The New Lombard Street

How the Fed became the dealer of last resort

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To Judy, the kids, and the grandkids

I am by no means an alarmist. I believe that our system, though curious and peculiar, may be worked safely; but if we wish so to work it, we must study it. Money will not manage itself, and Lombard Street has a great deal of money to manage.

Bagehot (1873, 20)

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Acknowledgements

This book has taken me fifty years to write, but it was Seth Ditchik's query back in November 2008 that finally got me to write it. Given the drama playing out before our eyes, he thought there might be room for a book that puts the current crisis in some larger historical perspective, and he thought I might be the person to write it. I don't know that I have written exactly the book he had in mind, but I can definitely say that I have written the book that I had in me. It revisits terrain that I have toured in my previous books, The Money Interest and the Public Interest (Chap. 2-3) and Fischer Black and the Revolutionary Idea of Finance (Chap. 4), but the perspective is new. That perspective has been hard-won from experience of more than a decade teaching patient New York undergraduates how the money markets downtown actually work (Chap. 5). But it is also fresh in the sense that it has been forced sharply into focus by the events since August 2007, and by my attempt to participate constructively in the policy response to those events (Chap. 6). The "money view" that I had been developing in the classroom seemed to make sense of what was happening even when other more familiar views, from economics and finance both, did not.

Above all others, Larry Kotlikoff deserves thanks for arranging my accommodations at Boston University during the year 2008-2009, for pushing me into the policy process, and then for backing off and letting me write the book. Probably I have not written the book he would have liked—he has written that book himself, under the title Jimmy Stewart is Dead—but the book I have written would be quite different, in ways that are impossible to imagine, without him. Thanks also to Joe Stiglitz and the folks at Columbia University's Initiative for Policy

Dialogue for making room for my somewhat premature maunderings about credit default swaps back in May 2008, and to Jamie Galbraith and the folks at Economists for Peace and Security for multiple opportunities to present my developing views, first in November 2008.

Thanks also to those, mostly at the New York Fed, who worked tirelessly behind the scenes during this crisis to create the programs that put a floor on the crisis, programs that I believe show us the road toward a workable future beyond the crisis. It is the nature of their work that I know a lot more about the programs than the people, so they are largely unsung heroes, but heroes nonetheless. Thanks also to my academic colleagues who, beyond the call of scholarly duty, found time in the middle of their own work to read and comment on chapter drafts along the way: Roger Backhouse, Aaron Brown, Andre Burgstaller, Ben Friedman, Charles Goodhart, Rob Johnson, Anush Kapadia, David Laidler, Daniel Neilson, Goetz von Peter, Sanjay Reddy, and Roger Sandilands. Probably all of these, both Fed staff and academic colleagues, will find something to disagree with in the book, and that is as it should be; one lesson of the history I tell is that when academics and practitioners agree, we should worry.

Thanks finally to my family, who made room for yet another summer of Papa In His Study, not excluding even two August weeks in Cortona, Italy, where the first draft of Chapter 3 was produced. None of this would have been possible without your lasting support. It takes a family to write a book; you are mine, and this is yours.

Introduction

The financial crisis that started in August 2007 and then took a sharp turn for the worse in September 2008 has proven to require more than the Subprime Solution advocated by Yale professor Robert Shiller, and to involve significantly greater loss than the Trillion Dollar Meltdown foreseen by Charles Morris. It is instead proving to be what Mark Zandi has called an "inflection point in economic history." That means that we need a historical perspective in order to understand our current predicament, and to see beyond it to a possible future.[1]

The intellectual challenge of producing such an account is large, given the scope of the crisis that is transforming not only banking and financial institutions and markets, but also the regulatory and supervisory apparatus within which those institutions operate, including most dramatically the role of the Federal Reserve. On this last point alone, textbooks still tell how the main task of the Fed is to control the short term rate of interest in order to achieve a long run inflation target. However, ever since the crisis began, the Fed has instead been fighting a war, using every weapon at hand, including a number of new ones never used before.

"Lender of last resort" is the classic prescription for financial crisis. "Lend freely but at a high rate" is the mantra of all central bankers, ever since Walter Bagehot's magisterial Lombard Street, A description of the money market (1873). That is what the Fed did during the first stages of the crisis, as it sold off its holdings of Treasury securities and lent out the proceeds through various extensions of its discount facility.

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[1] Shiller (2008), Morris (2008), Zandi (2009).

But then, after the collapse of Lehman Brothers and AIG, and the consequent freeze up of money markets both domestically and internationally, the Fed did even more, shifting much of the wholesale money market onto its own balance sheet, more than doubling its size in a matter of weeks. In retrospect this move can be seen as the beginning of a new role for the Fed that I call "dealer of last resort".

And then, once it became apparent that the emergency measures had stopped the freefall, the Fed moved to replace its temporary loans to various elements of the financial sector with permanent holdings of mortgage backed securities, essentially loans to households. This is something completely new, not Bagehot at all, an extension of "dealer of last resort" to the private capital market.

The transformation of the Fed's role during this crisis is evident in a simple chart showing the evolution of the Fed's balance sheet, both assets and liabilities, in 2007-2009 (see Figure 1). The stages of the crisis stand out clearly, marked by key turning points: the collapse of Bear Stearns in March 2008, and of Lehman Brothers and AIG in September 2008. The chapters that follow are an attempt to provide the historical and analytical context necessary for understanding what this chart means for us, today and going forward.

