

Analyzing the Economics of Financial Market Infrastructures

Martin Diehl
Deutsche Bundesbank, Germany

Biliana Alexandrova-Kabadjova
Banco de México, Mexico

Richard Heuver
De Nederlandsche Bank, The Netherlands

Serafín Martínez-Jaramillo
Banco de México, Mexico

A volume in the Advances in Finance, Accounting,
and Economics (AFAE) Book Series



An Imprint of IGI Global

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Published in the United States of America by
Business Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA, USA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: <http://www.igi-global.com>

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Library of Congress Cataloging-in-Publication Data

Analyzing the economics of financial market infrastructures / Martin Diehl, Biliana Alexandrova-Kabadjova, Richard Heu-
ver, and Serafin Martinez-Jaramillo, editors.

pages cm

Includes bibliographical references and index.

ISBN 978-1-4666-8745-5 (hbk. : alk. paper) -- ISBN 978-1-4666-8746-2 (ebk.) 1. Financial institutions--United States. 2. Financial institutions--Law and legislation--United States. I. Diehl, Martin, editor.

HG181.A595 2016

332'.04150973--dc23

2015019504

This book is published in the IGI Global book series Advances in Finance, Accounting, and Economics (AFAE) (ISSN: 2327-5677; eISSN: 2327-5685)

British Cataloguing in Publication Data

A Cataloguing in Publication record for this book is available from the British Library.

All work contributed to this book is new, previously-unpublished material. The views expressed in this book are those of the authors, but not necessarily of the publisher.

For electronic access to this publication, please contact: eresources@igi-global.com.

Chapter 17

Central Securities Depositories and Securities Clearing and Settlement: Business Practice and Public Policy Concerns

Alistair Milne
Loughborough University, UK

ABSTRACT

This chapter describes the emergence of national and international central securities depositories (CSDs) and the systems of tiered account-based security ownership they support. It examines clearing and settlement risks, including principal risk now largely removed by DVP, and liquidity risk reduced but far from fully removed by multilateral netting. Liquidity demand and the complexity of some underlying transactions results in a surprisingly high volume of postponed settlements (trade fails). Systems of clearing and settlement were resilient during the crisis of 2008, but the remarkable complexity of these networks suggests two policy concerns that need further examination. Problems in clearing and settlement could still magnify or transmit systemic financial risk in a future crisis, if firms do not again obtain public sector support; and the sheer complexity of clearing and settlement arrangements may both create operational risks and heighten barriers to entry, hence reducing competition and raising costs to investors.

1. INTRODUCTION

The execution of every financial market transaction is followed by a series of further processes, ensuring the resulting obligations are carried out as agreed and helping counterparties manage the risks of contractual failure. These processes are referred to collectively as ‘clearing and settlement.’

This chapter explains what clearing and settlement is and the institutional arrangements that support it including the role of central securities depositories and custodian banks. It also discusses the challenges of

DOI: 10.4018/978-1-4666-8745-5.ch017

promoting competition and efficiency and in clearing and settlement (and related services) and avoiding the transmission and amplification of systemic financial risk through clearing and settlement systems.

Before clearing and settlement can even begin there must be agreement on what has taken place in the trade. This requires matching of the two sides of the trade and confirmation of trade details such as price and quantity. In past times, before automated computer trading was commonplace, the processes of matching and confirmation required considerable manual reconciliation. Today, as trade execution is itself becoming increasingly automated, so is the subsequent matching and confirmation of trade details.

After matching and confirmation all financial trades must then be cleared and finally settled. Clearing refers to everything prior to settlement, establishing who owes what to whom and when. But the same word is often used as shorthand for ‘central counterparty clearing’, when the obligations to make payments or deliver securities arising from a financial trade are transferred to a central counterparty (or CCP); which thus becomes the buyer to every seller and the seller to every buyer. Not every financial transaction is ‘cleared’ through a CCP, but every financial transaction must be ‘cleared’ before it is settled.

¹ After clearing comes settlement i.e. the agreed exchange of money and ownership.

It is not necessary to have a degree in automotive engineering in order to drive a car or to be a qualified plumber in order to run a bath. So why should these post-trade processes matter to anyone who is not a technical specialist? They are in fact a central concern to many others: to traders and investment managers, because of the substantial associated costs and risks associated with processing of financial trades; to final investors and also competition authorities, because clearing and settlement arrangements are a potential barrier to competition and hence source of unnecessary trading costs; and to central bankers and ‘macroprudential’ regulators because problems in clearing and settlement can potentially lead to system wide disruption of financial markets.

This chapter not only describes the process of clearing and settlement, it also draws attention to particular aspects of clearing and settlement where policy makers may need to pay particularly close attention. Clearing and settlement operations have evolved over time to become remarkably complex. This complexity creates business challenges, especially for management of liquidity, which could potentially have systemic consequences for the wider financial system. This complexity may also increase the barriers to entry that can discourage competition in trade settlement and securities services.

The chapter is organised as follows. Section 2 describes how ownership (or title) is recorded and transferred in today’s financial markets, focussing on the hierarchical or tiered accounts in which securities are held. These are contrasted with earlier paper based systems of recording ownership that were widely used before the days of computers.

Section 3 then outlines the main issues of risk and cost involved in securities clearing and settlement. It examines four closely related issues: (a) ‘principal risk’ i.e. the risk that the purchased security is not delivered or the money promised is not paid and how this is overcome through ‘Delivery v. Payment’ or DVP; (b) the remaining replacement and operational risks that are further controlled through central counterparty clearing; (c) the close link between securities settlement, custodian accounts and the provision of liquidity for securities market transactions; and (d) the puzzle of surprisingly high levels of reported trade fails (i.e. postponements of final settlement).

Section 4 discusses two of the major challenges for industry and policy makers that arise in the context of securities clearing and settlement. The first is the maintenance of systemic financial stability and the possibility that a financial crisis might be amplified by problems emanating from securities clearing and settlement. The second are the appropriate steps to promote competition and reduce costs to final investors both in asset servicing and in financial market transactions. Section 5 summarises and concludes.

2. OWNERSHIP OF SECURITIES: A BRIEF HISTORY FROM BEARER BONDS TO BYTES

Paper Vs Account Based Ownership

In order to understanding today's systems of securities ownership, it is helpful to review how these emerged from the earlier paper-based arrangements used for recording and transferring the ownership of publically traded securities, before the advent of computerisation.²

For many years, until the late 1960s, most public traded securities were held as 'bearer bonds'. The name itself is misleading: a bearer bond could just as well represent a share of a corporate equity as well as a fixed income security. So what is a bearer bond? It is a negotiable instrument, meaning that ownership is transferred through the exchange of the physical paper instrument in return for payment

A comparison that some readers may be familiar with is the endorsement of the negotiable cheque.³ The owner of a certificate representing the ownership of a security, whether dividend paying or fixed income, endorsed their certificate of ownership so passing ownership rights to whoever held the certificate in their physical possession. The reason for doing this was to reduce the costs of trading, at the expense of relatively higher costs of securing the endorsed certificates in strong rooms. Fixed income securities were often also originally issued in bearer form, typically with detachable paper 'coupons' which were physically presented in order to claim interest payments.

As well as bearer bonds, there were two other alternative historically important arrangements for the paper based recording of title to a tradable security. In the London stock market, the leading global venue for the trading both of equity and bonds, change in ownership in many domestic (UK) securities used a different approach, the so called 'deed of transfer'. Ownership was established solely by the record of ownership in a central register as signified by a certificate. The deed of transfer was a further legal document which, signed by the seller and accompanied by the share certificate, allowed the buyer to apply to the company registrar (the keeper of the list of owners of the security) for the cancellation of the original certificate and the issue of a new certificate in their name.

