12. Modern Financial Instruments and Banking

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12.1 Introduction

Modern banking involves much use of derivative financial instruments. One use is in hedging risks created by the bank's activities. Another use is in providing such products to clients – either directly or as some component of a more complex financial product desired by the client. Yet another use is the involvement of the bank, through its trading desk, in trading in markets for such instruments in the form of proprietary ("own-account") trading (in addition to hedging activities).

Many such products are traded in over-the-counter (OTC) markets, via screens and telephones, while some may be listed on formal exchanges.

Derivatives, as the name suggests, are securities derived from positions in other more basic securities such that their prices must be linked to the prices of those basic securities. There are well-known arbitrage formulas for derivative prices generally incorporating a risk free interest rate, and derived on the assumption that there is no default risk associated with the counterparty. In practice, that assumption is not correct, although where trading is via an organised exchange and positions resulting from a trade are novated to the Clearing House, the default risk is generally seen as very low. But for transactions done OTC there may be non-negligible default risk, Even though banks will have lists of approved counterparties to limit such risk, events subsequent to a trade may lead to the counterparty default risk increasing.

One development in recent years has been the push by international standard setters and national regulators for the use of Central Clearing Counterparties (CCPs) for OTC derivative markets. While trading is still done OTC, positions are novated to the CCP which reduces counterparty risk and the interconnections between financial institutions which could otherwise threaten financial stability. CCPs are discussed in Chapter 26.

Another relevant development is regulatory requirements for valuation adjustments (discussed in Chapter 4) for derivative positions where there is some risk of counterparty default. Such risk will reduce the value of a position relative to the standard derivative valuation formulas used.

"First generation" derivatives such a options, futures and swaps will not be discussed here – not because they are not relevant – but because there are many source of textbook information about them and their uses elsewhere. Before examining a range of "modern" financial products, we consider the role of "reference" or "indicator" or benchmark" interest rates (those terms often being used interchangeably), which are important for the design and valuation of many of those products.

12.2 Indicator/Benchmark/Reference Rates

Many financial contracts have interest rates which are linked to some other *indicator* or *reference* or *benchmark* rate. For example a 5 year loan might specify an interest rate which adjusts every 6 months to maintain a fixed margin over the 180 day BBSW rate at that date. If the reset dates are July 1 and January 1, and the margin is 120 basis points p.a., then if the BBSW180 is 3.45 on July 1, 202X, then the interest rate for the following six months will be 4.65 percent p.a. If on the following January 1, the BBSW180 is 4.00, the interest rate for the next six months will be 5.20 per cent p.a. Most interest rate derivative contracts (swaps, FRAs etc) are written involving a reference rate.

Alim and Connolly (RBA Bulletin 2018) provide an overview, noting that the benchmarks are credit related. Thus, one issue in their design is to limit the influence of changes in default risk on the benchmarks, and hence interest rates for highly rated, low credit risk, borrowers are generally used. That does not, however, remove the possibility that such benchmarks might change because of market-wide repricing of credit risk. Changes in benchmark rates relative to risk free rates (such as the OIS rates of equal tenor) are often looked at as indicators of repricing of credit risk.

One reason for the use of benchmark rates in loan contracts is to enable the interest rate in a long term contract to adjust over time in response to changes in market interest rates in a way which is, in some sense, "fair" to both parties. This is because the indicator rate is determined by market forces and not subject to influence by either party. That, at least, is the theory, although major controversies arose in recent years regarding attempts by bank traders to influence the indicator rate in ways that would benefit their bank. That has led to changes in the way in which reference rates such as LIBOR or BBSW are determined, and prompted attempts to develop other reference rates not subject to manipulation. Interest Rate Benchmark reform in Australia is discussed on this RBA webpage and international developments discussed at this Financial Stability Board webpage.

The LIBOR Scandal

LIBOR (the London InterBank Offered Rate) was a reference rate calculated each day by the British Bankers Association, and based on the interest rates at which banks offered to lend money to other banks in the international wholesale market. The reference rate was calculated for loans in various major currencies and for specified tenors such as 1 month, 3 months, etc. The calculation involved taking data submitted from a panel of banks over a short time period (just prior to 11 am), deleting the extreme cases, and then taking the average (ie a "trimmed" mean). But a critical feature was that the calculation was based on self-reporting by the banks of the rate at which they claimed they would be able to borrow (unsecured) from other banks. In 2012 it was discovered that traders at a number of major banks had colluded, by inputting quotes aimed at affecting the average.

Large fines were imposed by regulators on the banks involved, and the British Financial Conduct Authority (FCA) transferred responsibility for determining LIBOR to the Intercontinental Exchange's (ICE) Benchmark Administration. Calculation of LIBOR rates for a number of currencies, including AUD and NZD was terminated. Stricter regulation of the LIBOR determination process has been put in place by the authorities and LIBOR is expected to no longer be available after 2021. In the US, the Secured Overnight Financing Rate (SOFR) is planned for introduction as a substitute in 2023, while SONIA (Sterling Overnight Interbank Average rate) is the British Pound equivalent. Some Australian banks have issued floating rate notes referencing SONIA

More generally the use of "IBORs" which are other similarly constructed benchmark rates in different markets, such as EURIBOR and TIBOR, is being discouraged by international standard setters and regulators. (Concerns also exist over the determination of benchmark FX rates). In 2014 the FSB published recommendations involving measures to

- "Strengthen IBORs in particular by anchoring them to a greater number of transactions, where possible;
- Improving the processes and controls around submissions;
- Identifying alternative near-risk free rates (RFRs); and,
- Encouraging derivative market participants to transition new contracts to an appropriate RFR, where suitable." FSB

Since then plans have been advanced to see the end of use of LIBOR by end 2021 and use of other benchmark rates.

One consequence of the termination of LIBOR rates is the need for financial institutions, which have many contracts linked to LIBOR, to manage the transition away from use of LIBOR. In general, contracts should have specified alternative contingency arrangements for such an event, such as moving to an alternative reference rate (ARR). But since any alternative reference rate will not be perfectly correlated with LIBOR, risks of gains or losses on the contracts exist when the switch of reference rates occurs. Moreover, particularly if an ARR is not specified, the possibility of conduct risk in dealing with customers with contracts currently specified with reference to LIBOR, has been a concern of ASIC.

BBSW

The Bank Bill Swap rate has been an important indicator rate in Australia since the mid 1980s. Like LIBOR it has been calculated by using quotes from participating institutions for the cost of issuing short term paper at tenors of one to six months, just before 10 am. That paper is bank bills or negotiable certificates of deposit (NCDs). BBSW was calculated by the Australian Financial Markets Association (AFMA) until 2017 when responsibility was transferred to the ASX. The ASX generally calculates the

benchmark using an average of all primary and secondary market transactions and report the BBSW rates at 10.30 am.[1]

One concern with the previous calculation method was the limited number of transactions occurring during the time window used for calculation. Since 2017, actual transactions are used over a longer time period and for a larger number of participants. The authorities have encouraged banks to concentrate their bill issuance in this time window (with reluctance to do so being one of the problems under the earlier system).

There have also been legislative changes in 2018 empowering ASIC to oversee benchmark interest rates.

BBSW Manipulation

Just as in the case of LIBOR there have been concerns over manipulation of BBSW rates by traders at major Australian Banks during 2010 to 2012. McConnell (The Conversation, 2017) provides a brief overview of how ANZ and NAB settled with ASIC prior to a court hearing. (CBA and NAB agreed to enforceable undertakings with ASIC over manipulation of the forex benchmark). Frost (AFR, 2019) reports that the court action cost ASIC $45 million and it received $125 million from pre-court settlements with ANZ, CBA and NAB. Westpac also was fined $3.3 million for BBSW manipulation.

In addition, a class action was initiated in 2016 in the USA against Australian banks over the BBSW manipulation. In March 2021, ANZ and CBA announced agreement to settle the class action – but without details of the cost.

BBSW Problems

Unlike the case of LIBOR and some other rates, Australia has aimed to maintain the use of the BBSW as a benchmark rate which can operate alongside the risk free rate – the cash rate.

But there are some significant issues with the reliability of some of the BBSW rates – particularly that for one month tenor. Because of the LCR requirement, there is virtually no issuance of one month paper by Australian banks. The one month paper trading in the market is paper which was initially issued with a longer tenor and the passage of time has led to its remaining tenor approaching one month. There is an incentive for banks to repurchase such paper, since once its remaining tenor falls below one month the LCR requirement imposes costs on the bank.

Figure 1 is indicative of the consequences of such behavior. Banks buying back outstanding paper as it nears one month remaining maturity will push the price up (yield down), This is reflected in the

[11] While the ASX only provides information for the last 10 days on its website, longer term data can be obtained in the RBA Statistical Tables. Reuters and Bloomberg publish bid and ask values for BBSW assuming 5 basis points above and below the BBSW value.

relative decline in the spread (over the same tenor OIS rate) on one month paper compared to three month paper, after the LCR requirement was introduced in January 2015. Of course, that is not conclusive evidence, but the disproportionate role of banks relative to investors in purchasing one month paper shown in Table 3 in Alim and Connolly (RBA Bulletin 2018) is also relevant. The behavior of both spreads since the RBA target cash rate was reduced to 10 basis points in March 2020 warrants further analysis.

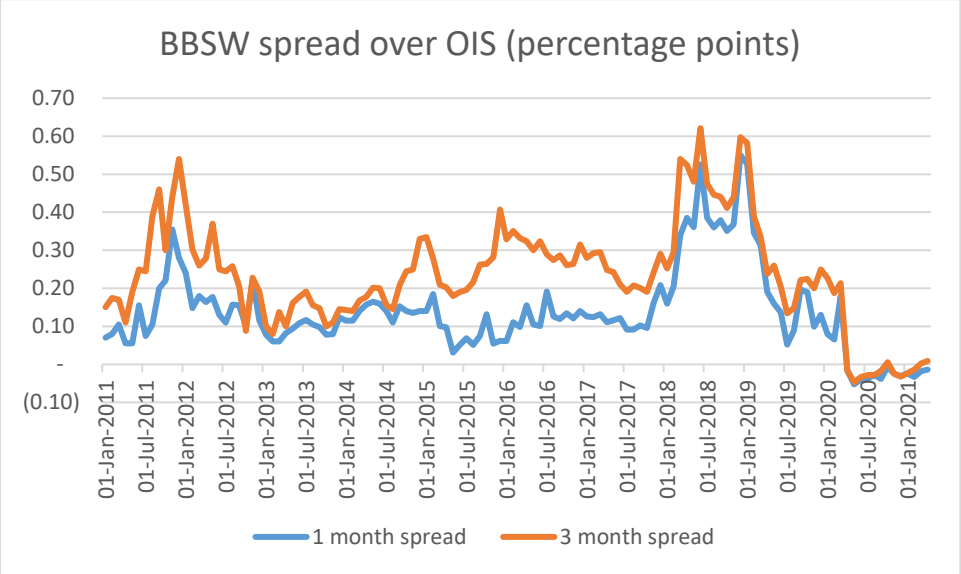


FIGURE 1: BBSW SPREADS (SOURCE RBA STATISTICAL TABLE F01D)

The Cash Rate and AONIA

The cash rate is the interest rate at which banks lend exchange settlement balances to each other overnight, on an unsecured basis. It is thus, effectively a risk free rate. The RBA announces a target for the cash rate at its regular monthly meetings. More details are available in Chapter 19.

Financial market participants often use the term AONIA in referring to the cash rate, with the acronym originally standing for the AUD Overnight Index Average. AONIA can be calculated for a one (or longer) month period by compounding the daily rates, and has thus been suggested as a possible alternative to the one month BBSW as a benchmark rate. However, the one month AONIA can only be calculated at the end of the month using historical data, whereas the BBSW is a forward looking interest rate. AONIA does have the advantage of being a rate which incorporates no credit risk.

Use of AONIA as a reference rate in floating rate securities is still quite uncommon as of 2021, although SAFA (the South Australian Government Financing Authority) issued the first of its FRNs paying a coupon over the monthly AONIA in 2019.

12.3 Overnight Indexed Swaps (OIS)[2]

OIS are interest rate derivatives and the OIS Market in Australia dates from 1999. In December 2015 ASIC determined that it (together with other derivatives markets) should be subject to mandatory central clearing, and legislation to effect that was passed in May 2016. Thus banks and other participants transact "over the counter" (telephone, via brokers or electronic platforms) with positions novated to a CCP. Market conventions for trading are available on the AFMA website and the minimum dealing parcel size is $2 billion for 1 month maturity, and declines with maturity to $150 million for 12 months. Most OIS contracts are for less than six months maturity (Cole and Ji, 2018).

An OIS is a swap involving one payment at maturity (eg three months) which is the difference between a:

- Floating payment: based on the average of the overnight rate over the term of swap, and a
- Fixed payment: based on the relevant agreed fixed (OIS) rate at the inception of the swap.

Figure 2 illustrates.