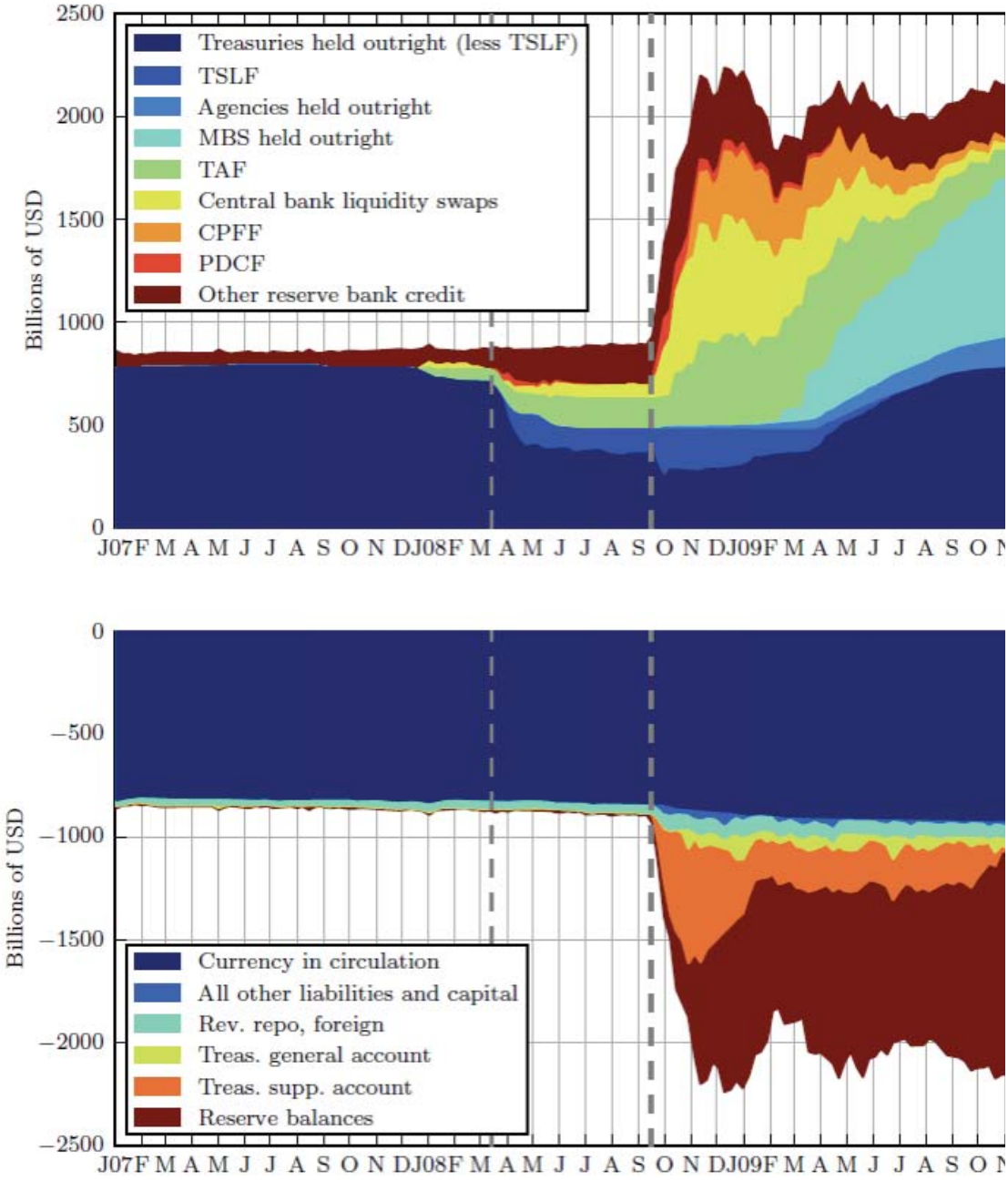

Figure 1: Fed assets (top panel) and liabilities (bottom), 2007–2009.

A Money View Perspective

It is no accident that the Fed has been at the center of policy response. Indeed, a fundamental premise of this book is that a "money view" provides the intellectual lens necessary to see clearly the central features of this multi-dimensional crisis. The reason is simple. It is in the daily operation of the money markets that the coherence of the credit system, that vast web of promises to pay, is tested and resolved as cash flows meet cash commitments. The web of interlocking debt commitments, each one a more or less rash promise about an uncertain future, is like a bridge that we collectively spin out into the unknown future toward shores not yet visible. As a banker's bank, the Fed watches over the construction of that bridge at the point where it is most vulnerable, right at the leading edge between present and future. Here failure to make a promised payment can undermine any number of other promised payments, causing the entire web to unravel.

The Fed does not just watch; it also intervenes. As a banker's bank, the central bank has a balance sheet that gives it the means to manage the current balance between cash flows and cash commitments. "Lender of last resort" is one example, in which the central bank temporarily offers up its own cash to meet commitments that would not otherwise be fulfilled. "Bank rate policy" extends this kind of intervention from crisis to normal times, in an attempt to ward off crisis before it happens. By intervening in the money markets, the Fed seeks to offer a bit more elasticity or to impose a bit more discipline, easing or tightening as conditions warrant.

A century ago, at the time of the founding of the Fed in 1913, this "money view" way of thinking was quite common, but today economic discussion is instead dominated by two rather

different views. On the one hand, we have the view of economics, which resolutely looks through the veil of money to see how the prospects for the present generation depend on investments in real capital goods that were made by generations past. On the other hand, we have the view of finance, which focuses on the present valuations of capital assets, seeing them as dependent entirely on imagined future cash flows projected back into the present.

The economics view and the finance view meet in the present where cash flows emerging from past real investments meet cash commitments entered in anticipation of an imagined future. This present is the natural sphere of the money view. But both economics and finance abstract from money; for both of them, money is just the plumbing behind the walls, taken for granted. Both largely ignore the sophisticated mechanism that operates to channel cash flows wherever they emerge, to meet cash commitments wherever they are most pressing. As a consequence, neither the economics view nor the finance view has been particularly well suited for understanding the crisis we have just been through, a crisis during which the crucial monetary plumbing broke down, almost bringing the rest of the system down with it.