A third approach to change in ownership, known as 'inscription', was found also in London, for example at the Bank of England for most British government bonds, and also in Vienna at the Wiener Giro- und Cassen-Verein established by the Vienna stock exchange in 1872 and in Germany in similar institutions the Kassenverein. For such inscribed securities there were no certificates at all, instead ownership was recorded only through book entry (the inscription) in a central registrar. The seller simply signed their approval for the transfer of ownership on the registrar. This offered another relatively low cost means of transferring ownership, provided that the seller could be physically present to complete the transfer.

Beginning in the late 1960s, as trading volumes rose, these paper based system of trading and settlement became unacceptably costly and inefficient. There was then a shift away from paper based arrangements, towards electronic recording and transfer of securities ownership and the development of the now standard arrangements for account based holding of securities.

These new arrangements have two key distinguishing features:

- The ultimate record of all issued securities is kept in a 'centralised securities depository' or CSD.
- Ownership of securities is recorded by holdings in securities accounts that can be traced back to the CSD.

Central Securities Depositories and Securities Clearing and Settlement

In some respect the CSD is similar to the long established inscription arrangements found in late 19th century London, Austria and Germany. Certificates, either in registered or bearer form are no longer necessary. Change in ownership is recorded purely through book-entry. There is however one major difference: securities accounts need not be held directly with the CSD. Market participants much more commonly hold these accounts indirectly with custodian banks or other financial institutions in order to benefit from other services (such as income and tax management, processing of corporate actions such as share buy backs or acquisitions or the execution of transactions). These intermediaries in turn maintain matching securities account that can be traced back down (possibly through further accounts) to the ultimate record of issue at the CSD.

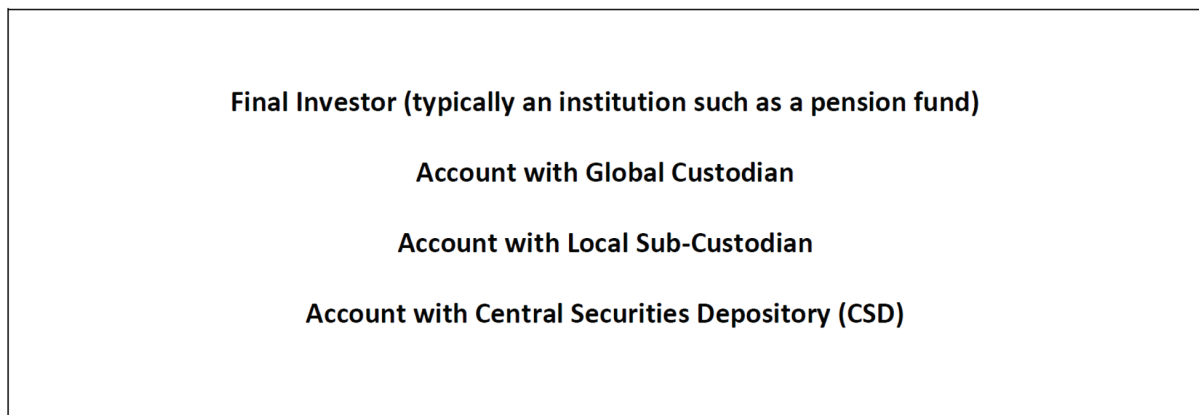
This resulting ‘multi-tiered’ ownership of shares and other securities typically required accompanying development of legal conventions and the passage of relevant legislation. Ownership rights are exercised through a hierarchy of account holdings. Figure 1 illustrates such a hierarchy incorporating the additional layer of intermediation required for a cross-border ownership.

A necessary support for these arrangements is that law recognises holdings of securities at each level as fungible i.e. not a direct claim on a specific security but a general claim on all the securities of that particular kind held at the next lower level in the hierarchy. For example here the final investor has a claim on a share of the securities held by a custodian, not a claim on an identifiable share certificate held at the central securities depository.

This legal principle of ‘fungibility’ facilitates trading in a number of ways. For example it makes it possible for custodians and for CSDs to lend securities to trading participants for delivery in settlement; this is a key aspect of managing security flows. It also makes it feasible to establish links between Central Securities Depositories in order to effect cross border delivery. This link is simply another level of the ownership hierarchy.

Account based ownership underpins the substantial and international custodian banking industry.⁴ Originally, in the old days of paper based title, the core function of a custodian bank was safekeeping of certificates (hence the name ‘custodian’). Today the business has moved on, exemplified by the global custodian banks – notably JP Morgan, State Street, The Bank of New York Mellon and also CitiGroup and BNP Paribas – who are the principal providers of security accounts for both domestic and international investors.⁵ Their business model is charging fees to investors for providing a combination of transaction

Figure 1. The hierarchy of cross-border security ownership



services (supporting the clearing and settlement of securities trades, securities lending) and asset services (collection of dividend and coupon income, tax payments, and exercise of shareholder rights such as proxy voting and take up of rights issues). These activities are all IT based and heavily capital intensive.

The Creation of National and International CSDs

This shift from paper to account based holding of securities occurred first in the United States.⁶ This was a response to the Wall Street paper work crisis of the 1960s (when the back offices of Wall Street firms were overwhelmed by rapidly increasing trading volumes, leading to transfer of title often lagging several weeks behind the original trade execution). The first response in 1968 was the immobilisation of certificates within the Central Certificate Service of the New York Stock exchange. Following the report of the ad-hoc US Banking and Securities Industry Committee, this service was spun out as the Depository Trust Corporation or DTC, creating a national US central securities depository in 1972 serving all the various US exchanges. A final step in the creation of the modern US securities clearing and settlement landscape came in 1999, various clearing houses for the different regional and New York exchanges were merged to form the NSCC (the national securities clearing corporation) and this was in turn merged with the DTC within a single industry owned holding company, the Depository Trust Clearing Corporation or DTCC. By this means the US acquired a single national infrastructure for all securities clearing and settlement (some bonds, e.g. municipals, continue to be held in depositories outside of the DTCC, but links with DTCC ensure that these are still accessible via this single infrastructure).

Similar difficulties with the settlement of securities held in paper form led the establishment of the two European based international central securities depositories, or ICSDs, Euroclear and Cedel, both created to provide settlement services for the international bond market that developed in Europe in the 1960s.⁷ Euroclear was founded in 1968 as an international bond settlement system by the Brussels office of Morgan Guaranty. Cedel was founded in 1971 as an alternative bond settlement system to compete with Euroclear. Cedel was subsequently acquired by DeutscheBorse and renamed as Clearstream International.

Since the late 1960s national CSDs have been established in all major financial centres, typically with either central bank or exchange sponsorship. One of the last to follow this route was London with launch of CREST (now a subsidiary of Euroclear) as the UK CSD in 1996. London could delay because it had a remarkably efficient system of paper based clearing and settlement, based on a two week trading-account period (bonds and shares were traded for settlement at the end of every fortnight); but this system was really only suited to a the kind of membership based exchange in which every participant was well known to other participants and hence, because counterparty default risks were comparatively low, there was no urgency to complete settlement.

Originating as it did from paper based processing it remained however relatively costly, compared to the more advanced systems of electronic settlement based on security accounts, and also inappropriate to the more anonymous and competitive trading environment that emerged in London after the 1986 'big-bang' removed barriers to entry. Shifting to modern T+3 CSD settlement by then standard in other financial centres proved to be difficult, but was eventually achieved by 1996.⁸

Recently, in October 2014, London together with the rest of Europe shifted to T+2 settlement for equity trades. The major markets in the US and Asia are now discussing a similar shift for the settlement of equity trades from T+3 to T+2 (see for example (DTCC, 2014a, 2014b)).⁹

A legal detail is that in some cases (e.g. France, Denmark, Norway, Italy) the CSD is dematerialised i.e. certificates have no legal status and securities are represented purely as entries on a computer data-

base. Where local law allows it, dematerialization is a useful tidying up of the arrangements for holding of securities; but this makes relatively little practical difference. Even if securities are deposited in physical certificated form (this is the case for example in the US where the large retail investor base has led to the retention of physical share certificates alongside CSD accounts with DTC, instead of full dematerialisation), the investors, custodians and others can still exchange claims on these securities against each other purely electronically.

