27 The Post GFC Regulatory Agenda

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27.1 Introduction

The Global Financial Crisis (GFC) of 2007-2009 was something of a turning point in attitudes to, and regulation of global financial markets. It sparked a global agenda of regulatory reform, led by the G20 which tasked the recently formed Financial Stability Board (FSB) and the global standard setters (BCBS, IOSCO etc) with developing and implementing a better regulatory framework to ensure that such a crisis would not recur. The G20 Leaders' Statement from The Pittsburgh Summit of September 24 – 25, 2009 stated agreement:

> "to make sure our regulatory system for banks and other financial firms reins in the excesses that led to the crisis. Where reckless behavior and a lack of responsibility led to crisis, we will not allow a return to banking as usual.
> We committed to act together to raise capital standards, to implement strong international compensation standards aimed at ending practices that lead to excessive risk-taking, to improve the over-the-counter derivatives market and to create more powerful tools to hold large global firms to account for the risks they take. Standards for large global financial firms should be commensurate with the cost of their failure."

This concerted action reflected the failings in financial sector practices and regulation which led to the GFC. In this chapter the first item is to consider causes of the GFC and the failings identified. This in then followed by the specifics of the G20 reform response and consideration of its implementation in the subsequent years. Following that, several specific reforms are discussed. These include: the regulatory approach to systemically important financial institutions (SIFIs); the promotion of Central Clearing Counterparties (CCPs); and attention paid to systemic risk. Other key bank-oriented components, including the Basel reform agenda and deposit insurance reforms, have been discussed in earlier chapters.

27.2 Origins and Features of the GFC

Origins

The crisis can (at risk of oversimplification) be attributed to four major factors.

The first was the growth of financial products and practices which involved high leverage and were sustainable only under conditions of increasing asset prices and investor confidence. Sub prime mortgage lending in the US is the obvious example which triggered the crisis, but the problem was more pervasive due to the second factor of uncontrolled (and not well recognized) liquidity creation. Financial engineering has prompted the growth of liquidity creation techniques based around collateralized lending (such as repos, securities lending, margin lending), where active securities markets for the collateral meant that lenders did not themselves feel exposed to significant liquidity or counterparty risk. Although asset price inflation was high Central Banks, focused on consumer price inflation targets and real sector activity, did not respond by attempting to restrict liquidity and "pricking the bubble".

A third factor was the growth of the, largely unregulated, "shadow banking" sector, involving investment banks, hedge funds, SIVs, conduits etc., and the construction of complex financial instruments and techniques which saw risk spread throughout the global financial sector and significant interdependencies created. Finally (the fourth factor), there was an absence of public information about the level and distribution of risk in the financial system. Inability to assess the risk

positions of potential counterparties meant that a crisis induced response for many institutions was simply to cease extending credit.

Financial Sector Shortcomings Identified by the GFC

The evolution of the crisis identified a number of important features of financial system behaviour which need to be borne in mind in policy responses and in designing future regulation.

First, consumers of financial products such as mortgage borrowers or investors generally do not have financial sophistication and knowledge which is adequate to assess the risk and return (or cost) of financially complex products.

Second, incentive and governance structures within financial institutions have been inadequate to prevent sales of unsuitable financial products.

Third, outsourcing of due diligence and risk assessment, including reliance on statistical models of risk assessment which use only "hard" information rather than "soft" information (such as loan officer opinion and assessment), has increased risk.

Fourth, even large, reputable, financial institutions will seek to avoid constraints imposed by regulations, as evident in the creation of SIVs and conduits using 364 day liquidity facilities to avoid capital requirements.

Fifth, risk management systems of banks have proven inadequate, reflecting problems with measuring risk, control systems, reporting arrangements and governance.

Sixth, liquidity creation by non-prudentially regulated institutions, involving massive growth in collateralized lending techniques, was not well recognized or controlled by monetary authorities.

Seventh, systemically important financial institutions exist outside the ambit of prudentially regulated institutions, and include investment banks and insurance companies who are important counterparties in risk transfer and in provision of liquidity.

Eighth, limited deposit insurance arrangements are inadequate for maintaining depositor confidence and dealing with systemic crises.

Ninth, opaqueness of financial institutions and inadequate information about details of complex financial products can quickly cause interbank and asset markets to "freeze", creating significant problems for both funding and asset liquidity.

Tenth, official liquidity support facilities need to be carefully structured so that market participants are not put off using them by the potential stigma of being perceived by the market as being weak, at risk, institutions.

Eleventh, risk based capital adequacy requirements appear to be insufficiently robust to financial innovation, prompting increased attention in the role of simple leverage ratios as a regulatory option.

Twelfth, globalization of finance has made the regulatory problem of dealing with multinational financial institutions extremely complex. Supervisory cooperation needs to be reinforced by improved alignment of national insolvency and resolution arrangements.

Thirteenth, the dramatic growth of the less-regulated non-bank sector ("shadow" banking sector) has meant that the macro-economic problems arising from a "flight to quality" to the banking sector and disruptions to proper functioning of the non-bank financial sector are particularly severe.

Short Term Regulatory Responses

Crisis induced responses by Governments focused primarily on offsetting the immediate effects of the crisis rather than addressing the underlying causal factors.

First, there were actions to shore up public confidence in national banking sectors, involving broad extensions of deposit insurance, guarantees, and government equity injections into, or full or partial nationalizations, of banks.

Second, there were actions to unfreeze and/or restore liquidity to asset markets and financial institutions, via widening of acceptable collateral in Central Bank repurchase agreements, and Government purchases of particular types of assets (including mortgage backed securities). Central Banks have also increased aggregate liquidity through their open market operations to cater for the fear induced increase in demand for liquidity and to lower official interest rates to offset adverse effects on the real economy arising from higher credit spreads on private sector lending.

A third response was the "bail out" of systemically important non-bank financial institutions such as investment banks in the US. The interdependencies within the financial system have been reflected in their roles as prime brokers for hedge funds, significant counterparties in derivatives transactions, and providers of credit through collateralized lending techniques. Ultimately, the disruption to asset markets from disorderly failure was deemed (with the aid of hindsight from the Lehman example) to be unacceptable.

A fourth response was the introduction of new, temporary, regulations on financial markets and institutions. Particularly notable here has been the introduction of bans on short selling of (some or all) equities on national stock exchanges, driven by concerns about destabilizing speculation.

These responses (and the crisis itself) had significant short term, and potentially lasting, impacts on the competitive position of various financial institutions. Non-bank investment vehicles (finance

companies, managed funds etc) suffered outflows, partly due to nervous investors being attracted to Government guaranteed deposits, but also reflecting the desire to avoid further losses on risky investments in such a bear market environment. Hedge funds (and others) using trading strategies based on taking short positions found their business models undermined by bans on short selling.