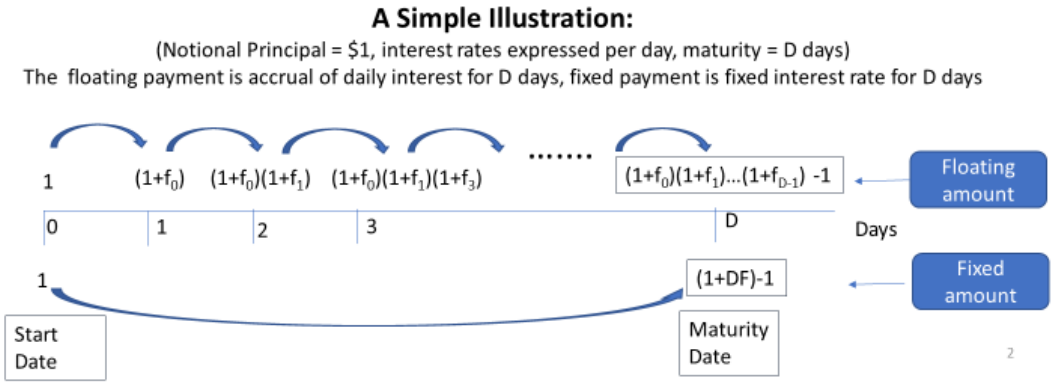


FIGURE 2: ILLUSTRATION OF AN OIS

The specific amounts are calculated as:

Fixed amount = $P.\frac{N.F}{36500}$ where P = notional amount, N= number of days, F = fixed rate (%)

$$\text{Floating amount} = P.\left[\left(1+\frac{c_1 D_1}{36500}\right)\left(1+\frac{c_2 D_2}{36500}\right)\ldots\left(1+\frac{c_N D_N}{36500}\right)-1\right]$$

[2] For more information see this 2002 RBA article

where c_i = the AUD interbank overnight cash rate for the ith reset day of the OIS transaction as shown on Reuters RBA30, and D_i = day count on i'th reset day (generally equals 1, different for weekends or holidays)

Example:
7 day OIS where: P = $1 mill; F = 2.8000; c_1=…=c_4 = 2.7500; c_5 = …c_7 = 3.0000

Fixed amount = $536.9863; Floating amount = $548.0739;

net payment = $11.08756 from floating to fixed payer (2 business days after maturity).

Several points regarding this calculation warrant mention. First the floating rate is the actual cash rate calculated by the RBA as a weighted average of transactions for overnight money and published each morning (and also referred to as AONIA). Thus, for example, if an OIS is agreed on a Tuesday, then c_1 will be the rate published on the Wednesday morning for transactions involving overnight money for the Tuesday night. Second, in practice, up until the RBA reduced its target cash rate to 25 bp in March 2020, the actual cash rate did not differ from the RBA's cash rate target. Since early April 2020 it has been lower than the target (initially around 13-14 bp versus the "target" of 25 bp, and then around 3 bp versus the "target" of 10 bp).

Figure 3 shows the recent behaviour of the OIS rate relative to other market rates, and this is discussed later.

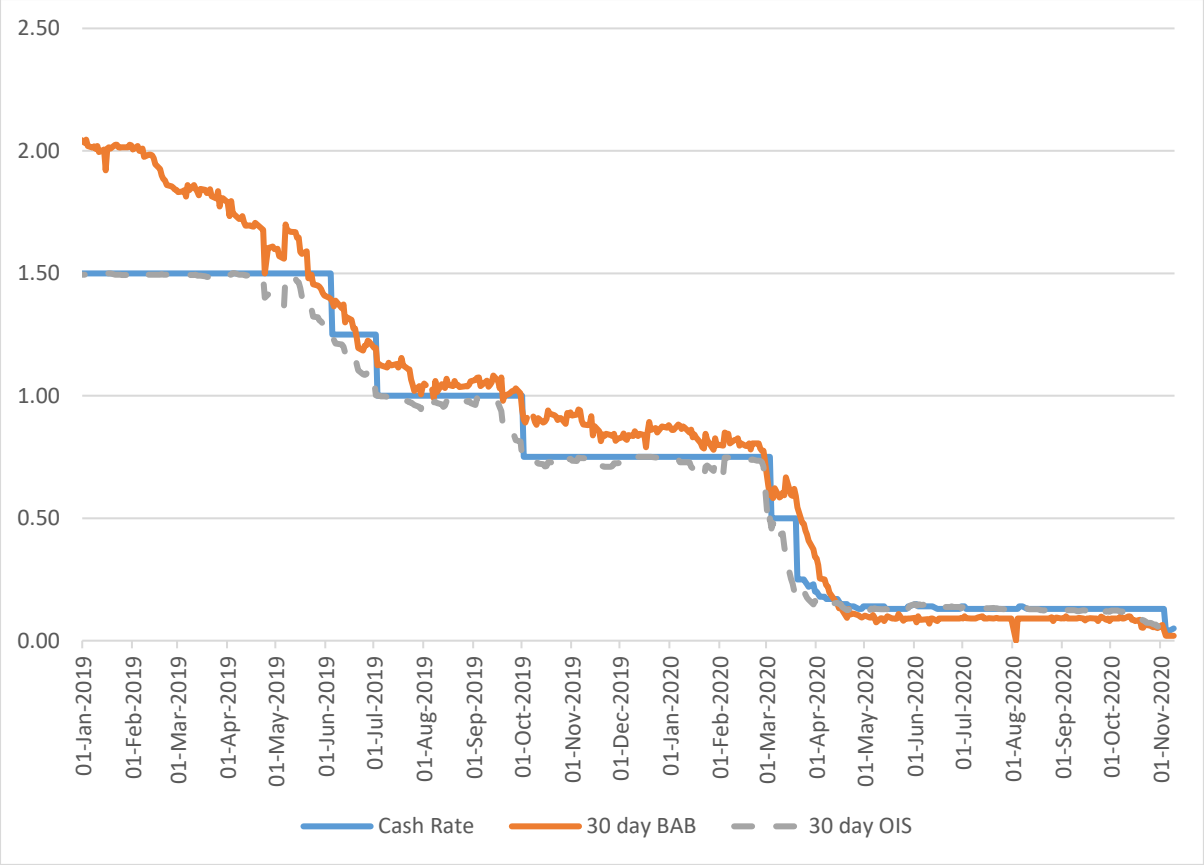


FIGURE 3: 30 DAY OIS RATE BEHAVIOUR

OIS Uses

The OIS market has a number of uses for banks and others including:

- Interest rate risk management
  - For example, if a one year fixed rate asset is financed by overnight funds then entering a 1 year OIS as the fixed payer would hedge interest rate risk. In practice the banks will not hedge individual positions, but would use the OIS market as one way of adjusting their overall interest rate exposure position.
- Separating liquidity and interest rate risk management
  - Derivatives such as OIS enable separation of deposit maturity (repricing) and liquidity issues. For example it might be desired to raise 90 day term deposit funding for liquidity management/funding purposes. Using an OIS can change the net interest rate exposure to the overnight rate by entering OIS as floating payer. Again banks will not generally focus on individual transactions, but apply a portfolio approach

The OIS rate has also been a useful source of information about market expectations of future RBA cash rate decisions and also, in conjunction with other rates, provides information about market perceptions of short term credit risk of banks.

Cash Rate Expectations

To the extent that the actual cash rate equals the RBA target cash rate, the OIS rate can signal market expectations of RBA intentions. If the OIS is above overnight cash rate this suggests the market expects the central bank to raise the cash rate during the term of OIS. As an example, assume:

- cash rate = 1.00%,
- CB changes in cash rate on policy reset date generally 25 basis points
- There are 15 days till next policy reset date
- OIS(30 days) = 1.125%,

This suggests the market expects the CB will raise the cash rate to 1.25%, reflecting an expectation over the next 15 days of the current rate of 1.00 and the 15 days thereafter at 1.25% giving an average of 1.125% over 30 days.[3]

Figure 3 illustrates how the OIS rate tracks very closely the cash rate, except in those periods which turn out to be just before a change in the cash rate. As the date when possible changes in the cash rate approaches, market expectations of a changed cash rate get reflected in the OIS rate. For example, it can be seen how the falls in the OIS lead the cash rate changes over the period shown as market expectations of reductions in the cash rate were validated by RBA decisions.

Changes to the RBA operating procedures during the Covid Crisis are likely to have reduced the use of the OIS rate as an indicator of market expectations about RBA future interest rate decisions. The actual interbank overnight (cash) rate rarely differed at all from official target cash rate up until the RBA reduced the cash rate to 25 basis points in March 2020. After that date, the rates in the overnight market have generally been significantly below the cash rate. Only if the margin between the actual and the target cash rate can be expected to remain constant is it likely that the OIS might give an indication of expectations (and the base for comparison would be the actual rather than the target cash rate).

Assessing Bank credit risk

A common benchmark for assessing the general level of short term credit risk associated with the banking sector is to consider the difference between LIBOR (or interbank loan or bank accepted bill

[3] Note, this example uses a simple arithmetic average and thus is slightly different from the actual figure which involves a compounding of daily rates (and would be 1.1255 rather than 1.1250).

rates) and the OIS rate for the same maturity. The reason is that the OIS rate can be regarded as a risk-free rate. Like other swap contracts, there are no principal payments involved, but only a net settlement of interest amounts on the notional principal. In addition, at the start of the OIS contract it is not clear which of the two parties will be making or receiving payments – that depends on the future course of interest rates.

In contrast, loans between banks involve default risk – which becomes more relevant as the term of the loan increases. Because bank bill rates will also incorporate expectations of changes in the cash rate during the tenor of the bank bill, the difference between the OIS and bank bill rate for the same tenor should be attributable to default risk. Figure 3 illustrates for the case of the 30 day bank bill rate and the 30 day OIS. There is evidence of a premium in the bank bill rate, although this has tended to disappear since the Covid Crisis when interest rates have been near-zero. Unfortunately, bank liquidity regulation (specifically the LCR, discussed in Chapter 18) has distorted the behaviour of the 30 day bill market, such that the premium at that tenor no longer provides useful information on default risk. Longer tenor rates are less distorted by that regulation, but with interest rates near zero, it is difficult to derive any reliable results.

In the US, the equivalent credit risk measure is often referred to as the "TED spread" (3 month LIBOR – 3 month Treasury Bill rate). The name is an historical acronym from T standing for T-bills and ED for USD LIBOR futures.

On 27/2/2012 the ASX introduced a 3 month OIS futures contract, with (cash) settlement dates each quarter up to 12 months ahead, but delisted it on 9/9/2014. The contract value was defined as ($1mill x r_1 x (90/365)) where r_1 is futures OIS rate at time contract entered, and settlement value calculated using actual OIS rate at settlement date.

OIS as a risk free rate

Donald Smith (JoD, 2013) argues that since the financial crisis, it has become common to use the OIS rate as a risk free discount rate rather than the LIBOR rate, such as when valuing a normal interest rate swap position. This reflects its more "risk free" nature compared to LIBOR, and with greater use of Central Clearing Counterparties and collateral requirements in swaps, a risk free discount rate is more appropriate than one which incorporates some counterparty risk (such as LIBOR). The issues involved can be seen by noting that, for example, a fixed-floating three year swap (with quarterly resets based on LIBOR) is equivalent (for the floating rate payer) to being long a 3 year fixed rate bond and short a 3 year floating rate bond. Valuation of an existing swap can be done by calculating the PV of each bond and using the fact that the floating rate bond can be valued as equivalent to a one period

bond with a coupon equal to the LIBOR rate at the last reset date and which has its market value reset to par at the coming reset date. (This assumes that the floating rate is a risk free rate). But if LIBOR is not a risk free rate, and not equal to the OIS rate, then the floating rate bond will not reset to par. Also, in calculating the PV of the fixed rate bond component, it is necessary to use a yield curve – which should be consistent with the credit risk of the counterparty. That was traditionally based on the LIBOR term structure, but if that rate has a credit risk element then if swaps have minimal counterparty risk due to CCPs or collateral, then a risk free rate term structure (such as derived from the OIS rate) should be used.

12.4 Credit Derivatives – Credit Default Swaps (CDS)

> "ANZ uses purchased credit derivatives to mitigate credit risk by lowering exposures to reference entities that generate high concentration risk exposures or to improve risk return performance. Only certain credit derivatives such as credit default swaps (CDS) are recognised for risk mitigation purposes in the determination of regulatory capital." (ANZ Bank, p51)

CDS involve a regular or one-off premium/fees paid in exchange for contingent pay off triggered by specified credit event (insolvency, credit rating change, etc such as listed below) of some third party (the reference entity) within the specified time frame (five years being common). The writer of the CDS (who pays out if default occurs) is the Protection Provider and the buyer (who pays the premium/fees) is the Protection Receiver. As well as being contracts on a specified "reference entity" such as a company or bank, there are also CDS baskets involving a specified index of reference entities.