The economics and finance views have taken turns dominating postwar economic discussion. First, in the immediate post World War II decades, the economics view held sway, understandably so in the aftermath of Depression and World War. Private and public sector alike built their present on the foundations of the past, the only solid ground that remained after the dust of War had cleared. Then, in more recent decades, the finance view has held sway, excessively so as the present crisis now confirms. Private and public sector alike dreamed fantastical dreams about the future, and financial markets provided the resources that gave those dreams a chance to become reality.

As a consequence of this long dominance of the economics and then finance views, modern policymakers have lost sight of the Fed's historical mission to manage the balance between discipline and elasticity in the interbank payments system. In Bagehot's day, the Bank of England understood "bank rate" as the cost of pushing the day of reckoning off into the future; manipulation of that cost by the Bank was supposed to provide incentive for more or less rapid repayment of outstanding credit, and more or less rapid expansion of new credit. No longer. Today policymakers understand the Fed's job to be taking completely off the table any concern about the mere timing of cash flows. The money view has been obscured by the other more dominant perspectives.

Abstracting from money, both the economics and finance views have in effect treated liquidity as a free good, and the ideal world they have pictured in their theories has come to serve as the norm for monetary policy. According to that ideal, liquidity should not be scarce at all; users of the monetary system should be making decisions based on their intertemporal budget constraints, not their immediate cash constraints. Ideally, money should be just a veil obscuring the real productive economic processes underneath, and the job of the Fed is to get as close to that ideal as possible. The rate of interest should reflect the price of time, not the price of liquidity.

Lessons from the Crisis

One lesson of the crisis is that this ideal norm goes too far. Our thinking about money has mistaken the properties of models that formalize the economics and finance views for

properties of the real world. This is an intellectual error, but one with significant practical consequences not least because it inserts a bias toward excessive elasticity at the very center of monetary policy. That bias has fuelled the asset price bubble that created the conditions for the current crisis, and that bias will fuel the next bubble as well unless we learn the lesson that the current crisis has to teach.

How ever did we lose knowledge that was once commonplace, the knowledge that came from the older money view? This book traces the origin to the well-meaning American economist Harold Moulton who, in 1918, urged the importance of commercial banking for capital formation. According to Moulton, American banks had improved on outdated British practice by relying on the "shiftability" (or saleability) of long term security holdings to meet current cash needs, rather than on the "self-liquidating" character of short term commercial loans. This change in banking practice made it possible for American banks to participate in financing long term investment, and that participation was crucial for the capital development of the nation. At the time, Moulton's shiftability theory provided intellectual support for those who sought to break from the conservative bank doctrine of yesteryear, and so helped to shift the balance from excessive discipline toward more appropriate elasticity, but it also did more than that.

This book tells the story how the triumph of Moulton's shiftability view, as a consequence of Depression and War as much as anything else, eventually led to the almost complete eclipse of the money view in modern discourse. Today policymakers focus their attention on the rate of interest that would be established in an ideal system of perfect liquidity. Instead of monitoring the balance between discipline and elasticity, the modern Fed attempts to

keep the bank rate of interest in line with an ideal "natural rate" of interest, so called by the Swedish reform economist Knut Wicksell.[2]

By contrast to the money view, the academic Wicksell did not see any inherent instability of private credit that central bankers must manage, but rather an inherent stability that central bankers are prone to mismanage. According to him, the profit rate on capital is a "natural rate" of interest in the sense that the economy would be in equilibrium at that rate. The problem comes when central bankers choose a "money rate" of interest different from this natural rate. If lower, then the differential creates an incentive for credit expansion to fund new capital investment, and the new spending tends to drive up the general level of prices. Higher prices bring improved profitability and hence also improved credit-worthiness, which creates incentive for further credit expansion in an unsustainable cumulative upward spiral.

Wicksell's academic way of looking at the world had clear implications for monetary policy: Set the money rate equal to the natural rate and then stand back and let markets work. Unfortunately the natural rate is not observable, but we do observe the price level, and so we can use that as an indicator of whether the money rate is too high or too low. If prices are rising, then the money rate is too low and should be increased; if prices are falling, then the money rate is too high and should be decreased. Unlike the classic British money view, Wicksell tells us that central bankers have no need to pay close attention to conditions in the money market. They just need to watch the price level.

In modern formulations, neo-Wicksellian policy rules are derived from somewhat different analytical foundations, and they focus attention not on the price level but instead on

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[2] Wicksell (1898).

price inflation as an indicator for policy.[3] But the idea is the same. Central bankers have no need to pay attention to conditions in the money market. They just need to watch prices, and adjust interest rates accordingly. One modern formulation of this type is the so-called Taylor Rule, which uses the level of aggregate income as well as inflation as an indicator of the appropriate setting for the money rate of interest. The Stanford economist John Taylor has suggested that the origin of our present crisis lies in the failure of the Fed to follow such a Taylor Rule, choosing instead to keep the money rate below the Rule level for about four years, 2002-2005, so fuelling the bubble that burst in 2007.[4]

Taylor's conclusion that the underlying problem was excessive monetary ease is compatible with the older money view, but the money view would look to developments in private credit markets as well as to actions of the Fed in order to understand what happened. From a money view perspective, instability is the natural tendency of credit markets, not necessarily a consequence of monetary mismanagement; as Bagehot famously stated, "Money does not manage itself." However, a central bank that understands its role to be the elimination of liquidity constraints will tend to exacerbate this natural tendency toward instability, since it eliminates a key source of discipline that would otherwise constrain individuals and coordinate their market behavior. The problem we face is not that the Fed failed to follow an appropriate neo-Wicksellian Taylor Rule, but rather that neo-Wicksellian policy rules are themselves excessively biased toward ease.

Such a bias, it is important to note, would have been impossible in the circumstances for which the money view was originally developed, namely the 19th century gold standard. In those

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[3] Woodford (2003).

[4] Taylor (2009).

circumstances, excessive ease would have led promptly to gold outflows, threatening maintenance of gold convertibility in international exchange markets. The breakdown of the gold standard, and its replacement by a dollar standard, meant that the U.S. monetary system faced no such reserve constraint.

