

THE ROLE OF DERIVATIVES
IN MARKET STRAINS DURING
THE COVID-19 CRISIS

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Abstract

Since the onset of the pandemic, the equity market has experienced bouts of high volatility, with private investors' use of derivatives for speculative purposes being cited as a relevant factor in some cases. This paper analyses two specific episodes: the revaluation of GameStop stock, and the swift rise and subsequent collapse of Archegos Capital. In both instances, the leverage provided by derivatives generated strains in the functioning of illiquid market segments in the form of trading feedback loops.

Keywords: equity derivatives, leverage, retail investors, feedback loops, market functioning.

JEL classification: G12, G13, G14.

Resumen

Desde el comienzo de la pandemia, el mercado de renta variable ha experimentado episodios de alta volatilidad. En alguno de ellos, el uso de derivados con fines especulativos por inversores privados ha sido citado como un factor relevante. En este documento se analizan dos casos concretos: la revalorización de la acción de GameStop, y el rápido ascenso y posterior caída del fondo Archegos Capital. En ambos, el apalancamiento facilitado por los derivados ha generado tensiones en el funcionamiento de segmentos de mercado poco líquidos en forma de ciclos retroalimentados de negociación.

Palabras clave: derivados de renta variable, apalancamiento, inversores minoristas, ciclos de retroalimentación, funcionamiento de mercado.

Códigos JEL: G12, G13, G14.

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1 Introduction

A financial derivative allows investors to hedge against changes in the price of the asset upon which it is based (the underlying asset). They can also be used to increase the exposure to the underlying asset beyond that assumed when directly purchasing the asset (intrinsic leverage), without needing to resort to direct financing for such purchases. This increases possible returns, but also magnifies potential losses.

This multiplying effect of exposures with the same amount of capital means that the taking or closing of derivatives-market positions can affect the underlying market. In the most extreme cases, excess leverage or a forced deleverage could put pressure on trading and generate feedback loops.¹ The market structure, the use of equity derivatives and the friction caused by this leverage were key factors in the two bouts of volatility in 2021 analysed in this paper. The GameStop stock price saw sharp movements and volatility in January, with notable activity on the part of retail investors in the exchange-traded stock options markets. As regards Archegos' collapse in March, the use of bilateral derivative contracts with several investment banks was particularly noteworthy.

The social and economic effects of the pandemic have triggered greater volatility and significant cross-sector behavioural divergence, creating strong investment trends as information arrived on restrictions or signs of reopening (see Chart 1). Thus, in the case of GameStop and other firms supported by retail flows, many sophisticated investors bet against these companies, partly owing to the impact lockdown had on these firms, as most of them belong to the specialised retail trade and entertainment sector.² Conversely, Archegos held leveraged positions in technology and communication firms, whose sectors had benefited from lockdown and an increased use of digital media.

The vaccine roll-out and the first signs of economic reopening prompted a change in trend and investment flows among sectors from end-2020, adversely affecting bearish positions in firms like GameStop and bullish positions such as those in Archegos' portfolio. As detailed in this paper, derivatives-market activity lies behind the heightening of the movements in the underlying asset prices in both cases, especially as both involved illiquid small-cap firms.

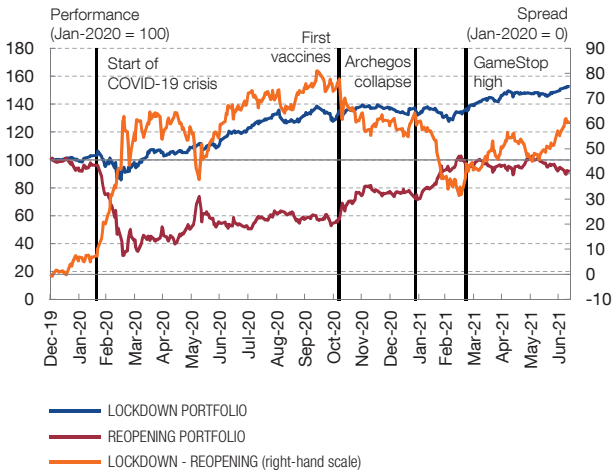
¹ Such as the liquidity spirals that occurred during the global financial crisis (Pedersen (2009)).

² GameStop is a brick-and-mortar video game retailer. Another favourite firm among the fora was the cinema operator AMC Entertainment.