27.3 The G20 Agenda

The G20 leaders identified a large numbers of areas for reform including (with the number of specific items in brackets):

- Macro/lending/trade initiatives (10)
- Governance/resourcing of IFIs and International Cooperation (34)
- Dealing with Tax Havens etc (8)
- Prudential regulation (16)
- Scope of regulation (9)
- Accounting Standards (8)
- Credit rating agencies (3)
- Compensation and remuneration (3)

Focusing primarily on financial regulation, it is possible to relate identified causes of the crisis with specific regulatory agenda items affecting banks (discussed in earlier chapters), as shown in Table 1.

TABLE 1:GFC CAUSES AND POLICY RESPONSES

Causes of Crisis	**Regulatory Responses**
Excessive leverage	Higher (and better) capital requirements
Risk taking incentives	Changes to required bank capital risk weights
Liquidity problems	New liquidity requirements (LCR, NSFR)
Depositor runs	New/higher deposit insurance limits, depositor preference
Too Big to Fail (TBTF)	Higher capital (loss absorbency) for "SIFI's"; specific taxes/levies
Taxpayer Bailouts v effective resolution	Better resolution powers / arrangements; living wills, "bail-in" debt / "CoCos"
Spill-overs /Contagion	Retail ring-fencing; Volcker rule; risk weights
Derivative Counterparty risks	Central Clearing Counterparties, margin requirements
Governance / Remuneration issues	Limits on banker pay, executive accountability
Asset price bubbles	Macro-prudential regulation (capital buffers, LVR limits)

Global imbalances/ liquidity	?
Unsuitable/complex products	risk weights, banning powers, advice reforms,
Transparency/Opaqueness	Accounting Standards, Disclosure requirements, STC securitisation, trade repository reporting
Supervisory deficiencies	FSB/IMF Peer review, changes to powers/mandates

The framework of the global financial regulation process is shown in Figure 1, which also highlights the role that specific domestic experiences and institutional arrangements play in translating international standards and recommendations into domestic regulations and cross-border regulatory relationships.

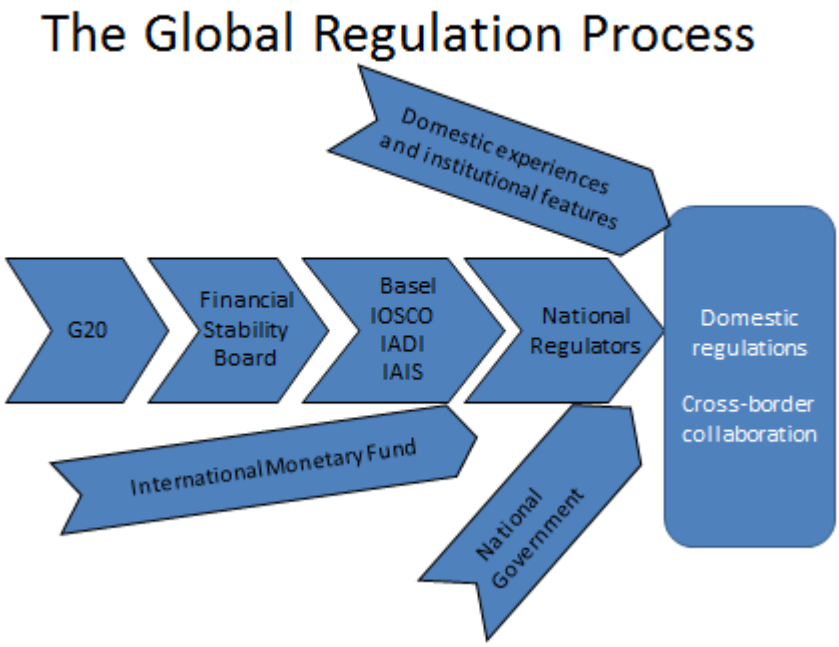

FIGURE 1:GLOBAL AND DOMESTIC REGULATION

27.4 The Current (2023) Status of Financial Regulatory Reform

In 2020 the Covid Crisis drew attention away from the financial regulatory reform agenda which the G20 adopted after the GFC. While it could be argued that most of the agenda was complete by the start of 2020, in its October 2019 report to the G20 the FSB highlighted the potential consequences for financial stability from rapid structural and technological change.

Nevertheless the "dashboard" summarising implementation status as at September 2022 in G20 countries of major planks of the agenda was largely either "green" signalling that targets had been achieved or "yellow" signalling good progress. In terms of major areas:

- Basel III –measures not fully/largely completed internationally were the large exposures framework, risk based capital, and implementation of a leverage ratio. Requirements for SIBs and implementation of the NSFR were largely completed.
- Compensation/Remuneration – largely implemented
- OTC Derivatives – Trade Reporting was almost universal and Central Clearing adopted by most, however use of platform trading and margining arrangements had less adoption – primarily among lower income jurisdictions
- Resolution arrangements – TLAC had been adopted in most countries home to G-SIBs, bail-in was well advanced as was recovery and resolution planning requirements for systemic banks. Arrangements for dealing with failures of insurers was less advanced, as was resolution of CCPs.
- NBFIs –a majority of jurisdictions had implemented agreed standards for MMFs and Securitisation, but reform of securities financing transactions was much less advanced.

27.5 Macro-Prudential Regulation

Interest in macro-prudential regulation was stimulated by the Global Financial Crisis (GFC). Although the term had been in use for a decade or more, the concept itself is not well defined. But it can be broadly interpreted as policies designed to achieve financial system stability and preventing adverse spillovers onto economic activity. It differs from (micro) prudential regulation which focuses upon the health of an individual financial institution in recognizing that the whole is more than the sum of the parts, and that the interactions between otherwise healthy financial institutions can contribute to instability of the financial system. It differs from monetary policy in not being focused upon activities designed to achieve desirable outcomes for particular economic aggregates (inflation, output growth etc), but upon financial system characteristics which may hinder achieving such desirable outcomes due to instability.

Macro-prudential regulation has two dimensions. In the cross-section dimension it is concerned with how the structure of the financial sector affects its response to shocks to the system. Do interrelationships and institutional practices, amplify or dampen the effects of shocks? In the time-series dimension, the focus is upon whether excessive risk-taking can emerge over time to threaten economic and financial stability.

Examples of problems arising in the cross-section dimension are easy to find from the GFC. A complex web of bilateral counterparty exposures in over the counter (OTC) derivative markets meant that the failure of one institution would impact a large number of other institutions. Because

market participants do not know the exposures of others, unwillingness to enter new exposures can occur if there are concerns about the possible failure of any significant institution.

One consequence of this has been regulatory desire to shift OTC derivatives onto organized exchanges, or involve Central Clearing Counterparties (CCCPs) for OTC trading. Under such arrangements, bilateral trades are novated to a central clearing house, generating a "hub and spoke" type of arrangement for exposures where the CCCP (the hub) manages its counterparty exposures by netting offsetting trades and appropriate margining policies. Individual institutions which have entered trades with a counterparty which subsequently fails are thus not exposed to default risk.

Another example can be found in the consequences of many large institutions making extensive use of high leveraged, collateralized borrowings such as by repurchase agreements (repos). This led to what has been described as a "margin-price" spiral, with institutions finding that they were exposed to interrelated "asset-liquidity" and "funding-liquidity" risk. When asset prices fell, counterparties who had lent funds by way of repos, made margin calls or refused to continue providing funds. Borrowing institutions were thus faced with a need to sell assets, but with such responses being widespread, this put further downward pressure on asset prices, prompting further margin calls, asset sales and so on in a downward spiral.

