

UNIVERSITY OF PITTSBURGH LAW REVIEW

Vol. 74 • Spring 2013

ARTICLES

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ISSN 0041-9915 (print) 1942-8405 (online) • DOI 10.5195/lawreview.2013.260
<http://lawreview.law.pitt.edu>



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Alessio M. Paces*

ABSTRACT

This article analyzes the determinants of liquidity crises based on the dynamics of banking and finance under Knightian uncertainty. In this perspective, the facts of the global financial crisis seem to confirm Minsky's hypothesis of endogenous financial instability derived from Keynes's theory of liquidity and expectations. Conventional expectations allow overcoming uncertainty via the liquidity of secondary markets and, in turn, of banks' liabilities that are accepted as money. However, the failure of existing conventions drives the system into uncertainty-driven liquidity spirals, which are the more dangerous the more private money financial intermediaries have managed to create in the first place. Despite limited availability of data that can proxy for Knightian uncertainty, this approach to liquidity problems may explain better than others how a relatively small shock, such as the default of U.S. subprime mortgages, could trigger a worldwide systemic crisis.

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The policy implications of this understanding of illiquidity are twofold. First, financial crises should be policed by tailoring the lender of last resort function of central banks to the creation of private money. By the same token, banking should be defined and regulated according to this monetary function performed by financial intermediaries, whether banks or non-banks. These institutions should face payout restrictions while being prevented from using retained earnings to increase the quantity of private money they can create through their balance sheet.

Second, the corporate governance of banks should allow insulating managers and controlling shareholders from the short-termism of stock markets. Inasmuch as myopic stock markets influence the balance sheet choices of bankers, investor-friendly corporate governance is a major amplifier of liquidity crises. This article thus suggests combining long-term remuneration with the possibility for bank managers to claim a compensation for parting with control. Similar implications are derived for controlling shareholders.

I. INTRODUCTION

“Liquidity” is a recurrent expression in the scientific and the policy debate on the financial crisis.¹ There is a broad understanding that only a combination of factors can explain turmoil of the proportions we experienced in the years 2007–2009—and that, albeit for different reasons, we are still experiencing with the current sovereign debt crisis in Europe.² Whatever opinion one may have on the leading cause of financial crises, the drying up of liquidity is generally considered a key part of the story.³ This matches our instinctive reaction to situations of financial turmoil, which is keeping (or making) our positions “liquid” whatever that means. A comprehensive theory of liquidity would then be most useful to understand financial crises, particularly what can make these so disastrous for a national and the global economy, and to devise policies aimed at containing illiquidity. Unfortunately, such a theory is very difficult to reconcile with mainstream economics.⁴

This article seeks to make a little progress in the study of liquidity by departing from asymmetric information problems, which normally plague financial markets, and pointing instead at how financial decision-making deals with *uncertainty* about the future, which may result in a financial crisis. To keep matters simple, I define finance as a transfer of resources to the future and uncertainty as lack of precise knowledge on what this future will look like. Rational actors, including professional investors, routinely take financial decisions under uncertainty about contingencies that will affect their payoffs. Uncertainty differs from risk because it is immeasurable, that is, it concerns situations that cannot be

¹ See, e.g., Ben Bernanke, Chairman, Fed. Reserve, Some Reflections on the Crisis and the Policy Response, Speech at the Russell Sage Foundation and The Century Foundation Conference on “Rethinking Finance” (Apr. 13, 2012), available at <http://www.federalreserve.gov/newsevents/speech/bernanke20120413a.htm>.

² Although the similarities of the current situation in Europe with some aspects of the global financial crisis will be emphasized at various junctures, this article does not deal with the sovereign debt crisis of the Eurozone. See Benoît Cœuré, Global Liquidity and Risk Appetite: A Re-Interpretation of the Recent Crises, Speech at the BIS-ECB Workshop on Global Liquidity and Its International Repercussions (Feb. 6, 2012), available at <http://www.ecb.int/press/key/date/2012/html/sp120206.en.html>.

³ RICHARD A. POSNER, A FAILURE OF CAPITALISM: THE CRISIS OF '08 AND THE DESCENT INTO DEPRESSION *passim* (2009).

⁴ For a state-of-the-art discussion of liquidity problems stemming from asymmetric information, see Jean Tirole, *Illiquidity and All Its Friends*, 49 J. ECON. LIT. 287 (2011); BENGT HOLMSTRÖM & JEAN TIROLE, INSIDE AND OUTSIDE LIQUIDITY (2011) (providing a thorough, technical discussion of the topic).

assigned a probability.⁵ The question is, then, how is rational finance possible in the presence of uncertainty?

According to Keynes,⁶ actors deal with uncertainty *as if* they were dealing with measurable risks based on “conventions” about the likelihood of future contingencies. These conventions provide rational economic actors with a sense of safety because the conventions allow trading assets, no matter with which maturity, for certain amounts of cash. Liquidity of this kind is compromised when the unfolding of events denies reliability to the underlying conventions, for instance because adverse contingencies that had been conventionally disregarded actually occur and nobody knows how to price the risk that they occur again. Actors then seek to disengage from the future until new conventions are developed that allow dealing with the new state of the world. People avoid committing to an uncertain future by demanding more liquidity than could be obtained on secondary markets for debt, which in the extreme means cash. As a result, the price of other financial assets—including those previously considered “safe”—plummet relative to cash and cash-equivalents, interest rates rise, and a financial crisis may ensue.

This Keynesian perspective on liquidity problems is often overlooked in contemporary economics. This article revisits this approach with a double purpose. The first goal is to apply the above understandings of liquidity to the global financial crisis, particularly to the unfolding of events in the United States between 2007 and 2009.⁷ It will be shown that the circumstances having the largest quantitative impact on the crisis—most prominently the liquidity premiums and the so called “haircuts” on private debt⁸—are hard to explain based on standard models of asymmetric information. Whereas, the liquidity premiums fit an uncertainty dynamic, implying, if anything, symmetric ignorance. After validating the link between uncertainty and liquidity problems, the next goal will be to derive policy implications from this approach.

⁵ The distinction between risk and uncertainty along these lines was originally developed by economist Frank H. Knight. FRANK H. KNIGHT, *RISK, UNCERTAINTY AND PROFIT* (1921).

⁶ JOHN M. KEYNES, *THE GENERAL THEORY OF EMPLOYMENT, INTEREST AND MONEY* 96–106 (reprint 2008) (1936).

⁷ For a careful illustration of these events, see Markus K. Brunnermeier, *Deciphering the Liquidity and Credit Crunch 2007–2008*, 23 J. ECON. PERSP. 77, 82–91 (2009) and GARY B. GORTON, *SLAPPED BY THE INVISIBLE HAND: THE PANIC OF 2007*, at 148–52 (2010).

⁸ Gary B. Gorton & Andrew Metrick, *Haircuts*, 92 FED. RES. BANK ST. LOUIS REV. 507, 508 (2010) (defining the industry term “haircut”).

Embedded in the notion of liquidity, however elusive, is the idea of a systemic externality:⁹ lending cash allows a capitalist economy to flourish; hoarding cash may make it collapse. If the presence of externalities implies that public intervention could improve welfare, the claim that liquidity (and thus its externalities) ultimately depends on uncertainty may cast doubts on the ability of regulation to control the generation of liquidity and its contraction. Yet, even without crediting policymakers with superior forecasting skills, authoritative economists and legal scholars increasingly advocate the study of uncertainty for better understanding economics and how to police it for the good of society.¹⁰

In order to investigate the implications of uncertainty for liquidity and its regulation, this article will focus on just two aspects of the recent financial crisis. These are banking and its corporate governance. The reason is that banking is the ultimate source of liquidity, due to its ability to finance long-term projects issuing short-term liabilities that are accepted as money. The incentive for banks to engage in this process, known as maturity transformation,¹¹ is profit measured as returns to equity. Most corporate governance decisions are based on these returns. The problem is that both banking and its corporate governance may be not in line with the interest of society when it comes to liquidity. Liquidity generation in the form of monetary liabilities may be either excessive or insufficient, particularly in the presence of swings in uncertainty.

Because liquidity allows financing valuable projects by overcoming uncertainty about the future, it is not intuitive how there could be too much of it. However, today's liquidity enables financial institutions to profit from increasing leverage, which magnifies the impact of tomorrow's illiquidity not only on individual institutions, but also on the solvency of the entire financial system.¹² Banks can issue virtually unlimited amounts of short-term liabilities when liquid,

⁹ See Dirk Heremans & Alessio M. Paces, *Regulation of Banking and Financial Markets*, in REGULATION AND ECONOMICS 558, 571–75 (Roger J. Van den Bergh & Alessio M. Paces eds., 2012).

¹⁰ See, e.g., Ricardo J. Caballero, *Macroeconomics After the Crisis: Time to Deal with the Pretense-of-Knowledge Syndrome*, 24 J. ECON. PERSP. 85, 94–98 (2010); Richard A. Posner, *On the Receipt of the Ronald H. Coase Medal: Uncertainty, the Economic Crisis, and the Future of Law and Economics*, 12 AM. L. & ECON. REV. 265, 272–79 (2010).

¹¹ Alessio M. Paces, *Consequences of Uncertainty for Regulation: Law and Economics of the Financial Crisis*, 7 EUR. COMPANY & FIN. L. REV. 479, 485 (2010).

¹² Tobias Adrian & Hyun S. Shin, *The Changing Nature of Financial Intermediation and the Financial Crisis of 2007–2009*, 2 ANN. REV. ECON. 603, 607 (2010) (illustrating the dynamic interaction between liquidity and leverage, which are mutually reinforcing both in upturns and downturns).

albeit long-term assets back them up. Call this collateral. Sudden illiquidity of collateral, for instance AAA bonds, cast doubts on every bank's ability to keep promises to deliver cash on demand. But the severity of the problem depends on how much leverage was enabled in the first place. Because assets may be collateralized more than once and the same collateral may guarantee multiple liabilities,¹³ liquidity and leverage are two mutually reinforcing factors of systemic instability. Maturity transformation is central to this process. Therefore, this article will focus on banking neglecting other important determinants of liquidity prior to the recent crisis, such as ratings of structured debt of and the savings glut from emerging markets.¹⁴

Banking, and not banks, is the focus because especially securitization of financial assets allows other financial intermediaries to engage in maturity transformation (so-called "shadow banking").¹⁵ Banking continuously evolves to capture profit opportunities from maturity transformation and in doing so, unavoidably injects new uncertainty in the system. We fully realize how banking has evolved only in hindsight; we do not know how banking will evolve in the future. Hence, we must live with unpredictable financial crises unless maturity transformation is to be prohibited altogether. However, such a prohibition would increase considerably and perhaps inefficiently the amount of "dead capital" unavailable for financing long-term investments.¹⁶

If we cannot eliminate uncertainty, regulation can still contain its adverse consequences on liquidity and financial instability. In order to discipline maturity transformation, banking should be defined functionally with respect to the liabilities that certain intermediaries manage to get accepted as money. This definition is broader than what is currently known as "shadow banking." The purpose of defining banking functionally is to constrain the endogenous *growth* of

¹³ In other words, collateral can be "rehypothecated." Gary B. Gorton & Andrew Metrick, *Regulating the Shadow Banking System*, BROOKINGS PAPERS ON ECON. ACTIVITY 261, 277 (2010).

¹⁴ I have dealt more broadly with other factors contributing to the global financial crisis—including rating agencies. See Alessio M. Paces, *Uncertainty and the Financial Crisis*, 29 J. FIN. TRANSFORMATION 79 (2010).

¹⁵ Gorton & Metrick, *supra* note 13, at 261–68.

¹⁶ MATHIAS DEWATRIPONT, JEAN-CHARLES ROCHET & JEAN TIROLE, BALANCING THE BANKS: GLOBAL LESSONS FROM THE FINANCIAL CRISIS 53 (2010). See also Ricardo J. Caballero & Pablo D. Kurlat, *The "Surprising" Origin and Nature of Financial Crises: A Macroeconomic Policy Proposal* 20 (MIT Department of Economics, Working Paper No. 09-24, 2009), available at <http://ssrn.com/abstract=1473918>.

the balance sheet of whatever financial intermediary promises to deliver cash on demand. This regulatory strategy may contain the explosion of liquidity in good times, but cannot stop its contraction when uncertainty kicks in. To this purpose, central banks must be committed to back up privately created money. Central banks have been doing this since their inception, but historically, only the commitment to do so ex-ante has prevented systemic crises.¹⁷ This public insurance, which is reminiscent of deposit insurance although it would be implemented as lending of last resort, should be crafted in such a way as to set a credible floor to collateral values without fueling moral hazard of institutions leveraging on that collateral.

If financial intermediation must rely so much on public intervention in order to avoid systemic externalities, the question arises whether its corporate governance should be regulated too. Following mainstream theory, namely the principal-agent model of the management/shareholders relationship and the rational expectations approach to stock prices,¹⁸ it is not obvious why this should be the case. This theory predicts that if banking is regulated as to internalize systemic externalities, shareholders bear through stock prices the effects of risk-taking on social welfare and thus they will align managers' incentives with the interest of society.¹⁹

Mainstream financial economics, however, does not account for liquidity crises. Although the impact of corporate governance on the recent financial crisis is ambiguous both theoretically and empirically,²⁰ the uncertainty perspective indicates at least one potential channel influencing banks' propensity to hoard or to

¹⁷ GORTON, *supra* note 7, at 28–38.

¹⁸ See Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 J. FIN. ECON. 305 (1976) (discussing principal-agent theory); Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383 (1970) (discussing the rational expectations model).

¹⁹ See Anat R. Admati, Peter M. DeMarzo, Martin F. Hellwig & Paul C. Pfleiderer, *Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity Is Not Expensive* (Rock Ctr. for Corporate Governance at Stanford Univ., Working Paper No. 86, 2011), available at <http://ssrn.com/abstract=1669704>.

