlantic	Jan-91	Jun-92	Aug-96
East North Central	May-80	Nov-82	Aug-86
West North Central	May-80	Nov-82	Sep-87
West South Central	Dec-84	Jul-86	Mar-89
Pacific	Mar-91	Nov-92	Dec-96

Table 2. Estimating the Effect of Past Changes in Real Housing Prices on Recession and Recovery Length using U.S. Regional Data.

<i>Dependent variable:</i>	<i>Recession length (number of months)</i>			<i>Recovery length (number of months)</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta rhp-1$	0.52 (0.59)		0.19 (0.58)	0.33 (0.47)		-0.04 (0.42)
$\Delta rin-1$		-3.69 ** (1.27)	-2.57 * (1.27)		-3.57 ** (0.92)	-2.88 ** (0.92)
$bust * \Delta rhp-1$	-4.35 ** (1.12)		-2.93 * (1.22)	-3.30 ** (0.88)		-1.90 * (0.88)
$bust * \Delta rin-1$		-0.31 (2.23)	0.31 (2.07)		0.69 (1.60)	1.24 (1.49)
Number of observations	28	28	28	28	28	28
Adjusted R ²	0.35	0.31	0.43	0.34	0.41	0.51

$\Delta rhp-1$ = percent change in real housing prices in the 12 months leading to the recession.

$\Delta rin-1$ = percent change in real regional income in the 12 months leading to the recession.

Real housing price and regional income respectively measured as the OFHEO home price index and personal income in the division divided by the CPI of the larger census region.

There are 9 Census divisions and 4 census regions.

Figures in parenthesis are standard errors. * means 5 percent level of significance and ** means 1 percent level of significance.

Sources: Office of Federal Housing Enterprise Oversight; Bureau of Labor Statistics; Haver Analytics; and staff estimates

VI. ANALYZING THE SOURCES OF (IN)STABILITY IN THE U.S. BANKING SECTOR

For More Detailed Results Contact: Christian Capuano and Miguel Segoviano

44. **Financial strains, including the rescue of Bear Stearns, have focused attention on links across financial institutions, including the concept of “too interconnected to fail”.**

Banks are linked directly through interbank markets and issuance of syndicated loans, and indirectly through lending to the same sectors. Given the uncertainties in measuring such linkages directly, it seems best to use estimates derived from market prices.

45. **Accordingly, this paper uses default probabilities extracted from credit default swaps to examine interdependence and systemic risk across the ten largest U.S. banks.**

It comprises five bank-holding companies (Bank of America, Citigroup, JPMorgan, Wachovia, and Wells Fargo) and five investment banks (Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch, and Morgan Stanley). They account for the bulk of the U.S. financial system (85 percent of assets insured by the Federal Deposit Insurance Corporation).

46. **The novel nonparametric approach used is equivalent to viewing the banking system as a portfolio of banks.** The results thus take account of how risks to one bank affect other banks’ default chances—in essence, the full probability function of default risks is estimated. A particularly useful feature of the approach is that, in contrast to most models, the estimates of systemic risk are time varying, allowing an examination of how they react to risks to individual institutions over periods of financial stress.

47. **The results suggest close links between default risks across major U.S. banking groups.** The top panel of Table 1 shows a matrix of probabilities that a given bank (either a bank holding company, BH1, BH2, etc., or investment bank IB1, IB2, etc.) would fail assuming that another bank has already failed at end 2006. For example, the entry in the second row of the first column indicates that, at the end of 2006, if BH1 were to default, BH2 would have a 42 percent chance of also defaulting. In reverse, looking at the first row of the second column suggests that a default by BH2 would lead to a 50 percent chance of BH1 defaulting. Across the entire matrix the lowest conditional probability of default is 18 percent and the highest 70 percent. In short, the U.S. banking system is highly integrated.