A consequence of this has been greater regulatory attention on liquidity management, reflected in the introduction of the LCR and NSFR requirements related to both funding arrangements and liquid asset holdings. On the latter score, the LCR objective is to ensure adequate holdings of liquid, gilt-edged, securities which can be sold in a crisis without leading to an increase in the credit-risk spread and reduced asset prices which prompt a margin-price spiral. (Macro-economic policy can adjust system wide liquidity to offset pressures on the level of official interest rates arising from such sales). On the former score, the NSFR objective is to ensure that institutions which make long term loans and illiquid investments fund themselves with sufficient stable (long term) sources of funding to avoid funding problems should shorter term funding become less available.

Because the transmission of shocks through the financial system depends upon the network of financial arrangements, and because failures of large important institutions have greater spillover effects, there is considerable interest in developing network models of the financial system. In such models, key institutions and their financial links to others are identified. Then, by tracing the consequences of a failure or stress of a key institution, their role in amplifying or mitigating shocks can, hopefully, be assessed. Such analysis can underpin the determination of additional capital requirements for systemically important financial institutions – in order to reduce their chance of

failure. It can also assist regulators in determining what are the most suitable responses to prevent transmission of a shock.

The time-series dimension of macro-prudential regulation is the determination of whether there are forces building-up over time in the financial system which increase its susceptibility to crisis. Looking at past financial crises, there are a mix of macro-economic fundamentals and financial market indicators which appear to be important. Financial crises appear to be preceded by developments such as large and persistent government deficits, large and persistent current account deficits on the balance of payments, and high inflation. But also important is the behaviour of asset prices in the form of stock market bull runs and housing price "bubbles", as well as the development of high leverage and risk-taking.

Recognizing whether such developments are indicative of unsustainable conditions or reflect "fundamental" factors is particularly difficult. Over past decades, Central Banks have been reluctant to act against asset price inflation, but that has changed, with "leaning into the wind" strategies becoming more accepted.

The other development is in terms of trying to moderate practices in financial markets which might generate such developments. Executive remuneration is one such area, where concerns that bonus-based remuneration has giving inappropriate incentives for excessive short-term risk taking. Another area lies in the interaction of regulatory and bank risk-management decision making. As a "boom" develops, increased asset valuations can improve the credit ratings of bank customers and provide banks with incentive and rationale to provide increased loan funding, thus exacerbating the boom. Removing such "pro-cyclicality" is an important component of changes incorporated in Basel 3.

27.6 SIFIs

The Rationale for the SIFI Framework

In November 2011 the FSB and Basel Committee announced a framework for identification an additional regulatory requirements for SIFIs (Systemically Important Financial Institutions). 28 institutions were initially designated as G-SIBs. At the end of 2021, the list had 30 members (with a small number of exits and new entries) shown in Table 3, which were determined based on the updated assessment methodology which can be found here.

Underpinning the approach is the argument that the stronger Basel 3 capital requirements are not of themselves sufficient to address the negative externalities (the private decisions made assuming TBTF which are not socially optimal) arising from G-SIBS, or to protect the financial system from spillover risks. This is largely based on the cross-border implications which are not fully addressed by

the Basel requirements, and hence the unit of focus is the consolidated global group. The objectives are to reduce probability of G-SIB failure by increasing going-concern loss absorbency, and reduce impact of any failure by improved global recovery and resolution arrangements. The FSB argues that the measures will also help to reduce TBTF funding advantages.

Identifying SIFIs: The Indicator Approach

The FSB has adopted an "indicator approach" shown in Table 2, noting that the robustness of available quantitative models aimed at measuring systemic risk is yet to be demonstrated.

TABLE 2: G-SIB INDICATORS

Category (weighting)	Individual indicator	weighting
Cross-jurisdictional activity (20%)	Cross-jurisdictional claims	10%
	Cross-jurisdictional liabilities	10%
Size (20%)	Total exposures as defined for use in the Basel III leverage ratio	20%
Interconnectedness (20%)	Intra-financial system assets	6.67%
	Intra-financial system liabilities	6.67%
	Securities outstanding	6.67%
Substitutability/financial institution infrastructure (20%)	Assets under custody	6.67%
	Payments activity	6.67%
	Underwritten transactions in debt and equity markets	6.67%
Complexity (20%)	Notional amount of over-the-counter (OTC) derivatives	6.67%
	Level 3 assets	6.67%
	Trading and available-for-sale securities	6.67%
Source: https://www.bis.org/basel_framework/chapter/SCO/40.htm		

TABLE 3: LIST OF G-SIBS NOVEMBER 2021

Bucket (LAC)	G-SIBs in alphabetical order within each bucket
5 (3.5%)	(Empty)
4 (2.5%)	JP Morgan Chase
3 (2.0%)	BNP Paribas, Citigroup, HSBC,
2 (1.5%)	Bank of America, Bank of China, Barclays, China Construction Bank, Deutsche Bank, Goldman Sachs, Industrial and Commercial Bank of China Limited, Mitsubishi UFJ FG,
1 (1.0%)	Agricultural Bank of China, Bank of New York Mellon, Credit Suisse, Group BPCE, Group Crédit Agricole, ING Bank, Mizuho FG, Morgan Stanley, Royal Bank of Canada, Santander, Société Générale, Standard Chartered, State Street, Sumitomo Mitsui FG, Toronto Dominion, UBS, Unicredit Group, Wells Fargo
Source: FSB	

TLAC Requirements for SIFIs

To determining the appropriate size of total loss absorbency capacity (TLAC) requirements for G-SIBs, the FSB has attempted to quantify things in the following manner.

First, they attempt to estimate the *expected* impact of a failure and argue that this should be the same for G-SIBs and non-G-SIBs. Since the impact of an actual G-SIB failure will exceed that of a non-G-SIB, this implies that the probability of its failure would need to be correspondingly lower. Higher loss absorbency is required to ensure PD(SIB) <PD(non-SIB) such that expected impact is equivalent – based on regulator assessment of relative impact (which is 3-5 times greater for highest-scoring SIB)

To quantify the required increase in LAC, three approaches were used.

First, the BCBS has used an expected impact approach (from EL) calibrated using (historical) return on risk-weighted assets (RORWA) data, and a Merton model (using equity price data) to relate PD and capital ratios. The RORWA approach essentially uses a value at risk approach (data from many banks, many countries, many years) to identify what negative net income a bank might experience in a crisis, and thus what capital buffer would be needed to prevent capital falling below a regulatory minimum.

Second, the BCBS also considered the long-term economic impact (the LEI Report) by comparing the long-run economic costs and benefits of higher capital requirements. These gave an optimal (risk-

weighted) CET1 capital ratio of up to 13% if permanent effects of a crisis were moderate and permanent.

Third, by assessing funding implicit (TBTF) subsidies for G-SIBs implied from market data, it is possible to estimate the extra capital which would be required in their absence to achieve the same funding costs.

