Counterparty credit risk: Lessons from recent events

Received (in revised form): 29th March, 2023

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Abstract This paper looks at the lessons learned for risk management from two recent events, the default of Archegos Capital Management in March 2021 and the unusually large price jumps in energy markets in summer 2022. The paper finds that the counterparty exposure from margined derivatives transactions exceeded the required initial margin significantly in both cases, so that the exposures were largely uncollateralised when it mattered. In addition, the standardised approach for counterparty credit risk (SA-CCR) resulted in regulatory capital requirements which were insufficient to cover the banks' losses from the unwinding of large and concentrated derivatives exposures. This made it difficult, even for some large banks, to identify the high loss potential of the transactions with a single client.

Keywords: *risk management, derivatives, collateral, standardised approach for counterparty credit risk (SA-CCR), initial margin, Archegos, energy markets*

COUNTERPARTY CREDIT RISK — LESSONS FROM RECENT EVENTS

Recent events such as the default of Archegos Capital Management or the spikes in energy prices in summer 2022 revealed fundamental weaknesses in banks' counterparty credit risk (CCR) management. In this paper, the lessons that can be learned from these events are discussed. After a short introduction on CCR, the default of Archegos in March 2021 is reviewed, with a particular focus on the reasons why some banks lost billions. Afterwards, the risks that banks faced as clearers of struggling energy firms in August 2022 are discussed. Although no material losses happened for banks from this case, the incident points to a high systemic risk lurking in this area. In the last part, the fact that the regulatory capital requirements for the transactions were, in both instances, insufficient is shown. The paper concludes with a summary of the main lessons learned.

COUNTERPARTY CREDIT RISK

Introduction

CCR is defined by the Bank for International Settlements (BIS) 'as the risk that the counterparty to a transaction could default before the final settlement of the transaction's cash flows'.[1] For derivatives contracts, payments or deliveries of securities are often staggered between the parties. This means that the party which has already fulfilled its part bears the risk that the other party is unable to do so when its consideration is due. The default of the counterparty leads to an economic loss for the non-defaulting party if it is entitled to a contractual

performance with a positive value, eg receiving a payment or the delivery of securities.

CCR is of bilateral nature.[2] It arises for the party for which the value of the derivative financial instrument is positive, which can alternate over time. Initially, the value of frequently traded derivatives such as swaps, futures or forwards is usually zero, since the present value of the mutual cash flows offset each other. However, subsequent movements in the underlying risk factors can shift the value of the derivatives contract in favour of one or the other party. Managing CCR therefore requires a good understanding of the dynamics followed by the value of a derivatives contract.

The value of a derivatives contract is also known as replacement value. This is because, in the case of a counterparty's default, the non-defaulting party needs to replace the defaulted contract with a new contract traded in the market at current prices, which entails a cost if the value of the cancelled contract was positive for the non-defaulting party.

The accounting treatment for derivative financial instruments is complex and depends on the features and purpose of the specific instruments, as well as the applicable accounting standards. Under international financial reporting standards (IFRS) and the USA's generally accepted accounting practices (US-GAAP), contracts with a positive replacement value are recognised on the balance sheet as assets and contracts with a negative replacement value as liabilities.

To reduce the adverse impact of a potential counterparty default, banks apply mitigation measures such as collateralisation, netting and/or settlement by a central clearing counterparty (CCP). These measures together play an important role in the management of CCR.

Collateralisation

To avoid a loss from the potential default of its trade counterparty, a party can request the other party to provide collateral in the form of cash or securities. If the counterparty is unable to perform its contractual obligations, the non-defaulting party can render itself safe by liquidating the collateral and using the proceeds to cover the losses from the defaulting exposure.

As a response to the 2007–8 financial crisis, the Basel Committee on Banking Supervision (BCBS) and the Board of International Organization of Securities Commissions (IOSCO) defined global standards for non-centrally cleared over-the-counter (OTC) derivatives in 2013.[3] These were implemented gradually over several years. Since 1st September, 2022, financial and non-financial entities in the major jurisdictions are mandatorily required to exchange initial margin and variation margin if their aggregated average notional amount (AANA) exceeds €8bn.[4]

Variation margin is due on the mark-to-market value changes of a derivatives contract. It ensures that the current exposure of a derivatives contract is covered by collateral. The daily exchange of variation margin in cash is an established feature of the OTC-derivatives market, which, *de facto*, leads to a continuous settlement of open contracts.

The initial margin is due at the inception of a derivatives contract by both parties. It provides a safety buffer against the potential losses that could arise if the counterparty defaults after a future value change of the contract.

To determine the initial margin amount, banks employ margining models. Often, these models are based on a quantitative, portfolio-based approach which estimates the magnitude of the mark-to-market change which is not exceeded at a certain confidence level over an assumed liquidation period. For example, the frequently used standard initial margin model (SIMM) developed by the International Swaps and Derivatives Association (ISDA) requires the initial margin to meet a 99 per cent confidence level over a ten-day period of risk.[5] This is consistent with the requirements specified by the BCBS.[6] As an alternative to the quantitative models, the BCBS offers additionally a standardised initial margin schedule. This simple approach can be particularly attractive for smaller market participants.

Central clearing counterparty

Central clearing requirements form a key element of the regulatory reform of the OTC derivatives market mandated by the G20 in 2009.[7] Instead of settling a trade directly between the two involved parties, a CCP is interposed. The CCP guarantees both

parties the terms of a trade, even if the counterparty of the trade defaults. This greatly reduces the CCR for the market participants.

The central clearing of trades has a long tradition on exchanges for listed derivatives. As opposed to trades in the OTC market, contract terms are standardised for exchange traded derivatives (ETD) and the exchange registers only an exchange member's net position in an ETD contract. Initial margin requirements and the daily exchange of variation margins have been well established for many years. The clearing of the trades occurs via the exchange's clearing house, which acts as a CCP. However, not all trading participants in an exchange are admitted to the clearing process. Only so-called clearing members are entitled to clear trades for their own account, for their clients or for exchange participants that are non-clearing members. To obtain a licence as a clearing member, a firm needs typically to be a regulated financial institution, to have an appropriate back-office infrastructure and be subject to a minimum capital requirement.