48. **Furthermore, these links appear to have risen as financial risks intensified, implying that systemic risk rose by more than those of individual institutions.** The middle panel of Table 1 shows the estimated default risks for March 14, 2008, at the height of concerns about the stability of the U.S. financial system. As can be seen in the middle panel, the probability of BH2 defaulting if BH1 defaulted is estimated to have risen to 71 percent. More generally, the range of all probabilities of default rose to 19-98 percent. Consequently, while the probability of an individual bank defaulting had risen by fourteen times from end-2006 to March 14, 2007, the probability of all banks defaulting had risen by

twenty five times (Figure 1). As a result of Fed actions, probabilities of individual and joint defaults have subsequently fallen rapidly, but remain elevated (see also the bottom panel in Table 1 for the default risks matrix for May 21).

49. **The method also provides estimates of changes in expected and unexpected losses (ULs) of the banking system at different points of the economic cycle.** A standard view is that expected losses should be covered by income and unexpected losses by capital. From the model, it is possible to examine how the need for capital has changed over time. Again, a novel feature of the analysis is that the estimated losses not only take into account changes in individual banks' probability of default, but also changes in banks' default interdependence. One limitation of this exercise is that, because of data availability, this analysis only covers on-balance sheet assets, and hence does not include the effects of off-balance sheet assets, such as those held in special investment vehicles or conduits.

50. **Compared to earlier calmer periods, unexpected losses have increased and regulatory buffers have eroded.** Compared to end-2006, expected and unexpected losses peaked in mid-March when systemic risks were at their height and have come down significantly since then, but remain much above pre-crisis levels. At the same time, provisions and profits, and different measures of capital buffers, have decreased (Figure 2). As a result, there still appears to be significant pressure on bank capital despite banks' actions to raise equity, consistent with anecdotal evidence about pressures on bank balance sheets.

Conclusions and Policy Implications

51. **The major U.S. banking groups appear to be highly interconnected, which helps explain the Fed's role in supporting the rescue of Bear Stearns.** The analysis suggests that a default by Bear Stearns would have involved significant risks of further defaults by other major financial institutions. Given these systemic risks, the Fed's actions to facilitate a rescue of Bear Stearns by JPMorgan appears prudent. These results also underscore the importance of the Fed's continuing efforts to enhance the market infrastructure for over-the-counter credit instruments in order to improve risk assessment and decrease interdependencies across banks. Finally, the results also suggest continuing strains on bank capital, underlining the importance of further encouraging institutions to raise capital.

52. **Systemic risks appear to rise and fall by more than risks to individual institutions, pointing to the need for a focus on systemic concerns.** The Fed and the Securities and Exchange Commission are already discussing new modalities for overseeing investment banks. More generally, the Treasury blueprint for the future of financial regulation sees the Fed as the institution responsible for systemic financial issues. Finally, the fact that systemic risks vary significantly over time suggests that it remains important for the Fed to retain access to supervisory information and direct connections to markets.