(There is a substantial literature which attempts to estimate the TBTF funding advantage. For example an FDIC Working Paper 2014-02 estimates uninsured deposit funding advantage for $100+ bill US banks at around 40 bp). A 2021 report by the FSB concludes that reforms directed at TBTF have had desirable effects in terms of improvements in resolvability of large banks and reducing the likelihood of government bail-outs, but that there remains scope for improvement.

Regulatory Consequences for G-SIBs

Four consequences, as well as G-SIB public disclosure requirements (in addition to Basel 3 disclosures) flow from being designated a G-SIB

- Higher capital buffer requirements phased in from 2016
- Total loss absorbency capacity (TLAC) requirements from 2019
- Resolvability Requirements: group-wide resolution planning etc.
- Higher supervisory expectations (risk management etc)

In November 2015, the TLAC principles were codified in a "terms-sheet" for G-SIBs, to ensure that there is sufficient loss absorbing and recapitalisation capacity to ensure an orderly resolution and avoid tax-payer bail-outs. From January 2019 minimum TLAC must be greater than 16% of group RWA increasing to 18% by 2022. Regulatory capital buffers are additional to these requirements. The minimum TLAC is also required to exceed 6% of the Basel 3 leverage ratio denominator from 2019 and 6.75% by 2022. Regulatory capital in general counts towards meeting the minimum TLAC, subject to a number of requirements on intra-group arrangements. Eligible TLAC instruments must be contractually subordinated, junior in the statutory creditor hierarchy, or structurally subordinated, and externally issued TLAC must have a contractual trigger or statutory provision for the resolution authority to require write down or conversion to equity. It is expected that TLAC eligible debt liabilities (ie can absorb losses) and other non-regulatory capital TLAC eligible instruments will be at least 33 per cent of minimum TLAC requirement.

As well as the higher TLAC requirements, the FSB released in March 2017 "Guiding Principles" on Internal TLAC of G-SIBs (where members of a group meet TLAC requirements via obligations of other members of the group).

Australian D-SIBs.

None of the Australian banks have been designated as G-SIBs, but APRA has declared the four major banks to be D-SIBs. This initially meant an additional 1 percentage point capital requirement (CET1 and total) for them. In December 2021, APRA finalised new regulatory requirements for D-SIBs. These involve:

- An increase in Total Capital by 4.5 percentage points of RWA on 2023 levels from 2026. (This follows an interim setting of 3 percentage points required to be met by January 2024 (which banks had exceeded by 2021).
- An expectation that most of the increase would occur in the form of Tier 2 instruments, and the interim stage enabled APRA to assess the impact on market spreads of an increase in the supply of Tier 2 instruments. APRA was of the view that the impact of the new requirement would not significantly affect the pricing of Tier 2 securities and have an impact on the banks' overall cost of funding by around 5 basis points.

Figure 2 shows the planned impact on D-SIB capital requirements.

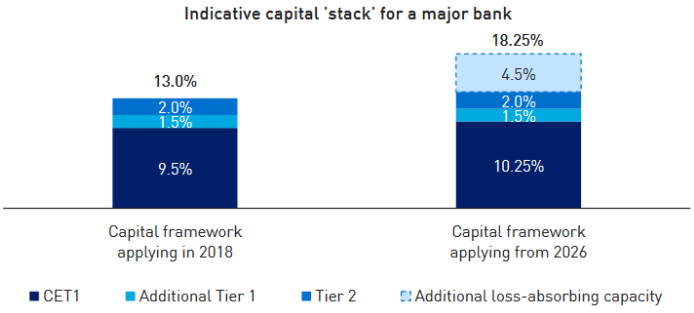

FIGURE 2 D-SIB CAPITAL REQUIREMENTS POST 2025 (APRA)

Systemically Important Insurers:

July 2013 saw the initial designation of 9 G-SIIs by FSB/IAIS.[1] However, in 2017 it was decided not to identify SIIs until the IAIS had completed work on better identification of systemic risk in the insurance sector. In 2019 the IAIS released its framework for identification of systematic risk, but consideration of whether to identify G-SIIs has been deferred to late 2022.

27.7 Central Clearing Counterparties (CCPs)

[1] At November 2016, G-SIIs were: Aegon N.V. ;Allianz SE; American International Group, Inc.; Aviva plc; Axa S.A.; MetLife, Inc.; Ping An Insurance (Group) Company of China, Ltd.; Prudential Financial, Inc.; Prudential plc.

> "Following its collapse, Lehman's uncleared derivative counterparties filed claims totalling $51billion in relation to its derivatives business. In the event, it was four years before the first payments were made…"
> "Lehman Brothers UK subsidiary had a $9 trillion cleared interest rate derivatives portfolio at LCH, comprising over 65,000 trades. In the period of extreme market turmoil following the firm's collapse, it took three weeks, rather than four years, for LCH to hedge and close out the entire $9 trillion position. It used only around a third of the collateral margin Lehman had deposited at the clearing house…" (Cunliffe, 2018)

Introduction

Following the GFC, and concerns that inter-linkages arising from OTC derivatives trading amplified the effects of financial shocks, the G20 committed to introduction of Central Clearing Counterparties for OTC derivatives. IOSCO and CPSS produced "Principles for Financial Market Infrastructures" (see here), and requirements for use in various countries reflected in national legislation such as the Dodd-Frank Act in the USA and EC decisions for the EU. (A recent description of the European CCP ecosystem can be found here).

With a CCP requirement derivatives trading can still occur OTC, but **novation** of those positions to a CCP is required. The CCPs involve trades between OTC counterparties in derivatives being novated to positions with the CCP – just as occurs with novation to the clearing house in futures exchange trading. The CCP has identical and offsetting long/short positions with the original counterparties who each now have a position with the CCP rather than the original counterparty. The CCP is perfectly hedged against market risk, provided that the counterparties fulfil their obligations, but takes on the counterparty credit risk from the possibility that the losing participant fails to meet its obligations. As with a futures exchange, this exposure will be managed by margin requirements applied by the CCP.

Some derivatives markets had already operated according to such a model (Culp (2010) gives details[2], and the introduction of CCPs for other markets has been occurring over the past decade. The FSB produced a report in late 2022 detailing progress on derivatives market reforms, including CCPs.

The objectives in requiring use of CCPs are:

- Reduce complexity of counterparty exposure relationships
- Ensure default risk managed by margining of positions by CCPs
- Reduce spillovers and "runs/flight" from dealing with individual institutions and systemic risk and disruption from resulting unwinding of positions

[2] Christopher Culp "OTC-Cleared Derivatives: Benefits, Costs, and Implications of the "Dodd-Frank Wall Street Reform and Consumer Protection Act"" *Journal of Applied Finance, 2, 2010*

Figure 3 provides an illustration of the change in exposure linkages between derivatives traders resulting from introduction of a CCP. Rather than a complex cross-participant set of counterparty linkages, a CCP will result in a "spoke and hub" structure (with the CCP at the centre) or a "core/periphery" spoke and hub structure where major bank participants have exposures to their clients but none to other banks.