CASE 1: ARCHEGOS CAPITAL MANAGEMENT

Large total return swap exposures

Archegos was a hedge-fund-like family office based in New York. It managed the personal assets of its founder, Sung Kook 'Bill' Hwang. When Archegos defaulted on 26th March, 2021, Wall Street banks lost over US$10bn. As summarised by the *Guardian*,[8] Credit Suisse was most affected, with losses of US$5.4bn. Nomura lost US$2.9bn, Morgan Stanley US$0.9bn and UBS US$0.9bn. Other banks, for example Goldman Sachs, Wells Fargo and Deutsche Bank also had exposures with Archegos but lost nothing, or only marginal amounts, according to the report.

A lawsuit raised by the US Securities and Exchange Commission (SEC) in April 2022[9] against Archegos, Bill Hwang and other key personnel provides some interesting facts: From March 2020, Archegos started to rapidly expand the size of its investment portfolio. As of 31st March, 2020, Archegos had a gross exposure of around US$10.2bn and its net asset value (NAV) was approximately US$1.6bn. By 22nd March, 2021, the portfolio grew to a gross exposure of over US$160bn and the NAV inflated to approximately US$36bn. This massive growth was possible since Archegos took highly concentrated and heavily leveraged bets on a few US tech stocks and American Depository Receipts (ADRs). The SEC's legal complaint accuses Archegos and the named persons of orchestrating a fraudulent scheme and manipulating the stock market.

Since not much information on Archegos's trading strategy is publicly available, the indictment of the SEC provides an important and reliable source to collect the necessary facts to describe and substantiate what happened before and during Archegos's collapse. It should be noted, however, that Bill Hwang and Archegos dispute the SEC's allegations. In October 2022, they urged a federal judge to dismiss the civil lawsuit raised by the SEC against them, since they consider their trading strategy common market practice and entirely lawful.[10]

According to the lawsuit, the majority of Archegos's leveraged stock exposures were synthetic. Archegos arranged total return swaps with the prime brokerage units of several banks. In this structure, the banks bought the underlying shares and held them on their own balance sheets. The profit and losses were transferred to Archegos via the total return swaps. This allowed Archegos to circumvent the applicable reporting thresholds when its positions exceeded 5 per cent of an issuers' outstanding shares. As further mentioned in the SEC's complaint, Archegos gave banks false assurance regarding its portfolio concentrations and concealed the similar exposures it had with other banks. Using total return swaps, Archegos was able to hide its build-up of enormous positions, for instance more than 70 per cent of the outstanding shares of GSX Techedu, more than 60 per cent of the outstanding class A shares of Discovery and over 50 per cent of the outstanding shares of Viacom CBS, according to the SEC's findings.

Incentives for market manipulations

According to the SEC lawsuit, Archegos entered into swaps to 'artificially and dramatically drive up the prices of the underlying securities'. The variation margin payments due on the daily mark-to-market changes of the total return swaps made such

Table 1: Sensitivity of total return swap variation margin cash flows for +/– 1 per cent change in the top ten exposures held by Archegos

Underlying	Exposure size in US$bn	Cash flow in US$m (share +/– 1%)	
Viacom CBS	28.6	286	(532)
Baidu ADR	14.6	146	
Tencent Musik Entertainment ADR	10.0	100	
GSX Techedu ADR	8.5	85	(967)
Vipshop ADR	7.6	76	
Discovery Class A Share	7.5	75	
iQIYI ADR	6.3	63	
Discovery Class C Share	6.0	60	
Farfetch ADR	5.7	57	
Shopify ADR	1.9	19	

Source: Own calculations, SEC complaint launched against Archegos and key individuals on 27th April, 2022

manipulations attractive for Archegos. Increasing share prices triggered material cash payments in its favour. Archegos could use these newly generated funds to arrange additional total return swaps with other banks. This had the convenient and desired effect that the new bank's purchase of the underlying shares to hedge its swap exposure further drove up the share price and induced additional variation margin payments for Archegos on its already existing positions. In other words, Archegos created what, for a time, could appear to be a perpetuum mobile.

In the lawsuit, Archegos is alleged to have carried out manipulations and non-economic transactions that drove up the stock prices in the final 30 minutes of trading to 'mark the close' to 'enhance the end of the day pricing for margin purposes'. Archegos had strong incentives for doing this. As shown by the sensitivity matrix in Table 1, a 1 per cent increase in the share prices of Archegos's top ten holdings could trigger a variation margin payment of US$967m in its favour, based on the portfolio composition as of 22nd March, 2021, available from the SEC. The three largest positions alone — CBS Viacom, Baidu and Tencent Music Entertainment Group — were sufficient to trigger a US$532m cash flow for a 1 per cent stock price move. Since the sensitivity works also in the other direction, Archegos was allegedly bidding up prices towards the end of days with falling share prices. This helped to reduce or even avoid variation margin payments to the banks.

Collapse triggered by margin calls

According to the SEC's lawsuit, Archegos's net asset value reached its peak of US$36.2bn on Monday, 22nd March, 2021. The share price of its main holding, Viacom CBS, traded for the first time above the mark of US$100. However, after the close, Viacom CBS announced a US$3bn share issuance. After market closing, the share price dropped significantly. On Tuesday, 23rd March, 2021, the share price of Viacom CBS was down 9 per cent and on Wednesday, 24th March, 2021, it fell by another 23 per cent. With the prices of some other stocks in its portfolio also declining, Archegos's net asset value fell to US$16.9bn on 24th March, 2021, down 53 per cent within two days.

As mentioned in the SEC's claim, Archegos had virtually exhausted its cash reserves when the market opened on 24th March, 2021. After further share price declines on that day, Archegos had to inform its counterparties in the evening that it was unable to meet anticipated margin calls of US$10.7bn the next day, according to the complaint.

Liquidation of hedge positions

The default of a counterparty breaks the hedge relationship between a derivatives contract and the underlying asset. A bank needs, therefore to terminate the contract and to liquidate its hedge

positions when the default of the counterparty becomes imminent.