Today CSDs, both national and international, and custodian banks work together and at the same time compete with each other. It is a natural step for a national CSD, working alongside the system for national large value payments, to use its processing systems to offer post trade settlement services i.e. managing the settlement cycle through the various stages of clearing i.e. indicating to each party of the trade their obligations whether delivery of security or in order for the trade to be settled and the point in time at which that obligation must be met; positioning i.e. obtaining confirmation from participants that they are ready to meet these obligations; guaranteeing services ; and finally completing i.e. initiating the appropriate payment and delivery instructions so that delivery with finality is achieved. But conceptually these CSD settlement and depository services are distinct functions and indeed, with appropriate links, a CSD can provide a settlement service for a security that is in fact held with another depository.

An example of such value added services is that Euroclear and Clearstream each maintain link with a network of custodian banks, national depositories and central banks and offer settlement services around the world. They also maintain a link with each other (known as ‘the bridge’). This bridge allows DVP where the two sides of the trade choose to settle through the two different systems. Other bilateral links have been developed between various national CSDs to facilitate cross border trading. Examples include links between CREST and the Swiss depository SIGA and between the Italian CSD Monte-Titoli and the Scandinavian CSDs.

3. SETTLING THE TRADE: MANAGING COSTS AND RISKS

This section examines the costs and risks involved in securities clearing and settlement. It begins by offering an analogy with the ‘closing’ of a house purchase, and then discusses the various risks and operational efficiencies involved in these processes.

Almost all security ownership is nowadays represented by the holding balances in security accounts, as described in Section 2. Settlement must be possible against the accounts of the various national central securities depositories (CSDs) or international central securities depositories (ICSDs, i.e. Euroclear Bank in Brussels and Clearstream International in Luxembourg) which are the ultimate record of securities issued.

Settlement can also take place on security accounts held with other institutions, for example custodian banks such as JP Morgan, State Street or The Bank of New York Mellon. This is relatively easy if both buyer and seller hold securities accounts with the same custodian, in this case settlement is simply an internal transfer of securities from one client account to another and no transfer of securities is required at the CSD. If the buyer and seller hold securities at different custodian banks, then a matching transfer of securities must take place on the books of the CSD to ensure that the total security accounts in each custodian match against a corresponding ‘omnibus’ account at the CSD.

Table 1 presents the analogy between the closing of a house purchase and the clearing and settlement of an equity transaction. As any house purchaser or equity trader will know, these practical processes, taking place from the initial agreement to trade until its eventual completion, are costly and all too often can go wrong.

As Table 1 illustrates, in each case there are two sides to the trade, a buyer and a seller, who are brought together by a broker. A difference is that in the standard purchase or sale of a security in a public market there is no need ever to know the identity of the counterparty.¹⁰

In the case of both a house and a security purchase there is a record of ownership. Records of house ownership can still be paper based (practice varies considerably between countries, and even within for example different US states). As described in Section 2 most securities holdings are now account based, typically with custodian banks. Again in each case the transfer of ownership requires a payment of an agreed sum of money in exchange for title. With large sums of money involved there are obvious risks involved, notably default or counterparty risk (does the seller really have title to this property? Will the buyer pay as agreed at the time of settlement?) and operational risk (are all the legal requirements for completing the transaction in order? Will the final steps be taken at their scheduled time?).

Details of settlement do vary from one financial transaction to another. In house purchases the money must be transferred to a third party (in some countries an ‘escrow’ account, in others an agent such a lawyer working on behalf of the seller) before the keys to a property are released. Once the keys are transferred then the money is passed on to the seller.

Settlement of a securities purchase similarly requires a transfer of ownership in exchange for a monetary payment. Settlement of foreign exchange and derivative transactions is a little different, undertaken entirely through the exchange of monetary payments. But the underlying risks – whether in housing, securities or in other financial transactions – are similar. This discussion will focus on four aspects of risk and cost: principal risk (and DVP), replacement risk (and netting), liquidity risk and securities borrowing, and finally the puzzle of high rates of settlement postponement.

a) Principal Risk and DVP

In securities transactions most default risk is nowadays avoided by ensuring that settlement is ‘DVP’ or delivery against payment. This is very similar to the requirement for ‘cash on delivery’ sometimes

Table 1. Clearing and Settlement – a Comparison

	House Purchase	Equity or Bond Purchase
Intermediary	Realtor	Broker
Record of ownership	The relevant municipal or county record of deeds	An account held with securities depository or custodian
Transfer of ownership	Closing (also called settlement) with exchange of money for title	Settlement through exchange of money and securities
Preparation for transfer	Title search	Confirmation, matching and netting
Risk and cost reduction	Use of an escrow account for closing Title insurance	Simultaneous delivery against payment (DVP) Transfer of obligations to a clearing house or central counterparty.

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used for the purchase of physical goods. Settlement, the exchange of securities for money, goes ahead only once both the securities are ready for delivery i.e. ready and waiting in the seller's security account for transfer to the buyer's securities account *and* money is ready in the buyer's bank account ready for transfer to the seller's bank account. Once this is confirmed then both transfers are authorised. DVP avoids the possibility of paying money for securities that are not delivered or delivering securities that are not paid (so called 'principal risk').

While DVP eliminates principal risk, it was far from trivial technical challenge to fully implement in the major markets as they moved from paper-based to electronic settlement. It was only following an influential report (G30 Working Group, 1988) emphasising the large exposures to principal risk in global securities markets, that the major financial centres adopted DVP. This required close co-operation with central banks because full DVP required the simultaneous adoption of so called 'Real Time Gross Settlement' (RTGS) in order that high value payments in central bank money could be initiated and completed simultaneously with the transfer of securities, hence eliminating principal risk.

This G30 report, developed under the chairmanship of John Reed, addressed a variety of problems of inconsistency in settlement arrangements between countries, including incompatible systems and procedures, different settlement arrangements and variation in the length of settlement cycle, all of which were a cause for concern, both because they hindered cross-border trade and as a source of systemic risk. The G30 recommendations were for: trade confirmation and affirmation on a compatible basis for both domestic and international markets by T+1; settlement on a rolling basis by T+3, "Delivery versus payment" or DVP in all settlements preferably via electronic or book entry payments with 'same day funds'; use of a central securities depository; encouragement of securities lending; and use of netting mechanisms where appropriate; and finally standard numbering systems. All there were to be in place by 1992 and remain best practice in all established financial markets today.

The G30 report set out what are now considered to be the basic standards for post-trade execution at the domestic level. Taken together with various reports of the Basel committee on payments and settlements it encouraged continued improvement in the speed and operation of payment and settlement cycles. A significant structural shift has been from batched settlement (e.g. the settlement at the end of a two week account period such as used to be used in the London Stock Exchange) to rolling settlement, with settlement a fixed period after the date of trade (e.g. t+3 implying final settlement 3 days after the trading date) and trades that fail to settle on this day deferred to the following day.

Implementation of DVP varies somewhat from one jurisdiction to another. A subsequent central bank report on the practicalities of implementing the G20 proposals, (CPSS, 1992), distinguished three models actually being applied to the achievement of DVP. Model 1 which fully eliminates principal risk, is real time exchange of securities and payments on a gross basis. This model – adopted in the major financial centres such as London, New York and Tokyo, however requires complementary development of RTGS capability in large value payment systems and can place substantial liquidity demands on market participants at times of stress. Model 2 involves gross exchange of securities, followed relatively closely, typically overnight, by a subsequent net payment in cash. This model does not fully eliminate principal risk and requires further safeguards to ensure that the subsequent net cash payments are forthcoming. Another possibility is what the CPSS refer to as model 3, in which cash and securities are exchanged simultaneously on a net basis. This also eliminates fully principal risk, but can lead to difficulties in the event of participant default with large subsequent knock on impact on other market participants through high levels of trade failure. As can be seen each approach to DVP has its own advantages and disadvantages.