²⁰ See William W. Bratton & Michael L. Wachter, *The Case Against Shareholder Empowerment*, 158 U. PA. L. REV. 653 (2010) (arguing on a number of grounds that empowering shareholders in corporate governance may increase financial instability if stock markets cannot be trusted to be efficient at any point in time); Andrea Beltratti & René M. Stulz, *The Credit Crisis Around the Globe: Why Did Some Banks Perform Better?*, 105 J. FIN. ECON. 1 (2012) (finding that the banks with better corporate governance, as this is commonly understood, performed worse in the global financial crisis).

lend cash differently from what would be optimal for the society. This is, as Keynes noted,²¹ the liquidity of stock markets. The liquidity of stock markets can induce managers and, perhaps surprisingly, controlling shareholders to cater to the short-termism of professional investors both when they demand excessive returns (underestimating uncertainty) and when they discount returns by excessive liquidity premiums (overestimating uncertainty). Thus, the corporate governance of banks should be insulated from stock market pressures not only by mandating longer-term managerial remuneration, but also by allowing management tenure and exit at a premium by controlling persons/shareholders.

II. LIQUIDITY, UNCERTAINTY AND FINANCE

There is no universal definition of liquidity.²² The characterization of financial assets as more or less liquid varies with the times. The notion of liquidity is clear in at least one respect: it points to the ability to transform a given asset into cash. There are basically two ways to perform this transformation: one is to sell the asset on a secondary market; the other is to raise funds posting the asset as collateral. These two ways are known in the literature as “market liquidity” and “funding liquidity,” respectively.²³ These methods to obtain liquidity are also well known to laypeople when they face an unexpected need of cash: either they go sell their assets or they put them in pawn.

Let us consider a person holding a certain asset to illustrate why she may choose to hoard cash instead. This person may fear three things: 1) an unexpected reduction of cash flow; 2) that the asset may fetch less than it is worth if sold abruptly in the market; or 3) that borrowing against the asset is constrained by a margin or “haircut” imposed by the lender on the market value of the asset, perhaps because the lender shares the borrower’s fears on market resilience. While the last two circumstances correspond with the market liquidity and the funding liquidity described above, the first is something else. It is the rationale of precautionary demand for money illustrated in Keynes’s *General Theory*.²⁴

²¹ KEYNES, *supra* note 6, at 98.

²² Finance scholars carefully avoid engaging in definitions. See HOLMSTRÖM & TIROLE, *supra* note 4, at 7.

²³ Markus K. Brunnermeier & Lasse Heje Pedersen, *Market Liquidity and Funding Liquidity*, 22 REV. FIN. STUD. 2201, 2202–05 (2009).

²⁴ KEYNES, *supra* note 6, at 107–09.

The precautionary motive to hold money plays a key role in Keynes's "liquidity preference"; although this role is less studied than the reaction of interest rates to open market operations.²⁵ As Keynes subsequently clarified, people's desire to hold idle balances of money is "a barometer of the degree of our distrust of our calculations and conventions concerning the future."²⁶ In other words, the precautionary demand of money depends on uncertainty. According to Keynes, uncertainty is the ultimate reason why people want liquidity, i.e. decide to hold money as a "store of wealth" in the face of alternatives yielding interest, utility or profit.

In the spirit of Knight,²⁷ Keynes argues that most future contingencies in the real world are inherently uncertain because they cannot be assigned a probability. The interesting question, however, is how individuals overcome uncertainty. In a capitalist economy, people must make decisions on whether to accumulate wealth for the future (or to borrow against expectations of future wealth) with only a very vague idea on what the future will hold. Investors are willing to take these risks, because they rely on a convention implicitly agreed upon with the other members of society. Conventional judgments under uncertain knowledge are based on the assumption that "the existing state of affairs will continue indefinitely."²⁸ This allows drawing probabilities on future events based on the distributions of similar events observed in the past. In this way, investors feel that they are acting rationally, which relieves them from anxiety, by following the conventional wisdom.

Real-life decisions by economic actors rely heavily on such conventions. For the purpose of this inquiry, ratings of debt are a case in point. But, it is worth noting that any standard supporting probability distributions about uncertain events (e.g. illness or unemployment) works in the same way. So long as the underlying convention holds, the future is handled as a collection of manageable risks, and the residual uncertainty is basically disregarded. In this situation, the demand of idle

²⁵ The modern understanding of Keynes's thought is mediated by the synthesis made by Professor Hicks. John R. Hicks, *Mr. Keynes and the "Classics;" A Suggested Interpretation*, 5 *ECONOMETRICA* 147 (1937). Many of the insights by Keynes—including those discussed in this article—were not included in the Hick's model (known as IS-LM model) because they could not be formalized.

²⁶ John M. Keynes, *The General Theory of Employment*, 51 *Q.J. ECON.* 209, 216 (1937).

²⁷ KNIGHT, *supra* note 5.

²⁸ KEYNES, *supra* note 6, at 152.

money is reduced, both because the future looks predictable, and because interest-bearing assets can be transformed into cash at a low cost if needed.

Conventions that allow the future to be treated and contracted upon as a set of probability distributions have an important downside: they are fragile. When the world turns out to be different from what it was expected to be (e.g. because of A-Influenza or an unexpected recession), the convention supporting the previous view of the world may be no longer recognized. Conventions may fail instantly, but they are never instantly replaced. While people are busy redoing their calculations on how to handle the future in probabilistic terms, they are facing bare Knightian uncertainty. The most rational strategy in this circumstance is to disengage from the future assuming that it will be as bad as it can be. Whenever economic actors are unable to overcome uncertainty in a conventional manner, they “prefer” liquidity to satisfy their want of safety.²⁹

The consequences of liquidity preference for finance are manifest. First, financial assets must offer a “liquidity premium” for parting with cash. The size of this premium varies with the levels of *perceived* uncertainty.³⁰ People’s propensity to hoard cash and the interest rate of illiquid assets are higher the larger the uncertainty; inversely, people’s propensity to invest or lend and the price of illiquid assets will be lower during times of great uncertainty. Liquidity premiums are a major cause of unemployment in Keynesian economics.³¹ Second, in order to keep liquidity premiums low, we need to accept short-termism of secondary markets and the persistence of disequilibrium that this involves. The problem with such operation of secondary markets is that prices of debt and equity tend to drop exactly when liquidity premiums rise and vice-versa, thereby perpetuating the slumps and the booms triggered by uncertainty and disregard thereof. The third consequence of liquidity preference is the existence of banking as provider of stores of wealth, which in turn depends on financial intermediaries’ credible commitments to exchange their liabilities for cash. This implication, absent from Keynes’s framework, was developed by his acolyte Hyman Minsky.³²

²⁹ Keynes, *supra* note 26, at 217.

³⁰ Jochen Runde has developed this insight at length. See Jochen Runde, *Keynesian Uncertainty and Liquidity Preference*, 18 CAMBRIDGE J. ECON. 129 (1994).

³¹ Keynes, *supra* note 26, at 221.

³² HYMAN P. MINSKY, JOHN MAYNARD KEYNES 115–27 (reprint 2008) (1975).

Minsky's work has been widely cited in the aftermath of the global financial crisis,³³ mainly because his financial instability hypothesis seemed to be confirmed by the recent events. Minsky contended that the finance of capitalist economies endogenously evolves towards financial crises. According to Minsky,³⁴ there are three models of asset financing. These are, in order of robustness: 1) Hedge finance: the expected cash flow from the asset matches the repayment schedule of debt; 2) Speculative finance: the expected cash flow is sufficient to repay debt interests, not the principal (which needs be refinanced); 3) Ponzi finance: the expected cash flow is insufficient to repay interests, so debt must increase. In spite of uncertainty, capitalism proceeds under the Keynesian assumption that the current state of affairs will continue indefinitely, which in turn validates a gradual move from hedge, to speculative and later to Ponzi finance until a debt crisis occur. This crisis will develop when there is some difficulty refinancing existing debt. This inability to refinance will bring uncertainty to the forefront, raise interest rates, make refinancing more difficult, and so forth.

The gist of Minsky's thought, however, is the role of banks in the above process. Banks—or more precisely “banking” as Minsky himself clarified—are specialized “merchants of debt.”³⁵ They profit from accepting private debt of different maturities and “selling” it as monetary liabilities. Maturity transformation makes banks the quintessence of speculative finance: banks fund long-term debt by rolling over short-term liabilities. Banking substitutes profits from maturity transformation to liquidity premiums. This substitution is in principle efficient because, by activating savings at lower interest rates than secondary markets, it allows more, potentially valuable investments to be financed. Yet this circumstance incentivizes banks to satisfy *any* demand of financing, possibly according to the Ponzi model, by increasing the size of their balance sheet. This is possible to the extent that larger amounts of liquid liabilities can be issued given the bank's equity, cash reserves, and assets cash flows—what Minsky called “margins of safety.”³⁶

Decreasing margins of safety depend not only on borrowers' and investors' confidence in liquidity, but also on bank shareholders' quest for profits via higher leverage. According to Minsky, the combination of leverage and liquidity is the

³³ See NOURIEL ROUBINI & STEPHEN MIHM, CRISIS ECONOMICS—A CRASH COURSE IN THE FUTURE OF FINANCE 88 (2010).

³⁴ HYMAN P. MINSKY, STABILIZING AN UNSTABLE ECONOMY 231–32 (reprint 2008) (1986).

³⁵ *Id.* at 229.

³⁶ *Id.* at 238.

reason why banking, which is otherwise necessary to overcome uncertainty in a capitalist economy, is an endogenous destabilizer of the system.³⁷ Banks may generate liquidity by increasing leverage so long as their assets are good collateral for cash promises. This mechanism works on the condition that there is no perceived uncertainty on debt values. Uncertainty determines a shortage of collateral for short-term promises, both because liquidity premiums rise (asset prices fall) and because the supply of stores of wealth shrinks. Banking contributes to the severity of financial crises via its monetary liabilities. In conditions of illiquidity, these liabilities become more unsustainable the higher the leverage they have enabled in the first place.

The relevance of Minsky's theory for the global financial crisis is contentious, particularly because his framework did not explicitly account for securitization and for the absence of any margin of safety in subprime mortgages.³⁸ Similarly, Minsky's advocacy of a Big Government to support financial stability seems difficult to reconcile with the current sovereign debt crisis in Europe. However, Minsky's analysis is prescient in a subtler sense. Two factors affecting the severity of the global financial crisis were clearly identified by Minsky; they are being only recently investigated by the economic literature. One is the instability of stores of wealth, equivalently called "collateral" or "liquidity."³⁹ This instability may suddenly lead to so-called "flights to quality,"⁴⁰ which are the modern version of bank runs. Another factor first identified by Minsky is the endogeneity of liquidity to a "leverage cycle."⁴¹ In what follows, I will illustrate how these phenomena interact dramatically with uncertainty and why they need to be addressed by *both* financial regulation and monetary policy.

³⁷ This insight matches the more recent theory by Adrian and Shin. Adrian & Shin, *supra* note 12, at 607–11.

³⁸ Jan Kregel, *Using Minsky's Cushions of Safety to Analyze the Crisis in the U.S. Subprime Mortgage Market*, 37 INT'L J. POL. ECON. 3 (2008).

³⁹ HOLMSTRÖM & TIROLE, *supra* note 4, at 7.

⁴⁰ Ricardo J. Caballero & Arvind Krishnamurthy, *Collective Risk Management in a Flight to Quality Episode*, 63 J. FIN. 2195 (2008).

⁴¹ John Geanakoplos, *Solving the Present Crisis and Managing the Leverage Cycle*, FED. RES. BANK N.Y. ECON. POL'Y REV. 101 (2010). *See also* Adrian & Shin, *supra* note 12.

III. UNCERTAINTY AND THE GLOBAL FINANCIAL CRISIS

A. *What the Global Financial Crisis Was Not*

The “easy” explanations of the global financial crisis were short-lived. Originally, much of the blame was put on the originate-to-distribute model of securitization.⁴² This model seemed to explain why extremely weak loans, like subprime and Alt-A mortgages, could be originated knowing in advance that they could only be repaid out of refinancing (that is, only if housing prices kept rising indefinitely). Allegedly, the reason was that the originating bank or bank affiliate did not retain sufficient, if any interest in the loans, as these were securitized and immediately sold to other investors. Short of the obvious question, why investors bought that stuff on these terms, we now know that the banks did not entirely divest the assets originated in this fashion.⁴³ They warehoused or otherwise repurchased big chunks of these securities directly or through off-balance-sheet vehicles. After the collapse of the market for asset-backed commercial paper at the beginning of the crisis, banks were forced to take back the Special Purpose Vehicles on their balance sheet because of implicit or explicit commitments to redeem the vehicles’ paper.⁴⁴ As one commentator put it, this model of securitization is better characterized as “originate and *pretend* to distribute.”⁴⁵

Another popular explanation of a similar tenor is moral hazard.⁴⁶ Banks engage in very risky lending practices because they anticipate that the government and the monetary authority will bail them out should anything go wrong. The moral hazard problem is indeed inherent in contemporary banking. Because the government wants to prevent a systemic crisis, banks are protected by a safety net,

⁴² See Steven L. Schwarcz, *Protecting Financial Markets: Lessons from the Subprime Mortgage Meltdown*, 93 MINN. L. REV. 373 (2008) (pointing at the excesses in the mortgage market as a major cause of the financial crisis); Martin F. Hellwig, *Systemic Risk in the Financial Sector: An Analysis of the Subprime-Mortgage Financial Crisis*, 157 DE ECONOMIST 129 (2009) (emphasizing, however, that the downturn of the mortgage markets can only result in systemic instability in the presence of moral hazard by banks); Emiliós Avgouleas, *The Global Financial Crisis, Behavioral Finance and Financial Regulation: In Search of a New Orthodoxy*, 9 J. CORP. L. STUD. 23 (2009) (arguing that subprime mortgages could feed the growth of securitization because of behavioral biases in decision-making).

⁴³ Augusto de la Torre & Alain Ize, *Regulatory Reform: Integrating Paradigms*, 13 INT’L FIN. 109, 120 (2010).

⁴⁴ Gary Gorton, *The Subprime Panic*, 15 EUR. FIN. MGMT. 10, 41 (2009).

⁴⁵ CHARLES A.E. GOODHART, *THE REGULATORY RESPONSE TO THE FINANCIAL CRISIS* 54 (2009) (emphasis in the original).

