

**Understanding Financial Crises:
Theory and Evidence from the Crisis of 2007-08
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For those who are willing to look at economic history, financial crises are recurring phenomena. They are not as rare as they are often perceived to be. And yet they show up in new guises each time. There are, however, and somewhat fortunately so, common economic forces at work across different crises. My current research has focused on using the financial and economic crises that erupted in the August of 2007 as a laboratory for theoretical and empirical analysis of these common economic forces. I have focused on three: (i) *market failures*, which arise due to externalities (“neighborhood” or “spillover” effects) from the distress of financial firms; (ii) *regulatory failures*, which arise due to time-inconsistency problems, cognitive capture, or capture that is rooted in political economy problems; and, (iii) *government failures*, which arise due to myopia of decision-making in fiscal and debt policy, as well as in policy to bail out a distressed financial sector. I summarize below the research on the first two of these failures and their interactions, based on my NBER Working Papers during 2009 to 2013.

Market Failures I: Short-term debt, default and externalities

Financial firms that engage in lending to households and corporations (banks and “shadow” banks that are not called banks but perform economic functions similar to banks), have always featured short-term debt in their funding structures. The underlying economic rationale

can be understood by considering the problem of the financier that funds a bank but due to information problems lacks precise knowledge and contractibility over loans made by the bank. The financier responds to this problem by saving the option *not to roll over*, or in other words, providing only short-term debt to the bank.

Financial crises occur when the economy is hit by shocks that lead the financier to exercise the option not to roll over the short-term debt because the bank is under-capitalized, i.e., bank-owners have little equity capital left as “skin-in-the-game”, to continue to lend prudently. If shocks are idiosyncratic to a bank, then the under-capitalized banks can be acquired, or their activities re-intermediated, by better-capitalized banks. However, if shocks are aggregate in nature and the entire banking sector is heavily short-term financed, then banks suffer a coincident loss of capital and efficient re-intermediation cannot take place (there may be disorderly liquidations or allocation inefficiency). This induces financiers to not roll over the short-term debt and a “crisis” materializes.ⁱ Indeed, absent sufficient pool of long-term capital in the economy, even relatively small aggregate shocks and inefficiencies perceived by financiers can lead to complete short-term debt “freezes”.ⁱⁱ Interestingly, losses to financiers are less likely in good economic times when the likelihood attached to aggregate shocks is small, leading to greater short-term leverage for the financial sector as a whole – including the entry of highly under-capitalized institutions. Therefore, somewhat counter-intuitively, severity of crises can be greater if an adverse aggregate shock does materialize in good times relative to bad times.

This *market failure* arises due to the coincidence of short-term debt in the capital structures of banks and related financial firms, and aggregate shocks to their asset portfolios. From a normative standpoint, a regulatory attempt aimed at addressing the failure has the flavor that it involves a “tax”, e.g., a requirement that a bank hold a minimum level of equity capital,

that is dependent not just on its own asset portfolio risk and short-term debt, but on “systemic risk”, consisting of the aggregate component of the asset risk and system-wide short-term debt.ⁱⁱⁱ In other words, regulation of the financial sector features *macro-prudential* concerns relating to financial crises and externalities, rather than (or not just) *micro-prudential* concerns relating to the health of individual financial institutions.

In modern financial systems, much leverage is “embedded” in derivative contracts rather than being just in the form of short-term debt. A related but subtler externality arises in the context of derivatives. When an insurer sells protection against a risk to a number of counterparties, each party’s position potentially affects the payoff on other party’s position, in state of the world where the insurer lacks capital to honor its contractual promises. To reflect this *counterparty risk externality* suitably in the price of insurance, it is not adequate for market participants to know the bilateral positions; they need to know “what else is being done”. When risks being hedged are aggregate in nature, private derivative contract terms will not in general internalize the counterparty risk externality, unless terms can be contracted upon the aggregate positions of the insurer. Thus, from a normative standpoint, creating transparency in derivatives market of such aggregate nature or requiring centralized clearing of relatively large over-the-counter (OTC) derivatives markets can be an important part of *macro-prudential* regulation.^{iv}

Regulatory Failures: Inadequacy of micro-prudential capital and liquidity rules

Financial crises engulfed the Western economies starting 2007 and most prominently the United States during 2007-08. In the period leading up to the crisis, banks and related financial firms had extensive short-term debt and common exposure to residential mortgage assets. When aggregate shock in the form of a secular housing price decline in the United States materialized

by end of 2006, short-term debt rollovers became increasingly difficult, there weren't adequate pools of capital to move mortgage assets off the balance-sheets of the financial sector, and eventually, short-term debt markets froze for many financial firms, leading to *en masse* failures in the Fall of 2008.