There is a large academic and practitioner literature on CDS – a 2016 survey of the academic literature commissioned by ISDA is here, which finds *inter alia* that CDS spreads contain valuable information on credit risk and is a leading indicator, and that the CDS market is one through which shocks are transmitted. That ISDA paper also provides an overview of how the definitions of credit events contained in CDS has varied over time, and a discussion of the auction method of determining the market value of a defaulted bond underlying a CDS contract. David Lando (ARFE, 2020) provides a primer and recent overview of market developments.

Aggregate global data on CDS markets is collected by the BIS. In 2018 and 2019 the notional amounts of CDS outstanding averaged around USD 8 trillion with gross market value in the order of USD 200 billion. The shares of single name instruments and multi-name instruments (primarily index products) were roughly equal. The Depository Trust and Clearing Corporation (DTCC) is the main clearing and settlement agency for CDS and thus generates substantial data on CDS markets.

Credit events

Bankruptcy: relevant only for corporate entities.

Obligation acceleration: obligation becomes due and payable before its normal expiration date.

Obligation default: refers to a technical default, such as violation of a bond covenant.

Failure to pay: failure of the reference entity to make any due payments.

Repudiation/Moratorium: provides for compensation after specified actions of a government (e.g. delay in payment).

Restructuring: reduction and renegotiation of delinquent debts in order to improve or restore liquidity. In 2009, US contracts eliminated restructuring as a potential trigger event.

In principle CDS are simple in structure, but complex to price (both at origination when a premium has to be determined, and subsequently when the market value of an existing CDS position needs to be calculated). There are also important issues involved in ensuring contractual integrity. Figure 4 provides a general depiction of how a CDS works, while Figure 5 from Duffie,(FAJ,1999) shows the cash flows associated with a CDS written on a Floating Rate Note (FRN) issued by Company C on which default occurs at date t, before the maturity date of the CDS, and has market value at that date of Y(t). U is the annuity premium which is paid up until the default date (or the maturity date of the CDS if no default occurs). Upon the default event, the protection buyer receives the difference between the par value ($100) and market value of the FRN.

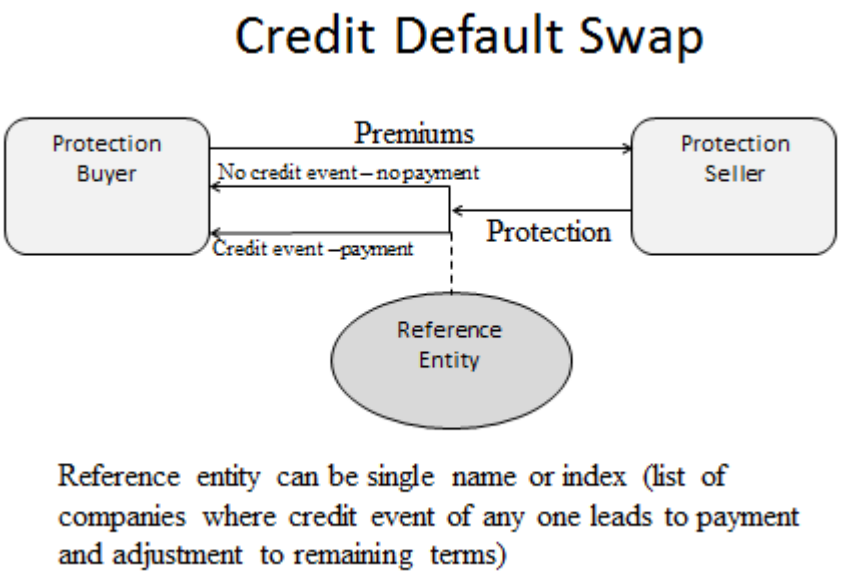
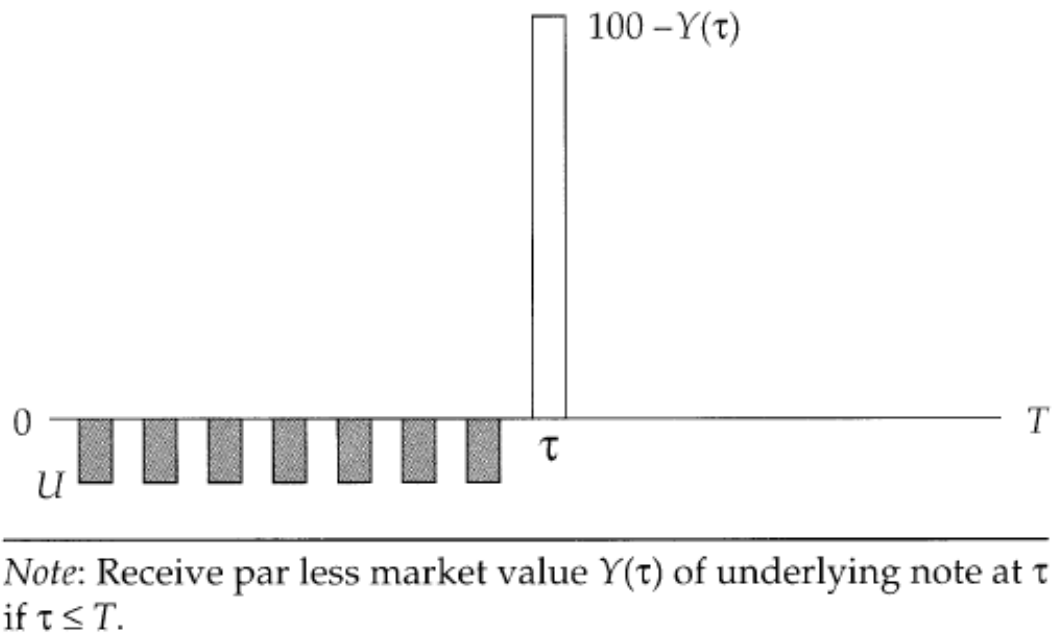


FIGURE 4: CREDIT DEFAULT SWAP



Note: Receive par less market value $Y(\tau)$ of underlying note at τ if $\tau \leq T$.

FIGURE 5: CDS CASH FLOWS (SOURCE: DUFFIE, 1999)

CDS Settlement

CDS has an agreed life: if no credit event occurs it expires and settlement could be either:

- Physical – delivery of specified bond for face value
- Cash – difference between face and market value of bond

A problem for physical delivery is that there may be more CDS than bonds on issue of a particular reference entity. There has thus been established an auction protocol to determine the value of the defaulting bond – and cash settlement.

More information available about CDS market structure and institutional arrangements is available at ISDA and HIS Markit provides CDS prices and constructs indexes.

CDS Premiums and Bond Credit Spreads

It is relatively straightforward to show via arbitrage that, in the absence of a number of market imperfections and with some very strong simplifying assumptions, the CDS premium (U) should be equal to the credit spread on a FRN issued by the reference entity (X) which is of same maturity as the CDS.

Assume the premiums are paid in arrears (at the end of each quarter) and settlement of the CDS occurs at the end of the quarter in which the default event occurs. Consider the arbitrage portfolio of going short the T period FRN issued by X (FRN_X) which pays coupon at date t of ($r_{f,t}$ + s) and long a risk free

FRN paying coupon of $r_{f,t}$. To go short, the FRN_X must be borrowed and obliges the borrower/short-seller to pay the coupon amount to the security lender at the end of each quarter, and *assume that the entire coupon must be paid for the quarter in which X goes into default*. The net cash flow at the end of each quarter including the one in which a default occurs is s. When the default event occurs, close out the arbitrage portfolio at the subsequent ex-coupon date (implying receipt of the risk free FRN coupon and payment of the coupon on FRN_X under the securities borrowing arrangement for net cash flow or r_{ft}). Buy X's FRN in the market for price Y(t) to close the short position, and sell the risk free FRN for \$100 for net receipt of 100 - Y(t). The net cash flows are the sequence [-s, -s, …,-s, -s +(100-Y(t)], while those of the CDS are [-U, -U, ….,-U, -U+(100- Y(t)]. To avoid arbitrage opportunities, U = s, ie the CDS premium equals the credit spread on the risky bond. (If default does not occur, the positions are closed out at the common maturity date of the CDS and FRN giving the same result).

Of course, this highly simplified example ignores many of the real world features of CDS contracts, and actual replication possibilities, and an important practical issue is the *CDS-bond basis* – the difference between a CDS premium and the yield spread (relative to the risk free rate) on an underlying risky bond. Various market features prevent perfect arbitrage between the CDS and bond markets, and there is a vast academic literature (reviewed by Lando) which investigates this.

To determine the appropriate CDS spread it is generally necessary to revert to more technical modelling (about which there is a voluminous literature). Augustin et al (2014) provide a survey of the nature of CDS markets and pricing approaches. ISDA provides a standardised model for CDS valuation.

Global Market

ISDA provides information on the global credit derivatives market. The number of trades in 2018 and 2019 averaged around 60,000 per quarter, with a temporary spike to 102,000 in the first quarter of 2020. The notional value of trades was in the order of USD 2.5 trillion per quarter. Most trading is in the various indices rather than single name reference entities. For the major indices, the number of daily trades averages around 200 -300 with an average trade size (notional value) of around USD 20 - 50 million. Over 80 per cent of trades are cleared with a CCP. Around 70 per cent are traded via trading platforms known as Swap Execution Facilities (SEFs) – the others traded OTC.

Australian Market and Trading Conventions

Australian market conventions for dealing in CDS (and other credit related products) are available from AFMA. For single name CDS trading, the standard notional size is \$5mill and for indices it is \$10 mill.

The determination of the cash flows associated with an agreed premium (as a number of basis points on the contract size) are complex. The premium is paid quarterly in arrears. As set out by AFMA:

> "Under Standard Australia and New Zealand Contract terms the Fixed Rate has been agreed to be quoted on a market standard basis as either 100bps or 500bps.
>
> The Dealt Rate is then applied to discount the Fixed Rate premiums and derive an upfront cash settlement on the transaction as determined under a standard model available at CDSW screen on Bloomberg, or at http://www.cdsmodel.com/."

Thus, if two parties agreed on a premium of 80bp, the seller of protection (who will receive a stream of payments of 100bp from the protection buyer) will make an upfront payment to the buyer equal in present value terms to the difference between payments 100 and 80 bp. Lando provides an explanation of why this convention was introduced and how it facilitates closing out a position. (Essentially because the 100 bp premiums of the long and short positions are offsetting there are no future cash flows and the close-out contract involves a contemporaneous payment or receipt of cash). CCPs facilitate the netting of the transactions and entities such as Tri-Optima and IHS Markit provide what are known as "compression services" which achieve the same effect for non-centrally cleared positions. In such services, partially offsetting gross positions with a counterparty are replaced by one net position which may have benefits for a bank if regulations incorporate levels of the bank's gross position.