⁴⁶ See Charles W. Calomiris, *Financial Innovation, Regulation, and Reform*, 29 CATO J. 65 (2009).

which, in turn, reduces the bank creditors' incentives to monitor.⁴⁷ This interpretation is seemingly supported by the massive interventions of governments and central banks to prevent the banking system from collapsing in various parts of the world. However, it neglects two factors.

First, the global crisis started in the form of bank runs in wholesale debt markets.⁴⁸ While the safety net has made traditional bank runs by depositors nearly obsolete, it did not address the wholesale market where most of the securitized banking (so-called "shadow banking") was carried out.⁴⁹ Short of their disruptive consequences on the financial system, bank runs are a genuine instance of market discipline, which naturally rules out moral hazard.⁵⁰ Second and related, banks and their financiers had no reason to expect the government to rescue distressed financial institutions before it became clear that this was the only way out of the crisis. In other words, in addition to the uncertainty as to whether private debt commitments could be honored, there was uncertainty as to which of these commitments, if any, would have been publicly supported. This uncertainty peaked with the failure of Lehman Brothers and it started to get resolved only when governments and central banks across the globe could credibly commit not to let this happen again.⁵¹

The bottom line is that moral hazard is very unlikely to have played a decisive role in the buildup of the global crisis. However, it may well be that moral hazard becomes a serious problem for the stability of financial intermediation once the turmoil is brought to an end, possibly with a credible public backstop.⁵² I will discuss the role of moral hazard in shaping regulation in Section 4.

⁴⁷ Heremans & Paccès, *supra* note 9, at 570.

⁴⁸ Gorton, *supra* note 44, at 34.

⁴⁹ GORTON, *supra* note 7, at 45–52.

⁵⁰ de la Torre & Ize, *supra* note 43, at 131.

⁵¹ Uncertainty was recently back on stage because the European Central Bank did not initially commit to supporting the sovereign debt of the Eurozone (and the banks holding it). See Paul De Grauwe, *Why the ECB Refuses to be Lender of Last Resort*, VOX (Nov. 28, 2011), <http://www.voxeu.org/article/why-ecb-refuses-be-lender-last-resort>. However, the European Central Bank recently announced that it will act as a backstop beginning in 2013. *ECB's Mario Draghi Unveils Bond-Buying Euro Debt Plan*, BBC NEWS (Sept. 6, 2012, 2:04 p.m. ET), <http://www.bbc.co.uk/news/business-19499950>.

⁵² See GOODHART, *supra* note 45, at 93–99 (discussing the right timing for regulators to worry about moral hazard).

Dismissal of the easy explanations helps focus the analysis on the heart of the matter. The global financial crisis was essentially a banking crisis depending on the inability of financial intermediaries (banks and non-banks) to maintain funding of their long-term investments. As is typical in banking, this funding was short-term and susceptible of runs. The new feature of shadow banking, as opposed to traditional banking, is that this funding comes from wholesale investors.⁵³ Because the “deposits” of the latter are not insured, most of this funding is collateralized.

Herein lies the importance of securitization: a bank’s incentive to generate securities out of its loans depends on the securities’ being eligible as collateral for short-term funding. This securitization is a way to extract additional profits from maturity transformation, which adds up substantially to the revenues from just originating and distributing the securities.⁵⁴ That said, in the absence of moral hazard, banks should be cautious in the maintenance of their funding, which in turn depends on the perceived quality of the collateral. The difficult question is how the quality of collateral could suddenly deteriorate, fail to support banks’ funding, and result in a systemic crisis.

This question does not have an easy answer. According to the Minsky framework adopted in this article, this outcome is to be expected as the financing pattern of an economy moving towards Ponzi finance.⁵⁵ At some point, the default of some intermediaries will trigger the fear that refinancing is not sustainable, determining massive withdrawals from the banking system and the collapse of asset prices. This explanation matches intuitively the dynamics of the global financial crisis, but it must be reconciled with its facts.

A good account of the financial crisis needs to explain two puzzling circumstances. First, it is widely held that the plummeting of securities backed by subprime mortgages was the major determinant of the crisis. The problem is that the business of subprime mortgage securitization was not large enough. Outstanding subprime-related Mortgage Backed Securities were some \$1.2 trillion,

⁵³ Gary B. Gorton, *Questions and Answers About the Financial Crisis* (Yale Sch. of Mgmt. and Nat’l Bureau of Econ. Research, Working Paper No. 15787, 2000), available at <http://ssrn.com/abstract=1557279>.

⁵⁴ There are two ways to look at this, which are not incompatible. According to Andrei Shleifer and Robert W. Vishny, *Unstable Banking*, 97 J. FIN. ECON. 306 (2010), banks profit from origination fees by fully leveraging their balance sheet to securitization. According to Gorton, *supra* note 53, banks profit from the earning spread between their securitized assets and collateralized borrowing against them.

⁵⁵ See *supra* text accompanying notes 34–35.

about 80% of which were rated AAA.⁵⁶ Even assuming that *all* underlying mortgages defaulted, the expected losses should have been contained to a few billion dollars (say, 30% of the outstanding amount) under the worst-case scenario of U.S.-wide housing prices collapse.⁵⁷ The actual losses have turned out to be much lower and, apparently, they have hardly affected the AAA tranches.⁵⁸ But, the crucial point is that subprime-related securities alone did not have systemic relevance.

The second puzzle is the timing of the crisis. Figure 1 reports an index on a synthetic credit default swap (ABX-CDS) measuring subprime risk as price of different tranches of subprime mortgage-backed securities (MBS). When we look at the most sensitive investment grade tranches (those rated BBB), the graph shows that the subprime fundamentals started deteriorating already at the end of 2006. However, the financial crisis began only a few months later, namely in August 2007, when investors started to withdraw funds from some hedge funds and from the banks' investment vehicles. The important events that followed have been entirely unrelated with the pricing of subprime risk by the ABX index.⁵⁹ How can these circumstances be reconciled with the standard narrative, according to which that was mainly a "subprime crisis"?⁶⁰

⁵⁶ Gorton, *supra* note 53.

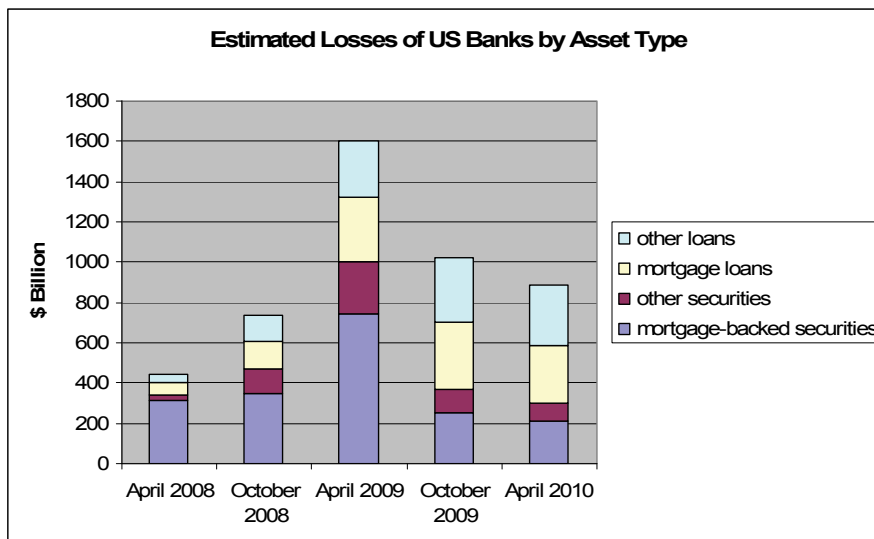
⁵⁷ Hellwig, *supra* note 42, at 131.

⁵⁸ Gorton, *supra* note 53.

⁵⁹ Gary B. Gorton & Andrew Metrick, *Securitized Banking and the Run on Repo*, 104 J. FIN. ECON. 425 (2012).

⁶⁰ See, e.g., Schwarcz, *supra* note 42.

Figure 1



Source: INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT (April & October 2008; April & October 2009; April 2010).

The crisis was *not merely* a problem of subprime mortgage securitization. This is evident by looking at the IMF estimates of the impact of the crisis on U.S. banks' losses reported in Figure 2. Already less than one year after the beginning of the crisis, banks suffered realized or expected losses on classes of assets that were unrelated either to mortgages, to securities, or to both. These components only become larger in the following estimates and, when the "subprime panic" comes to an end, they are the largest source of banks' losses. It is also noteworthy that the losses on MBS at the peak of the crisis vastly exceeded the worst-case scenario projections on subprime securities;⁶¹ this is partly because at some point the price of *prime* MBS (which should have been minimally affected even by a severe downturn in the housing market) plummeted too.⁶²

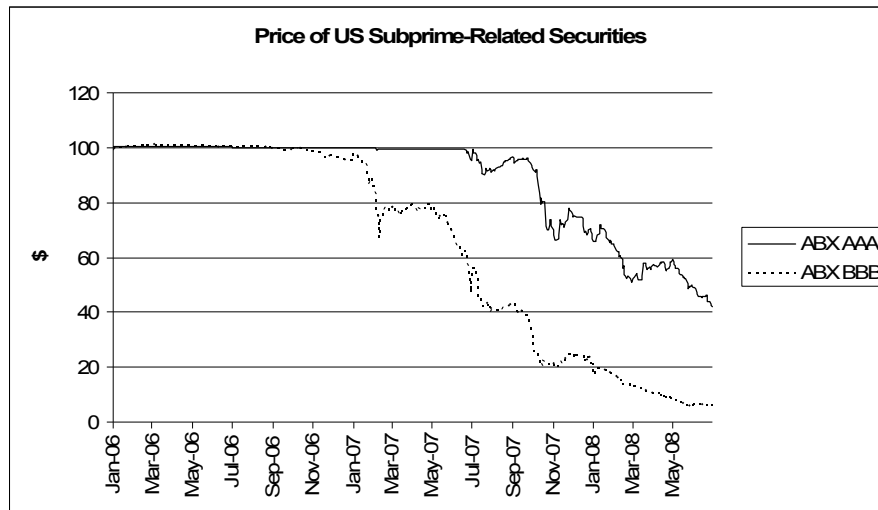
These data show mainly two things. First, the most severe and persisting effects of the crisis were on the real economy. The banking crisis determined a recession which, in turn, increased the defaults on banks' traditional loans. The second and more relevant point for the analysis of the crisis is that the losses on

⁶¹ Cf. *supra* text accompanying notes 56–58. See also Hellwig, *supra* note 42, at 130–31.

⁶² See Figure 1, *supra*.

securities affected classes of assets bearing no immediate relation with subprime mortgages. In addition, the losses on both mortgage-related and mortgage-unrelated securities were overstated by market prices during the panic.⁶³

Figure 2



Source: INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT (October 2008).

In order to understand this outcome, we need to take a closer look at the crisis events. What happened on August 9, 2007, when financial markets worldwide were hit by the first wave of panic?⁶⁴ The short answer is nothing special. There was no “new” information from the U.S. housing market regarding the price of subprime risk. To be sure, subprime risk had started to affect the price of AAA tranches of MBS a few weeks before (see Figure 1). This is puzzling because the junior BBB tranches had not yet lost enough of their value to justify that result. Anyway, that was not news on August 9. That day, the only news was that BNP Paribas froze redemption of three of its funds heavily invested in subprime

⁶³ The IMF estimates across 2008–2010 are based on different methodologies, but they all rely on marking-to-market of banks’ assets. Compare INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT: CONTAINING SYSTEMIC RISKS AND RESTORING FINANCIAL SOUNDNESS (2008), with INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT: RESPONDING TO THE FINANCIAL CRISIS AND MEASURING SYSTEMIC RISK (2009).

⁶⁴ GOODHART, *supra* note 45, at 1.

securities, declaring its inability to value structured financial products.⁶⁵ Differently from the downturn of the housing market and the falling price of subprime securities—both of which were already anticipated—the action taken by BNP Paribas was a surprise.⁶⁶ For the first time, a bank declared inability to make good on a promise to deliver cash against debt issued under its explicit or implicit guarantee.

The relevance of this circumstance may be questioned. In principle, a downturn in MBS prices can immediately affect the balance sheet of a financial intermediary by triggering a liquidity spiral.⁶⁷ This can happen when the assets in question are bought on margins, that is, when they are simultaneously posted as collateral for short-term funding. In this context, given an initially small shock, asset prices may increasingly deviate from fundamentals because investors are so leveraged that they have no choice other than reducing their position in order to keep their equity margin constant. In a typical collateralized transaction, like a repurchase agreement (repo), this margin is called “haircut.” For example, buying a security on a 10% haircut means that the investor borrows \$90 to purchase a security worth \$100, which is simultaneously posted as collateral. The investor’s equity in the transaction is \$10. If the investor has purchased \$100 million in this way and the price of each security drops to, say, \$95, half of the investor’s equity (\$5 million) is lost and—holding the haircut constant—she can only refinance \$50 million with the remainder. That implies selling assets worth \$45 million in a market that already undervalues them. As many investors are in the same position, the initial price drop is magnified by these sales, which further reduce the price, induce additional liquidations, and so forth.

This mechanism is known as fire sale, and it is the prevailing explanation of how the global financial crisis unfolded.⁶⁸ Investors are forced to sell their assets in a slump because they have no alternative to maintain the haircut requested by their financiers. This process creates a serious risk of bankruptcy accompanying the downward spiral of the asset prices. Therefore, the financiers will also raise the haircuts in order to protect themselves from the risk that, because of falling prices, the collateral is worth less than their exposure when they need to sell the

⁶⁵ GORTON, *supra* note 7, at 150.

⁶⁶ See Caballero & Kurlat, *supra* note 16.

⁶⁷ Brunnermeier, *supra* note 7, at 92–94.

⁶⁸ *Id.* at 91–92. See also Andrei Shleifer & Robert W. Vishny, *Fire Sales in Finance and Macroeconomics*, 25 J. ECON. PERSP. 29 (2011).

securities.⁶⁹ Raising haircuts exacerbate the downward spiral because this increases the pace of forced sales, up to the point in which the asset is no longer accepted as collateral or ceases to be traded altogether.

