Bank Liquidity and Bubbles: Why Central Banks Should Lean Against Liquidity[1]

Viral Acharya[2]
New York University Stern School of Business, CEPR and NBER

Hassan Naqvi[3]
National University of Singapore and NUS Risk Management Institute.

May 24, 2011

[1]This piece was written for the Loyola University conference on Bubbles and Macroprudential Regulation (April 2011). It is based on a paper written by the authors entitled "The Seeds of a Crisis: A Theory of Bank Liquidity and Risk-Taking over the Business Cycle," Working Paper, New York University Stern School of Business.

[2]Contact: Department of Finance, Stern School of Business, New York University, 44 West 4th Street, Room 9-84, New York, NY 10012. Tel: +1 212998 0354. Fax: +1 212 995 4256. e-mail: vacharya@stern.nyu.edu

[3]Contact: Department of Finance, NUS Business School, Mochtar Riady Building, BIZ 1 #7-62, 15 Kent Ridge Drive, National University of Singapore, Singapore 119245. Tel: +65 6516 5552. Fax: +65 6779 2083. e-mail: naqvi@nus.edu.sg

Abstract

When liquidity chasing banks is high, loan officers (or risk-takers) inside banks expect future losses to be readily rolled over. This insurance effect induces them to relax lending standards. The resulting access to cheap credit can fuel asset price bubbles in the economy. To curb such risk-taking incentives at banks and the resulting asset bubbles, Central Banks should "lean against bank liquidity". In particular, Central Banks should adopt a contractionary monetary policy in times of excessive bank liquidity.

JEL Classifications: E32, E52, E58, G21

Keywords: Bubbles, Greenspan put, leaning against the wind, monetary policy, moral hazard

What caused the tremendous worldwide asset growth in the period 2003–2007, especially in the housing sector, and its subsequent puncture, is likely to intrigue economists for years. However, it was likely not a coincidence that the phase of remarkable asset growth started at the turn of the global recession of 2001–2002 and the preceding South East Asian crisis. In response to the unprecedented rate of corporate defaults, investors looked increasingly to park their wealth in the perceived safety of financial sectors. Loose monetary policy adopted by the Federal Reserve further enhanced the liquidity of financial intermediaries. A period of abundant availability of liquidity to the financial sector ensued, large bank balance-sheets grew two-fold within four years, and when the "bubble burst", a number of agency problems within banks in those years came to the fore. These agency problems were primarily concentrated in centers that were in charge of underwriting loans and positions in securitized assets. Loan officers and risk-takers received huge bonuses based on the volume of assets they originated and purchased rather than on (long-term) profits these assets generated. Moreover, in many cases, it was a conscious choice of senior management to silence the risk management groups that had spotted weaknesses in the portfolio of building risks.[1]

Rajan (2005, 2008) called this bank-level principal-agent problem the "fake alpha" problem - wherein performance is measured based on short-term returns but risks are long-term or in other words in the "tail". An earlier report by the Office of the Comptroller of the Currency in the United States (OCC, 1988) had also found that "Management-driven weaknesses

[1] See Chapter 8 of Acharya and Richardson (2009b), which contains a detailed account of governance and management failures at a number of financial institutions. The most detailed evidence is for UBS based on its "Shareholder Report on UBS's Write Downs" prepared in 2008 for the Swiss Federal Banking Commission.

played a significant role in the decline of 90 percent of the failed and problem banks the OCC evaluated... directors' or managements' overly aggressive behavior resulted in imprudent lending practices and excessive loan growth." They also found that 73% of the failed banks had indulged in over-lending. This suggests that principal-agent problems within banks have been one of the key reasons for bank failures and that bank managers often tend to engage in 'overly aggressive risk-taking behavior'.[2] And, recently Reinhart and Rogoff (2008, 2009), among others, have documented that this lending boom and bust cycle is in fact typical since several centuries, usually (but not always) associated with bank lending and real estate, and also often coincident with abundant liquidity in the form of capital inflows.