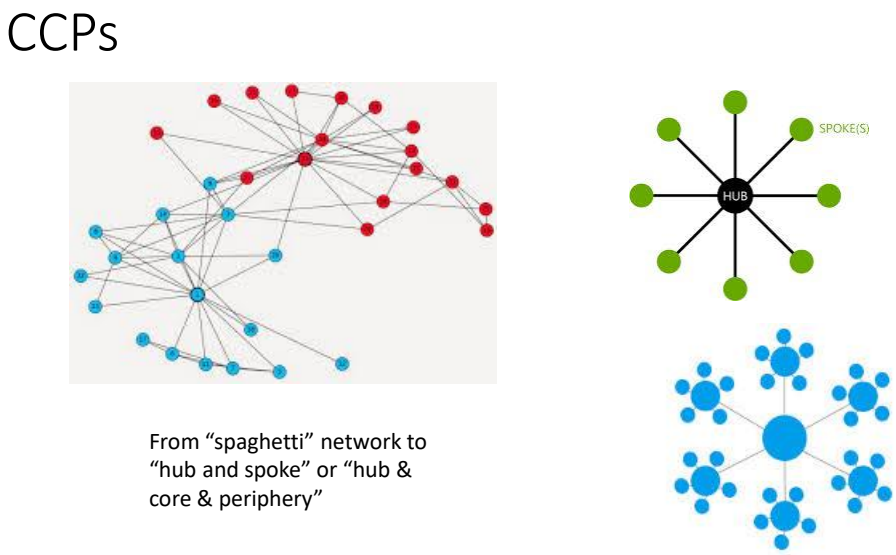

FIGURE 3: THE EFFECT OF CCPS ON EXPOSURE INTERLINKAGES OF DERIVATIVES MARKET PARTICIPANTS (SOURCE: ?)

There are a range of alternatives to CCPs which have been considered. One would be to require that derivatives markets be operated via trading on established platforms (such as occurs for equity derivatives or futures traded on an exchange), although this has not had substantial uptake. Another is mandatory Trade Reporting, whereby OTC trades are reported to a specified trade repository, which enables information on exposures of market participants to be aggregated and used.

One major complication in the establishment of CCPs is the fact that derivatives trading operates cross-border, raising the question of jurisdiction under which a CCP operates. One response to this has been national "deference" to requirements of other jurisdictions.

Australian requirements

In September 2015 mandatory CCP in Australia for OTC interest rate derivatives in AUD, USD, EU,JPY, GBP for internationally active dealers was required. This had benefits of substituted compliance (for

US/EU requirements) for Australian market participants. The authorities had preference for reliance on the market to transition to CCP for other contracts.

Licensed CCPs operating in Australia are ASX Clear (Futures), LCH.c Ltd, CME, and prescribed CCPs operating overseas are CME Clearing Europe, Eurex Clearing AG, JSCC, NASDAQ OMX Clearing AB, OTC Clearing HK.

There are perceived benefits from platform trading in some cases (consideration of mandatory obligation), which have implications for Australian Market Licence conditions including acceptance of prescribed facilities (overseas)

CCP	Jurisdiction	Total pre-funded pooled resources[(b)]	Millions
ASX Clear	Australia	ASX Clear capital:	A$250
ASX Clear (Futures)	Australia	ASX Clear (Futures) capital: Participant contributions, first tranche: ASX Clear (Futures) capital: Participant contributions, second tranche: ASX Clear (Futures) capital:	A$120 A$100 A$150 A$100 A$180
CME Inc. Base service	United States	CME Inc. capital: Participant contributions:	US$100 US$3 338
CME Inc. Interest Rate Swaps service	United States	CME Inc. capital: Participant contributions:	US$150 US$2 473
Eurex Clearing	Germany	Eurex Clearing capital: Participant contributions:	€50 ~€3 340

(Ref: Carter & Garner, RBA Bulletin, June 2015)

Australia and OTC derivatives

Trade reporting obligations were introduced Oct 2013 (Under Part 7.5A of Corporations Act, effective Jan 2013), and ASIC (2015), *Regulatory Guide 251 – Derivative Transaction Reporting*, February provides relevant information.

In September 2015 mandatory CCP use was introduced in Australia for OTC interest rate derivatives in AUD,USD, EU,JPY, GBP for internationally active dealers. This requirement applies for financial institutions which are large participants meeting certain volume thresholds and who are registered as "clearing entities" with ASIC. Most large banks have so registered.

DTCC Data Repository (Singapore), was designated as a licensed trade repository in Sept 2014

The Council of Financial Regulators examined arrangements for CCPs as part of financial market infrastructure in 2019. The CFR proposes to change the roles of the Regulators so that operational licensing and related decisions sit with the Regulators and not the Minister.

ASIC is the primary regulator for Australian market licensees (AMLs), benchmark administrator licensees (BALs) and derivative trade repository licensees (DTRLs). It co-regulates CSFLs with the RBA. All such entities are regulated under the Corporations Act 2001(Corporations Act).

Issues in CCP design, risk and regulation

There are a number of important considerations in the design of a CCP

- Separate CCPs for different assets?
- Can CCPs work well where derivatives are not standardised – what pricing models to use for margining etc?
- In which jurisdiction should CCPs be located?
- What ownership/organizational structure for CCPs?
- Mutual or Stock (now mostly stock)
- Liability of participants
- Sufficient trading to make viable (cover costs)
- Liquidity for contract close-out in member default event
- Regulation of CCP?

These are addressed in Principles for Financial Market Infrastructures, 2012 (CPSS/CPMI – IOSCO) which address

- CCP recovery tools: for continuity in stress
- CCP resolution regimes
- TLAC of CCP's – for dealing with participant default
- Transparency/disclosure of risk management etc

Risk management considerations (default waterfall) are addressed by

- Individual margin requirements – cover default by that participant (Initial and variation margins)
- Default/guarantee funds – contributed by CCP & participants
- Recovery tools – promised ex-post contributions (assessments), haircuts to variation margin gains
- (regulatory requirements on TLAC)

The CCP Failure Issue

In Sept 2018 a big default by a clearing participant at Nasdaq Clearing AB, a Swedish CCP (for power derivatives), decimated the default fund, requiring recapitalisation, and focusing attention on CCP solvency. See here for a short overview from the BIS.[3]

Figure 4 shows the effect of a participant default which gives rise to the risk management issues.

[3] Cross (RBA, 2021) examines causes of the few CCP failures to date.