Cross border settlement, increasingly common as financial markets have become more globalised, requires additional processes for handling transfer, both of money and of ownership, between jurisdictions; this can involve, for example, the settlement of monetary obligations in commercial bank rather than central bank money; and additional tiered arrangements for recording ownership by foreign investors. Thus for example ICSD settlement for Eurobonds by Euroclear and Clearstream is in commercial rather than central bank money, reflecting customer requirement for multi-currency settlement which makes settlement in central bank money impractical. Participants maintain cash accounts for finance settlement with the commercial banking arms of the ICSDs. Settlement is DVP and multi-currency in these accounts, but principal risk is not quite so effectively removed, since there is a residual albeit small risk of failure of these banks and the money deposited in them.

b) Operational Costs, Replacement Risk and Multilateral Netting

DVP in central bank money can eliminate principal risk, but does not remove the remaining residual risk of trade failures. If either money or securities are not ready for delivery then DVP cannot take place and there will be a delay in settlement. Dealing with such problems adds to operational costs and can potentially cause liquidity problems for one or both counterparties. In the event that settlement is not just delayed but does not take place at all, e.g. because of counterparty bankruptcy, then there are the additional costs and potential losses of having to replace the failed trade with a newly executed trade.

These replacement risks are just one of the operational costs and risks associated confronted by modern day systems of security settlement. Another key challenge is business continuity. Systems need to be robust in the event of a major disturbance such as a terrorist attack or other catastrophic event. There is a desire on the part of market participants to exploit technology and economies of scale in order to reduce both processing costs and operational risks. Thus in Europe, over the past two decades, there has been a considerable effort to develop pan-European arrangement for the clearing and settlement of securities trades (for example Target-2 securities, discussed below) to take full advantage of the cost reductions from economies of scale). The discussion here focuses though on replacement risk and the reduction in this operational risk through multilateral netting.

It is useful to distinguish different reasons for a delay in settlement. One, only touched on here, is operational integrity of the systems themselves. All market participants, both intermediaries and final investors, suffer enormous costs of the clearing and settlement systems themselves break down. There is therefore close monitoring of the operational integrity of these systems by both industry and regulators. Great care is taken with operational tasks such as software upgrades, to ensure that there is no break in service. Much of the costs of operating clearing and settlement infrastructure are operational.

Even when the systems themselves are robust, there is always still the possibility that a counterparty may fail to deliver either cash or collateral as promised. This has two consequences: in extremis, if the counterparty is bankrupt and will never deliver, then the consequence is a replacement risk, the trade must be replaced and market prices may have moved substantially and create a large cost for so doing. In most cases the counterparty is still trading and can be expected, eventually, to deliver; but this creates a liquidity problem, the securities broker must obtain the cash or collateral to deliver to clients.

These risks may be quite small for each individual trade, but in active securities markets with large trade volumes they are far from trivial. The front-line tool for reducing this replacement and liquidity risk is 'multilateral netting' through a central counterparty. A central counterparty (also referred to as a

Central Securities Depositories and Securities Clearing and Settlement

clearing house or central counterparty clearing house) is an institution that is interposed between buyers and sellers on a financial market, acting as the buyer to every seller and the seller to every buyer. Figure 2 illustrates:

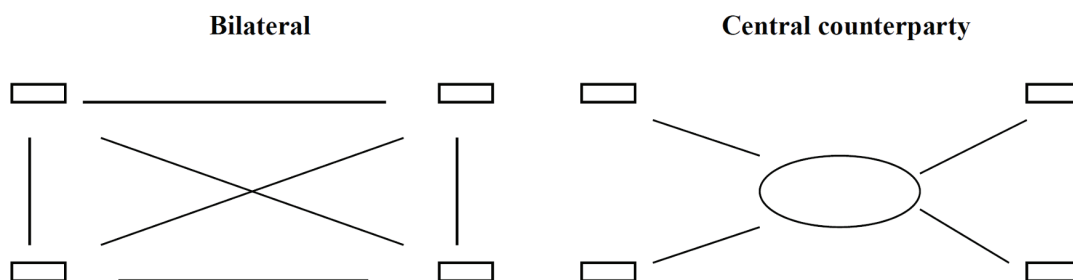
There is a potentially dramatic reduction in the number of trades to be settled. On a bilateral basis market participants have $(nn - 1) / 2$ bilateral positions. This is reduced to only n with a central counterparty. With 1,000 participants in the market, potential number of positions needing to be settled could be reduced from 499,500 to only 1000! The central counterparty must of course be extremely safe – if the central counterparty were to fail, then all participants in the market would be seriously affected.

Central counterparty clearing has been used for the best part of a century in derivative exchanges.¹¹ Examples include Chicago Mercantile Exchange Clearing for the main US derivatives exchanges and London Clearing House which developed as the central counterparty for the London derivatives exchange LIFFE and the London commodities exchanges (although a few years ago it lost the LIFFE contract).

As operational risks and costs have increased in securities markets, along with trading volumes, stock exchanges in all the major financial centres have adopted central counterparty clearing for their securities markets as well as exchange traded derivatives. This has several benefits in terms of reduced risk and cost.¹²

- It provides the maximum amount of multilateral netting. As illustrated in Figure 1, the introduction of a central counterparty results in automatic and full netting of all positions. In the case of the US securities markets this reduces the volume of trades that need to be settled by 98% (Morris & Goldstein, 2010) and as technology promotes even larger numbers of smaller trades this percentage netting efficiency is growing even higher.
- In the context of an order driven market, such a stock exchange or automated execution facility, they allow ‘anonymity of trading’ to be preserved – (something that happens automatically in a quote driven market because a market maker stands between buyers and sellers deal).
- They facilitate standardisation of post-trade processing, including both initial confirmation and matching, and then the subsequent clearing, and final settlement. Every trade is handled by the central counterparty and the systems of all other market participants must work effectively with the CCP.

Figure 2. Pre-settlement netting: Bilateral versus central counterparty



- Finally central counterparties facilitate so called “Continuous Net Settlement”. When a trade settlement fails, because either the buyer fails to provide cash, or the seller fails to provide the security, then the position can be marked to market, and carried over and netted with all of the following day’s trades for settlement one day later.

Also, as discussed in Section 4, a CCP can if it is accompanied by open access reduce entry barriers and hence support greater competition both trade execution and the provision of post trade services.

c) Liquidity Risk and Securities Borrowing

A third and closely related risk in securities settlement is liquidity risk, the risk that either cash or securities may not be available to settle remaining (unnetted) trades. This subsection provides a brief discussion of the role of custodian banks and CSDs in providing the necessary liquidity in securities accounts for completion of trades. The challenge is a long standing one in securities markets: it may not be necessary to be in possession of securities ready for delivery at the time an order to sell a security is submitted; this is only necessary at the time of settlement.¹³

As a result there is a market for securities borrowing and lending, through which market participants can temporarily borrow securities from the accounts of other market participants and deliver them for settlement.¹⁴ Historically, this was achieved in London markets through a fee known as ‘contango’, paid by a purchaser of securities for borrowing money against the loan of the security and thus being able to delay full payment and in effect financing a long position on margin.¹⁵

Occasionally, when there was abnormal demand for securities for settlement, these fees reversed in sign and a payment, then referred to as ‘backwardation’, was made by the lender of money to the owner of securities for the privilege of having possession of the security for settlement (an unusual situation arising only when there is substantial unsatisfied demand for that particular security in the cash market, arising for example if many securities have been sold forward in futures or forward contracts and there a sharp change in market sentiment leading to substantial closing of these positions and a hence a shortage of securities.)