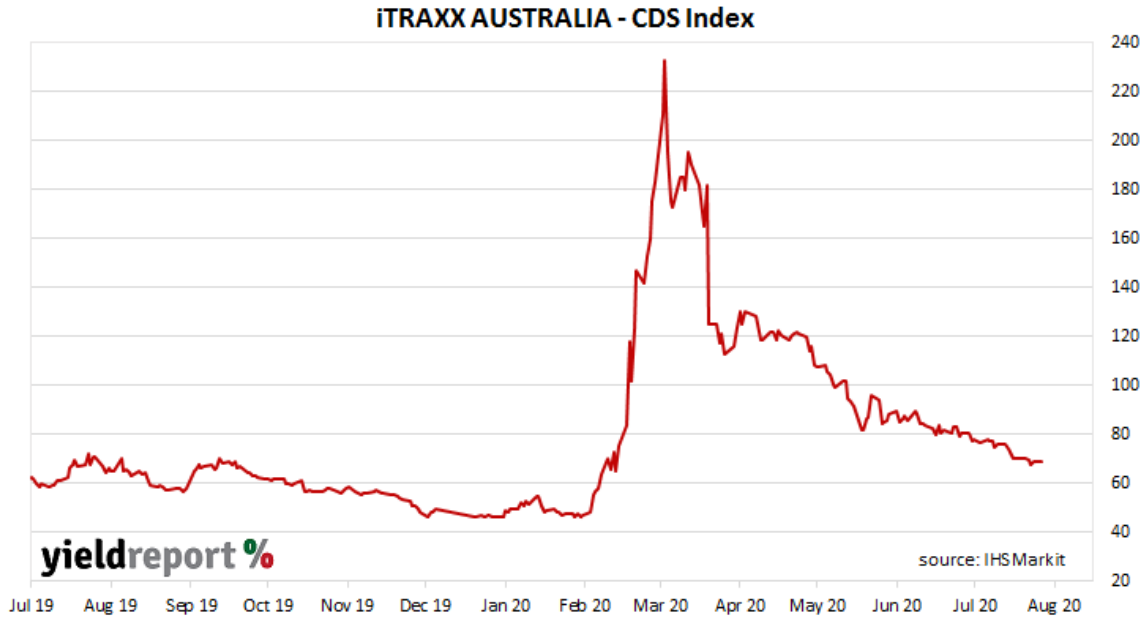
CDS Indexes

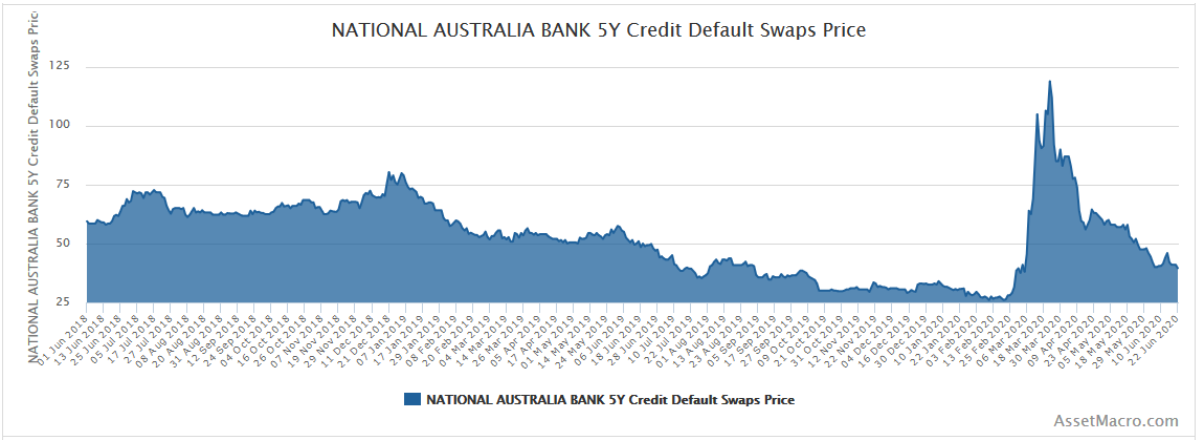
Much of the activity in CDS markets globally involves the trading of Index contracts, with features similar to the Australian iTraxx Australia index. This is an index based on the CDS's of 25 single name investment grade reference entities. The index is calculated as the equally weighted premiums (in bp) of 5 year CDS on the 25 reference entities. The ITraxx is an indicator of changes in the general level of credit spreads and positions can be taken to hedge or speculate on future movements in that level. A buyer of the index is essentially buying the equivalent of 25 individual CDS contracts on the reference entities (each with a notional amount of 4 per cent of the index notional principal). If subsequently there is an increase in market credit spreads and thus premia, the buyer of the contract would be able to sell the index at a higher premium and make a profit by closing out the position. The central clearing of CDS and the use of the standard premiums (as explained above) facilitate this. If one of the reference units experiences a default event, the buyer of the iTraxx will receive a payment and the notional amount and premia of that contract adjusted to covering the remaining 24 reference entities.

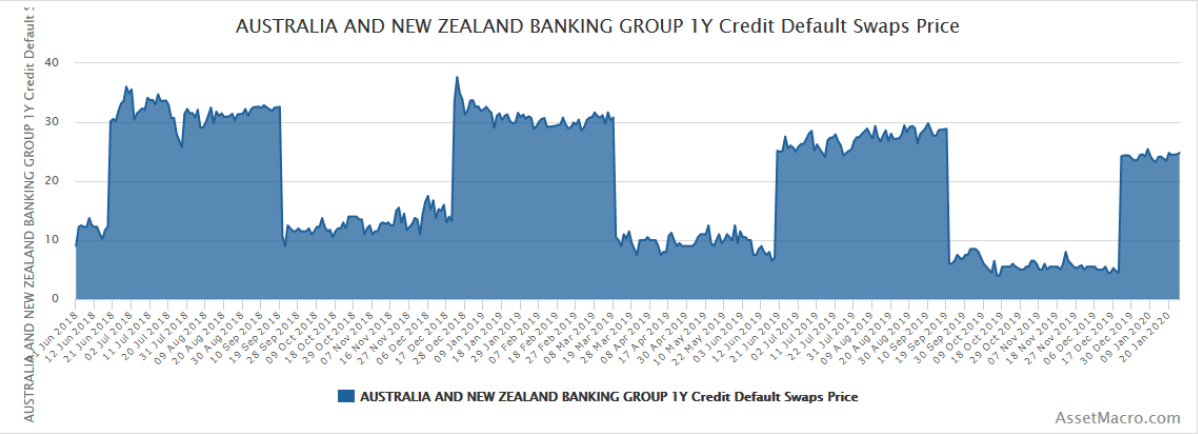
The main groups of international indexes are iTraxx and the CDX HY (covering higher yield firms) and the CDX IG (covering investment grade firms). The iTraxx Europe covers 125 firms, and there are similar

indexes for other markets such as Australia. The main CDX indexes are for North America and also for emerging markets. The Indexes are “rolled over” at regular intervals (eg every six months) with some constituent firms being replaced by others according to the specified rules.

Various derivatives on CDS Indexes have been developed. Akin to securitisation, “tranches” may be offered by investment banks and dealers in which the purchaser gets protection over some specified range of losses. Options are also available.







Information on the early development of the Australian CDS market as at 2011 can be found in this RBA article, which shows *inter alia*, how the close relationship for the major banks between CDS premia and bond spreads (to the swap rate) became less applicable in the years immediately after the GFC.

Bank Uses of Credit Derivatives

- Hedging specific default risk – a bank with loans to XYZ corporation could hedge the credit risk by purchasing a CDS on XYZ. To the extent that the bank has superior knowledge about the credit risk of XYZ than the market it could benefit by purchasing "cheap" insurance.
- Hedging overall bank credit risk – purchase of a CDS index product when the bank is concerned about a possible general downturn in credit markets could hedge its overall credit risk. Note however that there will be a basis risk in that defaults by the reference entities underlying the index need not necessarily be closely correlated with those of customers in the bank's loan book.
- Diversifying loan portfolio credit risk – a bank which specialises in lending to particular geographic regions or industries could have a risk concentration issue. Selling single name or index CDS could generate premium income and give it a more generalised exposure. More relevant, however, might be a tailored bilateral total return swap with another bank (with different exposures) in which the banks agree to exchange total returns from specified loan portfolios.
- Freeing credit lines – a bank will typically have an internal limit on the level of credit exposure to any one customer. If exposures to a valued customer are approaching that limit, the bank's ability to make further loans in response to requests from the customer would be limited. By purchasing a CDS with that customer as the reference entity, the credit exposure is reduced – enabling the bank to meet the customer's loan request.
- Tailoring exposures – a bank wishing to increase or decrease its credit risk exposure to certain sectors of the economy can achieve that via transacting in CDS.

- Hedging risks from participation in syndicated loans – being a syndicate member for a loan to a particular corporate might be desired for some reason, but the resulting credit risk not wanted. Purchase of a CDS could hedge that credit risk.
- Managing capital – a major determinant of bank regulatory capital requirements is credit risk. Purchasing CDS may lead to a reduction in assessed credit risk for regulatory purposes. Note, however, purchasing a credit derivative does not "remove" credit risk – it changes the identity of the counter party to the CDS seller, and this would have regulatory advantages if the credit risk of the CDS seller is lower than the borrower whose loan is being hedged. Credit derivatives themselves have credit risk.
- Trading profit opportunities from participating in CDS markets – the bank's generation of private information about its customers may provide it with the opportunity for expected profits from buying or selling CDS on that customer if CDS market prices are misaligned with the bank's view of the actual credit risk.
- CDS markets also provide an additional Information source about corporate risk. CDS prices enable comparison of market vs internal bank credit pricing.

Australian bank credit derivative use

In practice, Australian bank do not appear to make great use of credit derivatives for hedging of specific borrower risks.[4] ANZ Bank, for example, reported that at September 2019 that only around $1 billion of its $320 billion of corporate credit exposures were covered by credit derivatives. Westpac reported virtually no use of credit derivatives to hedge loan exposures. CBA reported that at December 2019 (December 2018), none (0.3 per cent) of its corporate credit exposures were covered by credit derivatives and only around 0.1 (1.1) per cent of its exposures to other banks (CCPs) covered. NAB reported that at March 2020 none of its credit exposures was covered by credit derivatives.

Information on trading activities in CDS is not easily come by.[5]

Regarding market risk arising from trading book activities, ANZ in the 6 months ending September 2019 reported a position of purchased $7 billion of CDS and sold $5 billion of CDS. It also reported that for that same period its average 99% 1 Day VaR for credit was $3.8 bill compared to $5.0 bill for Interest Rate and $3.4 bill for Foreign Exchange. For the 10 Day Stressed VaR, the figure for credit was slightly larger than for interest rate (and both well below FX). Westpac in its reporting of market risk did not separately identify credit risk (although it may be included in "other market risks". CBA does

[4] There is little public information on Australian bank use or activities in CDS. The Basel Pillar 3 regulatory disclosures do provide some information on use in credit mitigation in Table 10 and market risk in Table 11 of those reports.
[5] Some information can be gleaned from Table 14 in the regulatory disclosures.

not separately report components of overall market risk. The NAB's VaR figures were similar to ANZ (both in magnitude and relative size for different types of risk) but 10 day stressed VaR was above FX and well below interest rate.

Prior to the GFC, some of the Australian banks issued Credit-Linked-Notes which transferred some credit risk to purchasers of those notes. (The notes would offer a high rate of interest, but the investor's principal or interest rate would be reduced according to some schedule as defaults occurred on the reference assets). While the motivation behind issuance of these notes could be interpreted as hedging of bank credit risk, there was much concern at the time that the issuers were exploiting unsophisticated investors who, attracted by the high interest rates offered and not understanding the risks involved, were paying more than the notes were worth.

12.5 Repos (Repurchase Agreements)[6]

A Repo is the simultaneous sale and repurchase on agreed terms of a specified security for different settlement dates and which generates cash and an obligation to repay that cash on the settlement date. (A reverse repo is the same transaction viewed from the counterparty's perspective, ie a purchase and subsequent resale, involving an initial outflow of cash). Note: the security returned need not be the actual original one provided – just one identical to it.

Repos can be for a specified maturity or an "open" repo where the repo can be terminated at any time and terms are renegotiated each day.

The effect of a repo is that the seller of the security has borrowed funds on a secured basis for the term of the repo from the counterparty as is shown in Figure 6.

(Repos and Securities Lending are conceptually the same. The provider of cash in a repo is effectively being lent the underlying security. But motivation for securities lending is different, and the transaction may involve providing alternative securities, rather than cash, to the counterparty).

An Example

ABC (the "borrower") enters a repo contract with XYZ Merchant Bank (the "lender") where, on 12/1/XX ABC

sells a $100 face value T Note with maturity date of 30/4/XX and current market value of $99.00 to XYZ in return for $98.50 immediate settlement.

agrees to repurchase a $100 T Note with same maturity from XYZ for settlement on 14/1/XX for $98.51.

The cash flows (absent default on the contract) are that ABC receives $98.50 on 12/1/XX and pays $98.51 on 14/1/XX, implying that there is an implicit interest rate in the contract of 1.852 per cent p.a.[7] Note that the initial sale at a price below market value is offset by the subsequent repurchase at less than market value.

[6] A very useful reference is ICMA (2019) Frequently Asked Questions on Repo

[7] The interest amount is $0.01 on principal amount of $98.50 for two days. Thus r = (365/2)*(0.01/98.50).

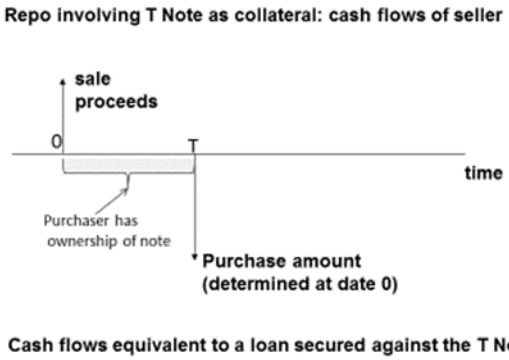


FIGURE 6: CASH FLOWS IN A REPO

Repos: A Little History

Originated in U.S.A. in 1918 with Federal Reserve offer of resale agreements against Banker's Acceptances with dealers. Over time Central Banks in many countries began to use repos as their primary tool for open market operations. (See CGFS, 1999). The use of repos between private sector counterparties grew from the 1950s. The CGFS (2017) note that in 2016, repos outstanding involving government bonds were equal to 32 and 16 per cent respectively of government bonds on issue in the Euro area and the USA.

Repo Characteristices

Traders in the market will normally quote repo terms using the implicit interest rate. (Market conventions and standard documentation are available on the AFMA website).

The "margin" involved in the repo is the difference between the collateral value and the loan amount. This provides the lender of cash with confidence that the second leg of the transaction will be completed (since the collateral value exceeds the repurchase amount). There will be "marking to market" such that if the underlying asset value changes the lender will require further margins to ensure the value of the asset is always in excess of the borrower's repayment obligation. This protects the lender against default risk, since should default occur they will be able to sell the collateral they hold. Consequently, the interest rate on the repo should be close to the risk-free rate for that maturity.