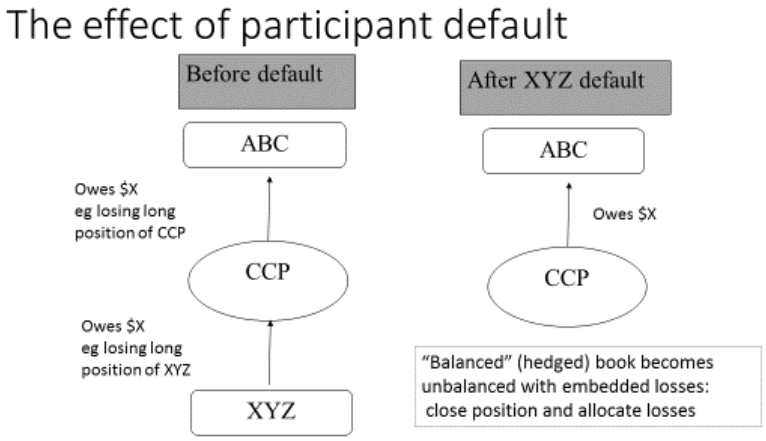

FIGURE 4: CCP PARTICIPANT DEFAULT (SOURCE : CARTER & GARNER, RBA BULLETIN, JUNE 2015))

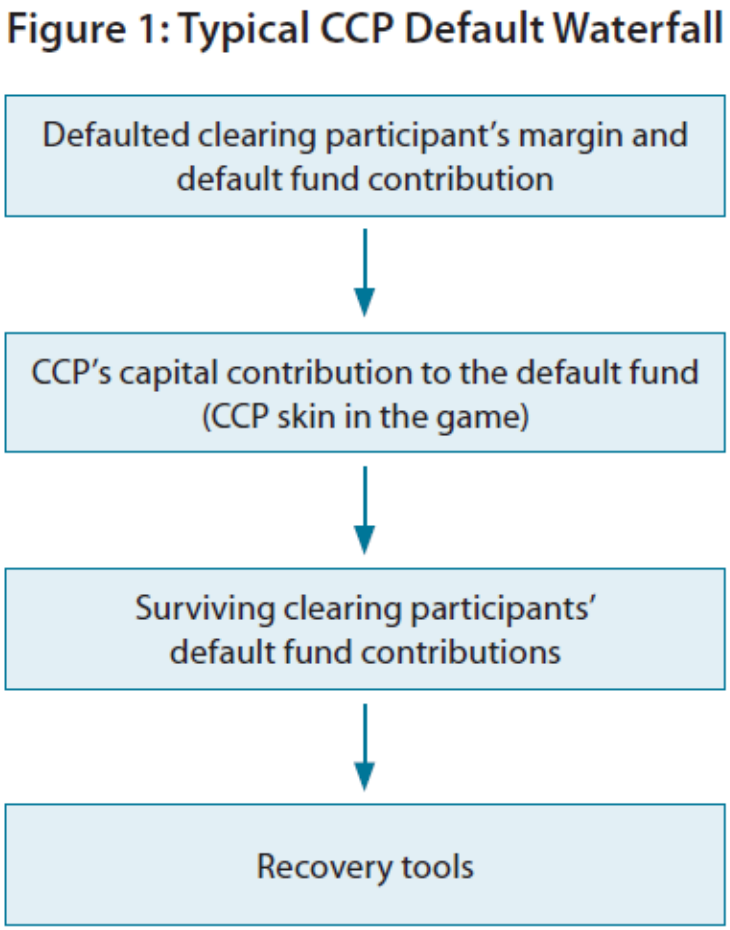

FIGURE 5: CCP DEFAULT WATERFALL ((SOURCE : CARTER & GARNER, RBA BULLETIN, JUNE 2015))

The structure of the default waterfall (Figure 5) can affect CCP and participant incentives. The EU (EMIR) – requires CCPs to contribute amount of at least 25% of regulatory capital to default waterfall (and to be used prior to participants' pooled contributions). "ASX Clear (Futures) breaks participant

contributions to the default fund into two tranches and would apply additional rounds of CCP capital after each tranche was exhausted". "ASX Clear, … does not collect participant contributions"

Figure 6 illustrates the variety of capital buffer arrangements.

CCP	Jurisdiction	Total pre-funded pooled resources[b]	Millions
ASX Clear	Australia	ASX Clear capital:	A$250
ASX Clear (Futures)	Australia	ASX Clear (Futures) capital: Participant contributions, first tranche: ASX Clear (Futures) capital: Participant contributions, second tranche: ASX Clear (Futures) capital:	A$120 A$100 A$150 A$100 A$180
CME Inc. Base service	United States	CME Inc. capital: Participant contributions:	US$100 US$3 338
CME Inc. Interest Rate Swaps service	United States	CME Inc. capital: Participant contributions:	US$150 US$2 473
Eurex Clearing	Germany	Eurex Clearing capital: Participant contributions:	€50 ~€3 340

FIGURE 6: CCP CAPITAL CONTRIBUTIONS IN DEFAULT (SOURCE: CARTER & GARNER, RBA BULLETIN, JUNE 2015)

The design of participant obligations is relevant for CCP Risk and Regulation via:

Participant Incentive Effects

- Margin requirements –own risk management and reducing incentive for strategic default
- Prefunded default fund – monitor broader CCP risk management framework, manage exposure to CCP
- Incentives depend on relative risk due to CCP own contribution requirements, share of exposure (size)

CCP Incentive Effects

- Own resource commitments – CCP risk management processes

Cross Currency Swaps and CCPs

A major issue in design of CCPs occurs when multiple jurisdiction currency contracts are involved. CCIRS used by Australian banks / securitisers, who Borrow/issue (eg) in USD and swap repayments into AUDv to "lock in" AUD cost of borrowing. Counterparties could be issuers of Kangaroo bonds etc.

Types of CCIRS (examples)

- Floating AUD to Floating USD (cross currency basis swap - most common). Includes market determined "basis spread" paid by counterparty making future non-USD interest payments which is typically positive
- Fixed AUD to Fixed USD, Fixed AUD to Floating USD, etc. These can be replicated using CCIRS plus interest rate swaps

CCIRS

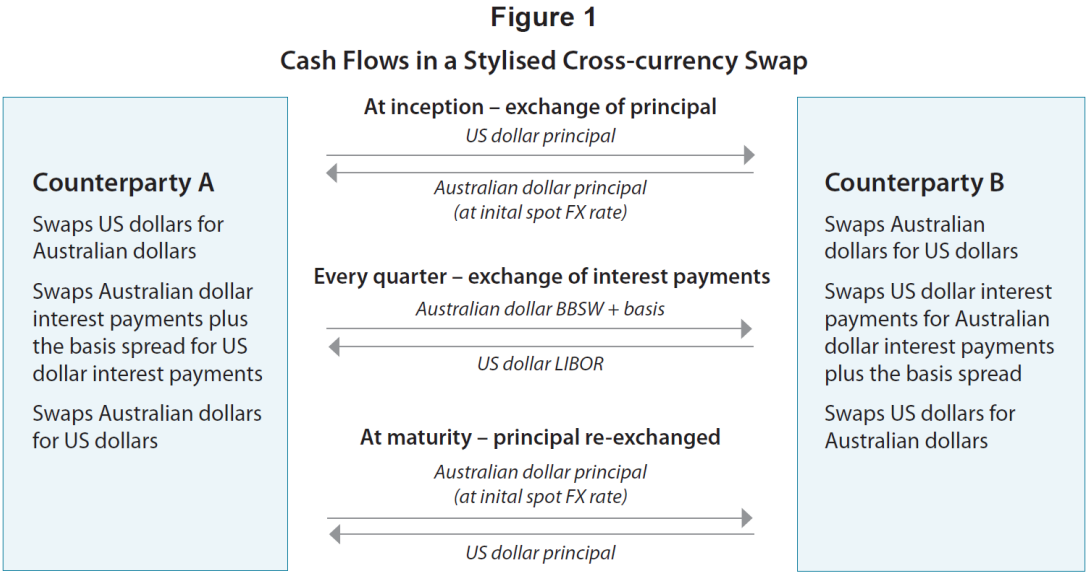

FIGURE 7: CROSS CURRENCY INTEREST RATE SWAPS (SOURCE: ARSOV ET AL 2013)