If we follow this explanation, however, the theory does not fit the empirical data from the financial crisis. The fire sale process can only be so disruptive when the vast majority of investors are so leveraged that any slight decrease in the asset price triggers a general margin call. If a sufficient number of investors is not in this situation (i.e. they have extra equity so that the margin requirements are not immediately binding), not only can they avoid fire sales, but they should rather buy assets being dumped at prices below fundamentals. These investors are known as “natural buyers” and the arbitrage opportunities available to them make it very difficult to start a fire sale.⁷⁰ The fact that arbitrage has not happened is not necessarily evidence that most U.S. investors were financially constrained when the subprime prices started to fall. Indeed, the data suggests quite the opposite.⁷¹

Whether forced or not, financial intermediaries effectively reduced their aggregate positions in a number of securities. Thus, liquidity spirals actually occurred, and they concerned much more than subprime MBS. As Figure 3 shows, the spreads on both non-mortgage asset-backed securities (ABS) and on corporate bonds rose as of August 2007, which implies that they started trading at significantly less than par. These securities were all rated AAA but, differently from subprime securities, there was no reason why they should not be expected to deliver the promised cash flows.

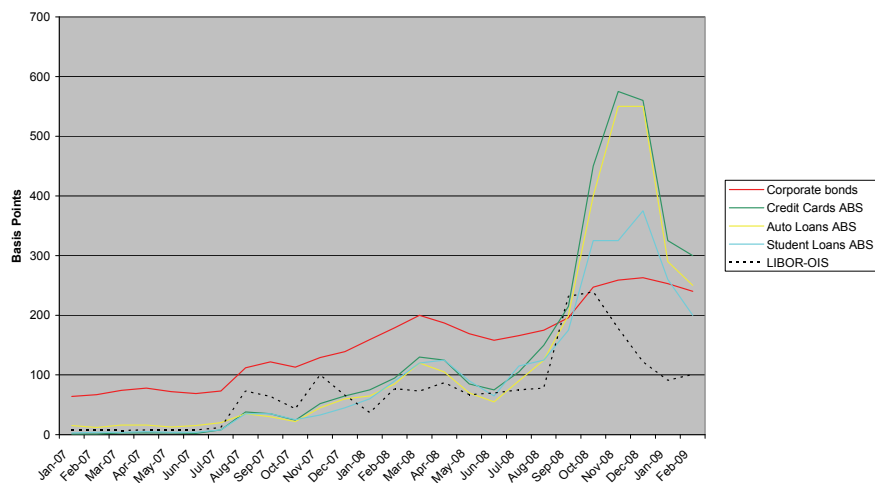
⁶⁹ Gorton & Metrick, *supra* note 8, at 511–13.

⁷⁰ On the notion of “natural buyer” see Shleifer & Vishny, *supra* note 68, at 36.

⁷¹ This point was initially made by Gorton. *See supra* note 44, at 38–41. Other commentators have subsequently subscribed to this view. *See, e.g.*, Arvind Krishnamurthy, *How Debt Markets Have Malfunctioned in the Crisis*, 24 J. ECON. PERSP. 3 (2010) (presenting empirical evidence on failure of arbitrage mechanisms, even in the absence of financial constraints). *See also* Arvind Krishnamurthy, *Amplification Mechanisms in Liquidity Crises*, 2 AM. ECON. J.—MACROECON. 1 (2010) (discussing a theoretical model of uncertainty amplifying an initially small shock from a financially constrained institution). In addition, there is uncontested empirical evidence that particularly commercial banks in the US had not been using their balance sheet capacity throughout the crisis. Adrian & Shin, *supra* note 12, at 612. *See also* Zhiguo He, In Gu Khang & Arvind Krishnamurthy, *Balance Sheet Adjustments During the 2008 Crisis*, 58 IMF ECON. REV. 118, 147–49 (2010).

Figure 3

Spreads on AAA US Securities



Source: INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT (April 2009 & April 2010).

Note: Spreads on corporate bonds are against 10-year U.S. government bonds. ABS Spreads are against 5-year swaps. LIBOR-OIS refers to 3-month maturities.

The leverage story alone simply cannot explain the financial crisis. First, an event other than the mere subprime prices downturn (but somehow connected with it) must have started the motion. Second, this event must have had sufficient impact to make the haircut/margin constraint eventually binding on the vast majority of financial intermediaries, so as to trigger the liquidity spiral described above. Third, this event needs to justify *net* sales of subprime-unrelated classes of debt securities, which can explain their falling prices. The only possible event of this kind is a generalized withdrawal from the banking system, that is, a bank run or the fear thereof.⁷²

B. *How Uncertainty Destroys Collateral (and Leads to a Liquidity Crisis)*

A series of bank runs actually happened after August 9, 2007,⁷³ but they were initially small. Some hedge funds deeply invested in subprime securities

⁷² See Gorton, *supra* note 53; Krishnamurthy, *Amplification Mechanisms in Liquidity Crises*, *supra* note 71.

⁷³ Brunnermeier, *supra* note 7, at 84–85.

immediately experienced a run by their investors and financiers, having to freeze redemption and to liquidate their positions at increasing losses; many of them eventually had to be shut down. If the banking sector had followed suit, this would have been a perfect example of liquidity spiral. But, particularly, U.S. investment banks did something different, at least initially. While a few banks were not sufficiently capitalized to bail out their off-balance-sheet vehicles, most banks could and did take them back.⁷⁴ Doing this in conditions of financial distress, which is a sufficient condition for being caught in a liquidity spiral, would have been suicide. On the contrary, all the U.S. major banks managed to stay afloat for more than half a year (the first big bank failure—Bear Stearns—only occurred in March 2008). However, after the first wave of panic, the banks had a substantial part of their balance sheet invested in illiquid assets. This transfer from off-balance-sheet vehicles is the connection with the falling subprime prices.

Falling subprime prices did not mean much in and of themselves.⁷⁵ They started to matter only when they affected the perceived liquidity of banks' liabilities. Hence, the news that BNP Paribas froze redemption from two small hedge funds had more impact than the longstanding bad news from the U.S. housing markets. For the first time, some AAA securities could no longer be traded for a certain amount of cash. In the words of one commentator,⁷⁶ this was "scary bad news"—news that is paradoxically uninformative because it makes the future look more uncertain than it was before the news.

The source of uncertainty was arguably twofold.⁷⁷ On the one hand, assets previously considered "stores of value" ceased to be good collateral because there was no conventional way to determine their value, and thus their prices fluctuated widely and unexpectedly. On the other hand, the scarcity of collateral brought counterparty uncertainty to the forefront, because suddenly, financial institutions became exposed to the failure of counterparties to make good on their promises. In what follows, I will try to show that these two effects are mutually reinforcing. Together, they may trigger liquidity spirals on broad classes of financial assets

⁷⁴ Hellwig, *supra* note 42, at 170–72; Gorton, *supra* note 44, at 41.

⁷⁵ As late as on July 10, 2007, Chuck Prince—former CEO of Citigroup—famously stated: "When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you've got to get up and dance. We're still dancing." POSNER, *supra* note 3, at 88–89 (noting that the music had already stopped, but Prince had not realized it).

⁷⁶ Geanakoplos, *supra* note 41, at 104.

⁷⁷ In a similar vein, see Gorton & Metrick, *supra* note 59, at 446.

when the natural buyers are *not* financially constrained—at least, not initially. The reason why fire sales occur in this setting is not that nearly all institutions are so much leveraged that they are forced to sell in falling markets, but rather that financially unconstrained institutions are *reluctant* to buy temporarily troubled assets, because those institutions fear a liquidity shock from some remote counterparty. This hypothesis is being investigated theoretically by a few scholars.⁷⁸ On the empirical side, there are two sets of problems. First, there is very little data available on wholesale funding markets. Second, because two main determinants of the demand for liquidity—rising counterparty risk and scarcity of collateral—change simultaneously, it is very difficult to disentangle what is causing what. Despite all these hurdles, it is worthwhile highlighting what the little data available suggests in this regard, at least in terms of correlations.

After the first wave of panic in 2007, the Keynesian convention according to which high-grade securitized assets are good substitutes for cash was compromised. Securitization was no longer a way to generate safe collateral.⁷⁹ Under conventional uncertainty about whether, when, and on what terms private debt will be repaid in the future, the amount of collateral that can be traded “safely” for cash suddenly shrinks to a narrow definition of cash-equivalents (e.g. sovereign debt, which at that time was neither experiencing nor was expected to experience trouble). This is the first reason why collateral becomes scarce—supply falls. The second reason is that the demand for cash increases for purely precautionary reasons. Because there is a limit to the adjustment of collateral prices to changes in demand and supply (nominal interest rates cannot fall below zero),⁸⁰ the scarcity of collateral exposes banks to an effective, but immeasurable risk of withdrawals either directly or via the default of counterparties.

This phenomenon is an example of a self-fulfilling prophecy depending on the sudden scarcity of collateral. Before financially unconstrained institutions can profit from purchasing a few securities at fire sales prices, say the subprime MBS,

⁷⁸ See Ricardo J. Caballero & Alp Simsek, *Fire Sales in a Model of Complexity* (Nat'l Bureau of Econ. Research, Working Paper No. 14997, 2012), available at <http://www.nber.org/papers/w15479>. See also Krishnamurthy, *Amplification Mechanisms in Liquidity Crises*, *supra* note 71, at 15–25.

⁷⁹ In passing, it is worth noting that something similar is happening in the Euro sovereign debt crisis. Public debt securities issued by some countries are no longer considered conventionally safe and thus they have lost liquidity, which is the main property of good collateral. See Peter Dattles et al., *The Sovereign Debt Crisis—Shifting from a Bad to a Good Equilibrium*, INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT, Apr. 2012, at 17–25.

⁸⁰ See ROUBINI & MIHM, *supra* note 33, at 144 (discussing how liquidity trap situations—where intermediaries are “awash with cash” but are still reluctant to lend—can arise from this circumstance).

larger liquidity buffers need to be created to protect from unexpected withdrawals. At this point, the question is whether to borrow that liquidity or to directly invest in more liquid assets, such as cash. When liquidity is contemporaneously becoming more expensive relative to other assets, even financially unconstrained natural buyers of troubled assets may choose to first sell untroubled assets for liquidity. As a result, currently untroubled assets suddenly trade at a lower price because of a liquidity premium. And untroubled assets may become troubled later on, if for any reason the liquidity premium rises so much as to trigger fire sales.

This theoretical sequence of events seems to be exactly what happened. The natural providers of liquidity, particularly in the United States, were the commercial banks that have access to relatively stable funding (insured deposits). There is evidence that U.S. commercial banks have ended up being net buyers of assets from financially constrained institutions (hedge funds and investment banks),⁸¹ but this has not prevented asset prices from falling. Most likely, U.S. commercial banks were simultaneously disengaging from unsecured interbank credit thereby making liquidity more expensive. Commercial banks were increasing their liquidity buffers by curtailing lending according to a general perception of rising counterparty risk. In secondary markets, this freezing of credit markets justifies a liquidity premium on every potentially illiquid asset so long as it is comparable to the cost for buyers to obtain cash for meeting unexpected withdrawals.

With all the caveats previously made about causality, the data suggest that there may be some truth in this hypothesis. Figure 3 shows that the spreads on mortgage-*unrelated* securities effectively moved together with the cost of (unsecured) interbank lending. The latter is plotted as the difference between the 3-month LIBOR and the spread on Overnight Index Swaps (OIS). Because the OIS spread takes out the expected impact of interest rate risk, the LIBOR-OIS can be considered as an indicator of counterparty risk among the major banks.⁸² In normal times, the LIBOR-OIS is just a few basis points. In August 2007, this indicator spiked at above 70 basis points and it subsequently increased with events worsening the counterparty risk (most notably, the collapse of Lehman Brothers in September 2008).

⁸¹ He, Khang & Krishnamurthy, *supra* note 71, at 136.

⁸² For a more detailed discussion of why this is the case, at least empirically, see Gorton & Metrick, *supra* note 59, at 446–47.

It is noteworthy that the spreads on mortgage-unrelated assets, both corporate bonds and ABS, increased immediately with the cost of interbank funds.⁸³ This circumstance suggests that banks curtailed lending immediately after the first wave of panic, which made liquidity more expensive and scarce, and induced some intermediaries to obtain precautionary liquidity more cheaply (at the margin) by selling assets. Causality could in principle run in the opposite direction,⁸⁴ namely from illiquidity of the assets to counterparty risk. However, this is unlikely. If banks are not distressed, the only reason to sell assets at a loss is to obtain liquidity at a cost that is lower, not higher, than tapping the interbank funds. If banks have to sell assets because they are distressed (the “classic” fire sale scenario), they are caught in a liquidity spiral, and so their demand does not affect the cost of interbank funds—the banks do not get any such funds. In the last scenario, the assets spreads should be significantly higher than the cost of unsecured borrowing. As Figure 3 suggests, this might have happened, but only after the bankruptcy of Lehman Brothers.⁸⁵

A similar dynamic of disengagement can be shown with respect to collateralized lending. In this context, withdrawal is operated via increasing haircuts: a 100% haircut means that the lender is unwilling to refinance the position. In normal times, haircuts reflect the expected volatility of the collateral regardless of the counterparty identity. Given the perceived safety of asset-backed securities, these haircuts were also very low before the crisis. Professors Gorton and Metrick report that they were zero in the most opaque repo markets.⁸⁶ Table 1 reports a broader information set from the International Monetary Fund’s *Global Financial Stability Reports*.

⁸³ With respect to Figure 3, it is worth noting that the assets spreads are calculated with different maturities, all longer than three months. Therefore, only the difference in trends is significant. INT’L MONETARY FUND, GLOBAL FIN. STABILITY REP. (Apr. 2009); INT’L MONETARY FUND, GLOBAL FIN. STABILITY REP. (Apr. 2010).

⁸⁴ Krishnamurthy, *Amplification Mechanisms in Liquidity Crises*, *supra* note 71, at 15.

⁸⁵ The study of secondary markets after the collapse of Lehman Brothers requires factoring in the effect of asset purchases by the government and central banks. This is beyond the scope of this inquiry. *See* He, Khang & Krishnamurthy, *supra* note 71, at 137–38.