The hedge relationship between the total return swaps and the underlying share was intact up to and including 23rd March, 2021. According to the SEC lawsuit, Archegos was able to meet the banks' margin calls for that day on the following day, albeit with some difficulties. However, Archegos could not meet the margin calls for the large share price declines on 24th March, 2021. After this became evident towards the end of the next day, a few banks started to sell the shares they held as hedge positions on their books. As reported by the media, some of the banks executed block trades with selected clients late Thursday, 25th March, 2021.[11] The remaining banks started to offload their shares in a fire sale on 26th March, 2021, after the default of Archegos was inevitable. This caused massive share price drops and triggered a debate over the legitimacy of the previous day's block trades. Plaintive investors claim that the banks used their insider knowledge of Archegos's imminent collapse to get rid of their exposures and to avoid their own losses, leading the SEC and the Justice Department to investigate the large share sales by Morgan Stanley, Goldman Sachs and other Wall Street firms, according to media reports and some of the involved firms.[12,13]

In the Archegos default, the fact that several banks had total return swap exposures in the same stocks played an important role. As will be shown by the following analysis, the exposure size and the speed at which a bank could sell the hedge position in the underlying shares were crucial factors. The analysis simulates the liquidation of a hypothetical position in the shares of Viacom CBS for different exposure sizes, starting at different points in time and assuming a different speed of the stock sales. Viacom CBS is used in this analysis, as it was the stock in which Archegos had the largest exposure. As of 22nd March, 2021, Archegos held 286m shares (cash equity and swaps) of Viacom CBS, worth US$28.6bn.[14]

Since some banks started to offload shares during late trading hours on the day prior to Archegos's default, 25th March, 2021, 3pm EST is used as the first starting point (SP1) in the analysis. The starting point includes the last trading hour, in which trading volumes are generally higher than in the hours before. Additional starting points are 26th March, 2021, 9am EST (SP2), 26th March, 2021, 12pm EST (SP3) and 26th March, 2021, 3pm EST (SP4), since most banks started their unwinding activities on that day. As is shown in Figure 1, the share price showed a rapidly declining trend and elevated trading volumes during this period. From Monday, 29th March, 2021 the situation started to stabilise.

The exposure sizes of the individual banks are unknown. Given that Archegos had around a dozen total return swap counterparties,[15] the assumed exposure sizes of US$1bn, US$2bn and US$3bn in Viacom CBS appear to be in a realistic range. It is also not known at which speed the banks could liquidate their exposures without causing a material impact on the underlying share prices. Archegos assumed, for their own analyses, that it could trade between 10 per cent and 20 per cent of a stock's average daily trading volume without a price impact if it had to sell its exposures.[16] Given that several banks unwound their positions concurrently on 26th March, 2021, the price impact on the shares was large in the aggregate. At the same time, trading volumes were a multiple of the volumes on a normal day, so that the incremental price impact of an individual bank's transaction was likely to have been less than usual. Since it is unknown at which percentage of the hourly trading volume a bank could trade without an incremental price impact, the simulation assumes that an individual bank could sell either 10 per cent, 15 per cent or 20 per cent of the hourly trading volume without a price impact that goes beyond the share price decline that was observed when the banks concurrently liquidated their hedge positions. The price at which the shares could have been sold is, therefore, assumed to be the volume-weighted average price (VWAP). Following a simple approach often used by practitioners, the VWAP is calculated for time buckets of one hour each based on the formula (high + low + close)/3. Since the number of shares traded in each time bucket is known, the chosen approach results in a realistically approximated average price at which a bank could have sold its Viacom CBS share exposure.

The results of the simulation are provided in Table 2. First, selling late was always disadvantageous. Regardless of exposure size and liquidation speed, a

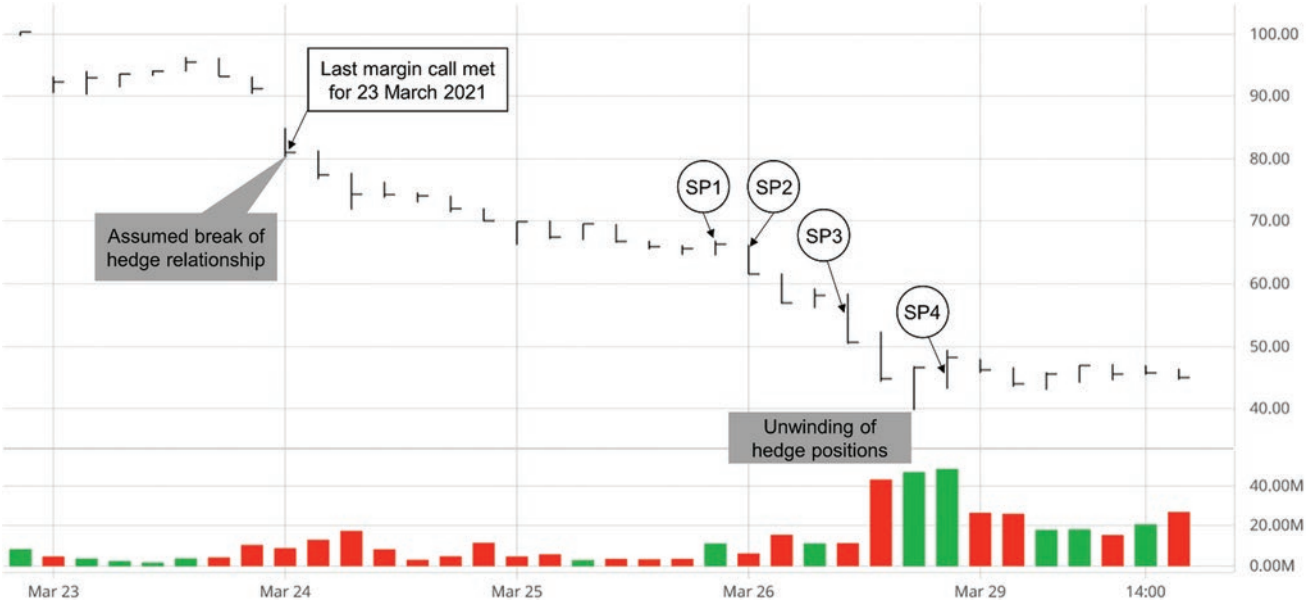

Figure 1: Viacom CBS share price and trading volume. The hedge relationship between the total return swaps and the underlying shares broke after Archegos was unable to meet the banks' margin calls on 24th March, 2021. The banks are assumed to have started to sell their share positions between 25th March, 2021, 3pm (SP1) and 26th March, 2021, 3pm (SP4)
Sources: www.barchart.com