This has now evolved into securities lending, one of the main services provided by custodian banks to their broker and investor clients. They can for a fee arrange for a loan of securities to take place on their books between one client’s account and another, matched by a loan from a cash account held by the security borrower to a cash account of the security lender. Investors are normally happy for their securities to be loaned out because this earns them a small additional income. The cash lenders are willing to receive a lower remuneration than they would from simply keeping the cash on deposit in order to have securities for settlement.

This securities lending is closely related to, and economically a close substitute for, the practice of “repo” or sale and repurchase agreements between investment banks and their clients. In both cases a security is used as collateral for borrowing of cash. The differences between the two arrangements are institutional: repo is used primarily for financing long positions in bonds and other fixed income securities; while securities lending is primarily used for obtaining equities for the settlement of short trading positions.

The tiered ownership described in Section 2 has resulted in another substantial difference between settlement arrangements used today and those used the paper based systems of the 1960s and earlier. In those days securities settlement meant exchange between the final buyers and final sellers of securities,

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money exchanged for either a physical certificate or for a change of entry in an inscribed security holdings record book. Today securities settlement means exchange of money for securities in held *in securities accounts with the brokers responsible for executing client orders*. This difference matters because the first responsibility for managing the liquidity and settlement risks in securities trading falls on the brokers rather than on their clients. They can of course ask clients to accept the costs, for example by requiring them to pre-fund trades, but the response of the clearing and settlement system to liquidity shocks is different and – an issue for further research – may be a source of systemic risk.

Figure 3 illustrates how, in order to trade, buyers and sellers hold securities in securities accounts held with the brokers who execute their instructions to trade. This may require transferring securities from an investment account held with a custodian bank. The securities broker in turn holds securities accounts with a custodian or CSD and cash accounts with central bank. After the trade is executed the trade is settled, from the customers perspective, by movement of securities into (or out of) these accounts with a matching and opposite cash payment out of held with custodian

This figure highlights these ways in which modern settlement arrangements that differ from those in the old days of paper based settlement. As already discussed, final buyers and sellers now hold both securities accounts and cash accounts with the brokers who execute security purchases and sales on their behalf. This is different from past practice when investors would have held only cash accounts with brokers (such a thing as a ‘security account’ did not then exist) and physically delivered security certificates for settlement (or physically presented themselves for a change of inscribed book entry.)

Also, as discussed, delays in settlement and resulting liquidity risk, are nowadays an immediate concern for the broker, the intermediaries, but do not impinge directly on their final customers. If settlement is at T+2 then the broker dealer will credit the buyers account with that security on T+2. If as happens occasionally the security is not delivered into the brokers own custodian account, then they will have to themselves borrow the security in order to meet their client obligations. This is very different from arrangements under the old paper based system of clearing and settlement when clients not brokers were responsible for managing liquidity risks using contango (margin) or backwardation (security borrowing) according to whether they were short of cash or short of securities.

Figure 3. The hierarchy of ownership in a trading environment

Buyer (asset manager, cash only institution such as an insurance fund or a leveraged institution such as hedge fund)		Seller (asset manager, cash only institution such as an insurance fund or a leveraged institution such as hedge fund)	
Investment accounts	Trading accounts	Trading accounts	Investment accounts
Cash and security accounts with Commercial Bank/Custodian	Cash and security Accounts with Security Broker	Cash and security accounts with Security Broker	Cash and security accounts with Commercial Bank/Custodian
Cash and security accounts with Central Bank/CSD	Cash and security accounts with Central Bank/CSD	Cash and security accounts with Central Bank/CSD	Cash and security accounts with Central Bank/CSD

The consequence is that under modern systems it is the security brokers who carry all these liquidity risks. They must therefore always be ready to borrow securities either in the securities lending market (used primarily for equities) or the repo market (used primarily for bonds). Thus brokers rely on both repo and securities lending as a source of liquidity. Repo lending is the main instrument for exchange of liquidity in the short term money markets. Securities lending is the corresponding instrument for provision of liquidity to those broker dealers in order to support their customers in taking short positions in equity markets.

d) When is Settlement a Settlement? The Puzzle of Trade Fails

The move over past decades from paper based and manual processes in clearing and settlement has accompanied a switch from manual (face to face and telephone based) trade execution to automated computer based or computer assisted orders for trade execution. These developments have long promised to lead to full automation of trading processes, from initial order through trade execution to final settlement, something described as ‘straight through processing’ or STP.

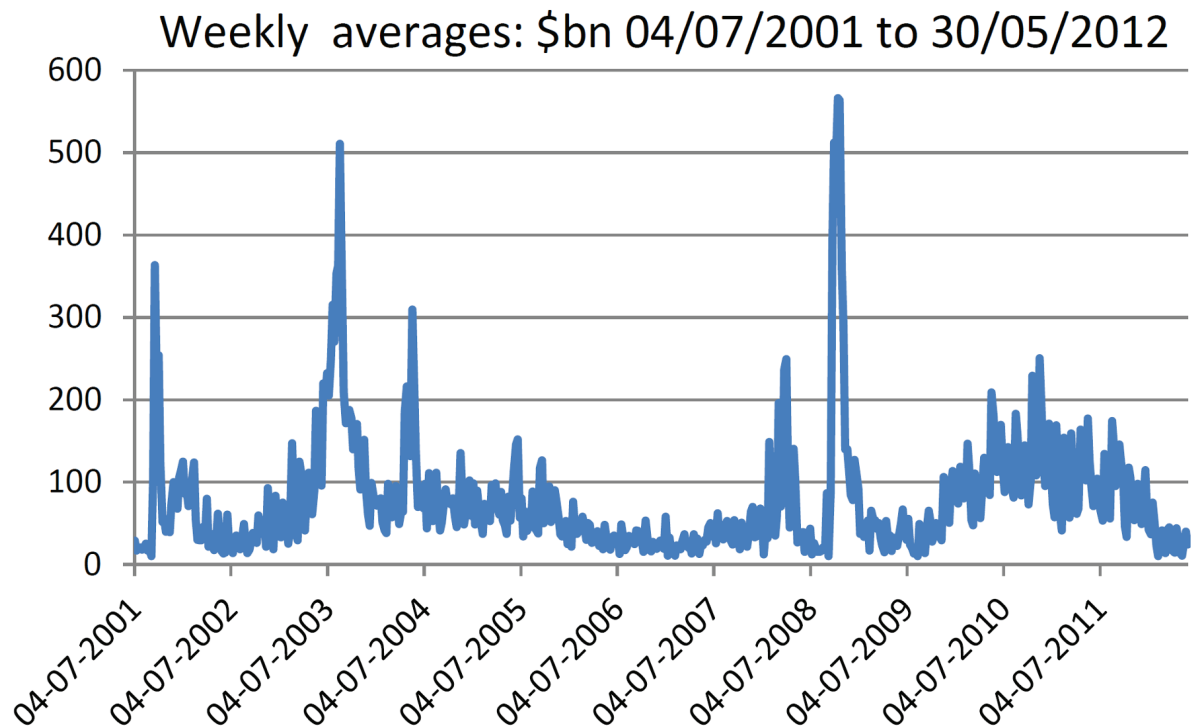
In theory in today’s financial markets where the large proportion of trades are initiated on a computer, either automatically or through a mouse-click, the post-trade process should be highly automated with only minimum manual intervention. However in practice, while there has indeed been considerable degree of automation of post trade services, an essential requirement to cope with the greatly increased trading volumes in modern computerised and screen based markets, it has also for a number of reasons proved difficult to achieve complete STP. Instead a surprisingly high proportion of trades fail. This is due to the challenges facing security brokers in managing both their cash and securities liquidity.

There has been progress. In the 1990s and earlier, when a large proportion of orders to trade and execution was manual, for example through voice instructions, then substantial resources had to be devoted to the initial matching and confirmation of trades. Securities markets have in the past two decades largely shifted to computerised trading, either through manual orders entered on a computer screen or through computerised algorithmic trading. These change have substantially reduced those trade fails arising because the original trade agreement itself was flawed because inconsistency of instructions on the two sides of the trade.