A "haircut" may be given to the value of underlying asset, such as an asset with a claimed value of $100 may treated as only worth $90, implying that less than $90 cash could be borrowed using the asset as collateral. This will occur when there is a lack of confidence that the market, or claimed, value is a good indicator ow what the collateral could be sold for. The terms "haircut" and "initial margin" are often used interchangeably.

In addition to margins, another form of protection for the lender is only accepting as collateral those securities which have low credit risk, to avoid the risk of loss from a situation in which the repo counterparty defaults and the issuer of the security also defaults.

In modern financial markets, repos can be done either on a bilateral basis or via a "tri-party" arrangement. In the latter, a large bank offers services of administration, collateral management etc as an intermediary between the two repo parties. In the USA, prior to the GFC much of the tri-party repo market involved those large banks providing daylight overdrafts to repo participants, since repo repayment would occur in the morning and rollovers (to obtain cash replacement) would occur in the afternoon.

Uses (Economic Functions) of Repos[8]

Repos are an important form of short term collateralised borrowing. For a financial institution they provide a way of obtaining short term liquidity at low cost rather than having to sell securities outright or borrow on an unsecured basis. They can also be used (and were extensively by US Investment Banks (IB) and others prior to the GFC) to finance holdings of long term assets. The IB would, for example, purchase a long term security on day 1 and fund it by using that as the collateral in a short term (eg one day) repo, and rollover or replace that repo with another one day repo the next day – and so on.

For those with surplus funds to invest (including pension funds, corporate treasuries, money market funds), repos may also be an attractive short term secured investment. One particularly relevant feature in this regard is that in many jurisdictions claims under repo transactions are not affected by insolvency/bankruptcy of the borrowing entity. The lender has a claim on (ownership of) the collateral which is not affected by the bankruptcy process.

A repo is essentially the same as a "securities loan" in which one party "lends" securities to another in exchange for collateral (often in the form of cash). In the example above, XYZ could be interpreted as borrowing the T-Note from ABC and providing cash as collateral. But the motivation for a securities loan is different, and the margin would be applied in the reverse manner (XYZ providing more cash than the value of the securities transferred).

Repos/Securities Loans are a way of participants getting access to particular types of collateral which they may need. For those institutions providing funds and receiving the collateral in a repo, they are able to "re-use" the collateral. For example they could raise cash by selling it (or deliver it against a sale already made) or by repo'ing it, or they could use it to meet margin calls on other positions they hold. (Of course, they need to be able to get collateral back to provide when the original repo

[8] See http://www.bis.org/publ/cgfs59.pdf for more detail and an overview of recent developments in global repo markets.

matures). For those involved in market-making activities, repos provide a way of getting access to securities to enable meeting demand for those securities or funding holdings of securities.

Central Banks make extensive use of repos for their open market operations to manage system liquidity and influence interest rates. In general, Lender of Last Resort (LOLR) activities will involve repos with the Central Bank providing cash temporarily to an illiquid (but solvent) bank and receiving assets of greater value under the repo to protect the Central Bank against risk.

Accounting for repos

Although the repo involves the sale of the security for a receipt of cash, accounting conventions treat the transaction as a form of collateralized borrowing (which it is). Thus if, say, a bank sells an asset under a repo in exchange for cash, the asset will remain on its balance sheet, and will have a new liability of a borrowing equal to the cash received. One consequence of repo financing is that some of the assets displayed on the bank's balance sheet will be "encumbered", not available for use since they are temporarily owned by the repo counterparty. Concerns over encumbrance of bank assets via this and other pledges of assets as collateral, and which are thus not available to meet the claims of depositors are commonplace. But whether they are justified is less clear.

Case Study: Lehman's notorious Repo 105s

Lehman (and other US investment banks) were able to disguise the extent of their leverage arising from using short term Repos to fund holdings of longer term assets via an accounting anomaly which could be used if the collateral provided was more than 105 per cent of funds advanced.

Example:

$100 of bonds sold via a repo for cash of $90, repurchase price of $90 (0% interest rate for simplicity). Cash received used to pay down debt

With proper accounting: the repo'd bond is still an asset; the $90 cash received via repo is a borrowing; and leverage is unchanged.

Under "Repo 105" accounting: the repo'd bond is treated as sold and removed as asset; no associated borrowing is recorded, and leverage reduced. The forward contract with an asset value of 10 represents the right to repurchase the $100 of bonds at a price of $90.

	Asset	**Liabilities**
Initially	Bonds 1,000	Borrowings 950 Equity 50
"proper" accounting	Bonds 1,000	Borrowings 860 "collateralized" borrowings 90

		equity 50
Repos 105 accounting	Bonds 900	Borrowings 860
	Forward contract 10	Equity 50

Global Size of Repo Markets

CGFS Papers No 59 *Repo market functioning* provides data on the size of Repo markets at mid 2016. Data on the size and features of European repo markets from surveys is regularly published by the ICMA. (A difficulty in conducting surveys to obtain information on repo usage is the need to avoid double counting the one transaction if both parties are in the survey).

Globally amounts outstanding against government bonds were USD 8.8 trillion, with about 1/3 share involving Euro-area and US government bonds each, and Japanese and UK bonds the other major contributors. The Australian share amounted to USD 106 billion. Total global outstandings (using both government and private collateral were USD 12 trillion).

There was a significant drop in use of repos globally after the financial crisis which has not been recovered (although the Australian market suffered a relatively small fall and has since continued to grow).

The CGFS suggests that banks in some jurisdictions have been structuring repo transactions to avoid regulatory balance sheet constraints in the following way. "Netting" of offsetting repo and reverse-repo transactions with the same settlement date but involving different collateral do not affect recorded balance sheet size. They indicate that the volume of such matched positions has not declined.

The Australian Repo Market[9],[10]

The Reserve Bank of Australia began undertaking repos with authorised money market dealers (a category of financial institutions that no longer exists) in August 1984, and subsequently allowed dealers to undertake repos with clients.

At the start of 2020 repo financing by Australian ADIs and RFCs was in the order of $200 billion (around 30% with other ADIs/RFCs, 35% with the RBA, 30% with foreigners). This was equivalent to around 4% of the total assets of ADIs and RFCs at that time (a little over $5,000 billion).

[9] Market conventions are available at AFMA. Margining guidelines are available here.
[10] For further information, see Wakeling and Wilson (RBA, 2010) and Becker et al (RBA, 2016).

Central Bank Use of Repos

Repos are a major tool used by the RBA in managing system liquidity; RBA open market operations are primarily via repo transactions. (The RBA is buying securities in exchange for providing cash, and thus refers them as reverse-repos). The range of acceptable instruments and terms of repos substantially increased during GFC.[11]

Repos are useful for the Reserve Bank (and other central banks) because:

1. they can be used for open-market operations, rather than outright sales or purchases of securities. Because the cash flows will be reversed at the specified future date, the repos can be structured to mesh with known future system cash inflows and outflows resulting from patterns in government payments
2. they can be used in Lender of Last Resort (LOLR) transactions - where the central bank provides a loan against good collateral to a bank which is solvent but facing a liquidity problem. The interest rate on such a loan implied by the terms of the repo may be high, and the central bank protects itself against loss by applying a sufficiently large haircut/margin on the repo.
3. They can use any government security (and since 2007 designated private securities) as the basis of a repo transaction. (*Internal Securitisations* by banks create securities which can be repo'd at the RBA).

There is little public information on the interest rates on repos between members of the private sector, which are traded OTC. There is regular information provided by the RBA (Table A3) on the interest rates at which it conducts repos. Until a change in March 2020, the RBA would announce its daily dealing intentions (quantities and maturities) and the rates would be the outcome of an auction. Since then, the RBA has effectively allowed the quantity of its dealings to adjust such that the repo rates have been stable at 13-14 bp p.a.

Figure 7shows how the relationship between RBA repo rates and the OIS30 and BAB30 rates has changed over time. (The repo rates are those on repos between 28 and 32 days). Because the RBA applies a margin (of 1 or 2 bp) for its purchases of government securities (such that the value of the collateral exceeds the cash amount lent), it might be thought that the repo rates would reflect a risk free rate. However, until recently the repo rates have been more closely aligned with BAB30

[11] APRA collects data on use of repos by ADIs and RFCs under ARS-221 and this has been published since 2009 by the RBA as Statistical Table B3. Data on RBA repo transactions are available in Statistical Table A3.

rates than the OIS30 rate. That reflects competition in the repo market with banks willing to bid repo rates up to the cost of equivalent maturity funding as represented by the BAB30 rate.

Following March 2020 changes to RBA operating procedures, the relationship between these rates has changed. The repo rate has been stable at 18 bp, while the OIS rate has declined to 14 bp. The BAB30 rate is lower at around 10 bp, but this type of funding attracts an additional 6 bp cost to the banks arising from the Major Bank Levy (MBL) making the cost around 16 bp. While repo funding also incurs the MBL, the levy base is reduced by the amount of ESA funds the bank holds. Thus entering a repo and acquiring ESA funds would not incur the levy thus the net cost of acquiring ESA funds via RBA repo would be around 8 bp (18pb repo rate less 10bp interest paid on ESA balances). Of course, once those ESA funds were reduced by lending the effective cost of expanding the balance sheet would be 24 bp (the MBL plus the repo cost).

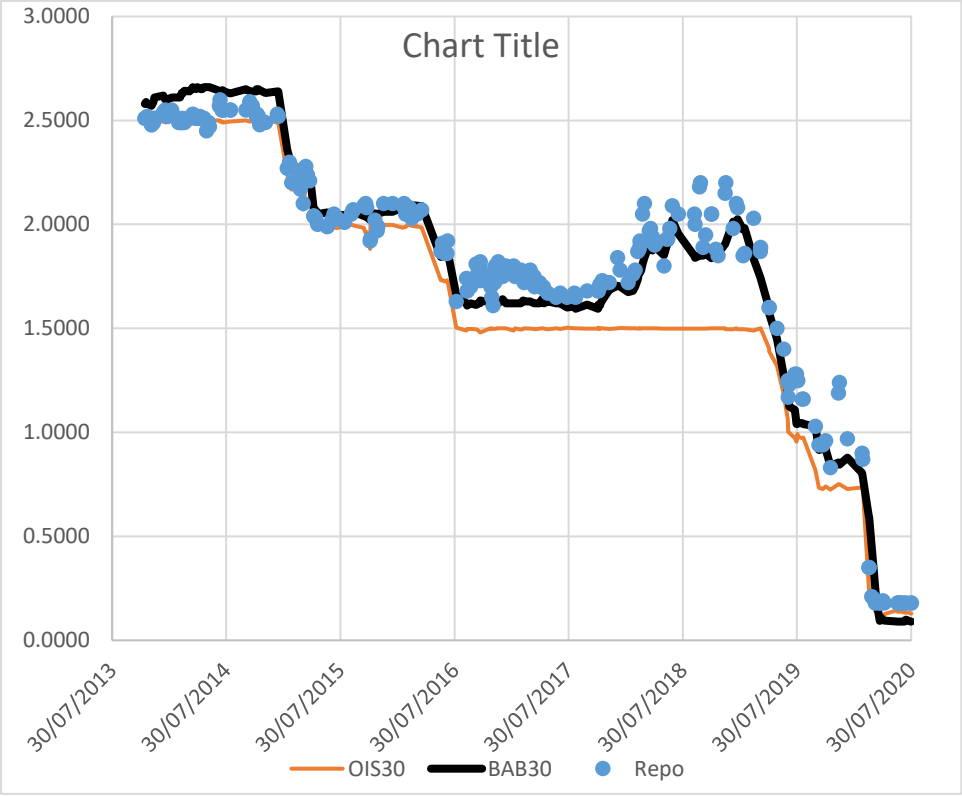


FIGURE 7: REPO RATES

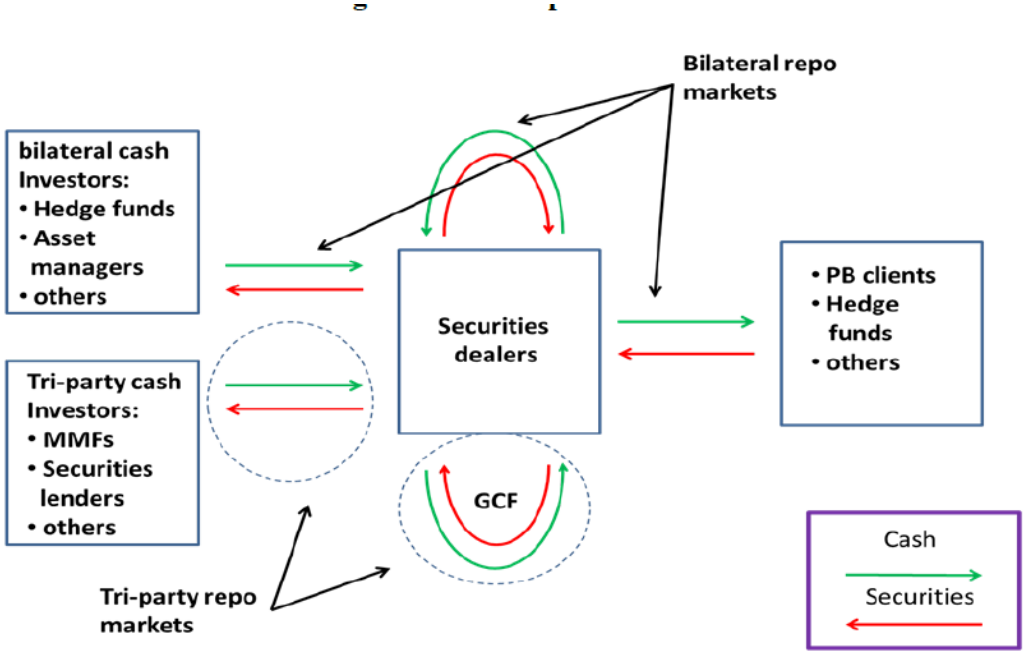
Regulation of Repos

Where banks use repos as a form of financing two forms of regulation are relevant. One is capital requirements. The introduction of the Basel leverage ratio as a supplement to the risk-weighted capital approach has been argued to have reduced the demand for such financing by banks. Van Horen and Kotidis (2018) find evidence from UK data to support this argument.