Why does access to abundant liquidity aggravate the risk-taking incentives at banks, giving rise to excess lending and asset price bubbles? A simple explanation is that easy access to liquidity gives bankers insurance against meeting their future losses. In response, they under-price the downside risk of loans they make and assets they fund. Somewhat paradoxically thus, seeds of the crisis are thus sown precisely at the turn of the previous crisis or recession, unless Central Banks rein in the abundance of liquidity at the right time.

Consider this argument informally. (The formal treatment is provided in Acharya and Naqvi, 2011). The representative bank collects deposits from savers in the economy and then allocates a fraction of these deposits to houses and investment projects in the form of mortgages and corporate loans. The bank runs the risk of facing interim deposit withdrawals. Alternately, it

[2] The OCC's study was based on an analysis of banks that failed, became problems and recovered, or remained healthy during the period 1979-1987. The study analysed 171 failed banks to identify characteristics and conditions present when the banks deteriorated.

needs to meet draw-downs on home equity and corporate lines of credit. In case, the bank is unable to meet its liquidity shortfalls, it may have to sell its assets at a short notice or raise equity in markets, suffering in the process some liquidation or issuance costs. In order to avoid such costs, the bank has an incentive to set aside some reserves (say, cash and marketable assets or other forms of ready liquidity). The key question is whether the bank sets interest rate on mortgages and corporate loans at a level that appropriately reflects the underlying risk of houses and corporate assets.

In practice, bankers and loan officers often have incentives to give out excessive loans since their payoffs are increasing in the amount of loans advanced. For instance, the Bureau of Labor Statistics reports that "Most (loan officers) are paid a commission based on the number of loans they originate." (See the Bureau of Labor Statistics' Occupational Outlook Handbook, 2008-09 Edition available at http://www.bls.gov/oco/ocos018.htm\#earnings.) It is not hard to see why such incentives arise as part of an optimal contracting outcome of a principal-agent problem. Put simply, if bankers are asked to bear almost all of the risk of loans, then they would be too risk-averse to originate any assets. Risk-averse bank officers need to be compensated for the effort induced in marketing loans. The upside from originating more assets gives bankers incentives to exert effort in seeking more customers and expanding financial intermediation.

However, such upside is usually also combined with performance evaluation of bankers. In particular, the bank's Board (or its risk management function) can conduct an audit to verify whether or not the bankers had acted prudently while originating assets, or instead had acted overaggressively by lowering the lending rate and sanctioning excessive loans. Suppose that subsequent to such an audit, it is inferred that bankers had

indeed acted over-aggressively, then they can be penalized for some (possibly all) of the costs the bank incurs from meeting liquidity shortfalls when the excessive loans go bad. In principle, the threat of such an audit and penalty, if sufficiently stringent, could ensure that bankers take appropriate account of the downside risk of assets while extending credit.

The problem, however, is that while commission or volume-based compensation schemes are pre-committed to bankers, their audits, risk management and subsequent penalties, if any, are necessarily ex post. This leads to a time-consistency problem inside banks. While the bank Board may want to commit ex ante to a tough audit policy, such audits and risk management are costly so that it is ex post optimal for the bank to conduct them seriously only if the bank suffers a liquidity shortfall that is large enough.[3]

This commitment to upside in bankers' payoff but uncertainty about the downside creates an interesting incentive trade-off for bankers. Bankers can increase their payoffs by under-pricing the inherent risk of loans and consequently setting a low interest rate for mortgages and loans. This effectively elicits greater demand for borrowing from households and corporations. But, an increase in credit volume can trigger a liquidity shortfall for the bank, subsequent to which the manager faces the risk of being audited and penalized. The level of bank liquidity, which on a day to day basis is readily observed by bank insiders but not as visible to the bank Board, becomes a crucial determinant of whether bankers will under-price loan risk in the interest rates. In particular, bankers under-price loan risk only when bank

[3] Tirole (2006) refers to this as the *topsy-turvy* problem of corporate governance (which our audit policy can be interpreted more generally as): The principal would like to commit to tougher governance standards, but since implementing them is costly, will do so ex post only if it is desirable at that point of time.

liquidity is sufficiently high.