It is though still quite common for settlement to be delayed by one or more days (rather confusingly these are still referred to as ‘trade fails’ even though the trade has not failed, rather instead settlement has been delayed). For this reason fully straight through processing has proved to be elusive, especially in either cross-border trades and in trades involving a number of underlying participants, for example both exchange traded and actively managed fund. As a result trade fails, i.e. settlement delays, are still comparatively high in some types of trades and some trade fails can still require relatively expensive manual intervention before they are finally cleared and settled.

The analysis of (Bradley, Fawls, Litan, & Sommers, 2011) (of the Kauffmann Foundation and the Basis Point Group) drawing on DTCC data has drawn attention issue of trade fails. (The Economist, 2011), in an article based on their work, highlights the high levels of trade fails, especially at times of systemic financial stress, for example at the time of the failures of Lehman Brothers and Bear Stearns (see Figure 4), and in particular instruments. In 2010-2011 US trade failures were especially high in Exchange Traded Funds, accounting for around \$7bn per day of the \$10bn per day of failed equity trades in 2010. Trade failures in US Treasuries and Mortgage Backed Securities were even higher.

Figure 4. US Daily Trade Fails



Note: The data in this figure was provided by the Basis Point Group consultancy. The data has been put together from statistical releases on the US Federal Reserve Bank of New York website for US treasury, Federal agency, other mortgage-backed and corporate securities trade fails reported by the US Primary Dealers (see <http://www.newyorkfed.org/markets/statrel.html>, <http://www.newyorkfed.org/markets/gsdsearch.html> and http://www.newyorkfed.org/markets/pridealers_current.html).

Do these levels of trade failure matter, given that final customers are not directly affected? Clearly it involves cost and risk to securities brokers but provided these risks are understood and managed then these not need be a cause of further concern. (Amery, 2011) reports a range of views on the ETF trade failures, some market participants regarding them as a benign consequence of the different tools used by brokers to manage collateral and liquidity (as already explained customers positions are determined by the trade not settlement, with the broker responsible for making up any losses arising from settlement failure); others including (Bradley et al., 2011) view them as potentially large source of systemic risk with the possibility of a cascade of trade failures leading to systemic financial problems.

(ECSDA, 2012) reports some statistics for trade failures in European markets. For example they report (Annex 1) March 2012 figures for the UK and Ireland – which have some of the lowest trade failure rates across Europe – indicating that 3.82% of the total volume of securities trades for which Euroclear UK and Ireland (the CSD) receives settlement instructions remain unmatched at T+2, the day before intended settlement; with 1.27% of trades by value failing to settle on the intended settlement day of T+3 and only a further 0.27% of trades settling one day late on T+4.

There are several underlying reasons for these sometimes surprisingly high levels of observed trade fails (see discussion in (ECB, 2011; Fleming & Garbade, 2005)):

- Failure of the cash leg of settlement is hardly ever a cause of trade fails, but problems arise relatively often with the security leg of settlement either because it can be difficult to secure the specific security required for settlement or because the securities dealer prefers not to use up their cash liquidity in securities borrowing. Failure volumes approaching 5% of average daily total equity market trading in 2011 have been reported in the US ((Mollenkamp, Podkul, & Toonkel, 2012)). Even higher US trade failure rates occur in Treasury and government agency bond markets.
- Market participants may consciously choose postponement of settlement as an alternative to securities borrowing because the penalty for a postponement are relatively low. Changes in regulatory penalties for settlement delay in the US have reduced rates of trade fails, but they have not disappeared entirely ((SEC, 2011))
- Settlement postponement in US treasury securities trades have been high during periods when there were relatively low quantities of securities available for lending (see (Fleming & Garbade, 2007))
- Settlement postponement is also associated with relatively complex deals, such as cross border participation or multiple participants in a fund transactions, the accounts of each of which must be credited with cash or securities.
- Settlement postponement can rise during periods of market stress when liquidity is scarce.

4. POLICY CONCERNS: THE CHALLENGE OF COMPLEXITY

This section discusses briefly two policy issues that arise in relation to securities clearing and settlement. The first is systemic risk, the second implications of post-trade clearing and settlement arrangements for competition and the cost and quality of services to final investors holding and transacting in securities. It will be argued here that there is at least some ‘prima facie’ evidence that the complex modern arrangements for holding securities and transferring ownership both reduce competition in securities services and heighten systemic risk. Policy makers need to pay close attention.

Systemic Risk in Securities Clearing and Settlement

Central banks across the world are closely involved in securities clearing and settlement and are especially concerned with the possibility that problems in clearing and settlement processes might amplify or transmit systemic financial problems. These concerns are regularly addressed at global level by the Committee on Payment and Market Infrastructures hosted at the Bank for International Settlements (formerly known as the Committee on Payment and Settlement Systems, see (CPMI, 2014)).

During the global financial crisis of 2007-2009 securities clearing and settlement systems proved to be remarkably robust, and did not amplify or transmit systemic risk (Borio, 2010). This is in sharp contrast with the 1987 Stock Market crash in the US where clearing and settlement systems came under great strain, with several problems including the failure of the Fedwire large value payments system, contributing substantially to the resulting panic (see (Bernanke, 1990) for summary discussion and more detailed references).

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There were though, as we have seen above, heightened rates of trade fails in 2008 at those times of greatest systemic financial stress when firms were scrambling for liquidity. (Bradley et al., 2011) argue that these trade fails, while not overwhelming the wider financial system on these occasions, still have the potential to result in such large “cascades” of trade fails that this could lead to widespread transmission of systemic financial problems.

Problems also arose in the global crisis of 2008 in closely related market arrangements, notably in repo markets. Because of loss of confidence in their quality as collateral, the ability to repo sub-prime MBS and other structured credit securities disappeared. ‘Haircuts’ widened i.e. the amount that could be borrowed against securities using repo fell.¹⁶

There were particular problems in US tri-party repo markets (see (Copeland, Duffie, Martin, & McLaughlin, 2012)). Tri-Party repo is an arrangement, more common in the US than in other markets, where a security that is pledged in repo is placed with a third party custodian bank. A key problem during the crisis was that the convention in the US for custodian banks involved in this business, chiefly JP Morgan and The Bank of New York, was to return securities pledged in overnight repo to their owners at the beginning of the next working day, leaving the matching loan as an uncollateralized daylight exposure.¹⁷ This substantially increased counterparty risk because the lender of money was exposed to the substantial counterparty risk of loan not being repaid later in the day.

Another obvious substantial and uncontrolled counterparty risks that emerged during the crisis, rather less closely related to clearing and settlement, was in over the counter credit default swap markets, against AIG and monoline insurers (these events are of course well documented, see for example (Milne, 2009)). This risk is the principal rationale for the newly introduced requirements for trade reporting and clearing and OTC derivative markets, but was not directly related to securities clearing and settlement.

The fact that clearing and settlement problems did not play a major role in the global financial crisis of 2008, does not imply that the role of securities clearing and settlement in a future systemic financial crisis can be entirely ignored. While clearing and settlement systems did not themselves amplify problems in the crisis, almost all participants in these systems were protected by emergency liquidity provision from central banks (and in many cases by explicit or implicit uncollateralised support from governments e.g. the widespread guarantees by the UK and other governments on many bank liabilities or the direct support by the US government to Citigroup and, through TARP lending, to many other US financial institutions). It is difficult to know what the counterfactual would have been: how would clearing and settlement systems have stood up had there not been extensive public sector support for financial institutions across the world?

The intention of regulators, going forward, is that such widespread support will not be repeated in any future crisis. In this case could liquidity or other problems then emerge in securities clearing and settlement? Or could exposures in clearing and settlement prove to be an obstacle to the orderly resolution of securities brokers, as envisaged in the US Dodd-Frank act or the Single Resolution Mechanism in European Banking Union?