At a high level, these facts fit the theoretical narrative of financial crises I laid out earlier. It is interesting to note, however, that there was elaborate regulatory apparatus in place both before and during the crisis, in particular in the form of Basel capital requirements. It is useful, therefore, to understand why the financial sector's health eroded so rapidly following the housing price shock. Three examples from my work of *regulatory failures* to address the exposure of the financial sector as a whole to short-term debt and aggregate risk stand out.

First, the financial crisis erupted in the form of rollover problems for short-term asset-backed commercial paper (ABCP) issued by special purpose vehicles (called "conduits" and structured investment vehicles or SIVs). Many of these vehicles were sponsored by commercial banks and effectively guaranteed by them. These guarantees implied that the perceived risk transfer from special purpose vehicles was in effect non-existent. Adequate treatment for sponsoring such conduits *with guarantees* was, however, absent in regulatory capital requirements.^v That this was a regulatory failure can be seen by examining the international data which show that countries such as the United States, the United Kingdom and Germany, which adopted lax capital treatment of ABCP vehicles, had significant presence of their commercial banking sectors in the ABCP market, whereas counterparts in Spain and Portugal, which adopted economically prudent capital treatment of ABCP vehicles, had virtually no presence in this market.^{vi} In effect, while the commercial banking sector looked well-capitalized on regulatory capital front during 2003-07, it had built up significant short-term debt in shadow banks without

an economic transfer of risks; this short-term debt experienced rollover problems starting on 8th August 2007, precipitating the crisis (see Figure 1).

Second, as the rollover problems of short-term debt persisted given the lack of housing market recovery during 2007-08, banks and shadow banks sustained severe losses. The market value of their equity collapsed. A *macro-prudential* or system-wide approach to capital requirement of the financial sector necessitated a prompt response at the early stage of the crisis to get banks to reduce their reliance on short-term debt by issuing equity capital to redeem the debt coming due. And, further erosion of equity capital through payouts to employees and shareholders would have made the financial sector even more fragile. Nevertheless, not only did the distressed financial firms not reduce reliance on short-term debt, they in fact paid out significant dividends – in some cases, increasing the payouts – in spite of mounting losses.^{vii} Throughout this period, banks were deemed to be well-capitalized by (micro-prudential) regulatory capital standards. This contributed to the lack of any significant regulatory action for addressing the worsening rollover risk of banks. In the end, this led to failure or near-failure of most of the largest financial firms in the United States and the Western Europe, captured saliently by the filing by Lehman Brothers for bankruptcy on 15th September, 2008.

Third, markets as well as regulators were caught off-guard by the case of AIG Financial Products which had over \$500billion in notional amounts of outstanding insurances (“credit protections”) sold to counterparties which were themselves large banks and financial firms. AIG FP was essentially deemed to be safe based on its *current* rating, but in effect it had significant leverage *conditional* on a future downgrade and especially so if such downgrade coincided with system-wide stress: such stress would lead to recognition of losses in market prices of its assets and demanding of immediate collateral – a form of rollover risk – by its counterparties. The

public disclosures provided by AIG FP show that the rollover risk it faced was never stated with adequate granularity with respect to significant downgrades nor did it take account of the underlying aggregate risk exposure of the insurances it had sold to counterparties. Such disclosure or transparency was also not required by AIG FP's regulators, allowing the build-up of its significant derivatives book in an unchecked manner.^{viii}

Why did these regulatory failures arise? While potential explanations abound, a leading candidate is that regulation was focused on ensuring the safety and soundness of individual financial institutions with rules and tools that were in many cases inappropriate for assessing the buildup of aggregate risk of assets and rollover risk due to short-term debt of the financial sector.