Table 2: Liquidation losses from unwinding of hedge positions in Viacom CBS shares starting at different points in time, assuming no incremental price impact

Exposure size	Trading volume	SP1	SP2	SP3	SP4
		25th March 3pm	26th March 9am	26th March 12pm	26th March 3pm
US$1bn	10%	–40.9%	–43.5%	–48.9%	–49.2%
	15%	–37.1%	–40.6%	–47.7%	–48.6%
	20%	–34.2%	–38.0%	–46.8%	–48.5%
US$2bn	10%	–45.4%	–46.6%	–49.1%	–49.6%
	15%	–43.5%	–45.5%	–48.9%	–49.5%
	20%	–40.9%	–43.5%	–48.9%	–49.2%
US$3bn	10%	–46.9%	–47.7%	–49.4%	–49.4%
	15%	–45.4%	–46.6%	–49.1%	–49.6%
	20%	–44.3%	–45.9%	–48.8%	–49.5%

Source: Own calculations, intraday share price data for 25th March, 2021–30th March, 2021 from www.barchart.com

bank that started its liquidation on the last starting point (SP4) on 26th March, 2021, 3pm EST, incurred an unwinding loss of 48.5–49.6 per cent, assuming no incremental price impact. By contrast, starting with the liquidation at the first starting point (SP1) on 25th March, 2021, 3pm EST was always better than starting on SP2, SP3 or SP4. This is because the share price showed a rapidly declining trend over several days. Secondly, smaller exposures were generally more advantageous. For instance, unwinding an exposure of US$1bn on SP1 would result in a loss of 34.2 per cent if 20 per cent of the stock trading volume could be traded by hour, compared to 40.9 per cent if the exposure size is

US$2bn and 44.3 per cent if the exposure size is US$3bn, assuming no incremental price impact. The pattern remains generally unchanged if later starting points or a lower liquidation speed are assumed. Thirdly, the liquidation speed is decisive likewise, especially if the exposure size is small. For instance, liquidating an exposure of US$1bn would result in a liquidation loss of 34.2 per cent if the liquidation starts on SP1 and if 20 per cent of the trading volume could be traded by hour, compared to 40.9 per cent if only 10 per cent of the trading volume could be traded by hour, assuming no incremental price impact. This result is driven by the fact that, for a small exposure size and a high liquidation speed, a relatively high proportion of the exposure could be sold in early periods when the prices were still higher than in subsequent periods. For higher exposure sizes and/or later starting points, the advantage of a high liquidation speed vanishes.

Insufficient initial margin

To collateralise the total return swap exposures, Archegos had to place initial margin with its counterparties. When Archegos defaulted on the variation margin calls, the banks could use the initial margin to indemnify themselves for the losses from the closeout of the total return swaps.

It appears that the banks requested from Archegos very different margin amounts. The SEC's complaint mentions leverages between 400 per cent and 700 per cent, but sometimes up to 1000 per cent.[17] This implies margin rates of approximately 10–25 per cent. For one bank, it is known from an independent investigation report mandated by its board of directors that Archegos negotiated a standard initial margin rate of 7.5 per cent.[18] In the specific case, the agreed margin was static, which means that the margin was not adjusted after the underlying share price significantly rallied so that the effective initial margin fell below even 7.5 per cent.

Table 3 shows a simulation of the losses that an individual bank was to incur from the unwinding of the hedge positions in Viacom CBS shares under the different scenarios used before. Different to Table 2, the losses also include the offset provided by the initial margin, based on three distinct margin rate scenarios. Panel A assumes an initial margin of 25 per cent, reflecting the upper bound of margin levels mentioned in the SEC's claim. Panel B assumes an initial margin of 10 per cent, reflecting the lower bound of margin levels. Lastly, Panel C assumes an initial margin of 7.5 per cent as applied by a bank who followed a particularly accommodative margin policy with Archegos. The losses under the 25 per cent initial margin scenario in Panel A range from approximately 9 per cent–25 per cent. Since the effect of the initial margin is additive, the conclusions from the previous subsection remain valid. The losses are the smaller, the lower the exposure, the higher the liquidation speed and the earlier the liquidation started. The losses for the 10 per cent initial margin scenario in Panel B range from approximately 24 per cent–40 per cent and they are on average 1.75 times higher than for the 25 per cent margin scenario. The losses for the 7.5 per cent initial margin scenario in Panel C range from approximately 27 per cent–42 per cent and they are on average 1.88 times higher than for the 25 per cent margin scenario.

The example demonstrates that the initial margin levels demanded from Archegos were insufficient given the large size of the transactions and the artificially inflated stock prices. Not all banks were well prepared to swiftly execute the unwinding of their hedge positions. At least for one bank (a G-SIB) it is known that its senior management and board of directors were unaware of their multi-billion engagement with a single client.[19] Banks may need to expend greater efforts to identify and limit large potential counterparty exposures from derivatives transactions and to detect fraudulent schemes that can result in a collapse of stock prices.

CASE 2: CLEARING RISKS IN ENERGY CRISIS

Spike in energy prices

Commodity markets are notorious for their high volatility and abrupt price jumps not seen in other asset classes. In 2021, the prices for natural gas saw some large jumps. During the year, prices more than doubled. Russia's invasion of Ukraine in February 2022 drove up the prices for natural gas to levels not observed for more than a decade. As shown in

Table 3: Losses from counterparty default on Viacom CBS total return swaps for different levels of initial margin (losses in percentage of notional amount)