⁸⁶ Gorton & Metrick, *supra* note 59, at 429.

Table 1
Typical Haircuts on U.S. Repo Transactions

	April 2007	August 2007	April 2008	August 2008
U.S. Government bonds	0.25	N/A	3	3
Corporate bonds (investment-grade)	0–3	0–3	8–12	8–12
Corporate bonds (high-yield)	10–15	10+	25–40	25–40
AAA CDOs	2–4	8–10	15	95–100
BBB CDOs	10–20	50	40–70	95–100
AAA ABS	3–5	8–10	N/A*	50–60

* The reported figure of 10–20 for AAA MBS can be considered as an upper bound.

Source: INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT (October 2007; April & October 2008).

The standard narrative about haircuts in the global financial crisis is that they rose reflecting the deterioration of the quality of the collateral, particularly of securitized assets. In other words, they rose because suddenly there was uncertainty on the price the underlying securities would fetch if the collateral had to be seized. Because lending is collateralized, counterparty risk is not supposed to matter. Despite the discontinuities in Table 1, this interpretation is apparently borne out by the data. But there is one circumstance suggesting that this might not be the whole story. Uncertainty about the quality of asset-backed securities kicked in at once when banks experienced the first wave of panic. The above interpretation implies that *haircuts should also rise at once* and remain almost at the same level until the uncertainty is resolved. However, Table 1 shows that haircuts increased very slowly even on the worse classes of assets. Perhaps the worst class of assets created from risky mortgages, the infamous Collateralized Debt Obligations (CDOs),⁸⁷ was accepted as collateral until the failure of Lehman, when cash became very difficult

⁸⁷ On the (obscure) logic behind the creation of CDOs, see Gorton, *supra* note 44, at 24–30.

to obtain across the board. Note that haircuts on corporate bonds increased too, but only in April 2008, despite these assets' being interested by a downward price trend similar to that of subprime-unrelated ABS—albeit less severe—already since August 2007 (Figure 3). These dynamics suggests that there could be *two* factors, and not just one, behind increasing haircuts.⁸⁸ The first is indeed the concern about the quality of collateral, which unambiguously increases the haircuts. The second factor is less straightforward. Liquidity could be drained independently from markets to intermediaries, in anticipation of future events that may make this liquidity very useful for profits or survival. The effect of this behavior on haircuts is ambiguous.

It is well established that counterparty uncertainty became relevant precisely when the collateral became unreliable. This correlation is clear, but it is puzzling.⁸⁹ In addition, as mentioned, it is difficult to say what caused what in a situation of falling prices and of intermediaries scrambling for cash. However, the precautionary motive for liquidity provides one theoretical reason why the haircuts should be low (or increase less rapidly) when there is fear that counterparties may default of their obligations. The reason is that *the borrower should be wary of the lender too*. If the lender defaulted and failed to return a security worth more than the funding it guarantees, the borrower would lose the haircut. In a situation where banks tend to hoard cash in anticipation of future withdrawals, lenders disengage by requiring higher haircuts. Borrowers, however, may refuse to accept higher haircuts, particularly on the best classes of assets, and instead close their positions at a liquidity discount. This dynamic parallels the disengagement from uncollateralized borrowing and contributes to explaining the initially moderate falling of subprime-unrelated securities prices (as well as their haircuts).

To appreciate the social waste implied by this behavior, let us consider an institution that is simultaneously both a borrower and a lender. A financially unconstrained bank protects from counterparty uncertainty by hoarding cash, which it can do by exiting the repo market in two ways. As a lender, the bank may require higher haircuts for fear that the price of collateral suddenly drops. As a borrower, the bank may deny any uncertain counterparty a haircut higher than the current liquidity discount and sell its best assets instead of borrowing against those assets.

⁸⁸ In a similar vein, Krishnamurthy argues that illiquidity depends on both the unwillingness of institutions to *purchase* on volatile secondary markets and on their aversion to *hold* illiquid investments (finding supporting evidence of both behaviors). Krishnamurthy, *How Debt Markets Have Malfunctioned in the Crisis*, *supra* note 71, at 14.

⁸⁹ Gorton & Metrick, *supra* note 59, at 446.

In this way, the bank reduces its exposure to lenders by tapping liquidity at a price between the cost of secured and unsecured borrowing. This strategy only makes sense under the worst-case scenario in which both the lender *defaults* and the assets prices *do not* fall. In this scenario, however, the protection of higher haircuts on the other side of the balance sheet is unwarranted. Asset prices cannot fall and not fall at the same time. Protection against immeasurable counterparty uncertainty thus leads to waste of liquidity. This situation is but one example of inefficiency due to double or multiple counting of the impact of worst-case scenarios, emphasized by the “flight to quality” literature on the financial crisis.⁹⁰

It is worth noting that the above mechanism of haircut adjustments involves adverse selection too, but only at a later stage. The natural consequence of disengagement from repo finance in that fashion is that both the best borrowers and the best assets gradually exit the market. Once only bad borrowers and bad assets are left will the haircuts rise to a point where the market collapses under massive fire sales. According to one competing explanation of the crisis,⁹¹ adverse selection materialized immediately when the AAA ratings on asset-backed securities became unreliable. These securities suddenly became “information-sensitive,”⁹² triggering incentives to process information on how much they were actually worth. In this perspective, rising haircuts are explained as an attempt by the most sophisticated investors to recreate information-insensitivity, which is a necessary condition for the securities to be acceptable as collateral.⁹³

While I share the view that asset-backed securities became information-sensitive upon the demise of their ratings, if not slightly earlier than that, I contend that uncertainty explains better than asymmetric information why information-insensitivity could not be recreated. If haircuts have not adjusted immediately to a market level, possibly as high as to trigger immediate systemic collapse through liquidity spirals, it must have been because no financial institution could credibly commit to a floor on the securities prices. In other words, nobody knew enough

⁹⁰ See Caballero & Krishnamurthy, *supra* note 40. See also Krishnamurthy, *How Debt Markets Have Malfunctioned in the Crisis*, *supra* note 71, at 12.

⁹¹ GORTON, *supra* note 7, at 144–47.

⁹² *Id.* at 112–13. See also Bengt Holmström, *Discussion of “The Panic of 2007” by Gary Gorton 2* (Oct. 14, 2008) (unpublished manuscript), available at <http://www.nber.org/papers/w14358>.

⁹³ See Tri Vi Dang, Gary Gorton & Bengt Holmström, *Ignorance, Debt and Financial Crises* (Feb. 13, 2012) (working paper), available at http://faculty.som.yale.edu/garygorton/documents/Paper_Ignorance_000.pdf.

about the future to establish a new Keynesian convention for pricing private debt securities. If this interpretation is correct, haircuts have been adjusting to worsening expectations on asset prices and counterparty defaults until they became so high to make these expectations self-fulfilling for certain assets and certain intermediaries.

If asymmetric information could not start this process, it has most likely increased its severity.⁹⁴ Institutions that could not hoard cash—for instance, because they were too heavily invested in MBS from the very beginning—were eventually caught in liquidity spirals that wiped out their equity. Forced sales are observable, and thus they are incompatible with the asymmetric information requirement of adverse selection. On the other hand, institutions that dumped healthy assets before being forced to do so were unlikely to deliberately suffer from adverse selection; more plausibly, they chose to sell in order to protect themselves from future withdrawals and from counterparty risk. In fact, a few classes of assets could be initially traded for cash at moderate liquidity discounts while mortgage-related assets could only be sold at fire sale prices immediately after August 2007 (compare Figure 2 with Figure 3). It looks like adverse selection kicked in dramatically only later on. After banks had disengaged from the least illiquid private assets in the quest for cash or cash-equivalents, the repo market could become a market for “lemons.”⁹⁵ This allowed both the spreads and the haircuts to skyrocket as the model predicts.⁹⁶ The increasing number of assets involved in fire sales would have driven all banks to bankruptcy, no matter how much cash they had managed to hoard, had the U.S. government and the Federal Reserve failed to prevent massive withdrawals from the banking system.

C. *Stopping a Liquidity Crisis: Limits and Potential of Monetary Policy*

Central banks reacted immediately. Already, in August 2007, they injected substantial amounts of cash via open market operations. Banks have been “awash with cash” since then.⁹⁷ Where did this cash go? Obviously, in the only kind of assets that could still be exchanged promptly and safely for cash, mainly deposits at

⁹⁴ Krishnamurthy also argues that both uncertainty and adverse selection played a role in the global financial crisis. Krishnamurthy, *How Debt Markets Have Malfunctioned in the Crisis*, *supra* note 71, at 14.

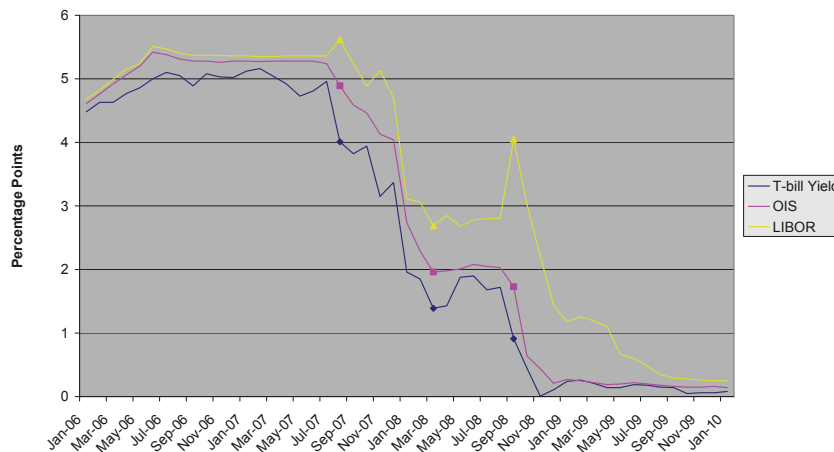
⁹⁵ George A. Akerlof, *The Market for “Lemons”: Quality Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488 (1970).

⁹⁶ See Gorton & Metrick, *supra* note 59, at 443–46 (documenting these two effects in the repo market).

⁹⁷ ROUBINI & MIHM, *supra* note 33, at 80.

the central bank and Treasury bonds. As Figure 4 shows, at the peaks of financial turmoil, investors did not mind earning on a Treasury bond nearly one percentage point less than the theoretical risk-free rate approximated by the OIS rate defined above. This preference for sovereign debt is evident in August 2007, and on the dates corresponding to the failure of Bear Stearns and Lehman. The negative spread of Treasury bonds from the OIS can be regarded as an indication of the price of cash: being a synthetic swap linked to monetary policy expectations, the OIS cannot be turned into cash, while a Treasury bond can. If both rates are risk free, the lower rate earned by a T-bond is suggestive of a liquidity premium. The size of the latter becomes all the more remarkable when our proxy for counterparty risk (LIBOR-OIS) is added. Both components skyrocketed after the U.S. government failed to rescue Lehman Brothers. But overall, banks hoarded more cash than the increasing fear of counterparty risk justified. As the more cash banks had, the more they hoarded, monetary policy became unable to control the money supply through open market operations.⁹⁸ This is exactly what Minsky had predicted would happen in a banking crisis.⁹⁹

Figure 4
US Rates on 3-Month Maturity



Source: INTERNATIONAL MONETARY FUND, GLOBAL FINANCIAL STABILITY REPORT (April 2010) and U.S. Treasury.

⁹⁸ *Id.* at 145.

⁹⁹ MINSKY, *supra* note 34, at 280–82.

It took quite some time for the monetary authorities to realize what was happening and to take the necessary measures to restore confidence and bank lending. The mechanisms of liquidity crisis that I have described above do not match mainstream economic theory.¹⁰⁰ However, they correspond with Minsky's view on how a systemic crisis arises when Ponzi and speculative finance are no longer sustainable.¹⁰¹ The systemic breakdown simply depends on the banks' inability to refinance their positions, which is a necessary condition for them to honor commitments to deliver cash on demand. Banks can only stay liquid as long as they are able to issue new debt. The reason why they lose this ability in a crisis is the general perception that the assets' cash flows will not be sufficient to service their liabilities. This perception, which triggers the withdrawals, is not justified by anything else than our humble Keynesian expectations under uncertainty.¹⁰² As soon as one event disrupts the convention that a certain debt, e.g. AAA securities, will eventually be repaid by future income, banks are in trouble because they may be asked to deliver cash against securities that are no longer traded for the cash flow they promise.

The event that triggers the switch of expectations is almost irrelevant. The unsustainable nature of subprime mortgages is a case in point. Drawing from their equity, banks could have possibly delivered cash against *all* subprime losses, with perhaps a few minor bankruptcies.¹⁰³ But the banking system could not withstand the suspicion that virtually all classes of private debts were financed according to the same Ponzi scheme, requiring the placement of additional debt in a situation where households could barely repay those they already had. That suspicion was highly unlikely to be true. According to Minsky's classification, banks engaging in maturity transformation perform mainly speculative finance in which the assets' cash flows are more than sufficient to pay the interest on liabilities.¹⁰⁴ Under reasonable conditions of risk diversification, this scheme only bears interest rate risk. Interest rates had been falling throughout the financial crisis.¹⁰⁵ However,

¹⁰⁰ *But see* PERRY MEHLING, THE NEW LOMBARD STREET—HOW THE FED BECAME THE DEALER OF LAST RESORT (2011) (considering a similar approach and discussing how it departs from mainstream economics and finance).

¹⁰¹ *See supra* text accompanying notes 34–35.

¹⁰² *See supra* text accompanying notes 27–28.

¹⁰³ Hellwig, *supra* note 42, at 181–83.

¹⁰⁴ MINSKY, *supra* note 32, at 118–21.

¹⁰⁵ ROUBINI & MIHM, *supra* note 33, at 144.

even the most conservative maturity transformation is exposed to the creditor's uncertainty as to whether banks can roll over their debts. The gist of Ponzi finance is not in its size, but in the consequences of its existence. When it is uncovered and obviously proven to be unsustainable, the Keynesian assumption that "the existing state of affairs will continue indefinitely"¹⁰⁶ cannot be maintained. This revelation adversely affects the confidence on other classes of debt regardless of how healthy they effectively are.