Intuitively, even though bankers face some downside risk, in the presence of excessive liquidity, the probability that the bank will ex post experience a liquidity shortage is low. In case of no liquidity shortfalls or only a low liquidity shortage, it will not be ex post efficient for the bank to incur costly audits of lending practices. Anticipation of this lax audit policy encourages bankers to engage in excessive lending. Put another way, high bank liquidity has an 'insurance effect' on bankers: it makes banker compensation more sensitive to loan volume – and less sensitive to the downside risk of loans. In turn, this incentivizes bankers to lend below the efficient rate and make more and excessively risky loans. Conversely, for low enough bank liquidity, the perceived risk of audits by bankers is high, the agency problem is not actuated, and bankers do not sanction excessive loans.

This dark side of bank liquidity in inducing excessive lending behavior by bankers ultimately has an impact on asset prices. Suppose that the demand for loans arises from investments by the household sector in real assets of the economy. Then, we can define the "fundamental" asset prices as those that arise in the absence of any agency frictions within banks. If the bank lending rate underprices risks, then there is an increase in aggregate borrowing by household sector from banks. This in turn fuels an excessive demand for assets in the real sector, which in absence of a perfectly elastic supply, leads to prices rising above their fundamental values. This asset price inflation constitutes a "bubble". Importantly, such bubbles are formed only when bank liquidity is high enough as only then do bank managers underprice risk.

To better understand the mechanics behind the formation of a bubble, the four-quadrant diagram in Figure 1 is useful. Quadrant I in the figure

depicts the relationship between the downside risk of project failure, and the loan rate charged by the bank. In general, the higher the downside risk of assets, the higher would be the equilibrium lending rate as is captured by the line AA. The loan rate in turn determines the demand for loans and the volume of credit in the economy. The lower the loan rate the higher is the amount of expected investment in the economy as is captured by the line NN in quadrant II. The increase in investment pushes up the asset demand which in turn pushes up asset prices. This relationship between the demand for the asset and the asset price is captured by the line YY in quadrant III. Finally quadrant IV derives the relationship between the asset price and risk. In general, the higher is the underlying risk the lower will be the asset price as is depicted by the line ZZ.

However, the equilibrium relationship between asset price and risk is derived by tracing the effect of risk on the loan rate, which in turn has an effect on the amount of investment which subsequently determines the asset price. Let the line AA represent the fundamental relationship between risk and the bank loan rate, i.e., the relationship that would be obtained in the absence of agency issues. Then for any given level of risk, the fundamental asset price would be represented by the line ZZ. However, the bank agency problem is actuated for sufficiently high bank liquidity levels whereby the bank loan rate is lowered for any given level of risk. This in turn shifts the AA line to A^1A^1. From quadrant II we know that the volume of credit in the economy increases following lower loan rates. Consequently asset prices increase as is shown in quadrant III. The final relationship between asset prices and risk is shown in quadrant IV and the actuation of the principal-agent problem shifts the ZZ line to Z^1Z^1. In the end, the asset price is higher for the same level of risk once the agency problem is actuated leading