Initial margin	Exposure size	Trading volume	SP1	SP2	SP3	SP4
			25th March 3pm	26th March 9am	26th March 12pm	26th March 3pm
Panel A						
25.00%		10%	–15.9%	–18.5%	–23.9%	–24.2%
	US$1bn	15%	–12.1%	–15.6%	–22.7%	–23.6%
		20%	–9.2%	–13.0%	–21.8%	–23.5%
		10%	–20.4%	–21.6%	–24.1%	–24.6%
	US$2bn	15%	–18.5%	–20.5%	–23.9%	–24.5%
		20%	–15.9%	–18.5%	–23.9%	–24.2%
		10%	–21.9%	–22.7%	–24.4%	–24.4%
	US$3bn	15%	–20.4%	–21.6%	–24.1%	–24.6%
		20%	–19.3%	–20.9%	–23.8%	–24.5%
Panel B						
10.00%		10%	–30.9%	–33.5%	–38.9%	–39.2%
	US$1bn	15%	–27.1%	–30.6%	–37.7%	–38.6%
		20%	–24.2%	–28.0%	–36.8%	–38.5%
		10%	–35.4%	–36.6%	–39.1%	–39.6%
	US$2bn	15%	–33.5%	–35.5%	–38.9%	–39.5%
		20%	–30.9%	–33.5%	–38.9%	–39.2%
		10%	–36.9%	–37.7%	–39.4%	–39.4%
	US$3bn	15%	–35.4%	–36.6%	–39.1%	–39.6%
		20%	–34.3%	–35.9%	–38.8%	–39.5%
Panel C						
7.50%		10%	–33.4%	–36.0%	–41.4%	–41.7%
	US$1bn	15%	–29.6%	–33.1%	–40.2%	–41.1%
		20%	–26.7%	–30.5%	–39.3%	–41.0%
		10%	–37.9%	–39.1%	–41.6%	–42.1%
	US$2bn	15%	–36.0%	–38.0%	–41.4%	–42.0%
		20%	–33.4%	–36.0%	–41.4%	–41.7%
		10%	–39.4%	–40.2%	–41.9%	–41.9%
	US$3bn	15%	–37.9%	–39.1%	–41.6%	–42.1%
		20%	–36.8%	–38.4%	–41.3%	–42.0%

Source: Own calculations, intraday share price data for 25th March, 2021–30th March, 2021 from www.barchart.com

Figure 2, power prices increased likewise. In August 2022, the significant capacity reduction and subsequent shutdown of the Nord Stream 1 pipeline triggered a massive price explosion in continental European power prices.[20] After the prices had already doubled from their long-term average of around €50/MWh to over €100/MWh at the end of 2021, the prices skyrocketed at the end of August 2022. Within only a few trading days, the futures contracts for German Baseload Power spiked to over

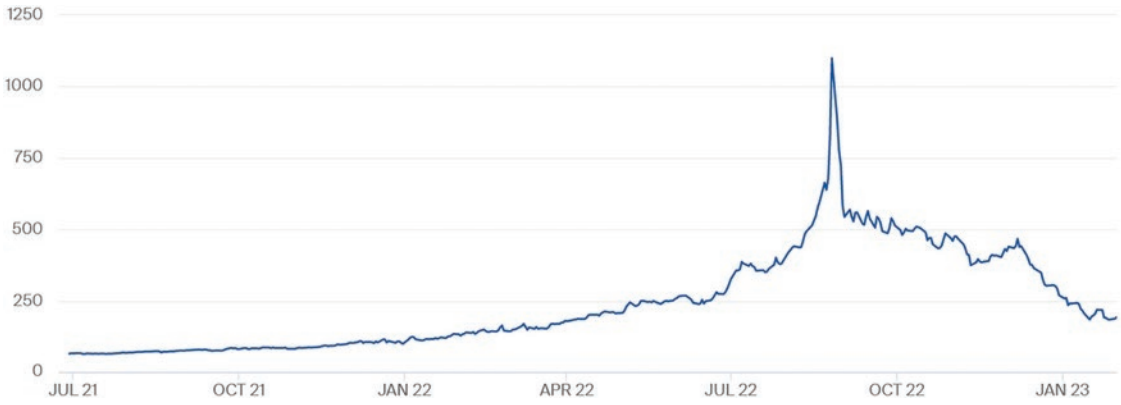

Figure 2: Price of ICE Endex German Baseload Power futures (Q423) in €/MWh, July 2021–January 2023
Source: www.ice.com

€1000/MWh, more than twentyfold of their long-term average price.

Liquidity challenges for energy firms

Energy firms are frequent users of derivatives. For instance, electricity suppliers can hedge their future power purchases by buying futures or forwards. Similarly, energy producers can use futures or forwards to hedge the purchase of their input factors (eg gas, oil, coal) or their revenues from the sale of their future power production. As opposed to trading firms, so called non-financial entities (NFE) are often either naturally long or naturally short and their positions in the respective contracts can be huge. Since they hold the derivatives for the purpose of hedging, their net market risk exposure is typically not very large.

The use of exchange traded derivatives to hedge long-term obligations can, however, be tricky. As shown by the example of Metallgesellschaft AG in the early 1990s, corporates can underestimate the liquidity needs arising from margin requirements on open derivatives contracts if the price of the underlying instruments moves persistently in the wrong direction. This is because the cash outflows on the derivatives contracts occur today, while the offsetting cash inflows arise in future years.

In August and September 2022, several energy firms needed state aid since they faced severe liquidity challenges. First, Uniper in Germany and Wien Energie in Austria had to ask for emergency government support, since rapidly rising prices for gas and power endangered their operations.[21] Only a few days later, Finland's Fortrum and Switzerland's Axpo had to arrange credit lines with their governments of €2.35bn and CHF4bn, respectively.[22] Both power producers faced difficulties to meet the large margin calls to maintain their hedge positions in power derivatives. Last, the Bank of England had to establish a £40bn bailout fund to help struggling energy firms.[23]

Huge margin shortfalls

The magnitude of the margin calls triggered by the spiking energy prices in late summer 2022 is unknown, but is probably huge. Norway's energy firm Equinor estimated, in September 2022, that the margin calls for continental European power firms exceeded US$1.5tn.[24] Consultancy firm Orbit36 looked at certain futures contracts for German Baseload Power and identified a €140bn margin shortfall when energy prices spiked on 26th August, 2022, according to the *Wall Street Journal*.[25] The approximately €60bn initial margin required as collateral was not sufficient to cover the €200bn variation margin due by the sellers at the end of that day.