The Fed could of course have imposed such a reserve constraint on the system as a matter of policy, but in general it chose not to do so. (The Volcker episode of 1979-1983 stands out as the only significant exception.) For that policy choice, the intellectual support provided by the economics view and then the finance view was critical. Abstraction from the plumbing behind the walls provided scientific support for a policy stance that was at systematic variance with what the older money view would have recommended. Dominance of the economics and finance views meant that policymakers chose from a palette of policy options that was biased toward ease.

That said, release from the excessive discipline of the gold standard was certainly a good thing, and it follows that restoration of the Bagehot-era money view is no answer to the current crisis in economic thinking. Bias toward excessive discipline is no answer to the current bias toward excessive elasticity. Instead, what is needed is a restoration of the ancient central banking focus on the balance between discipline and elasticity. Further, because the modern economic and financial world is much changed from the world in which the money view originally arose, restoration of ancient wisdom must be accompanied by reconstruction for modern conditions and concerns.

This book seeks to begin that reconstruction by taking a resolutely money view approach to understanding the recent credit crisis, and by drawing lessons from that crisis for the future.

The main lesson is that a modern money view requires updating Bagehot's conception of the central bank as a "lender of last resort". Under the conditions of the New Lombard Street, the central bank is better conceptualized as a "dealer of last resort".

Chapter 1: Lombard Street, Old and New

Writing in 1967, before he had yet formulated his famous Financial Instability Hypothesis, the American monetary economist Hyman Minsky identified the starting point for his analysis. "Capitalism is essentially a financial system, and the peculiar behavioral attributes of a capitalist economy center around the impact of finance on system behavior."[5] From this point of view, the key institutions of modern capitalism are its financial institutions, which make a business out of managing the daily inflow and outflow of cash on their balance sheets. And the quintessential financial institutions are banks, whose daily cash inflows and outflows are the mechanism of the modern payments system.

Everyone else—households, businesses, governments, even entire nations--is also a financial institution since, in addition to whatever else they do, they must attend to the consequences of their activities for their own daily cash flow. Indeed, this daily cash flow, in and out, is the crucial interface where each of us connects with the larger system. This interface provides the cash that makes it possible for us to pursue today dreams for the future that would otherwise be impossible; but it does so at the cost of committing us to make future payments that can, if our dreams do not work out, constrain our independence more or less severely. The seductive allure of present credit, and the crushing burden of future debt, are two faces of the same creature.

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[5] Minsky (1967, 33).

The Inherent Instability of Credit

The two faces of credit show themselves not only at the level of each individual, but also at the level of the system as a whole because one person's cash inflow is another person's cash outflow. If the allure of credit induces one person to increase spending, the immediate result is income somewhere else in the system, which income is then available for additional spending. Similarly, if the burden of debt induces one person to decrease spending, the immediate result is reduced income somewhere else in the system, and so possibly also reduced spending. This interaction of balance sheets is the source of what the British monetary economist Ralph Hawtrey called the inherent instability of credit.[6] In his view, the main job of the central bank is to prevent a credit-fuelled bubble from ever getting started, in order to avoid the collapse that inevitably follows.

But, from another point of view, the inherent instability of credit is not entirely a bad thing. On the way up, real things get built, new technologies get implemented, and productive capacity expands. The Austrian economist Joseph Schumpeter always insisted that credit is critical for the process of "creative destruction" that is the source of capitalism's dynamism, because it provides the crucial mechanism that allows the new to bid resources away from the old. Instability is, from this point of view, inseparable from growth, and a central bank that

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[6] Hawtrey (1923).

intervenes to control instability runs the risk of instead killing off growth by stifling the new on the way up, and coddling the old on the way down. [7]

In any concrete case, the question therefore arises, Are we looking at a Hawtreyan speculative bubble that we want to rein in, or at Schumpeterian dynamic growth that we want to let run? One reason this question is hard to answer is that a credit-fuelled boom typically involves a bit of both. That is why we seem always to be tempted to draw a distinction between speculative and productive credit, and to look for ways to channel credit preferentially to the latter. But in practice the distinction is often difficult to draw and, even more problematic, discrimination in credit allocation is often impossible to implement. In this latter regard, the institutional structure of finance, including the regulatory structure, is crucial. If potential borrowers and lenders can find one another and do business outside the reach of the authorities, then it will be impossible to allocate credit preferentially to socially desirable uses, even assuming such could be identified and agreed. (In such a situation, even control of aggregate credit can be quite difficult.)

In the last analysis, the only dependable source of leverage over the system as a whole is the role of the central bank as a banker's bank. If banks are the quintessential financial institution, because of their management of the retail payments system, then the central bank is the quintessential bank because of its management of the payments system that banks themselves use. When one bank makes a payment to another, the mechanism involves changing entries on the balance sheet of the central bank; there is a debit to the account of the bank paying and a credit to the account of the bank being paid. Here, in the requirement to settle net payments

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[7] Schumpeter (1934). There is of course also risk on the other side, of fostering excessive growth on the way up and excessive destruction on the way down. This is the risk emphasized by modern neo-Austrian writers such as Claudio Borio and William White (2004).

every day on the books of the central bank, we find the location of the ultimate discipline for the entire system.

Hyman Minsky called this requirement the "survival constraint"—cash inflows must be sufficient to meet cash outflows--and we all face such a constraint. For banks, the survival constraint takes the concrete form of a "reserve constraint" because banks settle net payments using their reserve accounts at the central bank. The leverage that the central bank enjoys over the larger system arises ultimately from the fact that a bank that does not have sufficient funds to make a payment must borrow from the central bank. In such a circumstance, the central bank must lend, else risk a breakdown of the payments system, but the lending does not have to be cheap or easy. It is the central bank's control over the price and availability of funds at this moment of necessity that is the source of its control over the system more generally.