Market Failures II: Transmission from distressed financial firms to the economy

The market failures arising from failures of large banks or of banking systems at large have received substantial attention in the literature. The focus is typically on the contraction of lending from banks to small and medium-sized enterprises – information-sensitive borrowers – bank lending to whom is not easily re-intermediated by other lenders. My recent empirical work, exploiting as a “laboratory” the period immediately following the rollover risk faced by banks in the ABCP market in August 2007, shows that effects of such failures are more far-reaching and multi-faceted than has been traditionally documented.

One, unlike the market stress episodes of the prior decade (notably the 1998 episode surrounding the near-collapse of Long Term Capital Management), in the 2007-08 crisis the banking sector did not experience an immediate net inflow of deposits. From early 2007 until the government bailout package was put in place, depositors appear concerned of the banking sector health and switched funds to prime money-market funds which invested only in

government securities. Indeed, several banks which had significant exposure to ABCP vehicles and undrawn lines of credit experienced significant rollover risk in the form of withdrawals of uninsured deposits. These banks responded by offering higher deposit rates in order to maintain their deposit base; up until a month before their failure, they succeeded in doing so by luring insured deposits even as their uninsured deposit base shrunk. Focusing *jointly* on deposit flows and rates helps understand that rather than banks being *passive* liquidity backstops or preferred “safe havens” for investors in a crisis, banks are in fact *active* seekers of funding liquidity. Importantly, the fact that banks in trouble sought funding at aggressive rates imposed a deposit-rate externality on the funding costs other banks.^{ix}

Second, the effect of aggregate risk on bank intermediation activity is not limited to spot or term lending as is the focus of current literature. Banks provide liquidity insurance in the form of lines of credit to corporations which enable corporations to free up cash holdings for profitable investments. As aggregate risk rises, ability of the banking sector to smooth fees across firms and honor the lines of credit declines, limiting the extent of liquidity insurance provided to corporations (fewer initiations of lines of credit, as well as higher fees, smaller amounts, and shorter maturities on initiations. This, in turn, induces greater cash holdings and lower investment, even by relatively large corporations of the economy.^x

Third, these effects were not limited to banks in the United States. A significant proportion of intermediation in the form of lines of credit in the United States is provided by foreign banks. While the US banks struggled for deposit funding too, as explained above, their funding was eased in part by the provision of public funding (starting Fall 2007) by the Federal Reserve and Federal Home Loan Banks. In contrast, many foreign banks without depository base in the US lacked access to public funding and faced “dollar shortages”, i.e., rollover risk in

dollars. As a result, the terms on lines of credit provided by foreign (European) banks to US corporations relative to foreign borrowers, worsened until December 2007 (when dollar swap lines were put in place by the Federal Reserve for foreign central banks), relative to such a differential effect in terms of lines of credit provided by US banks.^{xi}

Fourth, inter-bank markets were significantly impaired due to the precautionary demand for liquidity of banks exposed to rollover risks. Using data from the United Kingdom where large settlement banks indicate to the Bank of England each month their desired liquidity in the form of requested reserves, it can be seen that (exposed) banks raised their liquidity demands (more) following the ABCP freeze in August 2007 and the failure of Bear Stearns in March 2008. This liquidity demand was coincident with a rise in spreads charged in the inter-bank market, over and above the Bank of England policy rate, in both secured and unsecured markets. Furthermore, using data on bilateral inter-bank transactions, this rise in spreads can be attributed to the funding problems faced by lending banks rather than the condition of borrowing banks. This suggests that the inter-bank market stress during 2007-08 was at least in part due to precautionary hoarding of liquidity by a significant part of the banking sector that faced rollover risk, and not just due to an increase in the counterparty risk of borrowers.^{xii}

Finally, besides the precautionary demand for liquidity by banks facing rollover risk, relatively healthier banks can have a strategic demand for liquidity for acquiring troubled banks, especially as the crisis gets deeper and bank failures become imminent. This can lead to further reduction in liquidity that is available in the aggregate for funding the financial system, households and corporations. Evidence suggests that such a motive for holding cash took hold, especially around the failure of Lehman Brothers in September 2008.^{xiii}