When uncertainty kicks in, standard economic theory is unable to predict its developments. Most theoretical models use comparative statics and tractable measures of risk, which can capture some parts of the story at best. The paradox of uncertainty in a Minsky/Keynes framework is that, while the specific event that brings uncertainty to the forefront is unpredictable, the dynamics of its consequences follow a definite pattern. The only rational strategy when faced with uncertainty about future liquidity conditions is to hoard cash. From the perspective of banks, and investors in general, this strategy requires losing income in the hope of avoiding bankruptcy. From the perspective of society, carrying out this strategy is neither possible nor efficient. It is obviously not possible, because there is no way in which all debt can be liquidated at once. It is not efficient, because liquidity is actually not needed other than for precautionary reasons, and the lack of need is the reason why funds were committed to finance in the first place. The only impact of cash hoarding on society is destruction of value through liquidity spirals, banks' bankruptcies, and credit crunches. This impact does not happen immediately as the system does not have a sufficiently large stock of stores of value to absorb the dumping of private debt. Private debt thus trades at a liquidity discount or not at all, which keeps the banking system on the verge of insolvency until cash hoarding makes income and prices fall so much as to determine a debt-deflation.¹⁰⁷ At that point, all debt must be restructured and the financial system has effectively failed.

This perspective somehow simplifies the question of what should be done to avoid the collapse. Withdrawals must be stopped, and the only way to do it—other than prohibiting them altogether, which would consolidate rather than resolve uncertainty—is to support the classes of private debts on which banks draw their commitments to deliver cash on demand. The only economic actor that can do this

¹⁰⁶ KEYNES, *supra* note 6, at 99.

¹⁰⁷ The mechanism of debt deflation was first identified by Irving Fisher, *The Debt-Deflation Theory of Great Depressions*, 1 *ECONOMETRICA* 337 (1933). For an illustration, see ROUBINI & MIHM, *supra* note 33, at 136–42.

is the state, more precisely the central bank.¹⁰⁸ Taking the perspective of society, the central bank can avoid waste of liquidity nurtured by individual fears of the unknown.¹⁰⁹

Central banks do not know better than individual agents what the future will hold. But central banks do have two comparative advantages. First, they can net out the impact of aggregate withdrawals on different counterparties.¹¹⁰ Second, they can issue virtually unlimited quantities of money,¹¹¹ which will not have inflationary consequences as long as cash is hoarded. To be sure, printing money to reduce the burden of debt redistributes wealth from creditors to debtors, which may adversely affect the recovery.¹¹² But this wealth redistribution is a purely theoretical scenario, as central banks' willingness to purchase private debt does not need to result in a physical exchange for cash unless there are actual withdrawals. As liquidity is sought for only for precautionary reasons, the central banks' commitment to provide cash when needed will suffice to stop the withdrawals. The United States' private debt crisis was actually stopped in this fashion, although governments and monetary authorities understood the mechanism too late to avoid issuing money and public debt for actual bailouts, with negative impacts on the sustainability of governments' finance.¹¹³

Of course, ex-post public intervention has adverse consequences on private choice ex-ante. Resolving uncertainty is a great thing, but it brings back to the forefront all the incentive problems (moral hazard, excessive leverage, adverse selection) that may not have played a central role in the global financial crisis, but will likely lead to another financial crisis in the future. However, the key message of Keynes/Minsky's theory of financial instability is not that we should forget about incentives. The core of this theory is that liquidity problems are *endogenous*, because they depend on the private creation of money by maturity transformation, which is in turn the essence of banking business and the source of its profits. The

¹⁰⁸ The views on this surprisingly converge across different schools of thought. Compare MINSKY, *supra* note 34, at 358–65; GORTON, *supra* note 7, at 183; with Caballero & Kurlat, *supra* note 16, at 28–30.

¹⁰⁹ Ricardo J. Caballero, *Crisis and Reform: Managing Systemic Risk*, MIT ECONOMICS, 11–12 (Mar. 31, 2010), <http://economics.mit.edu/files/5614>.

¹¹⁰ Jean C. Rochet, *Regulating Systemic Institutions*, 22 FINNISH ECON. PAPERS 35 (2009).

¹¹¹ Krishnamurthy, *Amplification Mechanisms in Liquidity Crises*, *supra* note 71, at 27.

¹¹² Tirole, *supra* note 4, at 317–20.

¹¹³ For an excellent overview of this problem and of its consequences on global imbalances in the current accounts of the balance of payments, see ROUBINI & MIHM, *supra* note 33, at 238–65.

study of banks' (and bankers') incentives must then start from this fundamental insight. Understanding the factors determining banks' exposure to uncertainty is a necessary condition for public intervention to cope with uncertainty in an incentive-compatible fashion.

IV. BANKING, CENTRAL BANKING, AND THE ROLE OF REGULATION

Regulators cannot predict how exactly banks will engage in creation of private money. However, we know that they will do it and why. Banks maximize profits in two ways: by increasing the maturity mismatch between long-term assets and cheaper short-term liabilities and by increasing the size of their balance sheet. Leverage and liquidity are therefore two sides of the same coin.¹¹⁴ Moreover, the development of conventions upon which liabilities can be safely exchanged for cash progressively eases the constraints of both leverage and liquidity on a bank's viability. Over time, holders of short-term liabilities allow banks to carry out more maturity transformation and to issue more debt given their equity. This transformation happens under two loose conditions: a period of financial stability that is supposed to "continue indefinitely,"¹¹⁵ and a financial innovation that, in the conventional absence of uncertainty, promises to deliver cash today against an arbitrarily long horizon of future cashflows. Securitization and the use of its output in the repo market illustrate how this transformation happened the last time. But, this example does not tell anything about *how* it can happen again, save that *it will* happen again under the same loose conditions.

It would be a mistake to explain this pattern as mere greed. I spoke of banks in abstract, but I should rather refer to banking. As Minsky argued,¹¹⁶ it is not difficult to create money; the difficulty is to get it accepted. Contrary to a diffuse opinion, banks have no exclusive right to create money; neither do governments and central banks—with one exception that I will discuss shortly. Once the convention is established that a certain class of assets can be exchanged for cash on demand, virtually anybody having access to these assets can perform maturity transformation—that is, create money—on a scale commensurate to the equity necessary to guarantee investors against underperformance of a diversified portfolio. If the assets already represent a diversified portfolio, as in the case of

¹¹⁴ Adrian & Shin, *supra* note 12, at 607–11.

¹¹⁵ KEYNES, *supra* note 6, at 99.

¹¹⁶ MINSKY, *supra* note 34, at 255. *See also* GORTON, *supra* note 7, at 155.

ABS, the equity requirements (the haircuts) will be lower. This phenomenon explains the growth of shadow banking. If we think of shadow banking as a competitor of traditional banking,¹¹⁷ banks could not avoid engaging in shadow banking through appropriate techniques and vehicles reducing their capital charges; shareholders would have gradually moved away from banks otherwise. In addition, shadow banking could offer investors returns higher than traditional deposits under the same conditions of withdrawal on demand. The faith of investors in shadow banking explains how maturity transformation could increase through issuance of more and riskier long-term debt (e.g. subprime mortgages) exactly when the equity of financial institutions was shrinking. Not greed, but competition drives the mechanism.¹¹⁸

Competition and (financial) innovation are hardly bad things. At least in a dynamic perspective, they can be reconciled. However, in financial intermediation, the combination of these factors with the conventional dismissal of uncertainty can lead to disaster. Take securitization as an example. It powerfully slices risk, can create relatively safe stores of value via a seniority mechanism, and provides credit to units that previously had little access to credit. What is the “safe” amount of cash promises that can be drawn on a securitization? Nobody knows. It depends on the conventions upon which risk assessment is performed. Whatever financial institution performs banking (henceforth, for simplicity, banks) will, under competitive pressure, stretch these conventions as to make more classes of assets acceptable for short-term funding, thereby profiting from money creation, but increasing the amount of Ponzi finance behind it. Promises to exchange assets for cash can only be honored by issuing more debt. Eventually, this cycle will have to stop. The problem is that it can only stop dramatically. Either the convention is accepted—and then all debt will be repaid in a stable infinite horizon; or it is rejected—but then only short finite horizons are considered, in which long-term debt cannot be repaid.

It may be tempting to simply let banks bear the consequences of their reliance on conventions. But the fact is that uncertainty cannot be handled otherwise, and when it kicks in upon the demise of conventions, it affects all banks and the entire economy regardless of how conservative agents have been with their indebtedness. In other words, there are externalities from banking and uncertainty makes those

¹¹⁷ Hellwig, *supra* note 42, at 151–53.

¹¹⁸ GORTON, *supra* note 7, at 164–67.

externalities unavoidable.¹¹⁹ For this reason, monetary authorities must always back up privately created money and commit to honoring the cash promises that banks are unable to meet. In a sense, this financial backstop has always been in place, even before the institution of central banks. Think of the private clearinghouse in the Free-Banking era.¹²⁰ The important advantage of central banks is that they can issue a kind of money endorsed by the government, which, albeit at the cost of redistributing real resources from creditors to debtors,¹²¹ is acceptable under any state of nature including a debt-deflation. As I said, this costly advantage does not need to be actually used when central banks are aware of how banks create money and commit in advance to discounting the underlying assets on predefined terms. To this purpose, central banks should know in advance on which kind of assets financial intermediaries perform maturity transformation, even without being able to second-guess the conventions that make this transformation possible.

By no means should central banks allow *any* kind of maturity transformation. If banks were permitted unfettered maturity transformation, moral hazard would become unmanageable. Banks could in principle promise to deliver cash on any kind and maturity of private debt, which would make commitments of both central and private banks not credible. Instead, the policy implication of this approach amounts to little more than what the Federal Reserve actually did in the global financial crisis. That is, the central bank should identify the classes of private debt that are mispriced because of cash hoarding, and it should refinance only these assets as opposed to formerly liquid assets that cannot be expected to deliver the promised cash flows under the current state of nature.¹²² The only difference is that this commitment should be undertaken *ex-ante*, not *ex-post*, when any delay makes uncertainty worse and more costly to handle. It is a difficult exercise, but at least in principle, it can be performed in the following fashion.

The central bank should announce periodically its willingness to discount private assets at different rates and haircuts. The rates should be fixed under a zero-profit condition for banks. The haircuts should reflect the worst-case scenario expectations about each asset's risk of default for different maturities of funding. Based on Minsky's classification,¹²³ assets supporting hedge finance should carry

¹¹⁹ Heremans & Paccos, *supra* note 9, at 571–75.

¹²⁰ For a historical discussion of that experience, see GORTON, *supra* note 7, at 28–37.

¹²¹ Tirole, *supra* note 4, at 318.

¹²² See ROUBINI & MIHM, *supra* note 33, at 151–57 (discussing the Fed policy of “quantitative easing”).

¹²³ See *supra* text accompanying notes 34–35.

little, if any, haircut, at least on the shortest maturities. The haircuts on speculative-finance assets should be higher and related to the interest rate risk. Finally, the haircuts on Ponzi-finance assets should be as high as the difference between the expected cash flows to maturity and the current value of principal and interests. In this way, the central bank bears almost no risk on the positions made during turmoil, provided that the turmoil comes to an end. For the turmoil to end, position-making by the central bank must be *credible*. Credibility will hold under three conditions. First, haircuts need to remain constant at the levels announced before the turmoil begins, no matter how badly funding conditions deteriorate. Second, every eligible bank should have access to discount so long as its capital is sufficient to maintain the haircuts; after that point, the bank would be bankrupt and the central banks should discount the creditors' claims on the bank's assets under the same rule. Third, positions should *not* be marked to market at least until the turmoil is ended.

This solution, which parallels Minsky's proposals on how central banks should perform their lender of last resort function,¹²⁴ needs more elaboration than can be afforded here.¹²⁵ Intuitively, the proposal implies two things. First, the central bank only sets a lower limit on the contraction of private money supply in the event of a crisis. Private haircuts and refinancing rates will never exceed the levels set by the central bank, and they will always be lower in normal times. Second, lending of last resort is made sufficiently penalizing for the banks, as they would be allowed to make no profits on the discounted assets precisely when the remainder of their balance sheet is generating losses. In this perspective, the most binding constraint on the safety of banking is that they need to have enough *equity capital* to meet the haircuts in order to avoid going bankrupt. The proposal only prevents the bank's equity from being wiped out by rising haircuts. Otherwise, it gives the central bank (or the creditors, or the government, depending on the winding-up procedures) a call option on the private bank's equity.¹²⁶ This option

¹²⁴ See MINSKY, *supra* note 34, at 279–82.

¹²⁵ It is worth noting that the proposed approach would cope with one major problem with the implementation of lending of last resort in panic situations: the stigma effect and its potentially disruptive consequences on the perceived solvability of banks borrowing from the discount window. This is because borrowing from the discount window against hedge-finance assets would be institutionalized along the lines identified by GOODHART, *supra* note 45, at 70–74, perhaps making only more penalizing borrowing anonymous. This approach also reflects the recommendation by MINSKY, *supra* note 34, at 362, to control private money supply through the discount window, although it does not rule out open market operations for targeting interest rates and policing inflation.

¹²⁶ For an analysis of bankruptcy based on options theory, see NICHOLAS L. GEORGAKOPOULOS, *PRINCIPLES AND METHODS OF LAW AND ECONOMICS* 234–43 (2005).

would be exercised when the bank turns out to be invested in more troubled assets than its equity can insure.

One additional step is necessary in order to keep banks' moral hazard under control. Under the proposed configuration of the safety net, a bank may still carry maturity transformation with too little equity, because its creditors know that its money-like liabilities will be honored by the central bank until the equity is effectively wiped out by the losses and the haircuts. Because creditors will not demand a risk premium for the part of the downturn that is to be absorbed by the safety net, ultimately taxpayers will have to pay the bill. In addition, operating under such a safety net would still allow for bank runs accounting for the difference between the central bank backstop and the level of private market haircuts *before* the crisis begins. The regulation of bank capital is then necessary not only to prevent moral hazard, but also for reasons of externalities. This need for oversight is not new, as the matter lies at the heart of the regulatory debate. However, the dynamics of uncertainty bring in two important policy implications also as far as capital regulation is concerned.