Opportunities for such control arise naturally from time to time, simply because of fluctuations in the pattern of payments, but the central bank can also create such opportunities as the need arises. Just so, when the central bank "tightens money" by selling Treasury bills, the consequence is that the banking system as a whole has to make payments to the central bank, which amounts to tightening the survival constraint that all bankers face. Alternatively, when the central bank "loosens money" by buying Treasury bills, the consequence is that the banking system as a whole receives payments from the central bank, so relaxing the survival constraint. The effects of these central bank interventions show up in the short term rate of interest that banks pay as the cost of putting off to the future a payment that is due today. Historically, the art of central banking was all about the choice of whether to raise or lower that cost.

The central bank's ability to influence the degree of discipline or elasticity faced by banks at the daily clearing provides some control over the credit system as a whole, but that control is by no means absolute. Private credit elasticity is always a substitute for public credit elasticity. In its attempt to impose discipline, sometimes the most the central bank can do is to force banks to find and use alternative private credit channels. Similarly, in its attempt to impose elasticity, sometimes the most a central bank can do is to offer its own public credit as an alternative to collapsing private credit.

That's why Hawtrey referred to the "art" of central banking, rather than the "science" or the "engineering".[8] The central bank can use its balance sheet to impose a bit more discipline when the private market is too undisciplined; and it can use its balance sheet to offer a bit more elasticity when the private market is imposing excessive discipline. But it is only one bank, and ultimately small relative to the system it engages, especially so in the modern globalized financial system in which private credit markets are all connected into an integrated whole. Because the central bank is not all-powerful, it is especially important that it choose its policy intervention carefully, with a full appreciation of the origins of the instability that it is trying to counter.

According to Hawtrey, the inherent instability of credit has its origin in the way that credit-financed spending by some creates income for others, not only directly but also indirectly by pushing up the price of the good being purchased, so producing an upward revaluation of existing inventories of the good. The capital gain for holders of inventories tends to stimulate additional spending, in part to buy ahead of rising demand in order to earn additional profit from

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[8] Hawtrey (1934).

rising prices in the future. Because revaluation of existing inventories tends to improve credit-worthiness, this additional spending is easy to finance, even easier than the initial spending. The feedback of rising asset prices onto credit expansion is the source of the inherent instability of credit emphasized by Hawtrey.

The price-credit feedback mechanism is also the reason that credit-fuelled bubbles are so difficult to control, because it means that central bank interest rate policy can sometimes have very little traction. The question for the speculator is only whether the rate of appreciation of the underlying asset is greater than the rate of interest, and that is a condition often quite easily satisfied. If house prices are appreciating at 15% a year, it takes an interest rate of greater than 15% to stifle the bubble. Even supposing that the central bank is able to impose such a high interest rate, 15% would stifle a lot of other things as well. Conclusion: If you don't catch the bubble early, it may be impossible to do anything with interest rate policy.

Meanwhile, the larger the bubble grows, the greater the distortion in the allocation of credit, and in the allocation of real resources commanded by that credit. Not only does a bubble prospect of 15% attract new credit disproportionately, but also it bids up the price of credit across the board. Borrowers and lenders find one another at a rising market rate of interest, and the central bank must raise its policy rate merely to keep up. Eventually, and long before interest rates reach 15%, the effects of higher market interest rates are felt on non-bubble balance sheets throughout the economy, and it is these effects that bring the bubble to an end.

The way it works is this. Higher interest rates mean greater cash outflows for debtors, and eventually the most vulnerable among them find their cash outflows exceeding their cash inflows. If you are one of those vulnerable debtors, Minsky's "survival constraint" begins to

bind for you. Logically there are only three ways out. First, you can spend down any cash balances you may have, but these balances are finite and quickly exhausted. Second, you can borrow to cover the shortfall, but credit lines are also finite, and even possibly contracting in the face of declining credit-worthiness. Third, you can sell some of your earning assets, for whatever price they will fetch on the market. Typically these three ways out are used sequentially, as debtors hold on for as long as they can, hoping that some other balance sheet in the system will prove to be the weakest link. The important point is that sooner or later asset prices come under pressure, not just the prices that were rising at 15% but all asset prices, and especially the price of the assets held by the most vulnerable debtors who are forced to liquidate first.

When that happens, liquidity problems (the survival constraint) become solvency problems, and especially so for highly leveraged financial institutions. Even if they are not forced to sell assets in order to make promised payments, they may be forced to write down the valuation of their assets to reflect current market prices. For highly leveraged institutions, with financial liabilities many times larger than their capital base, it doesn't take much of a write-down to produce technical insolvency. And even before insolvency, asset write-downs can quickly generate serious liquidity problems as credit lines shrink to fit reduced collateral valuations. Liquidity and solvency problems thus reinforce one another on the way down, just as they do on the way up. This is the downside of the inherent instability of credit.

On the way up, as has been emphasized, the central bank tends not to have much traction, since borrowers and lenders share an interest in avoiding central bank discipline. On the way down a similar mutual interest, now in avoiding market discipline, brings both borrowers and

lenders back to the central bank as the last available source of credit elasticity. "Lender-of-last-resort" intervention involves the central bank extending credit when no one else will (or can); in effect, the central bank relaxes the survival constraint by providing current cash inflow to allow borrowers to delay the day of reckoning. Used wisely, such intervention can control the downturn, and prevent it turning into a rout. Used unwisely, such intervention can foster further continuation of unhealthy bubble conditions. In a crisis, as in normal times, the art of central banking is all about walking the fine line between providing too much discipline versus too much elasticity.

The Old Lombard Street

The impact and effectiveness of central bank control both depend crucially on the institutional organization of the banking system, and on its articulation with the financial system more generally. Walter Bagehot's Lombard Street (1873) explored these questions in the context of the London money market of his day, a set of institutional arrangements different in important respects from modern arrangements, but nonetheless a good starting point because the conclusions that Bagehot drew continue to shape the way we think today. The "Bagehot Principle" that guided central bankers in the current crisis has its origin in that ancient book.