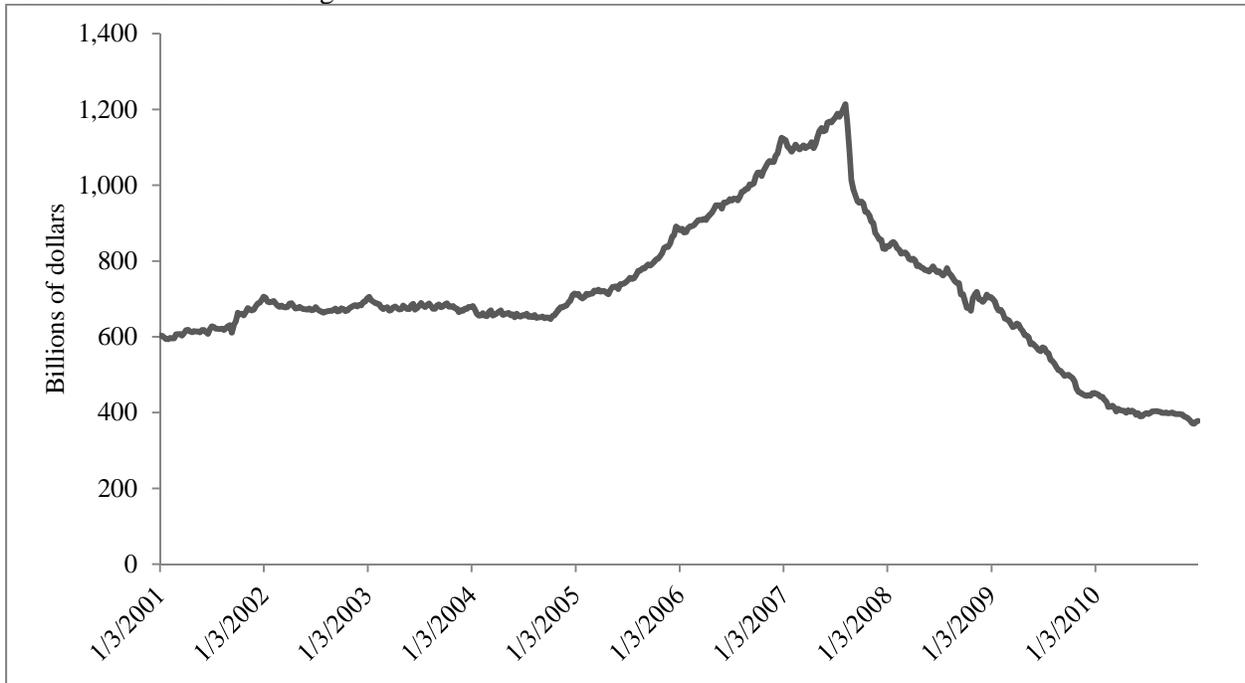
Conclusion

To summarize, existing theories and evidence on banking crises based on *market failures* (namely, the reliance of financial firms on short-term debt and the externalities from *en masse* failures of financial firms to roll over short-term debt) and *regulatory failures* (imperfect, incomplete, and sometimes misguided regulation) help understand both the regular incidence of crises in modern financial systems as well as their adverse consequences. Financial crises in the Western economies that started in 2007 bear testimony to the usefulness of this existing paradigm. Indeed, the paradigm appears to be a good starting point for thinking about sound normative aspects of financial sector regulation, in particular, that it needs to be *macro-prudential*, considering the financial system at large, rather than being *micro-prudential* or narrowly focused on health of individual financial firms.