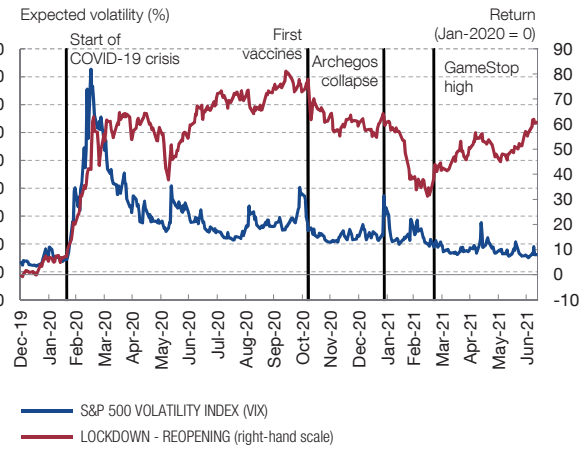
Chart 1

"LOCKDOWN" AND "REOPENING" PORTFOLIOS FOR THE S&P 500 (a)

1 CUMULATIVE RETURNS



2 RETURN DIFFERENTIAL AND IMPLIED VOLATILITY



SOURCES: Bloomberg and own calculations.

a The Lockdown portfolio comprises S&P 500 firms benefiting from greater household consumption and entertainment, in the retail food and primary product, home delivery and communications sectors. The Reopening portfolio comprises firms benefiting from reopening expectations, in the passenger transport, travel, oil and hospitality sectors.

2 Equity derivatives: concepts and type

The equity derivatives most accessible to retail investors are options contracts listed on different regulated markets. These options can be to buy (call option) or to sell (put option). Thus, by paying the contract premium, a call option holder acquires the right to buy the underlying asset at a fixed price (the strike price) on the contract expiry date, thereby benefiting from increases in the stock price with a smaller initial payment. If the price falls below the strike price, the holder would not exercise the right and would lose the premium paid; but if it exceeds the strike price, they can buy the stock at below market price (see Chart 2.1). Among other strategies, investors buy a call option to position themselves ahead of possible increases in the underlying price, which requires a smaller investment than if the stock were purchased directly. At the same time, a put option entitles the holder to sell for a fixed price at a future date, thereby benefiting from possible declines in the underlying asset's price.³

Over-the-counter (OTC) derivatives contracts, i.e. those not traded through organised markets, are designed for specialised investors with access to investment banks' brokerage services.⁴ The most widely used are equity swaps, which are structured as the swap of the total return of the underlying shares (total return swap), in the way that a contract for differences is⁵ (see Figure 1). The holder receives the changes in the share price and dividends and, in exchange, the counterparty (i.e. the investment bank) receives a variable payment, pegged to a benchmark interest rate (e.g. LIBOR) plus a spread, calculated so that the swap price at inception is zero. Thus, the investor is exposed to the market risk of the stock without having to make an initial payment. Collateral is provided by the investor to protect the counterparty in the event of default. The level of leverage will depend on the relationship between the total asset exposure and the collateral provided. If the stock price falls, these margins will need to be adjusted through a margin call to deposit more cash or collateral.

The counterparties for these derivatives must cover part of their position so as not to incur excessive risks. A significant concept of such hedging is the "delta", or the sensitivity of the derivative's price to changes in the price of the underlying asset. The delta determines the number of shares that need to be purchased to cover the risk of a given derivatives position, e.g. the stock that the call option writer must buy in order to avoid being exposed to changes in the underlying price. In an equity swap, the exposure to the underlying asset is linear and, therefore, these instruments have a delta equal to one. By contrast, call options have an asymmetric payoff, and their delta, rather than being constant, varies on the basis

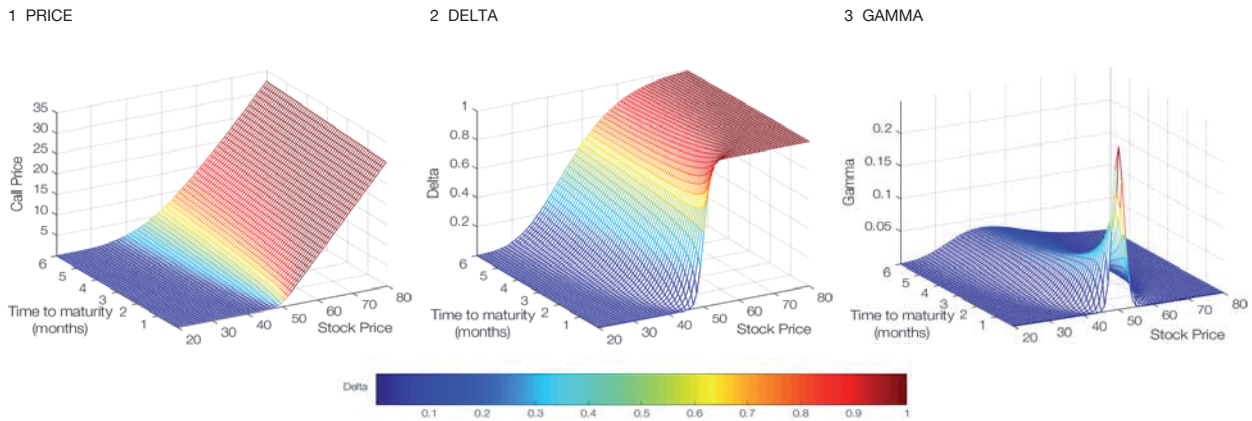
³ So-called European options can only be exercised upon maturity, while American options can be exercised beforehand. For a detailed analysis of options, their characteristics and pricing models, see Hull (2018).

⁴ See Avellaneda and Cont (2010) for an analysis of the different bilateral contracts concerning equity and of the market structure.