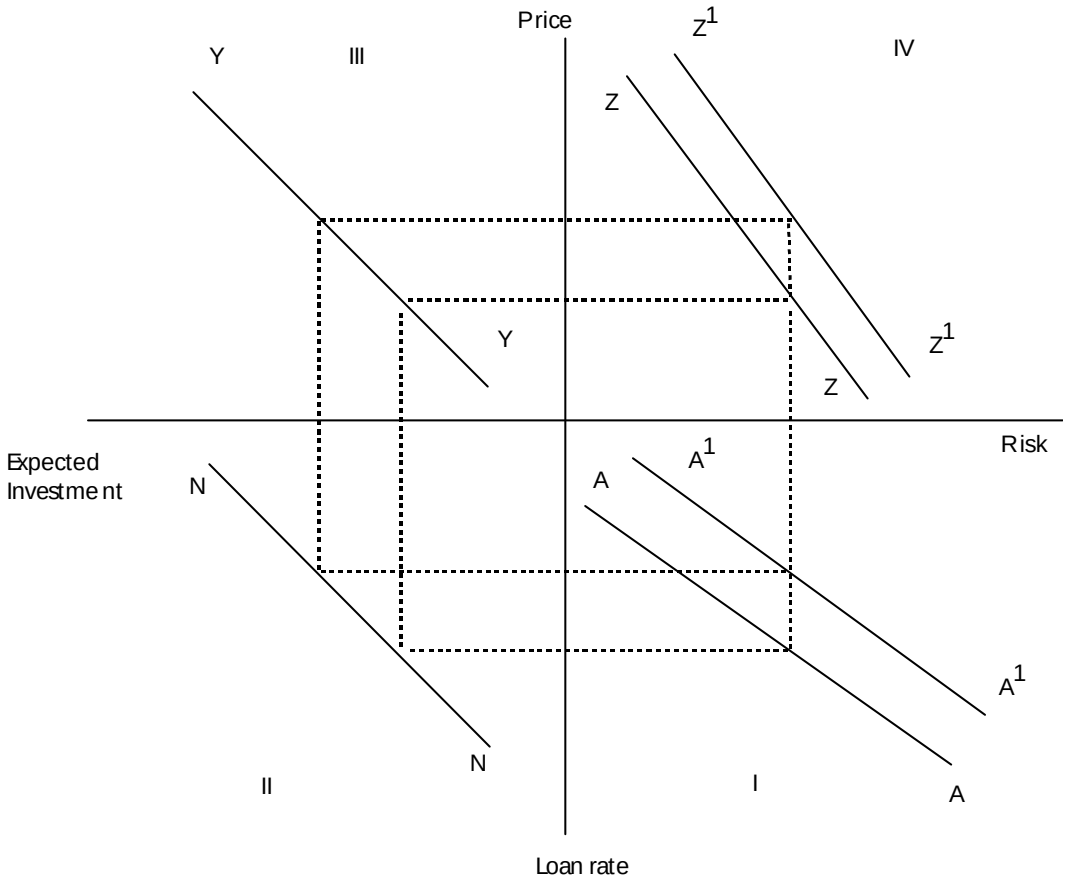

Figure 1: The mechanics of the formation of asset price bubbles.

to the formation of a bubble. This is different from restricting attention to quadrant IV alone in relating risk to asset price, which ignores the role of the banking sector in affecting asset prices.

Given asset price bubbles are formed when bank liquidity is substantially high, the question that arises is when are banks most likely to be flushed with liquidity? In an empirical study, Gatev and Strahan (2006) find that as spreads in the commercial paper market increase, bank deposits increase and bank asset (loan) growth also increases. The spreads on commercial paper are a measure of the investors' perception of risk in the real economy. Intuitively, when investors are apprehensive of the risk in the corporate sector they are more likely to deposit their investments in banks rather than make direct investments.[4] More generally, as macroeconomic risk increases, there is a flight to quality whereby investors prefer to invest in bank deposits rather than engage in direct lending. Subsequently, banks find themselves flushed with liquidity which encourages bankers to increase the volume of credit in the economy by mispricing downside risk of assets and fueling a bubble in asset prices.

What are the implications of this link between bank liquidity and asset prices for optimal monetary policy? If the Central Bank adopts a con-

[4] The flight of depositors to banks may be due to banks having greater expertise in screening borrowers during stress times, inducing a natural negative correlation between the usage of lines of credit and deposit withdrawals as argued by Kashyap, Rajan and Stein (2002). Alternatively, the flight may simply be due to the fact that bank deposits are insured (up to a threshold) by the Federal Deposit Insurance Corporation (FDIC) whereas commercial paper and money market funds are uninsured, at least until the extraordinary actions taken by the Federal Reserve during 2008 and 2009. Pennacchi (2006) finds evidence supportive of this latter hypothesis by examining lending behavior of banks during crises prior to the creation of the FDIC.

tractionary monetary policy in times of excessive bank liquidity, then it can counter the perverse incentive effect on bankers of flight to quality by drawing out the increases in bank liquidity and avoiding the emergence of bubbles. On the contrary, if the Central Bank adopts an expansionary monetary policy in such times, then this accentuates the formation of bubbles. Intuitively, an increase in the money supply only serves to increase bank liquidity further when there is already a flight to quality of deposits. In contrast, in times of scarce bank liquidity, banks raise lending rates which can adversely affect aggregate investment. If the Central Bank adopts an expansionary monetary policy in such times, then it can boost aggregate investment by effectively injecting liquidity into the banking system.