In current research, I am exploring the third of the failures, namely *government failures*, which arise due to myopia of decision-making in fiscal and debt policy, as well as in policy to bail out a distressed financial sector. These government failures have the dramatic implication that financial sector and sovereign credit risks are intimately tied. Bank failures can trigger sovereign credit risk if bailouts lead the sovereign to sacrifice its creditworthiness, and conversely, deterioration of sovereign credit risk can impose “collateral damage” on the financial sector directly through its holdings of government bonds and indirectly through the implicit government guarantees of the financial sector.^{xiv} Perversely, this bank-sovereign two-way feedback may in fact be preferred by myopic governments that are reluctant to cut back on populist spending: entanglement of the financial sector with the sovereign is perceived by investors as a sign that sovereign will find it too costly to default, boosting the sovereign’s ex-ante ability to raise debt and spend, but resulting in a worse sovereign and financial crisis ex

post.^{xv} Integrating governments and public policy into the existing models of banking crises remains an important topic for further work, as suggested by the ongoing banking and sovereign crises in the Eurozone.

Panel A: ABCP outstanding



Panel B: Overnight ABCP spread

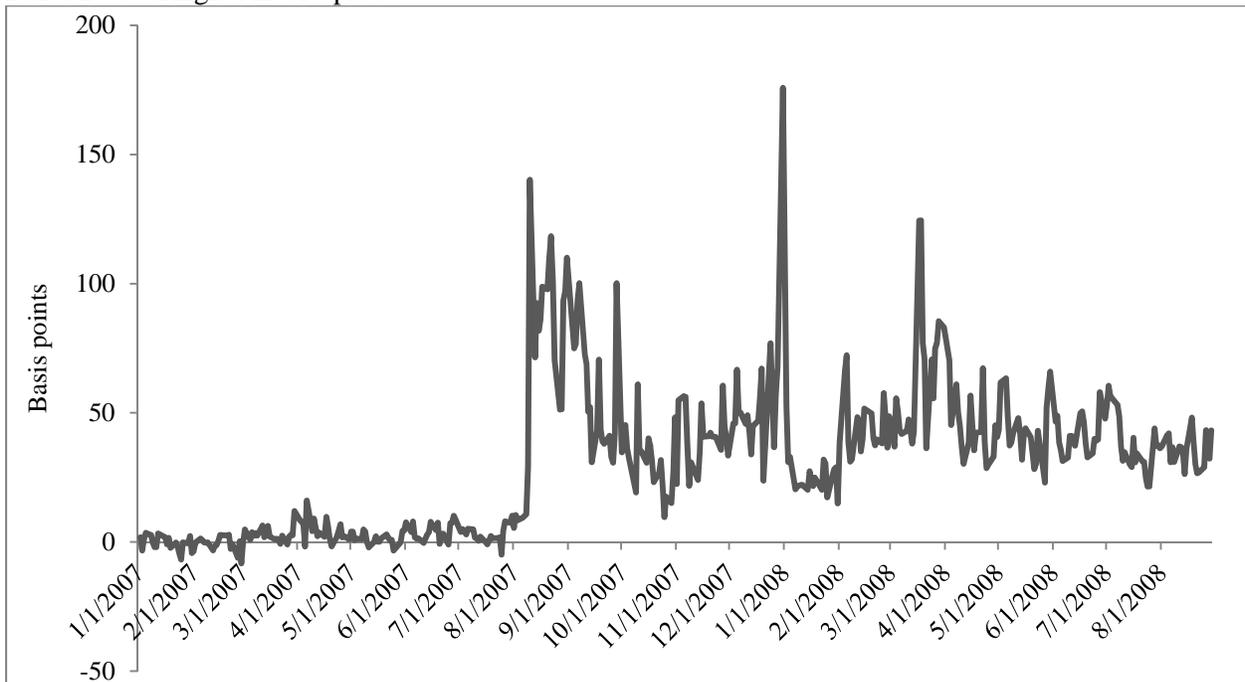


Fig. 1. Asset-backed commercial paper (ABCP) outstanding and spreads. Panel A plots total ABCP outstanding in the US market from January 2001 to April 2010. Panel B shows the spread of overnight ABCP over the federal funds rate from January 2007 to August 2008. The figures are based on weekly data published by the Federal Reserve Board. Source: Acharya, Schnabl and Suarez (2013), see endnote v.