Today we summarize the Bagehot Principle as "lend freely but at a high rate." Here are Bagehot's own words (p. 197):

> The end is to stay the panic. And for this purpose there are two rules:--First. That these loans should only be made at a very high rate of interest….Secondly. That at this rate these advances should be made on all good banking securities, and as largely as the public ask for them.

Why did Bagehot think this was wise policy for his world, and is it still wise policy for our own very different modern world?

Bagehot's world was based on a short-term commercial credit instrument known as the bill of exchange. Firms issued bills in order to buy inputs for their own production processes, and they accepted bills as payment for their own outputs. The bill of exchange was a promise to pay at a specific date in the future, perhaps 90 days in the future. For a fee, banks would "accept" bills, which meant guaranteeing payment. For another fee, banks would "discount" bills, which meant buying them for less than face value, the difference amounting to a rate of interest to be earned over the term to maturity. As payment for the bills, banks would offer either currency or a deposit account credit. Either way, the proceeds of the discount were most typically not held as idle balances but rather spent in payment of other maturing bills. In this way, the discount mechanism was crucial for British firms' management of their daily cash flow, in and out.

Ideally, over the 90 days between issue and maturity, the firm that issued the bill would use the inputs so acquired to produce output for sale, and then use the sale proceeds to pay the bill as it came due. Timely repayment thus depended on timely sale of the production financed by the bill. Assuming timely repayment, the banking business was all about managing one's

portfolio of bills in order to match up the timing of cash inflows (from maturing bills) with the timing of cash outflows (for new discounts). If ever a firm failed to pay, however, then the accepting bank would experience a cash shortfall.

In this system, banks managed their daily cash flow by managing the discount rate they quoted to their customers. If requests for discount were depleting one's cash reserve, one had merely to raise one's discount rate and the business would go elsewhere; if maturing bills were swelling one's cash reserve, one simply lowered the discount rate to attract additional interest-paying business. In this way, the market rate of interest fluctuated according to supply and demand. The rate of interest was high when requests for new discount were running ahead of repayments, and low when the balance went the other way.

It was in this institutional context that the Bank of England developed the principles of central bank management that laid the foundations for modern monetary theory. At first, so Bagehot relates, the Bank thought of itself as simply one among other banks, responsible to its shareholders for the profitability of its operations, and with no larger responsibility for the system as a whole. In accordance with this way of thinking, the Bank moved its discount rate in line with the market in order to attract its rightful share of the discount business.

The experience of periodic financial crises, however, eventually taught the lesson that the Bank was not like other banks insofar as it was the central repository of cash reserves for the entire system. In times of general crisis, all banks looked to the Bank of England for help, and in order to prepare for that day the Bank had to safeguard its own reserve. That meant keeping its own discount rate ordinarily somewhat higher than the market rate, even at the cost of sacrificing some discount business and so shareholder profit.

In this context, the Bagehot Principle can be understood as the distillation of hard-won practical wisdom about how to deal with a crisis when one comes. The proximate origin of the crisis could be many things, but from the point of view of the Bank it always took the form of a large, often sudden, demand for cash. Any hiccup in current sales would mean that maturing bills could not be paid by their issuer. As a consequence, the accepting bank would be called upon to make good from its own resources, which involved drawing down reserves held at the Bank of England and then, should that prove insufficient, borrowing more.

If the Bank of England failed to lend in such a circumstance, the needy bank would be unable to meet its commitments, and those who had been expecting payment from that bank would similarly find themselves unable to meet their own commitments, and so on and so on as the cascade of non-payment spread throughout the economy. The Bagehot Principle was designed to stop the potential cascade by providing completely elastic lending to needy banks against any security that would be acceptable in normal times. But it was also designed to provide discipline by charging a high rate of interest. Only those who really needed the cash would borrow at the high rate, and the high rate would also provide incentive to pay back as soon as possible.

The problem with elastic lending in time of crisis is that it tended to drain the note reserves of the Bank of England. Under the provisions of Peel's Act of 1844, the note issue was fixed, and any additional notes had to be backed 100% by additional gold reserves. In normal times, the bank held a significant fraction of the note issue as reserve against deposits in the Banking Department, and these deposits were held as reserves by the banking system at large. During a crisis, the demand for cash was met both by paying out cash reserves (notes) and by

expanding the supply of cash substitutes (deposits). When the crisis was over, the emergency loans would be repaid, the emergency supply of cash substitutes would be extinguished, and the Bank's cash reserve would be built up again. That is how it was supposed to work, and how in fact it did work, so long as the crisis remained within the confines of Britain itself.

The policy of elastic lending ran into trouble however whenever the crisis assumed international dimensions, which more often than not it did, given the centrality of the pound sterling in the world trading system. The same bills of exchange apparatus that merchants used to finance domestic production was used also to finance foreign trade, trade not only between British merchants and their foreign counterparties but also between different foreign parties themselves. No matter where you were in the world, if you wanted to import goods you were likely to be paying by issuing a bill of exchange payable at some London bank, and your counterparty was likely to be presenting that bill of exchange for discount prior to maturity in order to raise cash to meet his own payment obligations.

The problem was that foreigners did not consider either notes or deposits to be acceptable means of payment; they wanted gold. (Mechanically, payment would be demanded in notes, and those notes would be presented to the Issue Department at the Bank of England for payment in gold.) The effect of a foreign demand for cash was thus to reduce the supply of currency in Britain and also, more importantly, to drain the Bank's holding of gold which served as international reserve for the country as a whole.