Proponents of the "Greenspan camp" often argue that the Central Bank may not be aware where we are in the business cycle and hence whether bank liquidity is increasing or decreasing in macroeconomic risk. Nevertheless, a much simpler policy recommendation is to *lean against bank liquidity* regardless of where we are in the business cycle. The 'Greenspan put' should be employed in times of falling bank liquidity. However, in times when banks are flush with liquidity, a loose monetary policy only enhances the liquidity insurance enjoyed by banks, and thus aggravates their risk-taking incentives. This in turn increases the likelihood of bubbles in asset prices. Thus, the optimal monetary policy involves a "leaning against liquidity" approach, and "leaning against macroeconomic risk" is not necessarily the desirable policy.

One implicit assumption in the analysis is that the central bank can observe aggregate liquidity with a good degree of precision. But this assumption is justified along the following lines: individual bank level liquidity is hard to verify because the presence of the interbank market implies that liquidity moves around amongst banks and hence it is difficult to as-

certain an individual bank's liquidity. But this then implies that aggregate liquidity should be more precisely observable (by the central bank) vis-a-vis individual bank level liquidity (by its owners or the Board).

In terms of historical evidence on the effect of monetary policy on asset prices, Allen and Gale in their book *"Understanding financial crises"* document the following: "In Finland an expansionary budget in 1987 resulted in massive credit expansion. The ratio of bank loans to nominal GDP increased from 55 percent in 1984 to 90 percent in 1990. Housing prices rose by a total of 68 percent in 1987 and 1988... In Sweden a steady credit expansion through the late 1980's led to a property boom." These observations are perfectly in line with the link between bank liquidity and asset bubbles proposed above. Further, this proposed link is also consistent with the generally held view that lax monetary policy in Japan during the mid 1980s led to asset price inflation. Bank of Japan (BOJ) reduced the official discount rate five times between January, 1986 and February, 1987, leaving it finally at 2.5 percent. It is widely accepted that the easy credit policies adopted by BOJ created excess liquidity in the Japanese economy, as also acknowledged by Goyal and Yamada (2004). The sequence of events started with the Plaza Accord (1985), in which the G5 countries agreed on a stronger yen so as to lower the U.S. trade deficit. However, BOJ's intervention in foreign exchange markets appreciated the yen rapidly. Responding to the strengthening yen and seeking to avert deflationary effects in the domestic economy, Bank of Japan lowered interest rates and consequently increased liquidity in the economy. In the subsequent years a large real estate bubble was formed.

One of the causes of the recently witnessed sub-prime crisis has been suggested to be the loose monetary policy adopted by the Federal Reserve

in the United States. In 2003, the Fed lowered the federal funds rate to 1% - a level that at that time was last seen only in 1958. Subsequently banks mispriced risk and engaged in over-lending which finally culminated in the sub-prime crisis. In fact the world was awash with liquidity prior to the crisis creating incentives to disregard the downside risk of housing markets. In their counter-factual exercise, Bean et al. (2010) show (in their Table 3) that an interest rate scenario of 2.5% greater than the Federal Reserve policy rates in 2005 and 2006 would have reduced annual real house price growth by 7%, and 10%, respectively. Geanakoplos (2010) also documents that banks progressively made worse loans from 2003 to 2006; the down payment for mortgages fell from 10%, on average to a low of 2% while the Case Shiller House Price Index climbed from 145 to 190.

The issue of when a central bank should tighten monetary policy following a crisis has resurfaced in the aftermath of the rescue packages administered to recover from the crisis of 2007-09. For instance, the Federal Reserve in the United States has discussed raising the interest paid to banks on their reserves holdings and selling its inventory of mortgage-backed assets as potential tools. The Federal Reserve Chairman Bernanke has however assessed that "The economy continues to require the support of accommodative monetary policies. However, we have been working to ensure that we have the tools to reverse, at the appropriate time, the currently very high degree of monetary stimulus" (Financial Times, February 11 2010).