Table 1. Default Dependence Matrix 1/

Date	BH1	BH2	BH3	BH4	BH5	IB1	IB2	IB3	IB4	IB5	Row average
December 29, 2006											
BH1	1.00	0.50	0.39	0.55	0.45	0.24	0.24	0.26	0.30	0.27	0.36
BH2	0.42	1.00	0.31	0.46	0.37	0.20	0.23	0.23	0.28	0.24	0.31
BH3	0.67	0.64	1.00	0.66	0.61	0.40	0.38	0.40	0.44	0.41	0.51
BH4	0.39	0.39	0.27	1.00	0.38	0.18	0.20	0.20	0.22	0.20	0.27
BH5	0.56	0.54	0.44	0.66	1.00	0.25	0.27	0.28	0.29	0.28	0.51
IB1	0.54	0.56	0.53	0.58	0.46	1.00	0.44	0.50	0.52	0.49	0.54
IB2	0.55	0.63	0.51	0.63	0.50	0.44	1.00	0.53	0.55	0.50	0.54
IB3	0.60	0.62	0.54	0.64	0.51	0.50	0.54	1.00	0.58	0.50	0.56
IB4	0.53	0.59	0.46	0.55	0.42	0.39	0.43	0.45	1.00	0.46	0.47
IB5	0.66	0.70	0.58	0.66	0.54	0.51	0.53	0.52	0.63	1.00	0.59
March 14, 2008											
BH1	1.00	0.46	0.55	0.54	0.43	0.19	0.36	0.28	0.35	0.36	0.39
BH2	0.71	1.00	0.68	0.69	0.58	0.30	0.54	0.42	0.52	0.52	0.55
BH3	0.62	0.49	1.00	0.55	0.46	0.22	0.40	0.32	0.38	0.39	0.43
BH4	0.59	0.47	0.52	1.00	0.47	0.21	0.40	0.30	0.36	0.36	0.41
BH5	0.83	0.72	0.80	0.85	1.00	0.37	0.59	0.49	0.54	0.56	0.64
IB1	0.98	0.97	0.98	0.97	0.95	1.00	0.97	0.97	0.97	0.97	0.97
IB2	0.59	0.57	0.59	0.61	0.50	0.32	1.00	0.47	0.54	0.53	0.52
IB3	0.83	0.79	0.82	0.83	0.74	0.56	0.83	1.00	0.80	0.77	0.78
IB4	0.70	0.67	0.69	0.67	0.56	0.39	0.66	0.55	1.00	0.65	0.62
IB5	0.73	0.69	0.71	0.69	0.60	0.40	0.66	0.54	0.66	1.00	0.63
May 21, 2008											
BH1	1.00	0.51	0.62	0.62	0.47	0.47	0.45	0.36	0.36	0.43	0.48
BH2	0.76	1.00	0.74	0.75	0.63	0.61	0.64	0.51	0.52	0.60	0.64
BH3	0.63	0.51	1.00	0.59	0.48	0.53	0.48	0.37	0.37	0.44	0.49
BH4	0.58	0.48	0.55	1.00	0.46	0.44	0.45	0.34	0.33	0.39	0.45
BH5	0.87	0.78	0.86	0.90	1.00	0.67	0.70	0.59	0.58	0.65	0.46
IB1	0.51	0.45	0.56	0.51	0.40	1.00	0.48	0.40	0.38	0.45	0.52
IB2	0.55	0.53	0.58	0.59	0.47	0.55	1.00	0.46	0.44	0.50	0.52
IB3	0.86	0.82	0.87	0.86	0.77	0.87	0.88	1.00	0.77	0.80	0.83
IB4	0.88	0.86	0.88	0.87	0.77	0.86	0.88	0.79	1.00	0.86	0.85
IB5	0.78	0.74	0.79	0.77	0.66	0.77	0.76	0.63	0.65	1.00	0.73

Source: IMF staff calculations.
1/ Probability of default in one year of the bank in the row, conditional on the default of the bank in the column.

Figure 1. Probabilities of Default

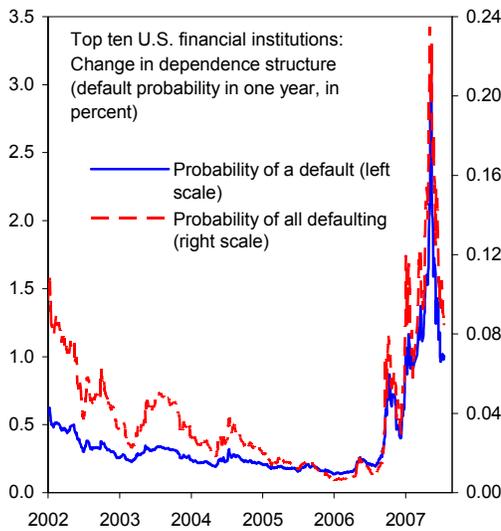


Figure 2. Change in Capital Buffers
Change with respect to December 29, 2006
(in percent of total assets)