Not only firms and banks but also nations have to look after their daily balance of cash inflows and outflows, and for nations on the gold standard that meant the daily balance of gold flows. For Britain, gold flows were mostly about the balance between payments on maturing

international bills of exchange (gold inflows) versus requests for new discounts (gold outflows). The money rate of interest in London was thus a symptom of international as well as domestic balance and imbalance, and the central position of the Bank of England in the London money market meant that its reserve was essentially the international as well as the national reserve. In normal times, if gold was flowing out of Britain, the Bank raised its discount rate in order to make new discounts less attractive, so shifting the balance of payments back in its favor. The high rate of interest recommended by Bagehot for times of crisis was intended not only to limit the supply of funds to those most in need, but also to safeguard the nation's gold reserve in the face of a potential external drain.

By 1873, when Bagehot was writing, the Bank had gotten used to its role as lender of last resort domestically, and this was the main focus of the Bagehot Principle. But the Bank had not at all gotten used to its role as lender of last resort internationally, nor did Bagehot endorse such a role. For him, elasticity was all about domestic lending—here the Bank should not safeguard its reserve but rather mobilize it, down to the last farthing. But once those farthings come into the hands of foreigners who ask gold for them, the Bank has to stop. It can create more deposits to meet an internal drain, but it cannot create more gold to meet an external drain. In a crisis, the Bank could and did suspend the gold reserve requirement for notes, so freeing up its gold holdings for payment to foreigners. But if that buffer was ever exhausted, there would be no choice but to suspend convertibility.

Clearly, the ideal solution would be to get foreigners to behave like domestic residents, which is to say to accept sterling balances (deposits or securities) as substitutes for gold. Britain's most significant colonial possession already did so, as the young John Maynard Keynes

pointed out in his first book Indian Currency and Finance (1913). According to Keynes, the case of India showed that a gold-sterling exchange system was a workable arrangement for international monetary affairs more generally. But World War and Great Depression, and then World War again, dashed that dream. What we got instead, after the dust cleared, was a gold-dollar exchange system established at Bretton Woods in 1944, which became a plain dollar standard in 1973 after the United States abandoned gold convertibility.

The New Lombard Street

Our modern world is not Bagehot's world, and not only because the dollar and the Federal Reserve have replaced the pound and the Bank of England, and the dollar standard has replaced the gold standard. For us, the most important money market instrument is not the bill of exchange but rather something called a "repurchase agreement", or repo. Repos are issued not to finance the progress of real goods toward final sale, as in Bagehot's world, but rather to finance the holding of some financial asset.

Formally, the underlying financial asset serves as collateral for a short term loan, often as short as overnight. The "repurchase" refers to a legal construction whereby the short term loan is arranged as the sale of an asset combined with an agreement to repurchase the asset at the original sale price plus some rate of interest. The original sale price is lower than the market value of the asset by an amount known as the "haircut"; the purpose of the haircut is to provide extra collateral for the loan, so the size of the haircut varies with the perceived riskiness of the

asset being used for collateral. The lowest repo rates, and the lowest haircuts, apply when the collateral for the loan is a Treasury bill.

In our world, the Treasury repo market plays a special role as the main interface between the money market and the Fed. (I speak here of the way things worked before the crisis.) The Fed enters that market typically as a lender, offering short term loans of high-powered money (deposits at the Fed) in return for Treasury bill collateral. On a daily basis, the Fed might "tighten money" by allowing outstanding repo loans to mature without replacement, or it might "loosen money" by offering new and larger loans. The immediate counterparties to these loans are the "primary dealers", so called for their commitment to bid for Treasury securities whenever the Treasury wishes to borrow. In normal times, the funds that the dealers borrow from the Fed at the daily repo auction are a low cost source of finance for their main business of making two-way markets in Treasury securities by posting offers to buy and sell.

The special position of the primary dealers can be considered a legacy of World War II, when the U.S. government issued vast volumes of Treasury securities not only to finance its own war effort but also to finance the war spending of its allies. When the war was over, the war debt remained, on the balance sheets of households who would use it to purchase houses and cars, on the balance sheets of corporations who would use it to fund conversion from wartime production, and on the balance sheets of banks who would use it to fund private loans. All of these debt holders depended on the ability to convert government debt readily into spendable cash, which is to say on the existence of the two-way markets provided by security dealers.

During the War and its immediate aftermath, the Fed directly fixed the price of government debt, and directly backstopped the convertibility of government debt into cash at that

fixed price. After the Fed-Treasury Accord of 1951, the Fed no longer fixed the price of Treasury securities, but it continued to provide liquidity support to the Treasury market. Eventually, even that responsibility passed on to the primary dealers, with the Fed backing up the dealers by providing liquidity support to them through its daily operations in Treasury repo.

Here then is how the New Lombard Street works. Whereas Bagehot's central bank used the discount rate to manage the system, the Fed focuses its attention on the price of overnight lending in the Federal Funds market, which is an interbank market for deposits at the Fed. (An overnight Fed Funds loan involves receipt of reserve funds today in return for payment of reserve funds tomorrow.) The Fed does not directly lend or borrow in the Fed Funds market, so the "effective" Fed Funds rate fluctuates depending on supply and demand. Instead the Fed uses the Treasury repo market to control the supply of the underlying deposits that are borrowed and lent in the Fed Funds market.

The Fed's monopoly supply of bank reserves gives it considerable control over the Fed Funds market, but there is quite a bit of slippage between conditions in the Fed Funds market and funding liquidity more generally. The Fed is only a small player in the enormous general collateral repo market where security dealers fund most of their activity. And it is not a player at all in the offshore market in Eurodollar bank deposits which is always available to banks as an alternative to Fed Funds, and indeed has grown up to be the most liquid money market in the world. In both repo and Eurodollar markets, borrowers and lenders find one another and do business outside the reach of the Fed.[9] As always, private credit elasticity is a substitute for public credit elasticity, indeed often an attractive substitute.

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[9] General collateral repo typically pays a higher interest rate than Treasury repo, but both rates are typically lower than the Fed Funds rate. Quoted Eurodollar rates are typically higher than Fed Funds, but usually only by a few basis points.