⁵ Contracts for differences (CfDs) allow buyers to position themselves ahead of changes in equity, currencies or commodities without actually owning the underlying asset. Payments are made for the difference between the underlying asset's price when the contract opens and when it closes; if the difference is negative, the buyer pays the seller, and vice versa.

Chart 2

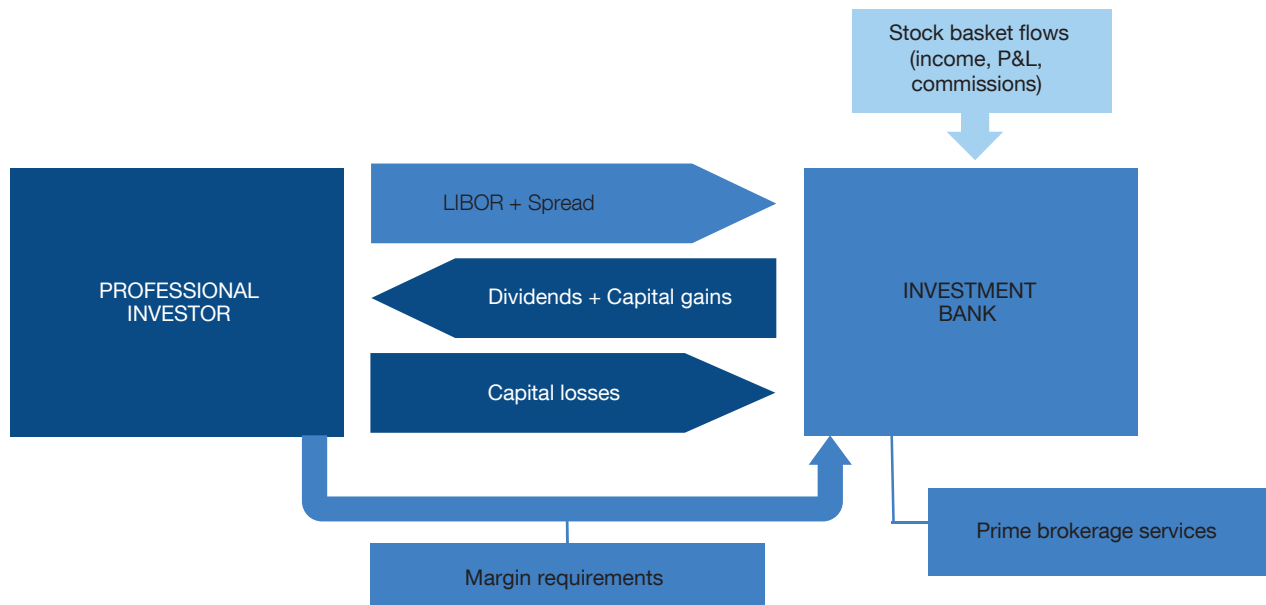
CALL OPTION (STRIKE PRICE = 50) PRICE AND SENSITIVITY TO UNDERLYING PRICE AND MATURITY



SOURCE: Own calculations.

Figure 1

EQUITY SWAP FLOWS

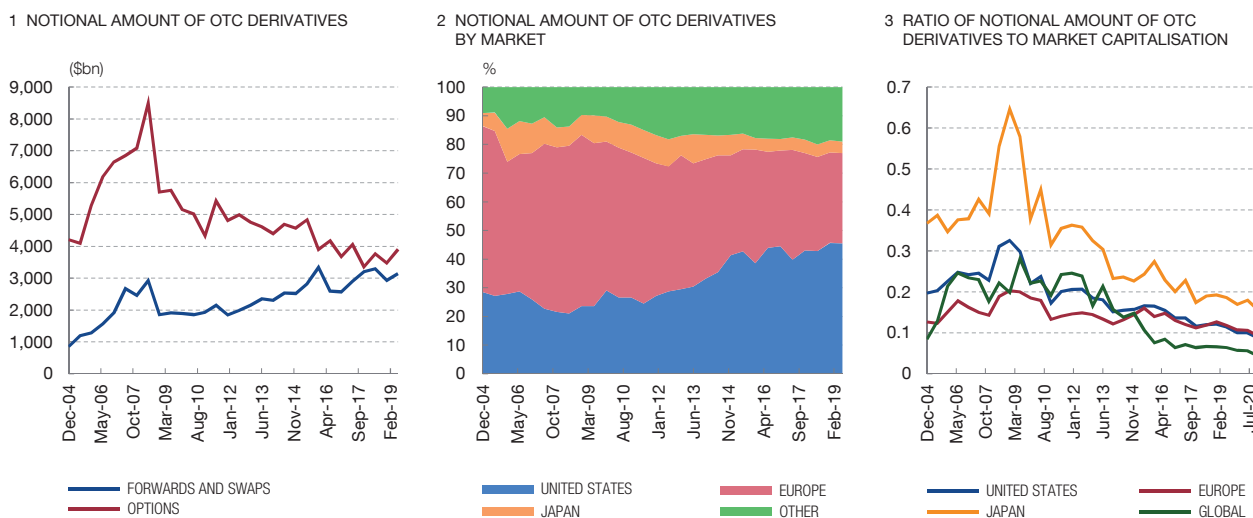


SOURCE: Devised by authors.

of the underlying asset's price, i.e. it increases if the price goes up (see Chart 2.2). The gamma, which represents the sensitivity of the delta to changes in the underlying asset's price, increases enormously when the price is around the strike price and the expiration is near (see Chart 2.3). Consequently, the dynamic hedging of the sale of a call option requires more underlying shares to be bought as their price approaches the strike price. When it is highly likely that the option will be exercised, the delta is close to one.