ⁱ For a formal model capturing both the private desirability of short-term debt and how it can lead to aggregate crises (especially in times of good fundamentals), see V. V. Acharya and S. Viswanathan, “Leverage, Moral Hazard and Liquidity”, NBER Working Paper No. 15837, March 2010, published in *Journal of Finance*, 2011, 66, 99-138.

ⁱⁱ Such rollover risk and short-term debt freeze is modeled in V. V. Acharya, D. Gale and T. Yorulmazer, “Rollover Risk and Market Freezes”, NBER Working Paper No. 15674, January 2010, published in *Journal of Finance*, 2011, 66, 1175-1207.

ⁱⁱⁱ An implementable tax calculation based on systemic risk assessment of the financial sector can be found in V. V. Acharya, L. H. Pedersen, T. Philippon and M. Richardson, “How to Calculate Systemic Risk Surcharges”, published in NBER book *Quantifying Systemic Risk*, February 2012, J. G. Haubrich and A.W. Lo, editors.

^{iv} Counterparty risk externality arising in opaque over-the-counter derivatives markets is formalized in V. V. Acharya and A. Bisin, “Counterparty Risk Externality: Centralized versus Over-the-counter Markets”, NBER Working Paper No. 17000, April 2011.

^v Description of the ABCP conduits, their guarantees from commercial banks, and their eventual “runs”, can be found in V. V. Acharya, P. Schnabl and G. Suarez, “Securitization without Risk Transfer”, NBER Working Paper No. 15730, February 2010, published in *Journal of Financial Economics*, 107, 2013, 515-536.

^{vi} See V. V. Acharya and P. Schnabl, “Do Global Banks Spread Global Imbalances? The Case of Asset-Backed Commercial Paper During the Financial Crisis of 2007-09”, NBER Working Paper No. 16079, June 2010, published in *IMF Economic Review*, 2010, 58, 37-73.

^{vii} See V. V. Acharya, I. Gujral, N. Kulkarni and H. S. Shin, “Dividends and Bank Capital in the Financial Crisis of 2007-09”, NBER Working Paper No. 16896, March 2011.

^{viii} See a discussion of current disclosure practices of large financial institutions with regard to derivatives-linked collateral or margin liabilities, in V. V. Acharya, “A Transparency Standard for Derivatives”, NBER Working Paper No. 17558, November 2011, published in *Risk Topography: Systemic Risk and Macro Modeling*, M. K. Brunnermeier and A. Krishnamurthy, editors.

^x These results are contained in V. V. Acharya and N. Mora, “Are Banks Passive Liquidity Backstops? Deposit Rates and Flows during the 2007-09 Crisis”, NBER Working Paper No. 17838, February 2012.

^x See V. V. Acharya, H. Almeida and M. Campello, “Aggregate Risk and the Choice between Cash and Lines of Credit”, NBER Working Paper No. 16122, June 2010, forthcoming, *Journal of Finance*.

^{xi} See V. V. Acharya, G. Afonso and A. Kovner, “How do Global Banks Scramble for Liquidity? Evidence from the Asset-Backed Commercial Paper Freeze of 2007”, NBER Working Paper No. ?????, March 2013.

^{xii} See V. V. Acharya and O. Merrouche, “Precautionary Hoarding of Liquidity and Inter-Bank Markets: Evidence from the Sub-prime Crisis”, NBER Working Paper No. 16395, September 2010, published in *Review of Finance*, 2013, 17(1), 107-160.

^{xiii} See theory and empirical evidence for strategic demand for cash in a crisis in V. V. Acharya, H. S. Shin and T. Yorulmazer, “Crisis Resolution and Bank Liquidity”, NBER Working Paper No. 15567, December 2009, published in *Review of Financial Studies*, 2011, 24(6), 2166-2205.

^{xiv} For theoretical and empirical treatment of this bank-sovereign nexus, see V. V. Acharya , I. Drechsler and P. Schnabl, “A Pyrrhic Victory? Bank Bailouts and Sovereign Credit Risk”, NBER Working Paper No. 17136, June 2011.

^{xv} See V. V. Acharya and R. G. Rajan, “Sovereign Debt, Government Myopia and the Financial Sector”, NBER Working Paper No. 17542, October 2011, forthcoming, *Review of Financial Studies*.