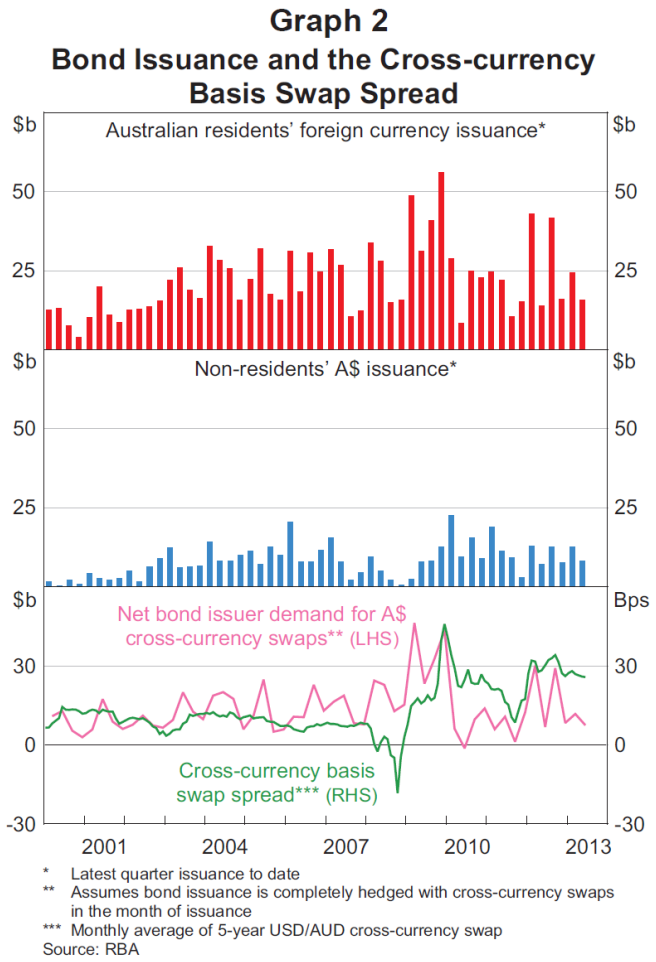

FIGURE 8: THE CROSS CURRENCY BASIS SPREAD (SOURCE: ARSOV ET AL 2013)

CCIRS Features

Counterparty default risk management

- Limited range of large counterparties (large banks)
- Collateral requirements
- Principal resets (pay principal gains/losses at each interest rate reset and final principal exchange at then spot rate)

These are deliverable contracts – ie exchange of final principal amounts etc. which creates complications for CCP relative to settlement based on notional principal. Need to link to arrangements for physical exchange of both currencies

Australian legislation enables regulators to require CCPs for OTC derivatives, but only required for domestic interest rate derivatives. Other countries have not required CCPs for FX products

Without CCPs

- Collateral requirement considerations
- Initial as well as variation margins for non-CCP positions (Working Group on Margin Requirements, Basel / IOSCO)
- Higher capital requirements for OTC – non CCP positions

- Increased cost for users??

The Duffie – Zhu analysis

Duffie and Zhu (RAPS, 2011) analyse whether the introduction of CCPs for OTC derivatives reduce netting and counterparty exposures? Not necessarily, they say – bilateral netting across multiple assets may involve greater netting than multilateral netting at individual asset level. It depends on structure of financial sector. Also relevant (Heath et al, RBA 2013) is the relative importance and structure of "core" and "periphery" institutions. The fragmentation of clearing services is the potential problem.

The Duffie and Zhu approach is captured in Figure 9 which shows that without the CCP two parties may net-off collateral requirements from trades in different markets. But a CCP for one market may limit the ability to undertake bi-lateral netting

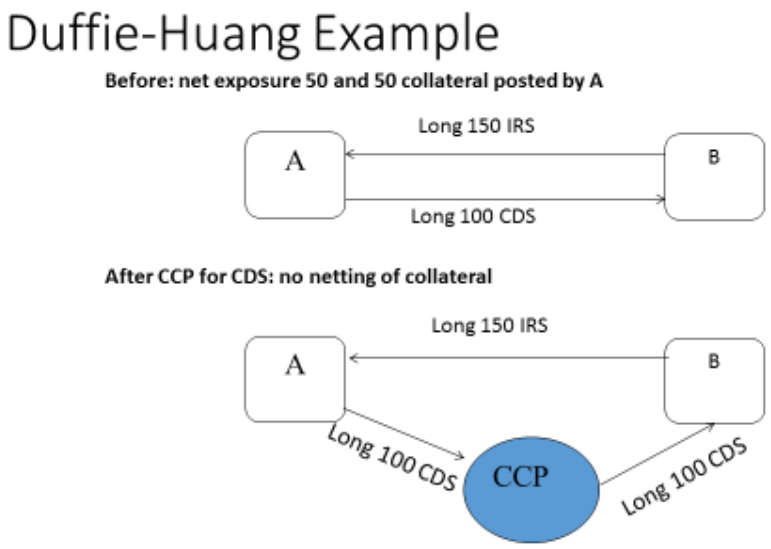

FIGURE 9: COLLATERAL AND NETTING

They note that

"introducing a CCP for a particular set of derivatives reduces average counterparty exposures if and only if the number of clearing participants is sufficiently large relative to the exposure on derivatives that continue to be bilaterally netted."

And that

"a single central clearing counterparty that clears both credit derivatives and interest-rate swaps is likely to offer significant reductions in expected counterparty exposures, even for a relatively small number of clearing participants."

Duffie and Zhu demonstrate these arguments with the following model

The Model

N market participants, can novate positions in one derivative (CDS) to CCP, others (eg IRS) remains with bilateral clearing.

K asset (derivative) classes, X^k_{ij} net amount j will owe to i on asset class "k"

This is a stochastic variable. Max(X^k_{ij}, 0) is exposure of i to j in class k. Max(-X^k_{ij}, 0) is exposure of j to i in class k.