Chart 3

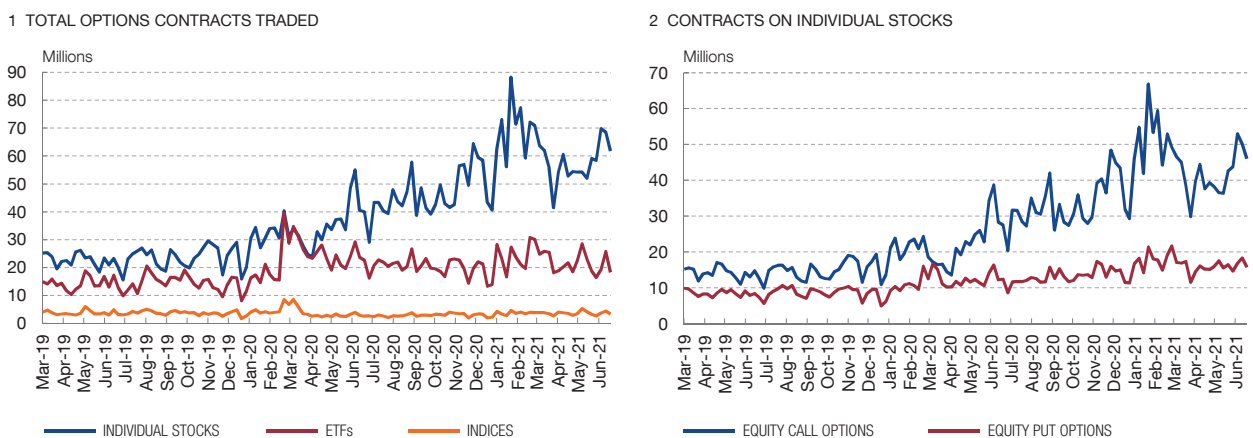
NOTIONAL AMOUNT OF OTC DERIVATIVES AND RATIO TO MARKET CAPITALISATION



SOURCES: BIS, MSCI, Bloomberg and own calculations.

Chart 4

VOLUME OF EXCHANGE-TRADED OPTIONS IN THE UNITED STATES



SOURCES: Options Clearing Corporation and own calculations.

The notional amount of swaps has grown since 2008 and they now account for half of the total OTC segment (see Chart 3). However, the ratio of OTC derivatives to market capitalisation has decreased across all markets since the record highs reached in 2008. In the case of exchange-traded options, the number of traded contracts, especially in individual stock options and in call options, has risen since early 2020, peaking at over 60 million in January 2021 (see Chart 4).

3 Market structure and participants

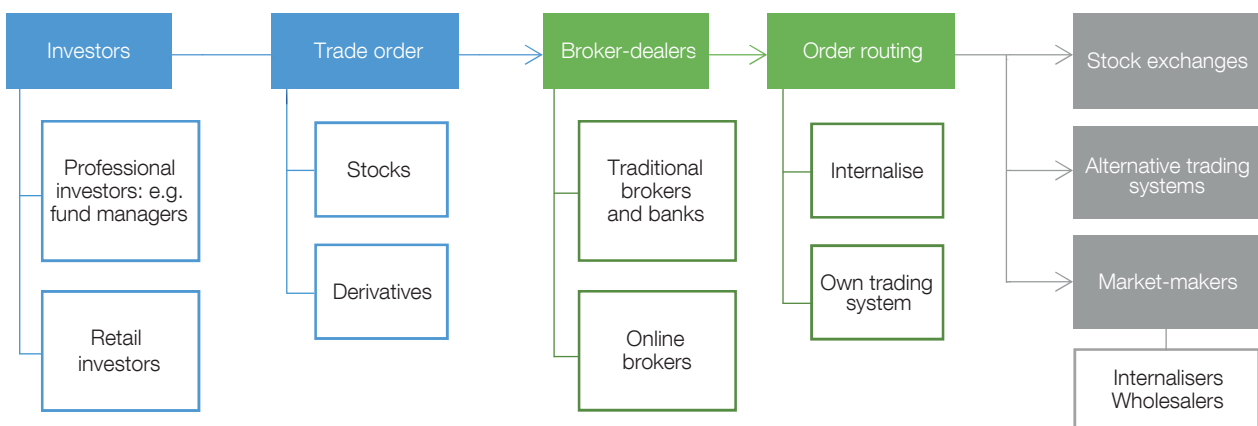
Regulatory and technological developments have driven structural changes in equity and derivatives markets across all jurisdictions, going from open outcry methods, with transactions being executed manually, to the widespread use of electronic trading, with automated executions. These changes have reduced the barriers to entry for new participants and fostered the emergence of new trading venues.