Addressing these questions in any detail goes beyond the main scope of this chapter, providing a description of clearing and settlement processes and the associated default and liquidity risks. What can be concluded from the material offered here is that modern clearing and settlement arrangements are extremely complex, involving intricate and to a substantial extent largely undocumented networks of account holdings together with explicit (and sometimes implicit) credit and liquidity exposures. This complexity is itself a potential source of systemic problems. The behavioural incentives on market participants, especially in relation to the hoarding of securities or cash liquidity at times of financial stress

are unclear and poorly understood. There are indications (for example from the data on “trade fails” i.e. postponed settlement, during the height of the global crisis), that systemic problems can still arise in modern systems of clearing and settlement during periods of market stress.

One aspect of this is the widespread practice amongst securities brokers of using assets, both cash and securities collateral, deposited with them by clients as tools for their own liquidity management. The best known example is rehypothecation i.e. when a dealer uses securities placed by clients in their securities accounts as collateral for cash borrowing by the dealer. Unwinding these positions, as was for example required following the failure of Lehman Brothers in 2008, can be difficult. The legal details matter, (see discussion in (Murphy, 2013)). The consequences of rehypothecation depends upon whether the transfer of cash and collateral is a transfer of title (with the security actually changing ownership) or whether ownership is unaffected by the pledging of collateral. At least in theory, if title is not pledged, the security should not be trapped in a bankruptcy of an intermediary in the rehypothecation chain. In practice the operating systems of the institutions involved may not be sophisticated enough to distinguish pledged securities to which they do not have title from other securities to which they do have title, so clients are exposed to loss in bankruptcy when they believe they are legally protected.

It may reasonably be asked whether there are not simpler mechanisms for the post-trade exchange of securities title and cash between final investors might not be worked out, imposing less operational and liquidity demands on broker dealers and hence reducing systemic risk in clearing and settlement. This is a major open issue for further research.

Complexity and Competition and Efficiency in Securities Transaction Services.

The remainder of this section discusses of the relationship between clearing and settlement infrastructure and competition and efficiency in the full range of securities transaction services, from initial trade execution through to final settlement.¹⁸ It first describes the debates on regulation of clearing and settlement in the European Union and then draws some more general policy lessons.

This topic of competition and efficiency in securities clearing and settlement has been the subject of considerable attention in the European Union where it has been argued that fragmentation of clearing and settlement infrastructure along national lines has increased costs and reduced competition, as a result reducing both market liquidity and substantially increasing transaction costs.

A number of studies, for example (Lannoo & Levin, 2002; NERA Consulting, 2004) have compared costs in US and EU securities clearing and settlement arguing that the presence of the DTCC as a single US infrastructure has supported both greater efficiency of settlement (exploiting fully economies of scale) and by allowing trades to be settled in a single system support greater liquidity in trading venues. Cross-border trades within the European Union have been especially costly.

Because of this European policy makers have adopted the development of pan-European securities arrangements for clearing and settlement as a key objective, in the development of single markets in financial services across Europe.¹⁹ The policy debate in Europe on clearing and settlement was substantially taken forward by the two reports of the Giovannini group (Giovannini Group, 2002, 2003) which identified fifteen separate barriers to integrated pan-European clearing and settlement, including market practice, law and regulation and technical interoperability. However even after some years progress in overcoming these barriers was limited, an outcome which (Giovannini, 2010) ascribes principally to weaknesses in the political process and the resulting failure to introduce a European directive to force a common legal framework on all participants in European clearing and settlement.

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Progress has however been made in some of the more technical obstacles to pan-European clearing, with the creation of a pan-European securities settlement infrastructure: Target2 Securities or T2S. This has been commissioned and overseen by the European Central Bank (see (ECB, 2014) for the technical details of the project and (Lannoo & Valiante, 2009) for a critical review of this initiative). T2S when it comes on stream (this is now scheduled for 2015) will provide a platform supporting securities accounts that is closely linked to the Target2 platform for Euro large value payments, thus facilitating DVP settlement. All European CSDs will be able to link their own securities accounts into Target2, so a financial institution e.g. a custodian bank, by opening securities accounts with one CSD will be able to offer settlement services in any European security. According to the ECB this will overcome six of the fifteen Giovannini barriers to pan-European clearing and settlement – some fifteen years after the Giovannini group first considered how to create a common clearing and settlement framework.

This slow and hesitant progress towards integrated arrangements for European securities clearing and settlement, illustrates many more general issues of competition and efficiency which arise in securities clearing and settlement.²⁰ These include the following:

- Clearing and settlement infrastructures are technical monopolies. Operating clearing and settlement on a ‘for profit’ basis is problematic because participants to the two sides of a trade typically have no choice about where ultimate settlement takes place, this is determined by the CSD that holds the ultimate securities accounts.
- One common response, this is the situation of the DTCC in the United States and Euro-Clear in Europe, is for the infrastructure to be user-owned and operated on an ‘at cost’ basis. The users though, in the case of DTCC are the major securities brokers, not final investors, so it may be argued that DTCC still operates to serve producer interests. This arrangement does however encourage competition between trading platforms.
- An alternative arrangement, which applies for example to Deutsche Börse Clearstream, the German clearing and settlement infrastructure which also owns the ICSD Clearstream International, is for the infrastructure to be owned by an exchange. This ‘silo’ arrangement has certain advantages, for example making it technically easier to have ‘straight through processing’ from trade execution to final settlement. The problem here is that the exchange, especially if is a ‘for profit’ as most exchange now are, may be tempted to use the market power created by its monopoly on clearing and settlement to charge higher fees above cost.
- Clearing and settlement arrangements have a major impact on competition for associated services such as securities lending and transaction reporting. In particular existing infrastructures, even when they are not for profit, have a vested interest in the growth of their own clearing and settlement solutions and the opportunities for new business that this creates. According to (Giovannini, 2010) a number of market participants were disappointed by the failure to develop a common legal framework that would encourage competition in securities settlement, believing that it gave too much competitive advantage to the largest provider Euroclear. Euroclear was in turn disappointed by the decision to create T2-S because it undermined the value of the investment it had already undertaken in its own pan-European settlement solution.
- As in other ‘network’ industries, greater technical inter-operability and the removal of access barriers can reduce the market power of the owners of clearing and settlement infrastructures. Achieving greater interoperability requires standardisation at both the technical level e.g. communications and messaging and at the business process level. But the necessary co-operation on

standardisation can be difficult to achieve, especially if this involves substantial new investments.²¹ Access regulation may be required to allow other suppliers to compete on ‘downstream’ services such as securities lending and transaction reporting.

The analysis provided in this chapter suggests a possible concern about competition and efficiency in securities clearing and settlement. As already emphasised, the interaction between securities brokers and custodian banks, on the one hand, and clearing and settlement infrastructures including CSDs on the other, is remarkably complicated, both in terms of the operational challenges of managing account flows and also the resulting responsibilities for managing cash and securities liquidity.

A consequence may be that it is very difficult for a new entrant to challenge the role of incumbent securities brokers. Arguably the sheer complexity of securities ownership and securities clearing and settlement entrenches the market power of securities brokers, at the expense of higher charges to final investors. While this goes beyond the scope of the present chapter, it is another issue where further research is again merited.

5. CONCLUSION

The purpose of this chapter has been to describe the legal and economic arrangements behind the ownership of securities and transfer of securities title. It aims to be both backward-looking, providing a brief history of how arrangements for ownership and sale have evolved over time; and forward-looking, discussing some of the current challenges in clearing and settlement, both from both a business and policy perspective.

While this chapter contains a lot of technical detail (clearing and settlement is an activity where technical details matter) a few issues can be highlighted. Section 2 has explained the tiered account based securities ownership arrangements that emerged in the late 1960s and early 1970s as securities processing was computerised. These arrangements are very different from the old paper based arrangements that preceded them. They allow the underlying securities, all ultimately located in a central securities depository, to be represented by a hierarchy of securities accounts offered by other financial intermediaries, with each account representing securities in an account at a lower level.