The second relevant form of regulation is liquidity regulation. Under the liquidity coverage ratio (LCR), a 5 day repo would be treated as a potential cash outflow.

The US Repo Market and the GFC

Figure 8 provides an outline of the US Repo market (prior to recent reforms to limit intra-day credit provided by the major government securities clearing banks (J P Morgan and Bank of New York Mellon) to securities dealers on tri-party repos. (In a tri-party repo, the clearing bank intermediary administers arrangements for investors (MMMF etc) and borrowers (securities firms), enabling them to avoid the need for back office functions, and provides intraday credit between rollovers to the securities dealers. (Repos are unwound in the morning and re-entered later in the day).



Source: Copeland, Duffie, Martin, and McLaughlin (forthcoming).
Note: MMFs are money market mutual funds and PB is prime brokerage. GCF is the General Collateral Financing repo market run by the Fixed Income Clearing Corporation; this repo market

FIGURE 8: US REPO MARKET (SOURCE, ADRIAN ET AL)

Gorton and Metrick (JFE, 2012) highlight the significance of the repo market both in terms of size and role in the GFC

> "The [US] Panic of 2007-2008 was a run on the sale and repurchase market (the "repo" market)".
>
> "U.S. repo market is likely to be roughly the same size (or larger) than the total assets in the U.S. banking system of $10 trillion"

It was a major source of US Investment bank funding prior to GFC. The investment banks would buy long term securities and fund them by a succession of overnight or short term repos (short term collateralised borrowing). The objective was to profit from the interest rate spread, but involved significant liquidity / rollover risk, and exposure to decline in LT securities price if sale required. The risk was the potential for increased collateral requirements / margin calls. The systemic risks were compounded by financing of purchases of complex securitised assets by repo financing – "securitised banking".

Repos: Some Issues

Bank resolution arrangements - Because repos involve transfer of ownership of collateral, lenders avoid being caught up in bankruptcy of borrower. Repo funding reduces assets available for other claimants (depositors), a form of priority

Repos and arbitrage

Becker et al (2016) provide two examples of how the repo market is used to exploit "mispricing" in financial markets. One relates to the foreign exchange swap basis, arising from willingness of Japanese investors to pay a premium to borrow AUD in exchange for JPY in an FX swap. Holders of AUD government securities can enter a repo to obtain AUD cash, swap the AUD cash for Yen cash, and then lend the Yen cash to obtain Yen securities. For a 3 month horizon (when the transactions are unwound) the premium earned over the 3 month BBSW was (in 2016) in the order of 70 bp.

The second use of repos described is to arbitrage bond futures prices. If the futures is overpriced, Figure 9illustrates the transactions.

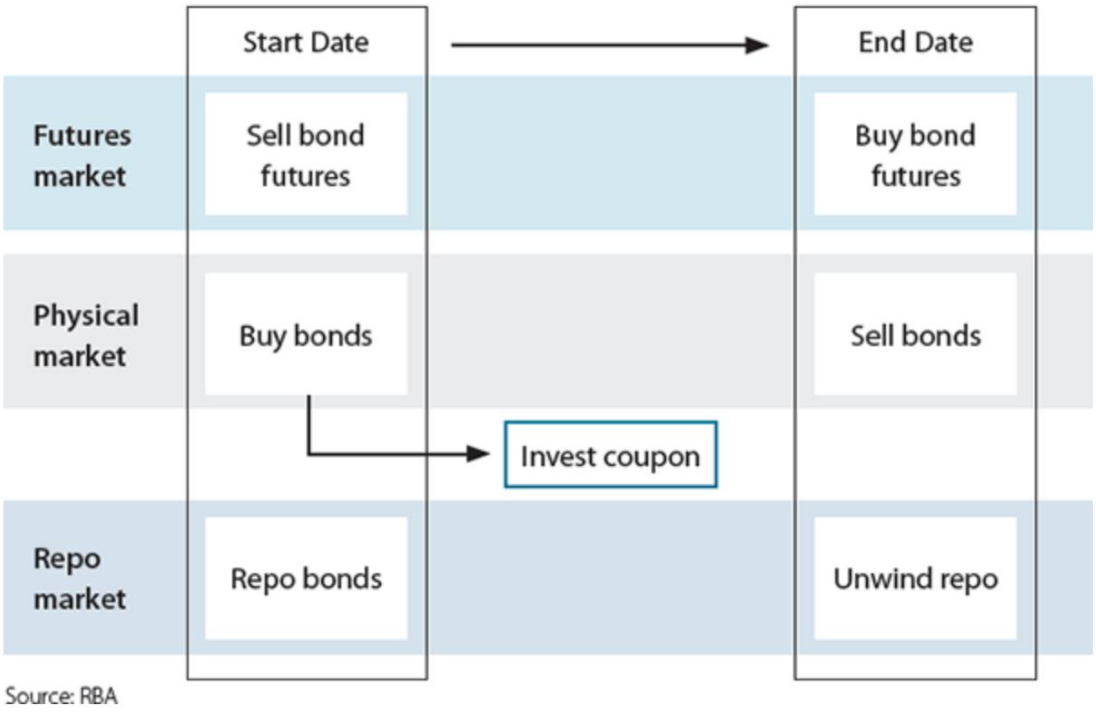


FIGURE 9: BOND FUTURES MARKET BASIS TRADE

Another use of repos for exploiting arbitrage opportunities is by using repos to create a forward contract which matches dates of a mispriced futures contract as shown in the figure below.

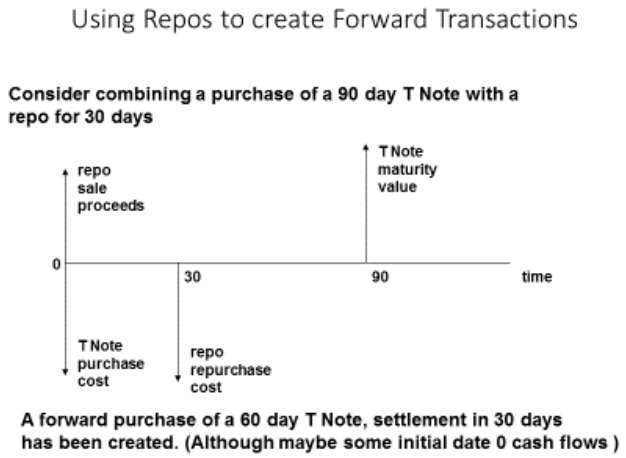


FIGURE 10: USING REPOS TO CREATE FORWARDS

The "run on the repo" (Gorton & Metrick, 2012)

Prior to the financial crisis, there was substantial usage in the US of repo financing using securitised assets as collateral. For example, an investment bank would securitise mortgages and hold some part (lower tranches) on balance sheet using these as collateral for repo financing. This often involved CDOs, combining tranches of ABS. Over half of investment bank financing was via repos.

In January 2006 *Markit* and *CDS IndexCo* launched ABX indices, which were based on the value of a portfolio of specified (origination dated) ABS tranches. These were derived from credit default swap quotes. In their study Gorton & Metrick use implied credit spread from the index. Figure 11 from Gorton and Metric shows for the ABX index for the 2006-1 BBB tranche, ABX spreads on right-hand y-axis and LIBOR-OIS spreads on left-hand Y-axis. Both scales are in basis points

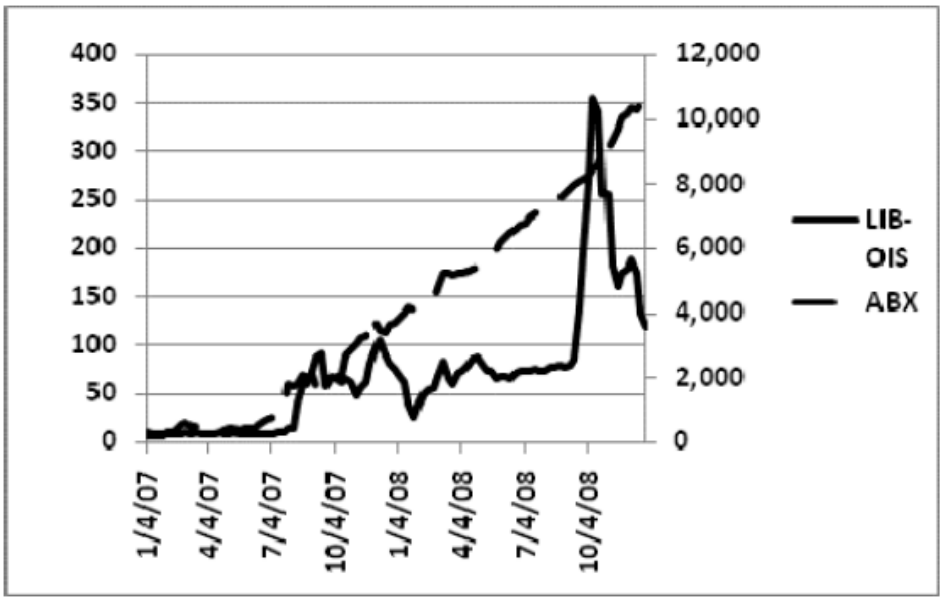


FIGURE 11: ABX V LIBOR-OIS SPREAD (GORTON AND METRICK, FIGURE 8)

As well as the massive increase in spreads on the ABX index (and the sharp spike in the LIBOR-OIS spread) Gorton & Metrick also provide information on the Repo Haircut Index (see Figure 12) which is the equally-weighted average haircut for all nine asset classes included in their data.

The increase in the haircut they equate to a bank run.

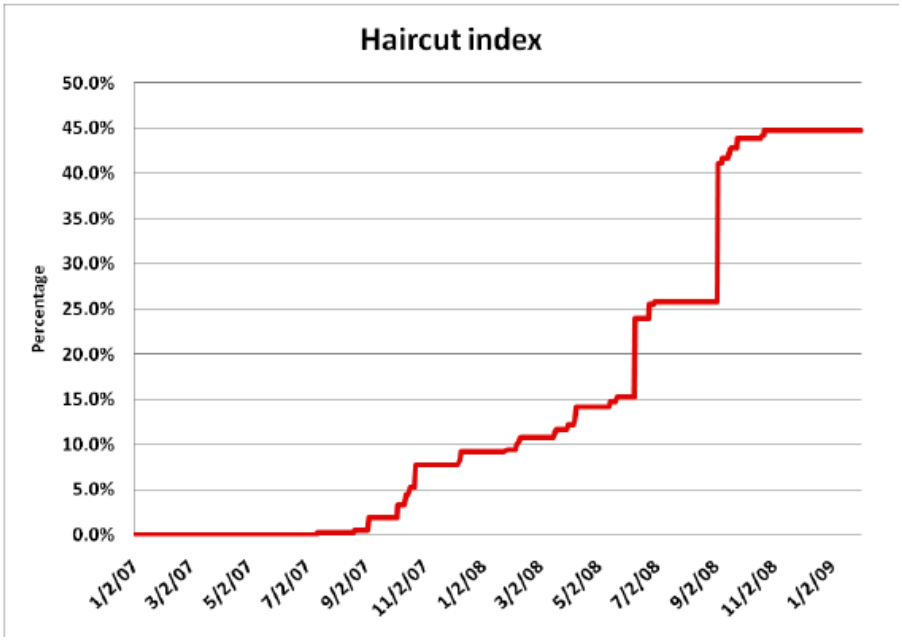


FIGURE 12: GORTON AND METRICK'S REPO HAIRCUT INDEX

Krishnamurthy et al (JOF, 2014) dispute the significance of the run on the repo, arguing that most of the shadow banking sector's use of repo financing involved government and agency securities, and that haircuts etc behaved differently for these securities than for private securities. They point instead to the role of ABCP financing by shadow banking, and links to the formal banking sector via liquidity guarantees as more important. Examining Figure 13 from Krishnamurthy et al, the transmission mechanism into tightening of credit was, they argue, more related to reduced flows (outflows) of funds into ABCP conduits from end investors.