Complex liability chains

Large energy firms are often trading participants at exchanges for energy derivatives such as the European Energy Exchange (EEX), Intercontinental Exchange (ICE) or Nasdaq OMX. This means that

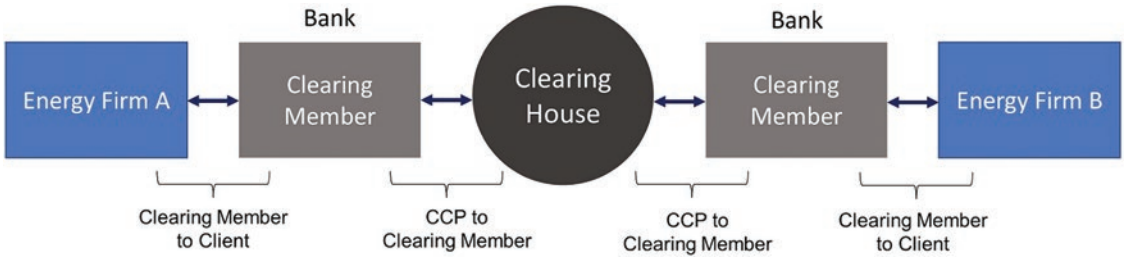

Figure 3: Liability chain created by ETD transaction between energy firm A and energy firm B
Source: Own illustration based on BCBS CRE 54

they can execute their trades directly on the exchange trading system, without the involvement of a bank or broker. However, energy firms are, in most cases, not clearing members. Therefore, they need to rely on a bank that acts as clearer for their trades.

ETD contracts are legally complex. There can be long liability chains. For instance, if energy firm A executes on the exchange platform a trade with energy firm B, this creates a series of bilateral contracts. This is illustrated in Figure 3. First, the trade creates a contract between energy firm A's clearing member and the clearing house. An identical contract is created between the clearing house and the clearer of energy firm B. In the Basel framework;[26] these contracts between the clearing members and the clearing house are named CCP-to-clearing member leg. Second, the trade creates bilateral contracts between energy firm A and its clearing member, as well as between energy firm B and its clearing member. These contracts are the so-called clearing member-to-client leg.

ETD transactions undergo daily mark-to-market valuation. Gains or losses are continually settled by variation margin payments in cash. The margin payments occur between the clearing members and the clearing house, but also between the clearing members and their clients. Initial margin requirements ensure that all parties can fulfil their contractual obligations.

Risks for banks as clearers

In the following, the implications from the potential default of an energy firm client on the banks who act as the firm's clearers are discussed. Banks acting as clearing members for their clients face the risk that they need to step in if the clients are unable to meet margin calls on their ETD transactions. The potential default of a clearing member or the clearing house is beyond the scope of this paper.

First, it is important to note that clearing members are typically obliged to apply to their clients' margin requirements which are at least as strict as their own. A bank can, however, demand from a client a higher margin requirement, albeit this is not general market practice for institutional or corporate clients. In spite of these margin requirements, banks acting as clearers are exposed to the risk that they may need to fulfil a margin call instead of a defaulting client. This risk is elevated in those situations where clients have large ETD positions to hedge their natural long or short exposures.

When energy prices skyrocketed on 26th August, 2022, the banks that acted as clearers for energy firms which had huge short exposures in power futures had to post several billions of margins to clearing houses. As mentioned above, alone the variation margin due on certain futures contracts for German Baseload Power traded at EEX was in the magnitude of €200bn on that day.[27] Typically, the margin due by a clearing member to the clearing house is settled on the following business day. How the clients settle their margin balances with the clearing members is subject to bilateral agreements. In practice, the banks may sometimes need to advance their clients' margin payments for a short period of time. This means that the clearers face a temporary counterparty credit risk versus their clients. While this normally can be handled smoothly, the situation in August 2022 was critical. The banks that acted as clearers for struggling energy

firms may have temporarily had billions at risk, although no specific case became public. In a report published in November 2022, the European Central Bank (ECB) highlights the risks of energy sector firms' use of derivatives.[28] The ECB is specifically concerned on the step-in liquidity risk faced by the few banks that act as clearers for ETD energy derivatives if their clients are unable to meet margin calls. The issue is aggravated by the fact that, at the end of August 2022, four banks were directing approximately 85 per cent of the volume in exchange traded commodities to CCPs, according to the ECB's report.

It is important that banks closely monitor the risks they face from potential margin calls on large positions held by their clients. Albeit they do not own these positions themselves, they are liable in their role as clearers for potentially unmet margin calls of their clients versus the exchange. This risk is particularly high in those instances where the banks' clients face margin calls on large derivatives positions used to hedge revenues which occur in the distant future. As shown during the extraordinary market situation in summer 2022, energy firm clients with one-sided derivatives exposures from their long-term hedging programmes faced severe liquidity problems which they might not have survived without governmental support.

DEFICIENCIES IN CAPITAL REGULATION

Shortcomings in SA-CCR

As highlighted by the cases discussed above, abrupt price changes in the underlying instruments can create unexpectedly large counterparty exposures on derivatives contracts. The initial margin in both cases turned out to be insufficient to collateralise the temporary exposures. While such shortfalls can occasionally occur, the margin deficits were large and a multiple of the initial margin amount. It is, therefore, crucial that banks hold sufficient regulatory capital to absorb the potential losses from the default of a counterparty.

The regulatory capital requirements for banks apply to their aggregated exposures, measured based on risk-weighted assets (RWA) and leverage exposure. It is crucial that the capital requirements lead to sufficient coverage of a bank's overall risk. It is well understood that capital requirements can only provide safety to a certain degree, for example at a confidence level of 99.90 per cent, and that the soundness of risk models can vary across risk types. This means that risks could be underestimated in some areas and overestimated in other areas. Observing events in which capital requirements are insufficient for certain transactions cannot, therefore, be seen as an indication that the capital framework is flawed overall. Nonetheless, it is important for banks and regulators to identify situations in which the regulatory capital requirements could possibly be underestimated. Pillar 2 of the Basel framework explicitly expects banks to have sound internal processes in place and to use appropriate risk management techniques to support their businesses.[29] In a recent 'Dear CEO letter', the UK Prudential Regulation Authority emphasised the need for banks to improve on counterparty risk management and to better understand *ex ante* risks across a wide range of situations.[30] For this reason, the regulatory capital requirements that were applied to the CCR exposures in the previously discussed cases are evaluated in the following.