In this new environment, upon receiving a buy or sell order from a client, a broker-dealer can match the transaction in-house, if it has the capacity to do so (for example, by using its own electronic trading platform), or it can decide to send it to any of the multiple trading venues where the equity and corresponding derivatives are listed: traditional stock exchanges, third-party electronic communication networks or market-makers' platforms (see Figure 2).

The decision to send orders to a trading venue depends on the broker-dealer's business model and is subject to minimising the transaction costs. For instance, online brokers, which are highly focused on retail investors, send orders to market-makers or liquidity providers (known as "wholesalers" or "internalisers"), which execute the orders. These market-makers intermediate between buyers and sellers, using their balance sheet and obtaining income from the bid-ask spread. The greater the number of orders received from individual investors, the smaller the risk that price movements will go against them.⁶ To encourage trades, they distribute part of the income they obtain to

Figure 2

TRADING AND EXECUTION PROCESS



SOURCE: Devised by authors.

⁶ As the buy and sell orders are not placed for the same volume or at the same time, the market-maker has to manage this imbalance by temporarily increasing its inventory and assuming the market risk. The greater the retail flow (i.e. the number of small and disperse orders), the more likely it is that transactions will be matched, reducing the need for them to be held on the balance sheet for a long time and generating income primarily from the bid-ask spread.

brokers for receiving their order flow. Thus, some brokers may offer their clients zero-commission trading, opening up access to small investors.⁷

Professional investors have access to the prime brokerage services offered by investment banks, which, in addition to acting as dealers, facilitate funds for their clients to take leveraged positions, be they in the form of exchange-traded derivatives, OTC derivatives, leveraged stock purchases or equity short sales.

With financing from one or several prime brokers, most sophisticated investors, like hedge funds, have leveraged long/short strategies, i.e. (long) buy positions on equity that may increase in value, and (short) sell positions on potentially overpriced equity. The proportion of hedge funds with biased long or short positions is much smaller (see Chart 6.1).

In general, short positions on stocks are more costly to implement.⁸ Thus, to short-sell stock, investors have to borrow it from their broker and deposit, as collateral, the cash proceeds from its sale on the market, plus an additional margin requirement to protect the lender from possible price rises. The short-seller expects the equity price to fall to buy it at a price that is lower than when it was borrowed, thus obtaining the price difference minus the loan fee. There is a recall risk if the lender claims the equity and few shares are available for purchase. There is also a funding liquidity risk, as the short-seller has to replenish collateral if the stock price goes up.

⁷ Off-exchange transactions grew in 2020-2021 and account for between 40%-50% of trading (see Bains et al. (2021)).

⁸ Lamont (2004) summarises short-sale constraints and how they can impact stock prices.

4 GameStop and retail investors: pressures and feedback loop

The participation of small investors in the stock exchange market substantially increased during 2020, particularly through investment in individual stocks and the use of leveraged instruments.⁹ Added to structural changes such as the elimination of online broker fees and easy-to-use trading apps were conjunctural factors, like the greater time and savings available owing to the social effects of the pandemic on some population groups. In addition, the widespread use of social media (Twitter, YouTube, Reddit, etc.) and specialised internet fora (such as the WallStreetBets forum on Reddit) has acted like an echo chamber, making it easier for small investors to share information.

In early 2021, all of this had an impact on the share price of GameStop and other companies that had been in the spotlight of these online fora for several months. More specifically, their stocks soared in a short period of time owing mainly to retail activity in the options market. These were small-cap firms with a very high percentage of outstanding shares shorted by professional investors who, moreover, considered these companies as having been hit particularly hard by the pandemic and, therefore, expected their price to fall (see Charts 5.1 and 5.2). In the fora, individual investors identified these firms as overly exposed to bearish bets, particularly if activity were to return to normal soon (while also citing sentimental reasons, brand connection, group loyalty).

Part of the retail investment flow was channelled through the purchase of call options with very short maturities and out-of-the-money strike prices (i.e. above the underlying asset's market price) with little likelihood of being exercised, meaning leverage was very high. The shortage of shares available for sale (because they were heavily shorted) combined with the increase in call option positions (see Chart 5.4) put a number of upward pressures on trading, triggering self-reinforcing cycles of purchases and steep rises in the prices of these shares. Thus, GameStop rose by more than 2000% in January, with high intraday volatility (see Chart 5.3).

Initially, since they were heavily out of the money, the delta of these options was very low. Therefore, if a market-maker could not find a writer for these options, the cost of holding them was practically zero. However, when the price started climbing and approached the strike price, the delta of the options increased, as did the number of shares that the market-maker needed to buy to hedge the market risk, pushing the price up further. These rises drew in new option and share purchases, increasing the delta even more. This feedback loop is known as a “gamma squeeze”.