First, there is no point of countering regulatory arbitrage on capital adequacy. The private sector will always be faster than regulators in developing innovations that allow carrying maturity transformation with increasing leverage.¹²⁷ This is a strong argument against the growing complication of capital adequacy regulation, as under Basel II and its prospective overhaul under the Basel III approach.¹²⁸ A simpler lower bound on the capital/asset ratio—which, to be sure, is being studied as a part of the Basel III framework¹²⁹—is more difficult to game, especially when the quality of bank's assets is being monitored by the central bank for lender of last resort purposes. More importantly, banking should be defined functionally as any kind of financial intermediation involving maturity transformation.¹³⁰ Any intermediary issuing short-term liabilities should be deemed a bank unless there is no mismatch with its assets (for instance because their liquidity is guaranteed by a bank). Only the leverage of banks according to this definition should be regulated. In exchange for this regulation, only banks would have access to lender of last

¹²⁷ See GORTON, *supra* note 7, at 170–73.

¹²⁸ BASEL COMMITTEE ON BANKING SUPERVISION, *BASEL III: A GLOBAL REGULATORY FRAMEWORK FOR MORE RESILIENT BANKS AND BANKING SYSTEMS* (Dec. 2010, rev. June 2011), available at <http://www.bis.org/publ/bcbs189.pdf>.

¹²⁹ *Id.* at 4.

¹³⁰ See Paces, *supra* note 11, at 506–07.

resort facilities, whereas all the other intermediaries should be allowed to fail regardless of the size of their balance sheet.

The second implication is more interesting. A bank's capital performs two functions.¹³¹ It is a buffer against unexpected loss; and it gives shareholder an incentive to avoid excessive risk-taking. Under uncertainty, these functions must be reinterpreted. The buffer function is easily undermined by the growth dynamics of a bank's assets under the conventional view that debts can be increasingly rolled over at a profit. When these profits are capitalized as retained earnings, the buffer shrinks over time. In times of crisis, the buffer becomes effectively a haircut on the bank's unsecured debt that must be relaxed in order to allow the bank to meet its obligations. This problem is known as pro-cyclicality of capital adequacy regulation, and it is exacerbated by uncertainty.¹³² However, the endogenous dynamics of a bank's instability provides a solution.¹³³ Retained earnings should indeed be capitalized, but they should not be counted in the capital/asset restriction on a bank's balance sheet. The advantage of this solution over the countercyclical buffer included in Basel III is that a cushion of safety based on retained earnings would be both specific to the individual bank and less prone to error or capture of the supervisory authority.

The obligation to build up a buffer from retained earnings also serves a purpose in regards to incentives. It prevents shareholders as a group from cashing in the profits of meeting uncertainty in good times while externalizing the effects of this uncertainty on society in bad times. To be sure, individual shareholders do not need dividends to cash in their stock returns: they can just sell the shares. As Keynes recognized, liquidity of stock markets is a necessary evil of equity finance. Restricting the payout ratio of banking companies, as advocated by Minsky to improve bank shareholders' incentives, may be therefore insufficient to constrain immeasurable risk-taking by shareholders and managers because, by definition, immeasurable risk-taking is not incorporated in stock prices.

¹³¹ Hellwig, *supra* note 42, at 193.

¹³² MARKUS K. BRUNNERMEIER ET AL., *THE FUNDAMENTAL PRINCIPLES OF FINANCIAL REGULATION* 31–37 (2009).

¹³³ See MINSKY, *supra* note 32, at 356–57 (advocating regulation of banks' retained earnings for purposes of buffer and, more importantly, of incentives).

V. CORPORATE GOVERNANCE OF BANKS

According to Keynes,¹³⁴ the liquidity of stock markets is most unfortunate. It allows shareholders to renegotiate continuously their commitments to equity capital. Because shareholders do this mainly for reason of speculation, the corporate valuation is often detached from fundamentals. Rather, it reflects the speculators' expectations on how investors will value the stock in the *near* future. These expectations are based on the assumption that the state of affairs will continue indefinitely, unless there is a *specific* reason to expect a change. In general, this implies that stock prices are affected by short-termism, a fact that supporters of the Efficient Capital Market Hypothesis have been unable to falsify.¹³⁵ In banking, this implies that the value of a speculation business (maturity transformation) is determined in turn by speculation on its short-term profits. Even if regulation restricts the payout ratio of banking companies to make shareholders internalize the effects of future unexpected illiquidity, the bank's equity may still be overvalued by markets because of immeasurable risk-taking—that is, embarking upon Knightian uncertainty. This point, however, is only relevant for financial regulation if overvalued equity affects the decision of bank managers to engage in socially excessive maturity transformation.

It is not immediately clear why this should be the case. In principle, bankers have much to lose from embarking on uncertainty. If bankers are lucky—that is, so long as existing conventions are maintained—they will eventually get rich. But when things go wrong—and it will happen eventually—bankers will be personally ruined unless they have already become rich enough to diversify their wealth. In more technical terms, managers are naturally risk- (and uncertainty-) averse.¹³⁶ Now look at the banks' shareholders. The shareholders can always cash in their returns in a boom whereas they are bound to lose only a portion of their wealth in a bust. Therefore, shareholders are the ones who want to load on uncertainty. So shareholders seek to counter managerial risk aversion. They can do it by threatening to fire those managers who underperform relative to their competitors. In exchange for that, managers contract for a compensation scheme allowing them

¹³⁴ KEYNES, *supra* note 6, at 98.

¹³⁵ For a discussion of the implications of the ECMH on corporate governance, see Bratton & Wachter, *supra* note 20, at 688–96.

¹³⁶ Marco Becht, Patrick Bolton & Ailsa Roell, *Corporate Law and Governance*, in HANDBOOK OF LAW AND ECONOMICS 829, 846 (A. Mitchell Polinsky & Steven Shavell eds., 2007).

to cash in short-term returns through bonuses and stock option plans. These compensation schemes allow managers to then diversify their wealth.

If that was the end of the story, prohibiting banks from increasing the size of their balance sheet via retained earnings (while constraining the distribution of the latter) would suffice to prevent bankers and shareholders as a group from cashing in the proceeds of uncertainty, eventually at the expenses of society. This perspective, however, neglects the role of Keynesian speculators. Under a convention that—given the bank’s equity—all debt created can be exchanged for cash, speculators may still reward banks engaging in excessive maturity transformation. This speculation will occur because the impact of a liquidity crisis on the bank’s equity and retained earnings will only materialize in some *future* state of the world unaccounted for by the existing convention. On the other hand, the existing convention bears out the *immediate* profits of maturity transformation. Note that this effect is amplified when the bank can increase its Return on Equity by leveraging on retained earnings, and it becomes extreme in the presence of moral hazard. However, the tendency of stock markets to reward strategies disregarding future uncertainty (as well as its externalities to society) would hold true also under the regulatory constraints introduced in the previous section, which in principle disallow both capitalizing retained earnings and moral hazard.

Speculation can affect bankers’ behavior in two ways. The first is the impact of large shareholders, who do not participate in speculation but whose portfolio returns are affected by it. Those shareholders can replace an underperforming management.¹³⁷ The second channel is pay-per-performance, which gives bankers themselves an incentive to behave like speculators, cashing in the short-term profits of meeting uncertainty while leaving the shareholders in the cold when uncertainty turns out badly.¹³⁸ The first hypothesis implies that managers’ incentives are effectively aligned with the interest of long-term investors; in other words, corporate governance—at least how we understand it—has no bearing on financial instability. Bankers engaging in excessive maturity transformation with excessive leverage are simply acting in the best interest of their shareholders, whose expectations fail to factor in the effects of uncertainty on their own wealth and on the wealth of society. Whether the problem is externalities, moral hazard, or both, it should be tackled by regulation of banking, not by banks’ corporate governance.

¹³⁷ *Id.* at 853.

¹³⁸ Bratton & Wachter, *supra* note 20, at 714–15 (hypothesizing, however, a straight departure from the ECMH for this to happen).

On the contrary, under the second hypothesis, corporate governance is part of the problem because bankers engage in more immeasurable risk-taking (Knightian uncertainty) than shareholders would want given banking regulation. This strategy imposes prospective losses on both shareholders and the society with the sole purpose to increase managerial remuneration.

The hypothesis of managerial opportunism has received more credit in the policy debate.¹³⁹ The preference for this hypothesis is understandable, as it seems that bankers have been the only winners of the global financial crisis. Bankers could take home substantial bonuses and gains from stock options just before the losses of the banks they had managed hit shareholders, taxpayers, and society at large.¹⁴⁰ However, what bankers actually cashed in does not say much about their incentives to take more immeasurable risk than it would be optimal for shareholders. What matters is whether they cashed in as much as they could, because only this circumstance could validate the suspicion that bankers knew better than shareholders what was going to happen. This proposition is not borne out by the empirical evidence. As shown by Fahlenbrach and Stulz,¹⁴¹ bankers rather chose to increasingly tie their destiny to that of shareholders, as they reinvested (and lost) significant parts of their remuneration in the banks' stock. The authoritative proposals to backload bankers' remuneration and to increase shareholders' voice in its determination,¹⁴² both of which were ultimately adopted in the U.S. Dodd-Frank Act,¹⁴³ are difficult to reconcile with this evidence. It looks like such measures will either increase the cost of bank management or decrease its quality, without affecting banks' stability.¹⁴⁴

¹³⁹ See, e.g., POSNER, *supra* note 3, at 98–99; ROUBINI & MIHM, *supra* note 33, at 68–72.

¹⁴⁰ This view has been vigorously aired by Professor Bebchuk and his co-authors in a series of recent articles. See Lucian A. Bebchuk, Alma Cohen & Holger Spamann, *The Wages of Failure: Executive Compensation at Bear Stearns and Lehman 2000–2008*, 27 YALE J. ON REG. 257 (2010); Lucian A. Bebchuk & Jesse M. Fried, *Paying for Long-Term Performance*, 158 U. PA. L. REV. 1915 (2010); Lucian A. Bebchuk & Holger Spamann, *Regulating Bankers' Pay*, 98 GEO. L.J. 247 (2010).

¹⁴¹ Rüdiger Fahlenbrach & René M. Stulz, *Bank CEO Incentives and the Credit Crisis*, 99 J. FIN. ECON. 11 (2011).

¹⁴² Sanjai Bhagat & Roberta Romano, *Reforming Executive Compensation: Focusing and Committing to the Long-term*, 26 YALE J. ON REG. 359 (2009); Bebchuk, Cohen & Spamann, *supra* note 140.

¹⁴³ Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. 111-203, §§ 951–956, 124 Stat. 1376–2223 (2010).

¹⁴⁴ See Steven N. Kaplan, *Should Banker Pay Be Regulated?*, 6 THE ECONOMISTS' VOICE (Dec. 2009).

The hypothesis that bankers' incentives were instead aligned with the interest of shareholders enjoys more empirical support. It seems that the bankers whose incentives were better aligned with shareholders' interest performed worse in the crisis. This conclusion is supported on several grounds. Managerial ownership,¹⁴⁵ the number of independent directors,¹⁴⁶ and a standard index of shareholder-friendliness,¹⁴⁷ are all negatively associated with bank performance *during* the crisis. However, the same indicators of incentive alignment are positively associated with bank performance *before* the crisis. It seems then that shareholders fell in love with the profits of securitized banking, which they regretted when the crisis unexpectedly hit.¹⁴⁸ It is hard to see how this outcome could be improved by supplying bankers with longer-term incentives. Although, as I mentioned, very authoritative scholars advocate this,¹⁴⁹ one should take into account that even the banks normally credited with a long-term orientation have failed in the global financial crisis. There is no evidence that banks with concentrated ownership in continental Europe have outperformed those with diffuse ownership in the U.S. and the U.K.,¹⁵⁰ while some studies even show the opposite.¹⁵¹

It is thus tempting to conclude that corporate governance had nothing to do with the global financial crisis. Under the conventional view of corporate governance according to which managers (the agents) are supposed to act in the best interest of shareholders (the principal) however far this interest is from that of society at large, the only plausible conclusion is that corporate governance played no role in the crisis. However, let us try to look at the matter in more abstract terms. Assume that, in the aftermath of a financial crisis, a credible safety net is established together with an incentive-compatible banking regulation, for instance along the lines sketched out in the previous section. Under this assumption,

¹⁴⁵ See Fahlenbrach & Stulz, *supra* note 141.

¹⁴⁶ See Renee Adams, *Governance and the Financial Crisis* (Univ. of New South Wales; Fin. Research Network; European Corporate Governance Inst., Working Paper, 2011), available at <http://ssrn.com/abstract=1945567>.

¹⁴⁷ See Beltratti & Stulz, *supra* note 20.

¹⁴⁸ Bratton & Wachter, *supra* note 20, at 718–19.

¹⁴⁹ See *supra* text accompanying notes 140–42.

¹⁵⁰ Beltratti & Stulz, *supra* note 20, at 13.

¹⁵¹ Reint Gropp & Matthias Köhler, *Bank Owners or Bank Managers: Who Is Keen on Risk? Evidence from the Financial Crisis* (Ctr. for European Econ. Research Discussion Paper No. 10-013, 2010), available at <http://ssrn.com/abstract=1555663>.

shareholders would now care to maximize profits minus the expected losses from illiquidity that will not be avoided by the safety net. In other words, for the moment I am assuming there is no moral hazard. The question would then be the following: after regulation has managed to have banks' externalities internalized by banks' shareholders, can the corporate governance of banks undermine this result?