In contrast, some other countries have already started the monetary tightening process. China, in particular, has "ordered its commercial banks to increase the reserves (by 50 basis points from February 25) they hold, as an effort to control rapid lending, rather than significantly tighten monetary policy" (Financial Times, February 13 2010). The Chinese economy

expanded by 10.7 per cent in the fourth quarter of 2009 and Chinese banks issued a record Rmb9,600bn in new loans in 2009, about double the amount from the previous year, which fueled a rapid increase in asset prices, especially in Chinese stock markets. House prices in China had increased by 7.8 per cent in December 2009 from the same month a year earlier (Financial Times, January 14 2010). Not surprisingly, the liquidity of Chinese banks also soared during this period. In fact, household and corporate deposits in the Chinese banking system are now equivalent to a record 150 per cent of gross domestic product (Financial Times, March 3 2010).

Both of these examples get at the heart of our policy discussion that the key parameter to examine is the extent of bank liquidity and lending in the economy, as in the discussion about Chinese lending and asset prices above. The risk of the Federal Reserve not tightening monetary policy sufficiently soon is precisely that lending may take off by several multiples given the high levels of bank liquidity (reserves) and force the Fed to either tighten excessively ex post or be mopping up after the asset prices have been inflated too high.

In summary, the seeds of a crisis may be sown when banks are flush with liquidity. In particular, (a) bank managers behave in an overly-aggressive manner by mispricing risk when bank liquidity is sufficiently high; (b) asset price bubbles are formed for high enough bank liquidity; (c) bubbles are more likely to be formed when the underlying macroeconomic risk is high as it induces investors to save with banks rather than make direct entrepreneurial investments; and, finally (d) bubbles are more likely to be formed following loose monetary policies adopted by the central bank.

Optimal monetary policy involves a "leaning against liquidity" approach,

i.e., a central bank should adopt a contractionary monetary policy at times when banks are awash with liquidity so as to draw out their reserves; and it should adopt an expansionary monetary policy at times when banks have scarce liquidity so as to boost investment.

Some, most notably Alan Greenspan, have argued that we are never certain "where we are in the cycle"[5] and hence monetary policy should not be used to target asset prices. Even if this is the case a "leaning against liquidity" policy can be rationalized. This is because our argument does not rely on the Central Bank's ability to observe macroeconomic risk. Our policy recommendations are relevant as long as the Central Bank can reasonably monitor aggregate liquidity. As argued earlier this is a plausible assumption. We thus argue that monetary policy should target not just interest rates and employment but also asset prices as they are reflections of the risk appetite of the financial intermediation sector (as also stressed by Adrian and Shin, 2009).

It should be noted that an increase in global macroeconomic risk can also increase bank liquidity of developed economies due to "global imbalances". For instance, Caballero (2009) argues that as a result of the South East Asian crisis and the NASDAQ crash there was an increased global demand for safe securities and the U.S. financial system catered to this demand by creating collateralized debt obligations (CDOs). This in turn was conducive to global imbalances whereby there was an influx of liquidity in the United States financial system from emerging economies. Inevitably this increased the liquidity of the U.S. banking system.

More broadly speaking, the rise in bank deposits in our model could

[5] Alan Greenspan, Financial Times, 27 May 08.

also be interpreted as capital inflows which find their way into an economy's financial system. For instance, similarly to Caballero (2009), Jagannathan et al. (2009) argue that after the stock market crash of 2000, savings from China flowed into the United States debt market. The flow of money into securitized mortgage pools drove down the cost of borrowing by banks, inducing them to relax credit standards, resulting in a housing bubble. The presence of explicit or implicit government guarantees, such as deposit insurance and too-big-to-fail problem (as considered by Allen and Gale, 2000), further accentuate the agency problems inside banks induced by access to abundant liquidity and accelerate the formation of asset-pricing bubbles.