At the same time, growing demand for these shares coupled with the price rises put pressure on the huge short positions, causing what is known as a “short squeeze”.¹⁰ Either to limit losses, or due to the broker requiring additional collateral that the seller was

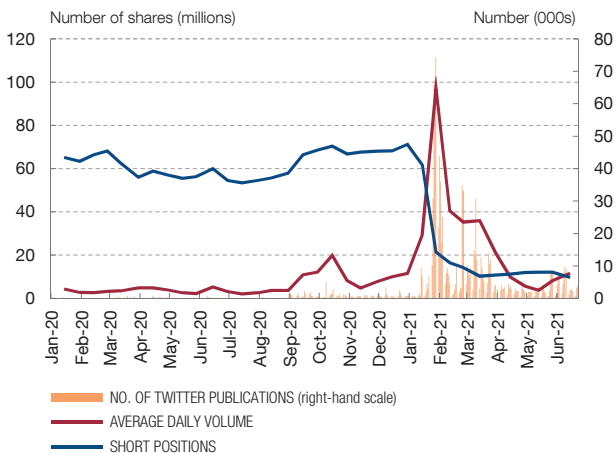
⁹ See Aramonte and Avalos (2021).

¹⁰ Duffie, Garleanu and Pedersen (2002) show how short selling can have these effects on the price.

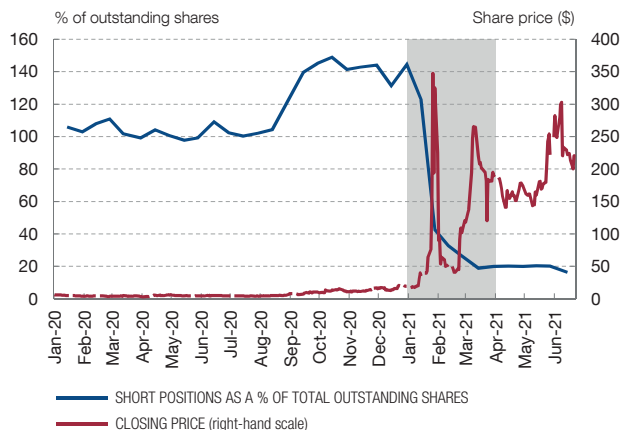
Chart 5

DEVELOPMENTS IN GAMESTOP SHARES: VOLUME, SHORT POSITIONS AND OPTIONS

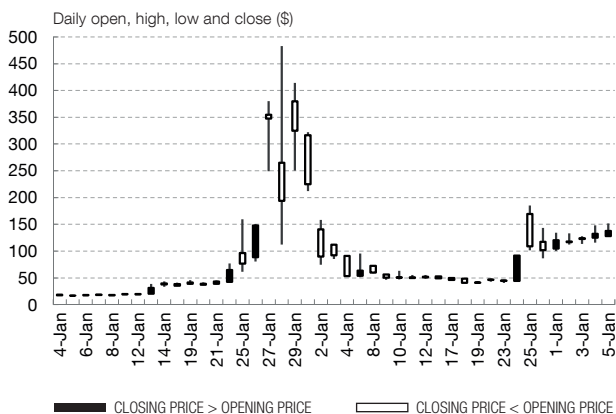
1 SOCIAL MENTIONS, VOLUME AND SHORT POSITIONS



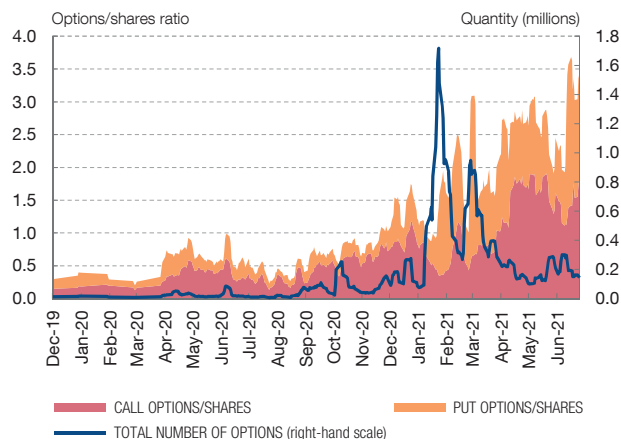
2 PRICE AND SHORT-INTEREST AS A PERCENTAGE OF OUTSTANDING SHARES



3 INTRADAY CHANGES: JANUARY-MARCH 2021



4 OPTIONS TRADED AND AS A PERCENTAGE OF THE VOLUME OF SHARES



SOURCES: Bloomberg, Twitter, Options Clearing Corporation and own calculations.

unwilling or unable to put up, short sellers were forced to buy back the shares and terminate the securities lending. This situation added more buyers to the market, leading to greater price increases and forcing more short positions to be covered. This deleveraging spiral also produced contagion effects on other shares owing to the de-grossing of long/short funds that reduced long positions, as they were forced to cover short positions, in turn leading other investors to reduce exposures as well.