Assume E(X^k_{ij}) = 0 and iid (normal) distributions for all k

$$\phi_{N,K} = \sum_{j \neq i} E\left[\max\left(\sum_{k=1}^{K} X_{ij}^k, 0\right)\right]$$ is Net exposure of i to all counterparties over all assets before any collateral is offered and is a measure of netting efficiency for bilateral netting

With normality and symmetry,

$$\phi_{N,K} = (N-1)\sigma\sqrt{\frac{K}{2\pi}},$$

If U is collateral per $ of exposure and c (b) are cost/benefit of collateral, average expected bilateral netting cost is $(c-b)U\phi_{N,K}$

$$\gamma_N = E\left[\max\left(\sum_{j \neq i} X_{ij}^K, 0\right)\right] = \sqrt{\frac{N-1}{2\pi}}\sigma.$$

Exposure of i to CCP introduced for class K (Ignoring any exposures from contributions to capital of CCP if others fail and CCP not fully margined)

Total exposure of i $\phi_{N,K-1} + \gamma_N$

Improvement in netting exposure if: $\gamma_N + \phi_{N,K-1} < \phi_{N,K}$

$$K < \frac{N^2}{4(N-1)}$$

γ_N could be negative, but CCP doesn't post initial collateral to members, hence overstatement of collateral gains

In this simple case (symmetric, iid)

K = 2; gains from CCP clearing for one asset class if N is 7 or more

K=4, requires N of 15 or more for gains

Their results are summarised in the following propositions extracted from their paper

Proposition 1. The introduction of a CCP for a particular class of derivatives leads to a reduction in average expected counterparty exposures if and only if

$$R > \frac{2\sqrt{N-1}}{N-2}, \quad (8)$$

where R is the ratio of the pre-CCP expected entity-to-entity exposures of the class in question to the expected entity-to-entity exposures of all other classes combined.

Proposition 2. For an arbitrary joint distribution of (X_{ij}^k), each entity's total expected counterparty exposure with $C > 1$ CCPs clearing derivative classes separately is greater than or equal to its total expected exposures with a single CCP clearing all C classes jointly.

More general specifications can allow for different variances and correlations etc

27.8 Systemic Risk

Systemic Risk has become an important topic for researchers and policy makers since the GFC. While it is intuitively apparent that the structure of a financial system can lead to interdependencies and spillovers which mean that shocks are amplified (rather than moderated) leading to crises, a precise definition is less clear. Also complicated is the issue of how to identify and measure the nature of interrelationships which could lead to crisis. A number of the policy changes considered earlier (introduction of CCPs, changes to capital requirements, special requirements for SIFIs) reflect attempts to change the structure of the financial system to increase its stability.

Haldane and May (Nature, 2011) focus on systemic risk resulting from network arrangements and refer to the recent "quest to understand the network dynamics of what might be called 'financial ecosystems'" (in contrast to the common economic/financial analysis focus on general equilibrium). In contrast to nature's ecosystems they note that government is involved in shaping the evolution (and, in reflection of the political-business interaction, refer to "survival of the fattest"). Network considerations have become increasingly relevant they argue because of the growth of intra-financial sectoral linkages. Shocks to the financial system can be propagated by counterparty failures, generalized "market liquidity" shocks due to falls in asset prices, and through "liquidity hoarding" by financial institutions. Brunnermeier (JEP, 2012) illustrates how these latter two propagation mechanisms can interact via a "margin-price spiral". Asset price falls reduce the value of

those assets as collateral, sparking margin calls or demands for more collateral, and requiring closing out of positions or price-depressing sales of other assets to acquire liquid assets to provide as collateral.

How is systematic risk measured?

One approach has been to try and "map" the financial system as a network, identifying key "nodes" and linkages. Tellez (RBA, 2013) undertakes such a task to derive an Australian Banking Network.[4] In doing so he focuses only upon large interbank exposures reported to APRA, which is about 6% of aggregate assets (and 1/3 of which was derivatives exposures). The major banks are (naturally) at the centre of the network with other Australian owned banks also significant, and with foreign owned banks and mutuals tending to be outliers with limited links to the two former groups. Only about five per cent of all possible pairs of ADIs have direct links between them, but many more are within two links of each other. A range of measures of network characteristics can be derived to identify the extent of linkages and key institutions within the network. As Tellez notes, networks can often exhibit "robust but fragile" properties such that most of the time shocks to the system are moderated, but in some case can be amplified leading to systemic problems.

Acharya et al (AER, 2012) implicitly focus upon bank capital (rather than liquidity) as being the key constraint on bank lending, and argue that systemic risk arises when the value of aggregate bank capital falls sufficiently to limit aggregate lending. In considering individual banks, this measure does not explicitly involve spillovers between banks or contagion, but focuses upon the extent to which a decline in a bank's capital value is correlated with an aggregate decline. They also use the market value of equity capital (rather than the book value favoured in regulatory models) which may be justified by the assumption that external raising of new equity capital is made difficult by the decline in equity prices (or, the unrealistic assumption that book and market values of equity are perfectly correlated via strict mark to market accounting).

Drawing on work by Engle and others at the NYU V-LAB they argue that systemic risk of a firm/bank can be measure (in real terms) as the product of: (a) real social cost per dollar of capital shortage (b) probability of a crisis (aggregate capital shortfall), (c) expected capital shortfall of the firm in a crisis. The measure of systemic risk for bank i at time t is

$SRISK_i = E_{t-1}$ (CapitalShortfall$_i$ |Crisis).

[4] Brassil and Nodari (RBA, 2018) provide a more recent analysis based on the Australian Inter Bank Overnight Cash (IBOC) market

This is only one among a wide range of systemic risk measures. Bisias et al (ARFE, 2012) provide a survey of 31 existing measures of systemic risk (and note that "regulators sometimes apply Justice Potter Stewart's definition of pornography, i.e., systemic risk may be hard to define but they know it when they see it"). They classify the measures surveyed under headings of: Network measures; Forward looking risk measures; stress test measures; cross-sectional risk measures; illiquidity and insolvency measures. Some examples include: Joint probability distribution characteristics (CoVaR); Illiquidity measures (actual v model based yields); Asset correlation measure (principal components); macro-indicators.

For policy makers, two dimensions of systemic risk appear to be particularly important. One is the *cross-sectional dimension* which is somewhat related to the network approach. It aims to identify how the structure of financial system affects responses to "shocks"? Does it amplify or moderate them? Among the relevant issues are: do institutions have similar exposures (ie the system is not diversified); are there spillover effects (liquidity issues; settlement failures etc); is there contagion risk? Macro-prudential policy measures include: CCP requirements; Activity restrictions / ring fencing / structural separation; SIFI imposts; Risk weight calibration (higher for financial sector counterparties).

In that regard, one development in recent years has been the introduction of Legal Entity Identifiers (LEIs) which is a global scheme to enable identification of entities & links. This reflects the problems which have been experienced in the GFC and other circumstances of difficulties in tracing interrelationships and potential spillover effects.

The *Time Series aspect* is more akin to the SRISK approach – how does systemic risk change over time. Policy thus focuses on preventing systemic risk build up over time, including analysis of financial-real sector interrelationships, causes of over-optimism, excessive risk-taking etc. Possible indicators include: Asset price inflation; Leverage trends; Credit growth; other historical predictors of financial crises. Macro-prudential policy measures include: asset price considerations in monetary policy; Counter-cyclical capital buffers; Loan/Valuation constraints; Dynamic loss provisioning; Margin requirement/haircut variations; Capital controls.