The calculation of the RWA-based capital requirement for counterparty exposures on derivatives transactions is made under the SA-CCR.[31] In a first step, the banks compute the exposure at default (EAD). It consists of the sum of a contract's replacement cost (RC) and potential future exposure (PFE), multiplied by a factor of 1.4 (Alpha). Margin posted as collateral is considered. In a second step, the EAD is multiplied by the counterparty's risk weight either under the SA[32] or the probability of default (PD) under the internal ratings-based approach (IRB).[33]

CCR RWA for Archegos transactions

Table 4 shows the PFE, RWA and regulatory capital requirements which result for the hypothetical total return swap exposures on Viacom CBS shares used in the illustrative example before (exposures normalised to US$100). The computations assume that the trades are subject to daily margining, using different initial margin levels. Further, for simplicity it is assumed that the swap transaction is the client's

Table 4: PFE, RWA and Basel III total capital requirement

Total return swap on equity underlying with BB-rated corporate counterparty	Initial margin		
	25%	10%	7.5%
PFE (in US$)	2.4	5.5	6.4
RWA (in US$)	5.1	11.7	13.4
Basel III total capital (in % of notional)	0.61%	1.40%	1.61%

Total capital requirement for total return swap with normalised exposure of US$100. Own calculations based on SA-CCR and SA for credit risk

sole exposure with the bank, so that no netting with other exposures is possible. This results in PFE from US$2.4 to US$6.4. For the client, a counterparty rating of BB or below is assumed. This leads to RWA ranging from US$5.1 for the 25 per cent initial margin level to US$13.4 for the 7.5 per cent initial margin level, respectively. Given the risk of the transaction, implied risk weights between 5 per cent and 13 per cent seem very low.

To determine the regulatory capital requirement, the above RWA are multiplied by the risk-based capital requirements for global systemically important banks (G-SIBs). Under Basel III, the total capital of a bank needs to be 10.5 per cent of RWA.[34] G-SIBs must hold an additional capital buffer of between 1 per cent and 3.5 per cent, depending on the bank's allocated bucket.[35] Since the banks involved in the Archegos failure are predominately in the 1.5 per cent G-SIB bucket or below, the total capital requirement used for the analysis is 12 per cent of RWA. This implies that the banks had to hold between 0.61 per cent and 1.61 per cent of total capital on the swaps' notional amount.

As shown in Figure 4, regulatory capital provides only a very thin additional cushion to absorb losses that go beyond the level covered by the initial margin. The liquidation of the hedge position in Viacom CBS shares resulted in an estimated execution price (based on VWAP) between 34.2 per cent and 49.6 per cent below the price of the shares at the time the hedge relationship broke (for the simulation results, see Table 1). This not only exceeded the initial margin amount, but also the regulatory capital the banks required to underpin the risks of the transactions.

The reasons for the insufficient regulatory capital requirements under SA-CCR are as follows. First, the potential exposure was underestimated in the Archegos failure. The concurrent position liquidations by several banks caused a price drop in the underlying shares, which resulted in uncovered exposures of up to 42 per cent of a swap's notional amount. Secondly, the use of an identical supervisory factor for all equity underlying does not consider differences in volatility and market liquidity. This results in a PFE that is only a fraction of the simulated exposure. Thirdly, the application of a counterparty specific risk weight or IRB PD does not consider the material wrong-way risk associated with the large and concentrated derivatives exposures. In particular, hedge fund or family office clients are more likely to default in situations where the exposure is high and after unusually large market movements not sufficiently covered by collateral. Or, put differently, counterparty exposure size and PDs are positively correlated.

The low CCR RWA for synthetic financing structures highlighted by the Archegos example can make it difficult for a bank's senior management and board of directors to detect and understand the potentially large and uncollateralised future credit exposure to a single counterparty. The case showed that this can even be an issue for G-SIBs. The use of counterparty exposure stress tests can provide a helpful tool to identify and mitigate such risks.

RWA for clearing exposures with clients

As mentioned, ETD transactions lead to a series of bilateral contracts between the trading parties, their banks and the CCP. Regulatory capital requirements apply on all legs of a transaction involving a bank. Suppose that an energy firm, eg a power generator, hedges its future power production by a short position in futures contracts on German Baseload