5 Archegos Capital and its banks: deleveraging and liquidity spirals

Archegos Capital Management was a family office, i.e. it operated as an investment vehicle for the personal assets of a single person.¹¹ Archegos invested in equities, using strategies typical of a highly leveraged long/short fund. During 2020, it took huge leveraged positions using equity swaps, concentrated in a small group of small and medium-sized Chinese and US communication and technology companies (including ViacomCBS, Discovery, Tencent Music and Baidu), which had a potentially lower pandemic-related risk and could therefore yield returns above the market index.¹² The counterparties in these swaps were several investment banks which provided the fund with prime brokerage services (see Figure 1).

According to some estimates, this leverage using swaps allowed its own buy transactions to account for a high percentage of the liquidity traded in this group of stocks. In some cases it held positions of between 10% and 25% of their capitalisation, without directly owning the shares,¹³ which remained the property of the investment banks which were the counterparties for these derivatives.

Since these are relatively illiquid shares within the sector, it is believed that the buy pressure exerted by the investment bank counterparties to Archegos' swap contracts was partly responsible for the strong revaluation of some of these stocks from April 2020. As the price rose, the fund had more capital at its disposal, allowing it to increase its positions in these firms by using new swaps and loan facilities with the investment banks and to maintain a high level of leverage despite the price rises. According to some reports, the fund may have had leverage of up to 10 to 1, with a combined long and short market position of between \$50 billion and \$100 billion and capital of around \$10 billion,¹⁴ well above the average leverage of equity hedge funds (see Chart 6).¹⁵

At end-March 2021, Archegos experienced significant declines in its long positions while the market as a whole rose. ViacomCBS, which had appreciated 600% in less than a year, fell by more than 25% in one day, in the wake of an unsatisfactory capital increase and analysts' pessimistic outlook (see Chart 7). Archegos was unable to provide the additional collateral required by the investment banks after the slump. The banks deemed this to be a breach of the derivatives contracts, triggering a spiral of forced liquidations.¹⁶

The banks that liquidated the stocks more quickly through block sales were able to limit their losses, but contributed to exacerbating the stock declines (see Chart 7). This caused

11 It was therefore not subject to the regulation applicable to hedge funds.

12 One possible way to implement this type of long/short strategy is to be long in the stock basket and sell stock index futures.

13 See Zuckerman, Chung and Farrel (2021).

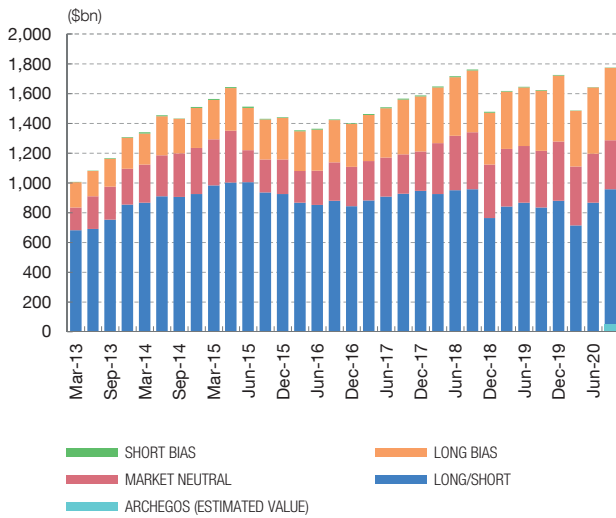
14 See Schatzker, Natarajan and Burton (2021).

15 Following the episodes of stress and illiquidity since the onset of the COVID-19 crisis, several regulators and central banks have pointed to the need for greater transparency regarding risks relating to hedge funds and other non-bank financial institutions (see Federal Reserve Board of Governors (2021) and Cunliffe (2020)).

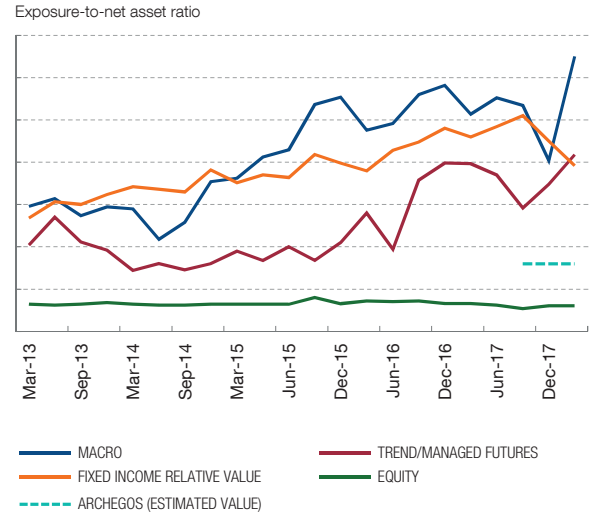
16 See Das (2021).