While these arrangements have supported the dramatic increases in the volume of trading on today’s financial markets, they have also fundamentally shifted the responsibilities for management of cash and liquidity in securities trading. Whereas under older arrangements these were the responsibilities of final investors, now it is the intermediaries, the securities brokers, who have the ultimate responsibility for delivering cash and securities to settle trades.

Over the past quarter of a century ‘principal risk’ – i.e. the risk of delivering a security and not getting paid, or paying and not getting title – has been largely eliminated through ‘delivery versus payment’ of DVP. It is now standard practice in all markets to have payment and delivery made either simultaneously or at least for payment to follow very soon after delivery. There are still however substantial liquidity risks in securities markets, and in the underlying processes of clearing and settlement. These liquidity risks are one major reason why postponement of settlement between brokers (so called ‘trade fails’ although this is a bit of a misnomer since the original trade is typically valid) remain so surprisingly high.

In some respects modern clearing and settlement systems are impressive technical achievements. They have successfully provided business continuity even under extreme stress (for example the 9-11

attacks in New York). The operational costs of trading have been closely controlled, even while trading volumes have massively increased over past decades. Clearing and settlement systems also proved to be resilient during the 2008 crisis, in sharp contrast to their degradation during the 1987 stock market crash. This was due to the adoption of DVP but also because of the widespread guarantees and public sector support to market participants.

Despite these achievements, authorities will need to continue closely monitoring the possibility of systemic problems in securities and settlement systems. The sheer complexity of modern securities ownership arrangements, and the challenge to securities brokers of managing liquidity, result in a very complex network of credit and cash obligations. So it remains an open question as to whether breakdown of clearing and settlement might transmit systemic problems in a future financial crisis. Another potential problem is that arrangements (“recovery and resolution plans” also known as “living wills”) for resolution of large financial firms might prove infeasible because clearing and settlement exposures cannot be dealt with in an orderly fashion.

Clearing and settlement systems are also a potential competition concern. The need to clear and settle through a shared system creates market power and if this market power is exploited final investors in securities may pay substantially more than underlying costs, both for clearing and settlement services and for the trade execution that relies on subsequent clearing and settlement. Institutional arrangements, such as user ownership and/ or interoperability and pen access can and do limit this market power. But a concern remains that the sheer complexity of clearing and settlement systems still acts as a barrier to entry in securities brokerage.

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KEY TERMS AND DEFINITIONS

Brokerage: A financial institution that facilitates the buying and selling of financial securities between a buyer and a seller.

DVP: Delivery versus Payment scheme.

Liquidity Risk: the risk arriving from the lack of possibility that an investment cannot be bought or sold quickly enough to prevent or minimize a loss.

Netting: The legal framework, under which one or more series of related transactions among parties are canceled and a new obligation to make only the net payments is created.

Principal Risk: In securities transactions is the risk that the security is not delivered after the payment is made or the risk that a payment is not received after a security was delivered.

Repurchase Agreement (repo): It is a short term financing transaction securities in which securities are sold with the promise of buying (repurchasing) them back.

Securities Lending: Securities lending involves a temporary transfer of the ownership of a security to a borrower who is required to put up collateral. These type of securities transactions are commonly used in short selling trading strategies.

Short Selling: A trading strategy which involves borrowing a security in order to sell it immediately with the expectation of buying it at a lower price in the future.

ENDNOTES

- ¹ Further confusion arises from inconsistencies in usage; for example the Euroclear group is a leading European provider of settlement and related banking services, but it is not a CCP that centrally clears trades.
- ² Standard histories of securities markets, for example (Michie, 2006), contain little or no information on clearing and settlement arrangements. Much of the description here is gleaned from (Armstrong, 1934).

³ The widespread use of bearer bonds relies on the concept of a “negotiable instrument”, deeply rooted in US law and commercial practice but with much more limited British practice. (Beutel, 1940) provides an historical account.

⁴ See (Chan, Fontan, Rosati, & Russo, 2007) for a fuller account of the work of custodian banks.

⁵ These named banks were the leading providers of custodian services in 2006, see (Chan et al., 2007) Table 2.

⁶ These developments are described in (Norman, 2007).

⁷ See (Norman, 2007) for an account of this history and some of the colourful characters involved.

⁸ The initial effort was the Taurus project, which turned out to be a complete failure, with costs spiralling out of control and the complex outsourced software never being delivered in a useable form. Eventually in March 1993, after expenditure of £70mn, the project was cancelled. A small team from the Bank of England, with experience of the Bank’s involvement in high value payment systems, was brought in and they successfully delivered a fully functional CSD and electronic settlement system, CREST, which went live in 1996, at a cost of only £30mn. (Currie, 2007) provides a fuller comparison of the Taurus and Crest projects.

⁹ T+2 means final transfer of title to a security by the morning of the second working day following the execution of a trade. Government bonds are already often settled T+2 and money market transactions same day.

¹⁰ Typically today a securities trade is executed by computer (automatically or through manual execution via a computer screen) and often – if obligations are transferred to a central counterparty -- the other side of the transaction remains anonymous even during subsequent clearing and settlement.

¹¹ (Milne, 2012) provides a short account, with further references, of the history of exchange trade derivatives clearing and the challenges of providing similar services in OTC markets.

¹² The discussion of central counterparties (CCPs) in this chapter focuses on their role in securities markets and in particular their role in reducing operational and liquidity risks. There is in addition (and see also Cruz, Manning et alia as well as Pliquet in this volume) a large literature on the somewhat different role of central counterparties in derivatives markets (where counterparty risk is so much more important), and in particular on the controversies over the requirement agreed at the 2009 G-20 Heads of Government Pittsburgh Declaration for many OTC derivative transactions to be guaranteed by CCPs. This recent research has focused on the implications of OTC derivative clearing for collateral demand, counterparty and systemic risk, for example (Cont & Kokholm, 2014; Duffie, Scheicher, & Vuilleme, 2015). Some, e.g. (Pirrong, 2012), argue that CCP clearing in OTC markets can exacerbate rather than reduce systemic risk.

¹³ Recent regulations, e.g. the European Union ban on so called ‘naked’ short selling (introduced by Regulation (EU) No 236/2012 on short selling and certain aspects of credit default swaps, see (ESMA, 2012)) means that nowadays it is often necessary to borrow the security first before selling. Naked short selling means executing an order to sell a security without the seller already holding that security in a securities account. It is still possible to take a short position without doing this, first borrowing the security and then executing an order to sell. A puzzle (see below) is why the ban on naked short selling has not eliminated ‘trade fails’.

¹⁴ (Faulkner, 2008) provides a fuller account of the operation of securities lending. A succinct discussion of both securities lending and repo is provided by (ICMA, 2014).

- ¹⁵ As described by (Armstrong, 1934) under the traditional fortnightly system of accounts settlement these deals were arranged by stock brokers in the London markets on behalf of clients and recorded in their so called “Contango book”. Before World War I substantial net long positions in securities were held using contango.
- ¹⁶ See (CGFS, 2010), Table 1, many of these repo markets disappeared altogether.
- ¹⁷ The underlying problem is operational design. Similar tri-party repo facilities in Europe, for example those provided by Euroclear use intraday DVPO settlement to avoid such daylight exposures.
- ¹⁸ No attempt is made here to discuss the related question of whether modern tiered security title arrangements limit competition in portfolio services such as asset management and custodian banking.
- ¹⁹ Key documents relating to these debates can be found at (The European Commission, 2014).
- ²⁰ For further discussion of the industrial economics of securities clearing and settlement see (Milne, 2007b) and the various contributions to the same special issue of that journal.
- ²¹ For further discussion of standardisation in clearing and settlement see (Milne, 2005, 2007a).