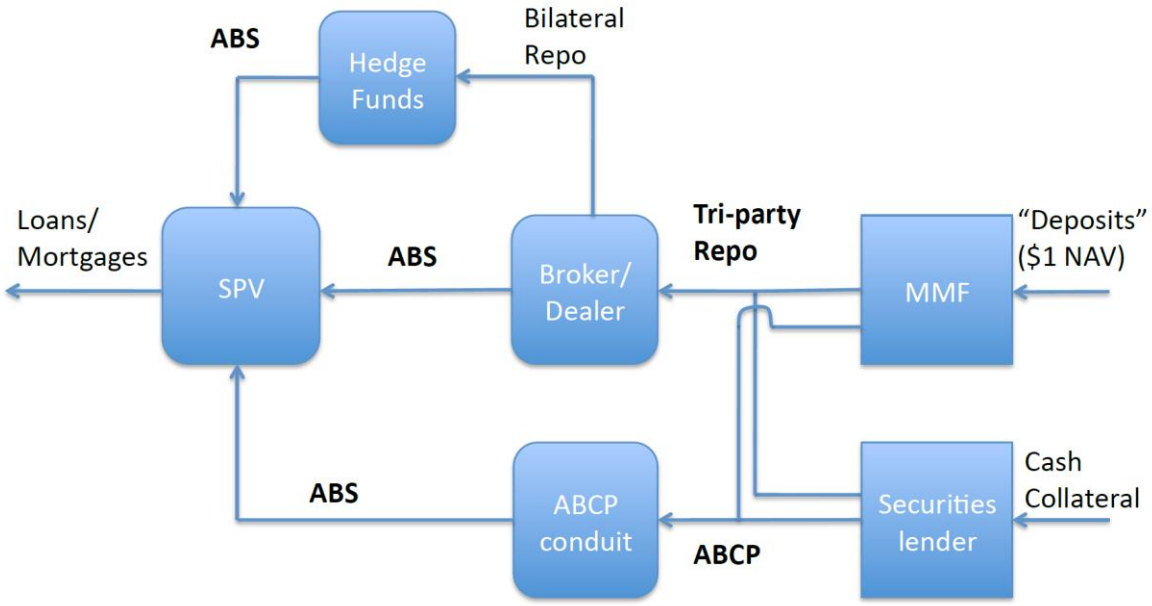


FIGURE 13: GFC TRANSMISSION MECHANISM

12. 6 Securities Lending

A recent overview of the (equities) security lending market in Australia and regulatory arrangements is provided by Carroll and Clarke (RBA, 2014).

> "Securities lending involves the temporary exchange of securities, usually for other securities or cash of an equivalent value (or occasionally a mixture of cash and securities), with an obligation to redeliver a like quantity of the same securities at a future date. Most securities lending is structured to give the borrower legal title to the securities for the life of the transaction, even though, economically, the terms are more akin to a loan. The borrow fee is generally agreed in advance and the lender has contractual rights similar to beneficial ownership of the securities, with rights to receive the equivalent of all interest payments or dividends and to have equivalent securities returned. The importance of the transfer of legal title is twofold. First, it allows the borrower to deliver the securities onward, for example in another securities loan or to settle an outright trade. Second, it means that the lender usually receives value in exchange for the disposition of legal title (whether in cash or securities), which ensures that the loan is collateralised." Ref: http://www.iosco.org/download/pdf/1999-securities_lending.pdf

Figure 14 provides an example of a securities lending transaction in which A lends shares in XYZ Ltd to B on 1/1/XX, for repayment on 20/1/XX. On 1/1/XX Ownership of XYZ transferred from A to B. B pays $C cash to A as collateral (or this could take the form of other securities) where the collateral value exceeds the market value of the securities lent.

Over that period XYZ pays dividend $D on 18/1/XX which is received by B as the legal owner – but which the loan agreement requires be reimbursed to A (plus the value of any attached franking credits). On 20/1/XX, ownership of XYZ shares is transferred back from B to A and B pays dividend equivalent ($D plus value of any tax credits). A returns the collateral plus some agreed part of the interest A has earned on cash collateral, or alternatively B pays some agreed fee to A.

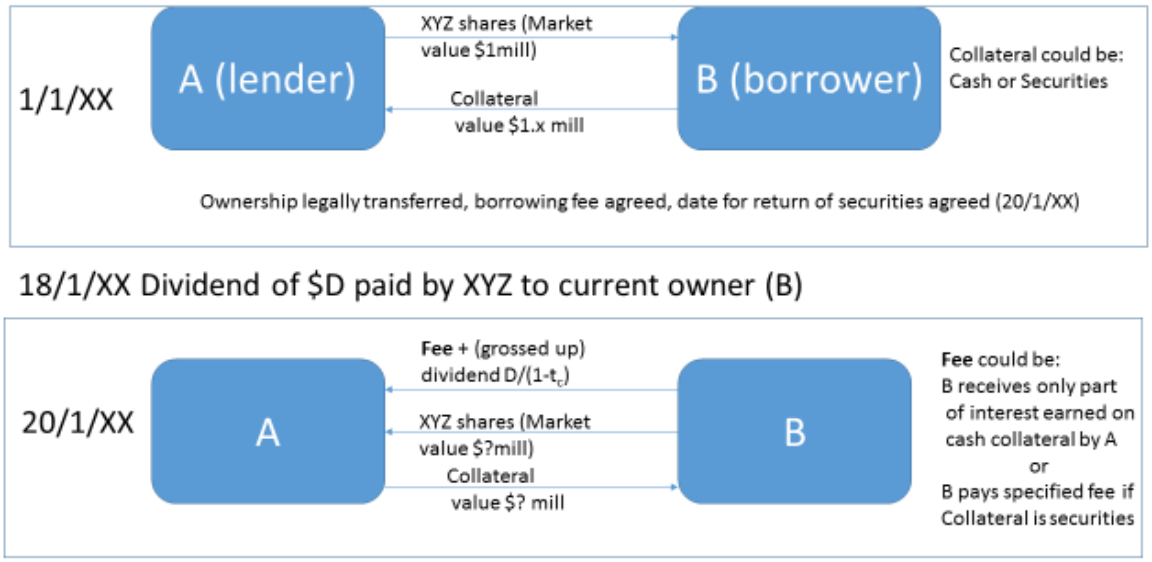


FIGURE 14: SECURITIES LENDING ILLUSTRATION

The Securities Loan is equivalent to a spot purchase of XYZ shares by B plus a forward sale of XYZ shares by B (with same counterparty A). There are obviously counterparty risks involved. For A this arises if XYZ share price increases and B doesn't redeliver stock. A will protect against this by demanding that the value of collateral exceeds the value of the stock lent.

For B counterparty risk arises if the XYZ share price decreases and A doesn't accept redelivery and make payment via return of the collateral.

One important feature of the securities loan is that voting rights transferred to borrower. This gives rise to an "empty voting" potential problem (decoupling of voting rights and economic ownership) relevant for control and governance. (Ali, Ramsay and Saunders, 2014). In 2019 ASIC released Consultation Paper 319 regarding substantial holdings disclosure by agents having securities borrowing rights from their clients. This would extend the relief given to prime brokers which required then to disclose only when they exercise a right to borrow, rather than when an agreement is entered into which gives them that right.

In a perfect market, collateral cash flows $C (at initial date) and $C* (at repayment date), and dividend $D adjustment should reflect "cost of carry" arbitrage relationship between spot and futures. The borrower of securities who provides cash collateral should get interest earned on that collateral returned. Otherwise it would be cheaper to buy the securities spot (at price S_0) and sell them forward at $F = S_0 (1+r)$ rather than provide the cash collateral $C = S_0$ and get back less than $C^* = S_0 (1+r)$.

In practice, legal restrictions, incomplete markets and inability to replicate transaction, supply-demand conditions, transactions costs etc., mean that the implicit interest rate on cash collateral provided in securities loans can differ from, and will be lower than, the risk free rate. Because it is the borrower of securities who is seeking a service (temporary use of the securities) they can expect to incur some cost (either lower interest rate on cash collateral provided or an explicit fee if securities provided as collateral). For the lender of the securities, undertaking the transaction provides a source of income additional to that earned from ownership of the securities.

The Australian securities lending agreement involves payment of any dividends received by the borrower plus the cash value of any attached franking credits. While that might appear to provide an opportunity for arbitrage of franking credits – by a shareholder who doesn't value franking credits lending the stock to another entity who does, the legal holding period restrictions on ability to use franking credits precludes this.

Securities Lending History (See http://www.asla.com.au/).

1960s – emerged in UK in operations area of stockbrokers, spread to other markets

1970s – emerged in Australia, waxed and waned – affected by capital gains tax treatment. In 1985 introduction of CGT meant that securities loans triggered a tax event since a "sale" was involved. This impediment to securities lending was removed at the start of the 1990s.

Custodians are major stock lenders both on an agency basis (for eg super funds) and as principals (ie take on risk of lending securities of their clients). See here for a recent innovation aimed at opening securities lending up to direct participation by wholesale investors.

The obvious question is why do market participants engage in securities lending.

Uses of Securities Lending

- Borrowing for failed trades -by brokers where clients haven't delivered securities on time
- Borrowing for Margin requirements
- By writers of derivative contracts
- Borrowing for Market Making and Proprietary Trading
- Where securities need to be sold for hedging, arbitrage, market making
- Borrowing for short selling
- Income Generation – lenders of securities receive a fee, giving income additional to dividends etc

As in many other markets there are Intermediary Brokers who borrow and lend securities to clients.

Superannuation funds have at times been significant lenders of equities they hold in order to generate some fee income to supplement returns for members. This has led to significant criticisms, based on the fact that short-sellers borrowing securities will tend to depress the price of the shares borrowed – which is against the interest of members. See here for a recent AFR article. In 2019 Vanguard announced that its ETFs would engage in securities lending.

Securities Lending and Repos

Repos and Securities lending are essentially opposite sides of the same type of transaction – a temporary exchange of one type of security for another or for cash. Repos are generally seen as *"Cash Driven"* – objective is short term financing. Repos are more "commoditized" – direct dealing with electronic quotes, focus on government securities; typically fixed term; collateral is securities

Securities lending is generally seen as *"Securities Driven"* – objective is temporary acquisition of securities. Securities loans are intermediated – customised, focus on equities; typically "open" maturity; collateral is cash

In both cases, collateral given may be given a "haircut" and adjusted value required to exceed market value of loan plus margin. Margin calls made as required.

Margins and Haircuts

The terms "margin" and "haircut' are sometimes used interchangeably, but actually refer to different things. When collateral is provided in the form of some security, its current value will need to be ascertained. It might be claimed that the market value is $120, but there may be no trading in the security and/or concerns about its value, such that the receiver of the collateral gives a "haircut" (h)of (say) 10% and regards the collateral value as only being $108. (For cash collateral there would be no haircut).

The receiver of collateral will also want the collateral value received to exceed the amount to exceed the amount of cash or securities provided to the other party by some margin (m), say 5%. So if $100 was being provided, the value of collateral received (after the haircut) would need to exceed $105.

The relationship between initial margin and haircuts for an acceptable transaction is

$(1+m)\ s \leq (1-h)\ c$

where m = initial margin, s = market value of securities loaned, h = haircut and c = market value of collateral taken.

Example: $100 ANZ shares lent (s), margin (m) of 5% required, $120 of DOG shares (c) offered as collateral but given a haircut (h) of 10%; $(1+m)S=\$105 < (1-h)c - \$108$

The initial margin and haircut reflect price volatility and valuation uncertainty of the items in question.

Gross and Net Stock Lending

Because the borrower of stock can on-lend it in another securities lending transaction, there is often a chain of collateral which means gross and net lending figures differ substantially. Figure 15 illustrates for two Australian stocks

Gross and Net Stock Lending: 7 August 2017

Outstanding Borrowed Stock (million)

ASX Code	*Gross Volume*	*Gross Value*	*Net Volume*	*Net Value*	*Daily Turnover ($ mill value)*	*Net Borrowed Value (% of Daily Turnover)*	*Stock value ($mill) Committed to Lending Arrangements**	*Borrowed stock (net) / Committed Amount*	*Market Capitalisation ($mill)*	*Net Borrowing / Market Capitalisation (%)*
ANZ	15	459	0.02	0.60	95.09	0.63	10020	0.01%	87535.0	0
AMP	95	512	42	229	23	9.94	1689	13.55%	15730.5	1.46

(net < gross implies on lending)

* preceding quarter end

FIGURE 15: STOCK LENDING (SOURCE: ASX)

Securities Lending & Short Selling

Short sale requires securities to be borrowed. This is facilitated by "street name" registration. The short seller must pay any dividends declared to the lender. Margin required (ie account will have asset balance equal to sale proceeds plus margin funds deposited, and liability equal to current market price of shares short sold). Net proceeds not available until position closed (some part of profits may be withdrawn if stock price declines).