The answer is a qualified yes, which calls for some regulatory intervention in the contract between shareholders and bank managers. Under the above hypothetical scenario, initially we would expect shareholders to ask bank managers to share in the prospective losses from illiquidity even if these losses materialize after they are gone. Bankers, on the other hand, will likely ask something in exchange of such a claw-back provision. This can be either a higher fixed compensation or tenure, in the absence of which the best bankers would rather go work somewhere else: for instance, a hedge fund. The reason why tenure matters for bankers is that the norm of prudent banking is a very fragile convention that only holds in the aftermath of a crisis. Eventually, it will be replaced by another convention, namely that creating money out of long-term debt in some new fashion is again "safe." This convention will in turn induce shareholders to overlook future losses from illiquidity. At that point, an untenured manager would be exposed to short-termist pressure independently of any claw-back provision. The manager will have to take some immeasurable risk or be replaced by somebody else willing to do it. Because either way the claw-back would make the manager bear prospective losses from illiquidity, she would rather keep her job and manage to the bullish market. This effect is avoided if bankers accepting the claw-back provisions are tenured or can be compensated for the value of their tenure, for instance through a golden parachute.¹⁵²

Tenure and golden parachutes efficiently protect bankers from stock-market speculation because they commit shareholders to refraining from putting short-term pressure on managers. Of course, this solution allows managers to extract higher private benefits of control. I leave the general discussion on whether this outcome is good or bad for corporate governance for another time.¹⁵³ Intuitively, however,

¹⁵² According to a general model of severance payments, ex-post compensation in the form of a golden parachute commits shareholders to tolerating moderate underperformance, in which case compensating tenure is cheaper than the higher fixed salary demanded by a manager that can be replaced at will. See Andres Almazan & Javier Suarez, *Entrenchment and Severance Pay in Optimal Governance Structures*, 58 J. FIN. 519 (2003).

¹⁵³ Alessio M. Paccès, *Control Matters: Law and Economics of Private Benefits of Control* (European Corporate Governance Inst., Working Paper No. 131, 2009), available at <http://ssrn.com/abstract=1448164>.

the extraction of private benefits should be less harmful in banking than in other businesses because managers' inclination to enjoy "free cash flow" when they are insulated from hostile takeovers turns out to be beneficial for society in a liquidity crisis.¹⁵⁴ The crucial point, however, is that this solution needs to be supported by regulation.

First, the claw-back provisions cannot be left to shareholders' choice as in the previous example in which moral hazard was assumed away for convenience. Shareholders may well endorse claw-backs in the aftermath of a financial crisis, but their commitment would not be robust to changes in the stock market's expectations. Claw-backs will disappear from the market as soon as speculators return bullish about the profit potential of banking. Because stock markets can be short-termist, claw-backs must be imposed by regulation.¹⁵⁵ However, the rationale here is not to align managerial incentives with shareholders' interest, but rather to draw a wedge between these.

Secondly, regulation should support bankers' tenure. Managerial tenure is not in line with the general attitude of policymakers, which rather support shareholder empowerment *vis-à-vis* the management. This approach should change with the purpose of enabling long-term commitments of shareholders as opposed to their short-termism fueled by speculation. Shareholders should have free choice about whether to give bankers tenure and for how long, or rather pay them a higher salary in return of the pay-per-performance mandatory claw-back. Regulation should just be enabling on this point, namely neither mandate nor prohibit bankers' tenure.

Thirdly, regulation should allow golden parachutes freely, instead of restricting them as it is inclined to do.¹⁵⁶ Particularly, any amount contracted for replacing a manager before her term is expired should not fall within the scope of the claw-back provision unless the latter has been already triggered. Shareholders who, under pressure by speculators, want a new management to take more immeasurable risk should pay for that upfront. Conversely, shareholders who already suffered losses because of the current management's dealing with uncertainty should be able to claim back the bankers' gains whether they decide to replace them or not.

¹⁵⁴ For the illustration of how entrenched managers tend to waste free cash flow, see Michael C. Jensen, *Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers*, 76 AM. ECON. REV. 323 (1986).

¹⁵⁵ Albeit timidly, Section 954 of the Dodd-Frank Act seeks to achieve this outcome. See Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. 111-203, § 954, 124 Stat. 1376, 1903 (2010).

¹⁵⁶ See *id.* at § 951, 124 Stat. at 1891 (subjecting severance payments to shareholders' say-on-pay).

A similar approach—namely, insulation of bank control from stock market speculation—should govern the regulation of banks having a controlling shareholder. In this context, claw-backs are not necessary, unless the controlling shareholder is directly involved in the management (in which case, the same rules as above should apply). Differently from a manager on a pay-per-performance scheme, a controlling shareholder naturally bears the long-term consequences of her actions, including the choice to take immeasurable risk. A controlling shareholder cannot exit her investment unless she gives up control, so at least in principle she should be insensitive to speculation. Then, the question is why banks with a controlling shareholder have performed as bad, and possibly worse, than banks under managerial control?

There is probably more than one answer to this question, but one plausible conjecture is that controlling shareholders are *not* as insensitive to speculation as standard theory suggests. The investment of a controlling shareholder has an opportunity cost, which is given by the return on the same investment as a diversified portfolio. This opportunity cost increases when the bank's stock returns decrease relative to alternative investments, which is the case when speculation induces other banks and firms in general to take more risk. A good reason for a controlling shareholder to forego these higher returns is private benefits of control. This hypothesis does not seem to be supported by the empirical evidence: all proxies for the presence of private benefits of control have no significant impact on banks' risk-taking before the crisis.¹⁵⁷ However, this applies only to indicators of *measurable* risk, which surprisingly, are associated with worse pre-crisis returns and better performance post-crisis. According to the uncertainty approach developed in this article, the stock market was instead rewarding *immeasurable* risk-taking by the bank in the buildup of the crisis. The empirical studies carried out so far do not refute this hypothesis. If the hypothesis is true, controlling shareholders could have foregone the market reward of immeasurable risk-taking if they were able to appropriate likewise immeasurable private benefits of control. Elsewhere, I have characterized these as idiosyncratic private benefits of control, including the individual satisfaction of controlling a successful enterprise supported by the ability to claim a control premium in exchange for this satisfaction.¹⁵⁸ Safeguarding these benefits can be a good reason for controlling shareholders to be insensitive to speculation and short-termism.

¹⁵⁷ Beltratti & Stulz, *supra* note 20, at 14–15.

¹⁵⁸ See Paces, *supra* note 153.

In one empirical analysis discussed earlier,¹⁵⁹ proxies of outside shareholder control—which is conventionally considered good governance—are positively associated with the pre-crisis stock returns, but negatively associated with the post-crisis performance of banks. Now, consider the position of a controlling shareholder who wants to steer clear from a conventional policy of high indebtedness and extreme maturity transformation, but has to deal with outside investors empowered by “good” corporate governance. Such a controlling shareholder would have to fight constantly with a board that is strong by assumption; she would eventually lose support by her financiers; and she would be most probably derided by her peers. This situation would hardly compensate the money lost under her unconventional view of the uncertainty ahead. For one, she might be wrong in choosing the debt to steer clear from or in predicting a systemic crisis that will not happen soon. Even if she is eventually right, she will not regain the support of shareholders and financiers who opposed her. As Keynes put it, “it is better for reputation to fail conventionally than to succeed unconventionally.”¹⁶⁰ The anecdotal evidence on hedge fund controllers who shorted the subprime business confirms this hypothesis. All they earned was ingratitude and withdrawals from the investors they had just made rich.¹⁶¹

One way for a bank’s controller to oppose the conventional safety of immeasurable risk-taking is to threaten appropriation of immeasurable private benefits of control. For this strategy to be credible, the controlling shareholder must be always in the position to leave *for an arbitrarily large control premium*. It is normally believed that in this situation control hardly ever changes hands.¹⁶² But, this conclusion is unwarranted when the opportunity costs of control are factored. The incumbent controller cannot credibly ask more than the stock valuation under her unconventional view of uncertainty, which would be by definition lower than the conventional valuation based on more immeasurable risk-taking. So, the control transaction will eventually take place depending on the relative robustness of the incumbent’s and the insurgent’s expectations. Of course, we do not know *ex-ante* which expectations are right (the optimist’s or the pessimist’s), but that does not matter. What matters is that insurgents and incumbents pay and receive the price for what they believe is the future value. The only condition for such a control

¹⁵⁹ Beltratti & Stulz, *supra* note 20, at 12.

¹⁶⁰ KEYNES, *supra* note 6, at 102.

¹⁶¹ See generally MICHAEL LEWIS, THE BIG SHORT—INSIDE THE DOOMSDAY MACHINE (2010).

¹⁶² See, e.g., Becht, Bolton & Roell, *supra* note 136, at 851–52.

transaction not to result in higher externalities of banking is that, however the takeover is implemented, retained earnings can increase neither the size of the bank's balance sheet nor its payout ratio, as argued in the previous section.

Unfortunately, takeover regulation often stands in the way of such transactions by placing restrictions on the controller's ability to claim a control premium. One prominent example is the European Takeover Directive,¹⁶³ whose mandatory bid prevents controlling shareholders larger than 30% from selling their shares at a premium over non-controlling stock. Such restrictions should be removed, or at least waived for banks. This waiver would be the companion of allowing bank managers to contract for tenure and severance payments in exchange for mandatory claw-back provisions. If we consider that claw-backs aim to make bank managers behave more like block-holders than like speculators,¹⁶⁴ the logic of lifting both kinds of restrictions is identical: to avoid that bankers become victims of speculators under any ownership structure. Paradoxically, restrictions on control premiums are present in Europe,¹⁶⁵ where the majority of banks have concentrated ownership, whereas the Dodd-Frank Act has introduced "say-on-pay" restrictions on golden parachutes in the U.S.,¹⁶⁶ where virtually all banks have dispersed ownership. I hope to have demonstrated that these regulations are a mistake. All restrictions on the ability of controlling shareholders and managers to sell bank control for a premium should be lifted. Once again, shareholders who want bankers to take more immeasurable risk should pay for that upfront.

VI. CONCLUSION

I have presented an alternative approach to financial crises based on uncertainty as conceptualized by Knight,¹⁶⁷ developed in a theory of long-term expectations by Keynes,¹⁶⁸ and applied to banking by Minsky.¹⁶⁹ This perspective

¹⁶³ Directive 2004/25/EC of the European Parliament of the Council of 21 Apr. 2004 on Takeover Bids, 2004 O.J. (L 142) 12 [hereinafter *Takeover Bids Directive*].

¹⁶⁴ Bratton & Wachter, *supra* note 20, at 724–26.

¹⁶⁵ *Takeover Bids Directive*, *supra* note 163, at art. 5 (prescribing the mandatory bid).

¹⁶⁶ Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. 111-203, § 951, 124 Stat. 1376, 1891 (2010).

¹⁶⁷ KNIGHT, *supra* note 5.

¹⁶⁸ KEYNES, *supra* note 6.

¹⁶⁹ MINSKY, *supra* note 32.

reveals how banks perform maturity transformation by conventionally disregarding uncertainty about future liquidity conditions, which eventually undermines acceptance of the private money they create and determines systemic liquidity crises. This approach explains better than others the unfolding of the global financial crisis, the behavior of banks, and the role of regulation and central banks. Compared to other formalized models of uncertainty in financial crises,¹⁷⁰ the dynamic approach of this article fills one important gap in the theoretical literature. Not only does it explain why banks hoard cash in bad times, it also describes the dynamics of uncertainty in good times, when private substitutes for cash are created in the first place through increasing maturity transformation. The formalization of the complex dynamics of construction and subsequent dismissal of conventions to handle uncertainty, first identified by Keynes, is an issue for future research.

It may be asked why creation of private money should be allowed at all. Under slightly different behavioral assumptions, one recent model shows that the supply of private money is inefficient as it results in the generation of false substitutes of safe cash.¹⁷¹ This thesis stands in sharp contrast with evolutionary theories of banking,¹⁷² which show how also historically creation of bank money is endogenous to competition and growth. The present study endorses the view, accepted by Keynes too, that the private supply of liquidity is an unavoidable consequence of capitalism. Besides, as the more recent crises of sovereign debts demonstrate, there are no “true” or “false” substitutes of cash under structural conditions of uncertainty.

The approach of this article shares the conclusion of others that private incentives tend to generate excessive supply of bank money because of externalities.¹⁷³ Hence, the ability of financial intermediaries to engage in maturity transformation should be constrained by regulation. However, it is even more important that monetary authorities monitor and back up private money because failure to do so undermines the efficacy of monetary policy and can lead to financial meltdown. Following Minsky, this article contends that the supply of private money should be disciplined by an adaptive configuration of the lender of

¹⁷⁰ See, e.g., Caballero & Simsek, *supra* note 78.

¹⁷¹ Nicola Gennaioli, Andrei Shleifer & Robert Vishny, *Neglected Risks, Financial Innovation, and Financial Fragility*, 104 J. FIN. ECON. 452 (2012).

¹⁷² MINSKY, *supra* note 32, at 249–82; GORTON, *supra* note 7, at 38–59.

¹⁷³ See Jeremy C. Stein, *Monetary Policy as Financial Stability Regulation*, 127 Q.J. ECON. 57 (2012).

last resort function of central banks and by imposing a strict counter-cyclical capital/asset ratio on the balance sheet capacity of all intermediaries issuing money-like liabilities—that is, banking as functionally defined. It is worth mentioning in passing that this approach has important points of tangency with the current debate on the sovereign debt crisis of the Eurozone.

The global financial crisis has been sometimes popularized as “the Minsky moment.”¹⁷⁴ Had Hyman Minsky still been alive, he would have probably credited this to Keynes. However, in one key aspect Minsky’s theory of financial instability departed from that of Keynes: the role of equity markets. According to Keynes, liquidity of stock markets is most unfortunate because it conditions managerial decision-making to the conventional expectations of speculators. When applied to banks, this approach has one important implication for corporate governance. Managerial claw-backs or the ownership structure appear to foster long-term orientations in bank management only to a limited extent. In booms, bankers will always tend to cater to the short-termism of stock markets—unless they have tenure and the possibility to trade private benefits of control for compensation. If these options are allowed, prudent managers are likely to negotiate them in exchange for mandatory claw-backs. Under this regime, short-termist shareholders would have to pay upfront for replacing a prudent manager or controller, for embarking in more immeasurable risk-taking, and possibly for externalizing part of the consequences to society. Therefore, regulatory restrictions on golden parachutes and control premiums should be removed.

¹⁷⁴ ROUBINI & MIHM, *supra* note 33, at 91. *See also* GEORGE COOPER, THE ORIGIN OF FINANCIAL CRISES: CENTRAL BANKS, CREDIT BUBBLES AND THE EFFICIENT MARKET FALLACY (2008).