References

[1] Acharya, Viral V., and Hassan Naqvi, 2011, The seeds of a crisis: A theory of bank liquidity and risk-taking over the business cycle, Working paper, New York University Stern School of Business.

[2] Acharya, Viral V., and Matthew Richardson, 2009a, Causes of the Financial Crisis, *Critical Review*, 21(2:3), 195–210.

[3] Acharya, Viral V., and Matthew Richardson (editors), 2009b, *Restoring Financial Stability: How to Repair a Failed System*, New York University Stern School of Business, John Wiley.

[4] Acharya, Viral V., and Tanju Yorulmazer, 2007, Too-Many-To-Fail – An Analysis of Time-inconsistency in Bank Closure Policies, *Journal of Financial Intermediation*, 16(1), 1-31.

[5] Adrian, Tobias and Hyun-Song Shin, 2009, Money, liquidity and monetary policy, *American Economic Review 99(2)*, 600–605.

[6] Allen, Franklin, and Douglas Gale, 2000, Bubbles and crises, *The Economic Journal 110*, 236-255.

[7] Allen, Franklin, and Douglas Gale, 2007, *Understanding financial crises*, New York: Oxford University Press.

[8] Bean, Charles, Matthias Paustian, Adrian Penalver and Tim Taylor, 2010, Monetary policy after the fall, Paper presented at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming.

[9] Bureau of Labor Statistics' Occupational Outlook Handbook, 2008-09 Edition available at http://www.bls.gov/oco/ocos018.htm\#earnings.

[10] Caballero, Ricardo J., 2010, The "other" imbalance and the financial crisis, NBER Working Paper No. 15636.

[11] Farhi, Emmanuel and Jean Tirole, 2009, Collective Moral Hazard, Maturity Mismatch and Systemic Bailouts, NBER working paper 15138.

[12] Friedman, Milton, and Anna J. Schwartz, 1963, *A Monetary History of the United States, 1867-1960*, Princeton University Press.

[13] Gatev, Evan, and Philip E. Strahan, 2006, Banks' advantage in hedging liquidity risk: Theory and evidence from the commercial paper market, *Journal of Finance 61(2)*, 867-892.

[14] Geanakoplos, John, 2010, Managing the leverage cycle, Presentation at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming.

[15] Goyal, Vidhan K., and Takeshi Yamada, 2004, Asset price shocks, financial constraints, and investment: Evidence from Japan, *Journal of Business 77(1)*, 175-199.

[16] Jagannathan, Ravi, Mudit Kapoor, and Ernst Schaumburg, 2009, Why are we in a recession? The financial crisis is the symptom not the disease!, NBER working paper 15404.

[17] Kashyap, Anil K., Raghuram G. Rajan and Jeremy C. Stein, 2002, Banks as liquidity providers: an explanation for the co-existence of lending and deposit-taking, *Journal of Finance 57(1)*, 33—74.

[18] Kindleberger, Charles P., 2005, Manias, panics, and crashes: A history of financial crises, New Jersey: Wiley.

[19] OCC, 1988, Bank failure: An evaluation of the factors contributing to the failure of national banks, Washington D.C., Office of the Comptroller of the Currency.

[20] Pennacchi, George, 2006, Deposit insurance, bank regulation, and financial system risks, *Journal of Monetary Economics 53(1)*, 1–30.

[21] Rajan, Raghuram G., 2005, Has financial development made the world riskier?, *Proceedings of the Federal Reserve Bank of Kansas City, Jackson Hole symposium*, 313-369.

[22] Rajan, Raghuram G., 2008, "Bankers' pay is deeply flawed", *Financial Times*, January 9.

[23] Reinhart, Carmen M., and Kenneth S. Rogoff, 2008, Is the 2007 US sub-prime financial crisis so different? An international historical comparison, *American Economic Review 98(2)*, 339-44.

[24] Reinhart, Carmen M., and Kenneth S. Rogoff, 2009, *This time is different: Eight centuries of financial folly*, Princeton University Press.

[25] Tirole, Jean, 2006, *The theory of corporate finance*, Princeton, NJ: Princeton University Press.