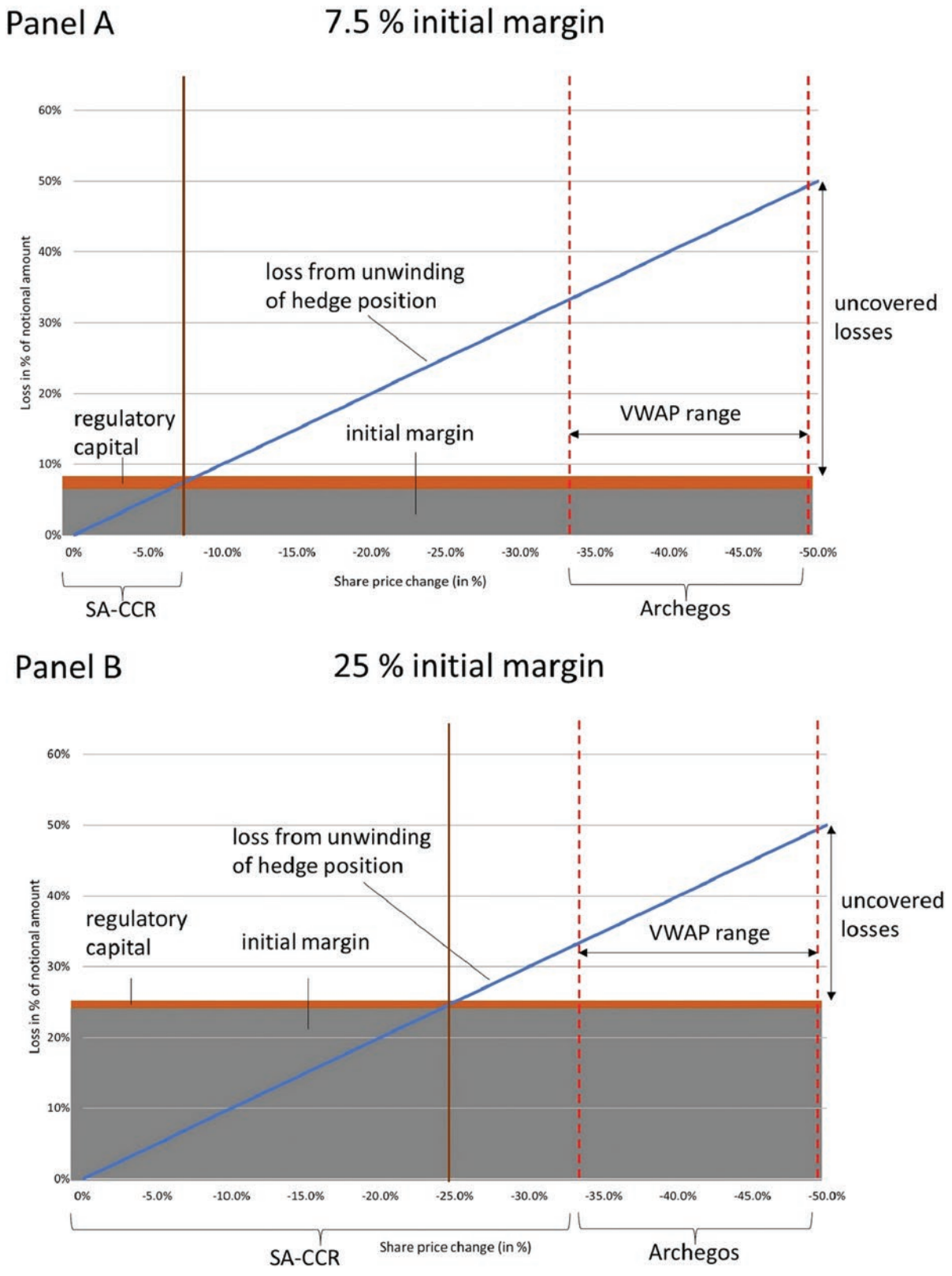

Figure 4: Losses from unwinding of hedge positions in Viacom CBS shares insufficiently covered by initial margin and regulatory capital (Basel III Total capital). Panel A shows the situation for an initial margin level of 7.5 per cent, Panel B for an initial margin level of 25 per cent

Table 5: Potential future exposure, RWA and Basel III total capital requirement for EEX German Baseload Power futures contract (Cal23) on clearing member-to-client leg

	Initial margin	
EEX German Baseload Power futures (Cal23) cleared for BBB-rated corporate client	8.5%	ECC initial margin requirement as of 25th August, 2022
Potential future exposure (in US$)	5.0	
Risk-weighted assets (in US$)	5.2	
Basel III total capital (in % of notional)	0.62%	

Own calculations based on SA-CCR and SA for credit risk

Power traded at EEX. The clearing of the energy firm's trades occurs through a bank that is admitted as clearing member at European Commodity Clearing (ECC), the central clearing house for transactions at EEX. The power futures trades create two legs for the bank, which are subject to the following capital requirements specified by the BCBS:[36] the CCP-to-clearing member leg needs to be risk weighted with 2 per cent if the bank guarantees the trade in the event that the CCP defaults; the clearing member-to-client leg is treated as a bilateral contract between the bank and the client, following the same rules as OTC derivatives contracts under SA-CCR.

Table 5 shows the RWA, PFE and regulatory capital requirements that result for the clearing member-to-client leg of an EEX German Baseload Power futures contract for the calendar year 2023 (Cal23) under SA-CCR, assuming a hypothetical trade conducted on 25th August, 2022, the day before the price for the contract spiked by 31.6 per cent. The initial margin required by EEX on that day was approximately 8.5 per cent of the contract's notional amount (€509,560 per contract[37]), which is considered in the calculation. The resulting CCR RWA for a normalised exposure of US$100 is US$5.2 if a BBB rated corporate is assumed as the bank's counterparty, for which a 75 per cent risk weight applies under the SA.[38] The CCR RWA translates into a total capital requirement of 0.62 per cent of the contract's notional amount. The PFE for the normalised exposure amount is US$5.0. This contrasts with an effective normalised exposure of around US$23 temporarily observed on that day (31.6 per cent price move net of 8.5 per cent initial margin). Hence, the PFE was underestimated by a factor of over 4.5 times under SA-CCR.

The reasons for the low need of regulatory capital are similar to those given before. The PFE is materially underestimated under SA-CCR. The price spike of the power futures contract observed on 26th August, 2022 was a multiple of the move implicitly assumed by the supervisory factor for commodities in the PFE calculation. Although no energy firm defaulted on the large margin calls on that day, the government schemes hastily arranged in the following days suggest that the wrong-way risk for the banks' clearing activities could be material. This is particularly the case if the banks' clients have large one-sided exposures in derivatives contracts, even if they arise from non-speculative transactions.

Counterparty exposures resulting from banks' clearing activities in ETD contracts are difficult to detect from traditional risk reports. Similar to the total return swap exposures with Archegos, low CCR RWA do not indicate the high loss potential that arises if a bank's clients are unable to meet large margin calls on ETD trades and if the bank needs to step in instead.

LESSONS LEARNED AND RECOMMENDATIONS

The insights from the two events discussed in this paper are as follows.

1. Unexpectedly large moves in the underlying risk factors can lead to a counterparty exposure on derivatives transactions that is significantly higher than predicted by commonly used models. The

daily exchange of margin can give banks and regulators a false sense of safety.
2. Banks acting as clearing members on commodity and energy exchanges face the risk that they need to step in if their clients are unable to meet margin calls on ETD transactions. This risk is elevated for clients that hold large and one-sided positions in ETD contracts to hedge their natural exposures.
3. Exposure size and default probabilities are positively correlated for large and concentrated derivatives exposures. This material wrong-way risk is not considered in the RWA calculations under SA-CCR. Particularly for speculatively oriented clients such as hedge funds or family offices, the likelihood of default is increased in situations where the exposure is large.
4. The regulatory capital required to underpin CCR on derivatives transactions is insufficient. In those cases where the initial margin could not cover the losses from the close out of the positions, the shortfall was a multiple of the regulatory capital available to absorb the losses. It is important that banks and regulators are aware of this gap and consider mitigation measures.
5. The low CCR RWA and capital requirements for ETD and margined OTC derivatives transactions can make it difficult for the senior management and the board of directors to identify large and potentially devasting exposures. The Archegos case has shown that this can even be an issue for G-SIBs.
6. Banks need to expend additional efforts to identify and limit the large potential credit exposures that can result from derivatives transactions with single counterparties, which can be magnified if clients hold similar positions with other banks. Next to measures in the front office, improvements in risk governance and firm wide-risk management frameworks are also necessary.

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