Often restrictions exist on stocks which can be short sold and circumstances when a short sell can be made (e.g. only on an uptick).

Prior to GFC much short selling in Australia was "naked" (without having borrowed securities) even though not permitted ("covered" short sales required). At the time of the GFC, short selling prohibitions were introduced on a number of stocks and maintained for some time in the case of financial stocks.

12.7 Collateral

Provision of collateral protects a counterparty who is a creditor (via reduced loss given default, reduced borrower moral hazard risk). It is relevant to :

- repos, securities loans
- Lending – secured by financial or real assets
- Mortgage lending, pawnbroking
- Derivatives exposures (bilateral or CCPs/exchanges)

High quality collateral – government securities, also demanded for meeting regulatory liquidity needs (CLF)

Re-use (rehypothecation) of collateral is common. An RBA survey estimates 1.6 times p.a. for govt securities

Lehmann failure illustrated risks from "collateral chains". Figure 16 shows an example of a collateral chain.

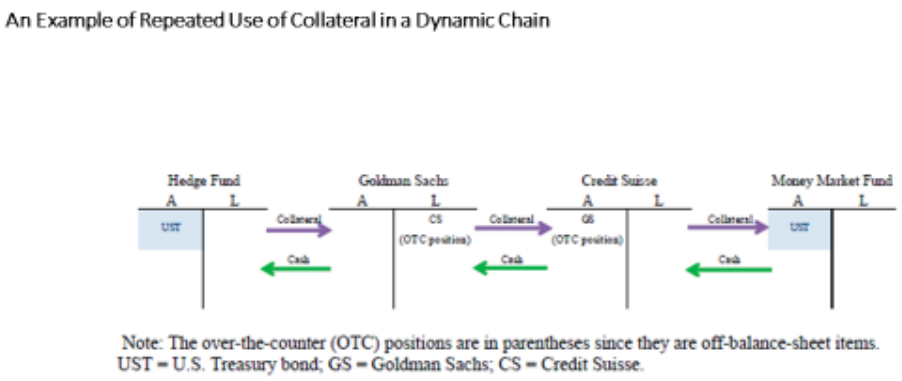


FIGURE 16: COLLATERAL CHAIN (SOURCE: CLAESSENS ET AL 2015)

Collateral and Encumbrance

The use of collateral creates a number of complications because assets become "encumbered", and there has been iIncreased use of collateralised funding by banks such as for Repos and covered bonds etc. Concerns re increased "encumbrance" of bank assets, also arising from collateral provided for exposures due to derivatives positions

One issue is unavailability of encumbered assets for use to compensate unsecured creditors / depositors in bank resolution. This affects priority (preference) rankings.

Another issue is the Increase in financial system interconnectedness, may create procyclicality (eg effect of higher haircuts/margins)

Policy issues: include disclosure, limits, deposit insurance pricing

12.8 Prime Brokerage

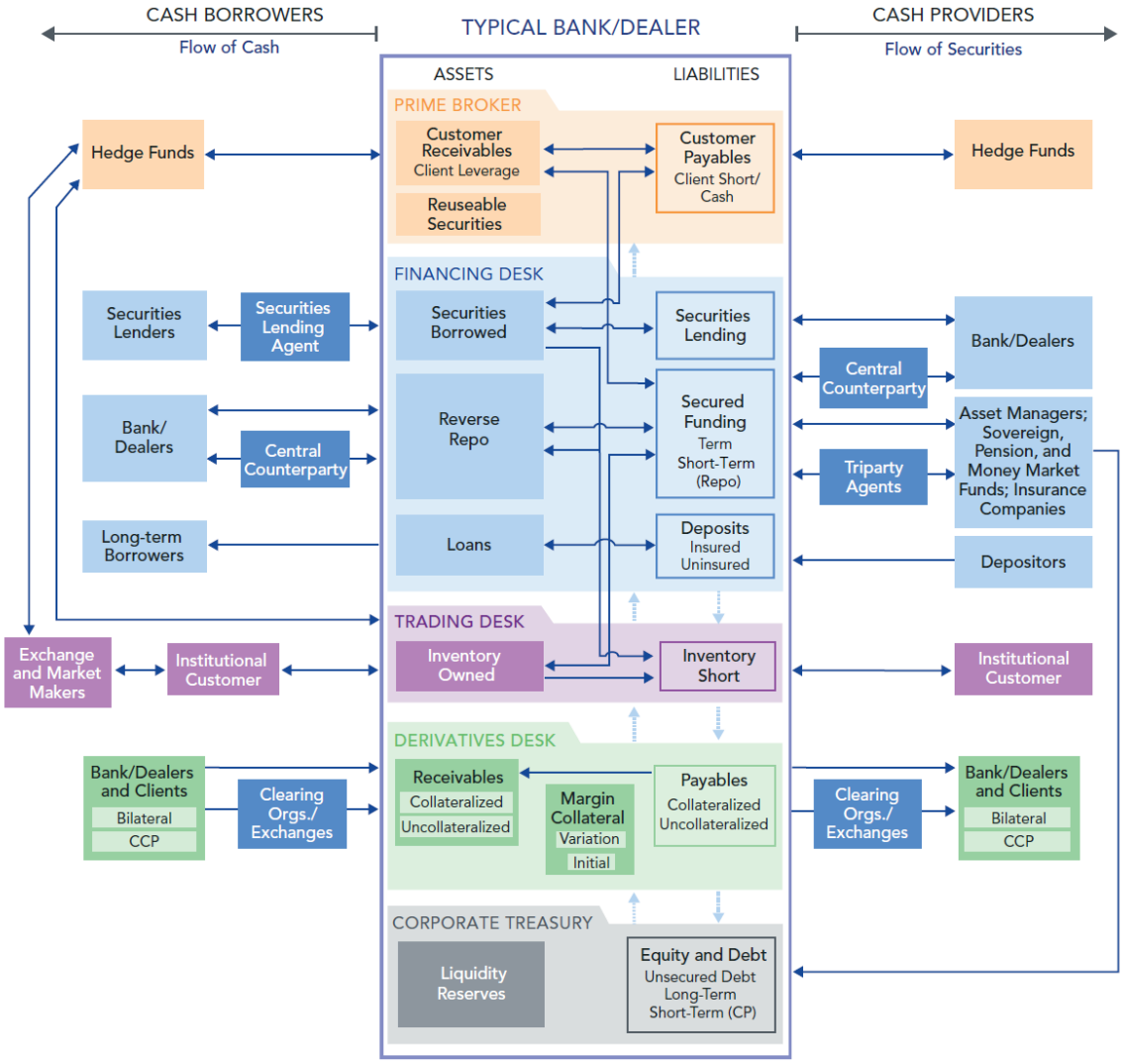
These are services provided by large financial institutions to hedge funds and others, involving financial, administrative, operational services. Prime brokers provide finance, manage collateral, global custody, clearing, margin lending, securities borrowing, financing, execution, portfolio reporting, and operational support. Financing may occur via margin financing or repos.

Hedge funds are reliant on such services, and the failure of Lehmans in the GFC led to the failure of many of its prime brokerage clients whose accounts were frozen and who were unable to switch to other service providers. (Aragon and Strahan, 2009). Rehypothecation (using collateral provided by others to provide collateral for own borrowings) by Lehmans of securities provided by the hedge fund as collateral was one way in which hedge fund clients were exposed to default risk of their prime broker.

Several other authors have suggested that hedge funds gain information advantages from their links to the large banks providing prime brokerage services. Kumar et al argue that "hedge funds make informed trades in the stocks of firms that obtain loans from their prime-broker banks." Chung et al observe co-movement of performance of hedge funds using the same prime broker which they argue can be attributed "to the prime broker providing valuable information to its hedge fund clients"

Prime Brokerage functions are one of the activities which may increase interlinkages and risk in the financial system from large bank activities as shown in Figure 17 from a paper from the US Office of Financial Research (OFR).

Figure 1. Financial Network Map Showing Relationships among Market Participants



Note: Key market participants and bank/dealer desks involved in funding are displayed in dark colors; others are shaded lightly.
Source: Authors' analysis

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FIGURE 17: PRIME BROKERAGE FUNCTIONS

Other perspectives on prime brokerage are provided in Figure 18 and Figure 19.

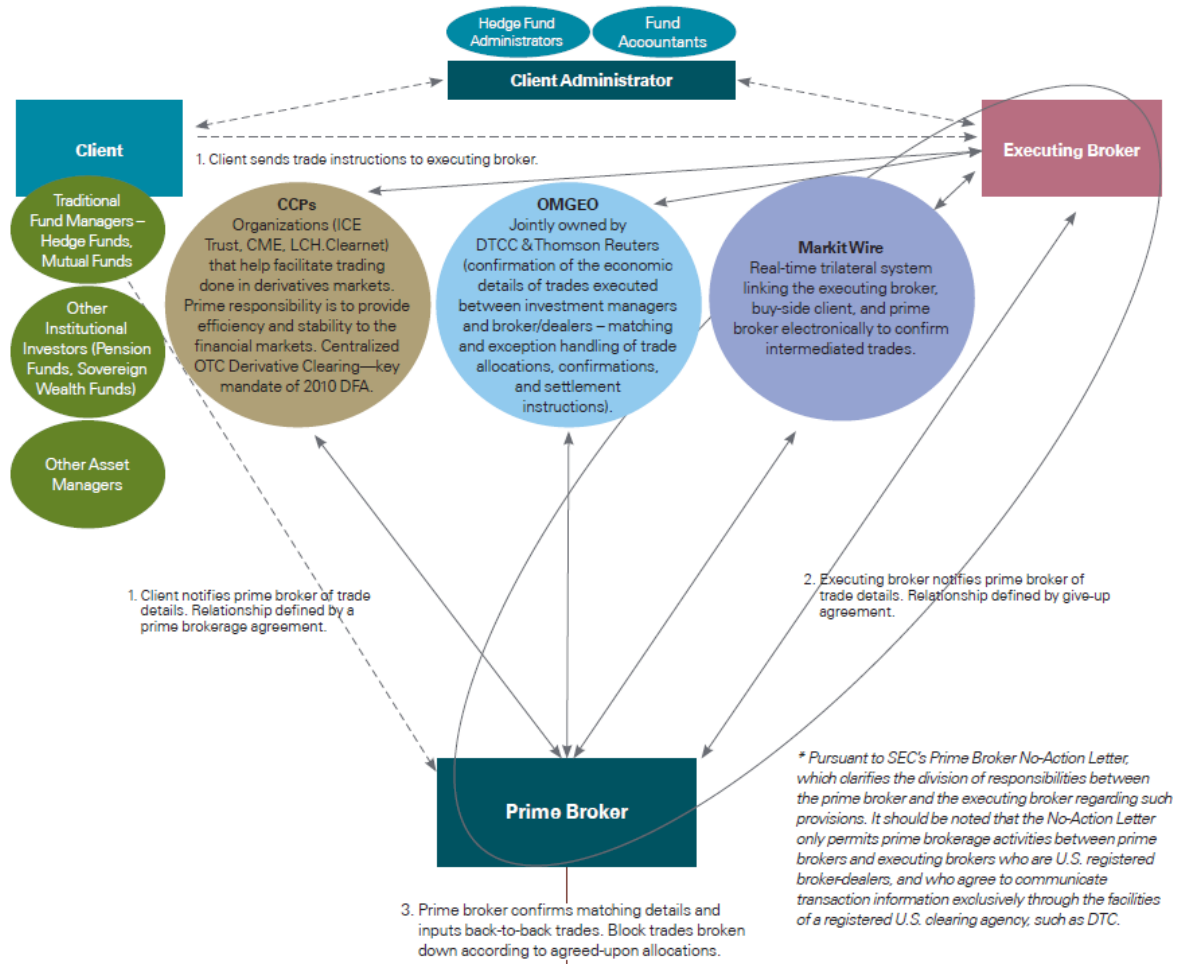

FIGURE 18: PRIME BROKERAGE (SOURCE KPMG, 2011)

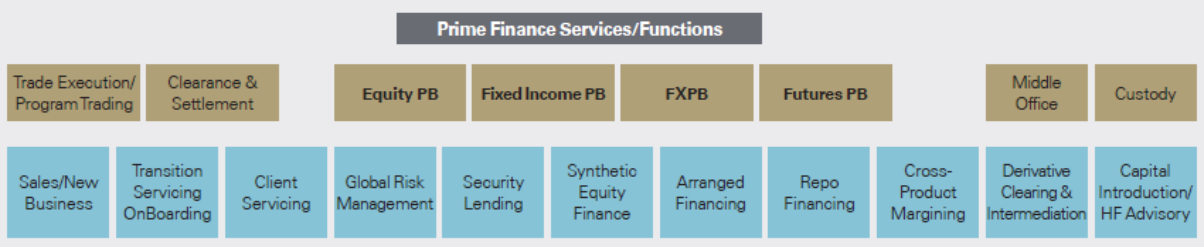

FIGURE 19: PRIME BROKERAGE (SOURCE KPMG)