Nevertheless, it remains true that balance sheet operations by the Fed affect funding liquidity and so also market liquidity, through the risk calculus of security dealers. Dealers post prices at which they are willing to buy and sell a particular security, the buy (bid) price lower than the sell (offer or ask) price, and then they adjust those prices depending on customer response. If they find themselves accumulating a large position in a particular security, they lower their posted prices. The main idea behind this practice is to control risk by allowing their exposure to increase only if it comes at an attractive price. But the effect of lowering price is also to control cash flow by attracting more buyers and fewer sellers, hence more cash inflow through net sales and less cash outflow through net purchases.

Actual dealing operations are more sophisticated than this, but even this simple account is enough to make clear that security dealers provide a sensitive link between conditions in the money market and conditions in broader financial markets. At one end of the chain of causation, we have the Fed setting the Fed Funds rate; at the other end we have private dealers seeking profit by making markets. Private dealers borrow in the money market in order to finance their market-making operations in capital markets; that is the way that "funding liquidity" in money markets gets translated into "market liquidity" in capital markets.[10] The market for Treasury securities is the first place this market liquidity shows up, but then it gets spread by means of arbitrage more or less quickly and efficiently to other related markets such as those for corporate bonds and, more recently, residential mortgage-backed securities. (I remind the reader again that I speak of the way things worked before the crisis.)

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[10] Brunnermeier and Pedersen (2009).

By contrast to Bagehot's time, under modern conditions, the Fed's discount window has fallen into disuse. When individual banks need money to meet their commitments at the daily clearing, they usually raise it from other banks in the wholesale money market. And when the banking system as a whole needs money, that money is usually raised by selling security holdings into liquid markets. Both channels are backstopped ultimately by the Fed's commitment to stabilize the Fed Funds rate around a chosen target, and by its intervention to make good on that commitment by lending in the Treasury repo market. Put starkly, under modern conditions, the Fed is always lending freely, but only to primary security dealers, only against Treasury security collateral, and only at the Treasury repo rate that corresponds to the target Fed Funds rate.

This practice was supposed to prevent crisis. The way it was supposed to work is that the Fed would lend freely to the dealers, and arbitrage would do the rest, modulo some term spread between Treasury bills and longer maturity issues, and some credit spread between Treasuries and non-government issues. By raising the Fed Funds rate, the Fed would raise the funding cost of making markets, and so induce some deleveraging and push around the spreads. By loosening, the Fed would lower the funding cost, and so lessen the pressure to liquidate, again pushing around the spreads. That is how it was supposed to work, and in fact how it did work, until the recent crisis.

In the crisis, this system broke down. As asset valuations came into question, haircuts for secured borrowing rose sharply, even for Treasuries but especially for non-Treasury securities, and the result was forced deleveraging, and disordered markets.[11] The problem was that, in

[11] Adrian and Shin (2009).

private credit markets, collateral is marked to market not to fundamental value. Bagehot's admonition to lend freely against any security that would be acceptable collateral in normal times is a principle for central banks only. Individual banks have always followed the save-yourself rule of lending only against securities that can be readily liquidated in current extraordinary times. This time was no exception.

In response to the severe contraction in private liquidity, the Fed stepped in, widening the category of counterparties to which it was prepared to lend, and widening also the category of collateral it was prepared to accept. Borrowers and lenders who had previously found each other in the wholesale money market now found each other only through the intermediation of the Fed. The result was, first, a hollowing out of the Fed's balance sheet as it sold off its Treasury securities (to the former lenders) to fund new loans (to the former borrowers), and then an explosion of the Fed's balance sheet as it expanded its deposit liabilities (to the former lenders), and used the proceeds to fund additional lending (to the former borrowers).

The Fed's response to the crisis can be understood as a modern adaptation of the Bagehot Principle, at least in part. Rephrased in terms that connect up with modern institutional arrangements, Bagehot can be understood as arguing that the central bank should act as money market dealer of last resort, providing both borrowers and lenders with what they want but at prices that are worse than they would be getting if they were meeting directly rather than on the balance sheet of the Bank. In Bagehot's conception, not only would the borrower pay a high borrowing rate, but also the lender would accept a low deposit rate. It is the gap between the borrowing and lending rates that provides incentive for borrowers and lenders to find one another again once the storm dies down. In effect, the Bagehot Principle can be understood as

recommending that the central bank post a wide bid-ask spread in the money market, and use its balance sheet to absorb the resulting flow of orders.

That is more or less exactly what the Fed did in the various emergency liquidity facilities that it opened in response to the crisis. The Fed's bid-ask spread was not always as wide as Bagehot might have wished--the Fed charged only a small spread over the Fed Funds target for its TAF lending facility, and it also paid interest on its deposit liabilities. But other facilities had wider spreads, and as a consequence wound down rather quickly—to wit, the commercial paper funding facility and the central bank swap facility. So far, so Bagehot.

What was not Bagehot was the level of interest rates, which fell almost to zero. This was possible only because the Fed, unlike the 19th century Bank of England, faces no reserve constraint in terms of gold. The whole world treats dollar deposits at the Fed not only as good as dollar currency, but also as the ultimate world reserve in a time of crisis. That means that the Fed, unlike the Bank of England, can create both more domestic dollars to meet an internal drain and more international dollars to meet an external drain. The Fed has no need to safeguard its holding of world reserves by keeping the Fed Funds rate high, since world reserves are its own liability.

But just because the Fed can evade the reserve constraint that others must obey does not mean that it should. There are reasons to question whether such evasion is the correct policy even for crisis times, and a fortiori for normal times. From a Hawtreyan point of view, the very fact of the crisis stands as an indictment of Fed policy in the years leading up to it. Hawtrey would have had no trouble understanding the present crisis as a consequence of the central bank losing control of a runaway credit expansion; at root the boom must be a problem of excessive

elasticity and insufficient discipline. How did it happen that the inherent instability of credit was allowed to play itself out as it did? Where was the Fed?