Chart 6
HEGDE FUNDS VS. ARCHEGOS

1 EXPOSURE

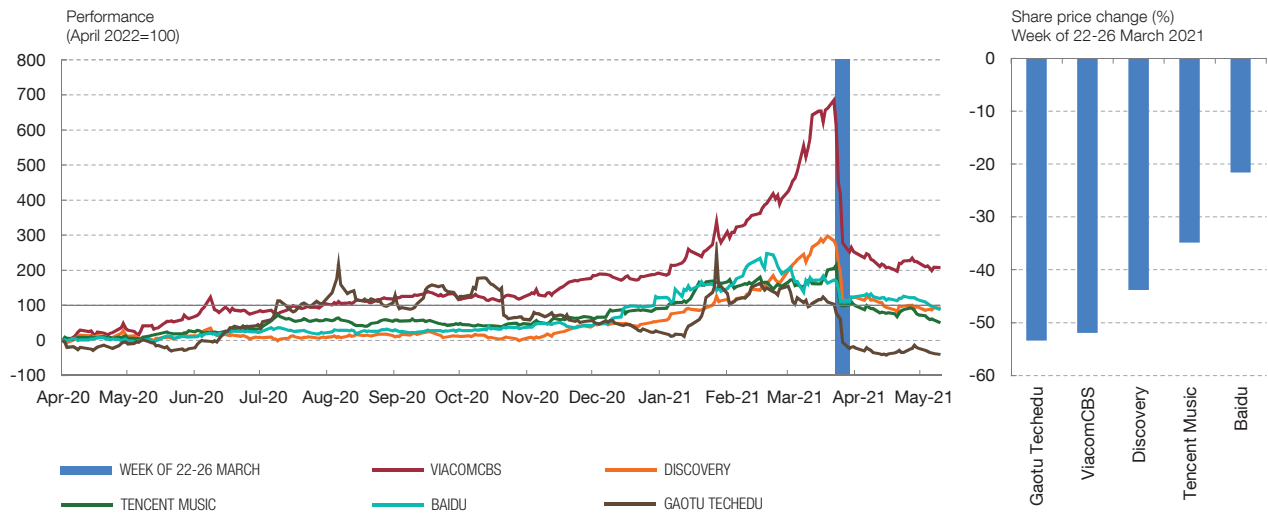


2 LEVERAGE



SOURCES: US Securities and Exchange Commission, Wall Street Journal, Bloomberg and own calculations.

Chart 7
CHANGES IN ARCHEGOS' PORTFOLIO



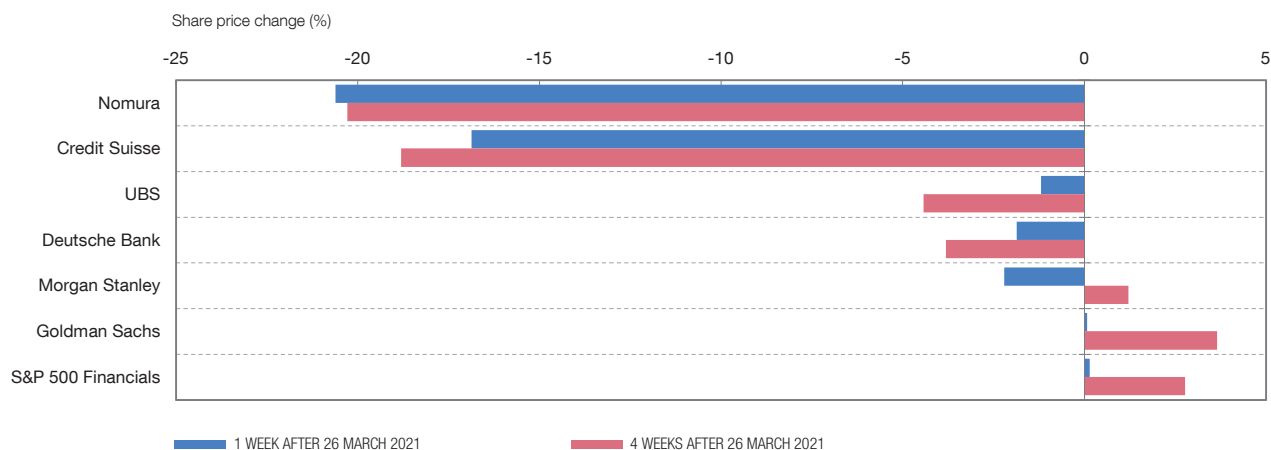
SOURCES: Bloomberg and own calculations.

other investors to trim positions, either because of internal risk limits or for opportunistic reasons, triggering new margin calls, in a self-reinforcing cycle.¹⁷ The investment banks that acted as Archegos' counterparties and kept the shares on their balance sheets for longer

17 Brunnermeier and Pedersen (2005) analyse such trading pressures and the interactions between players with large positions, along with their impact on the market.

Chart 8

IMPACT ON THE SHARE PRICE OF BANKS DEALING WITH ARCHEGOS



SOURCES: Bloomberg and own calculations.

ended up selling at a significant loss (see Chart 8). In all, the institutions affected reported losses of almost \$10 billion.¹⁸

¹⁸ According to analysts' estimates or data published by the affected institutions (see Abouhossein and Ranjan (2021))

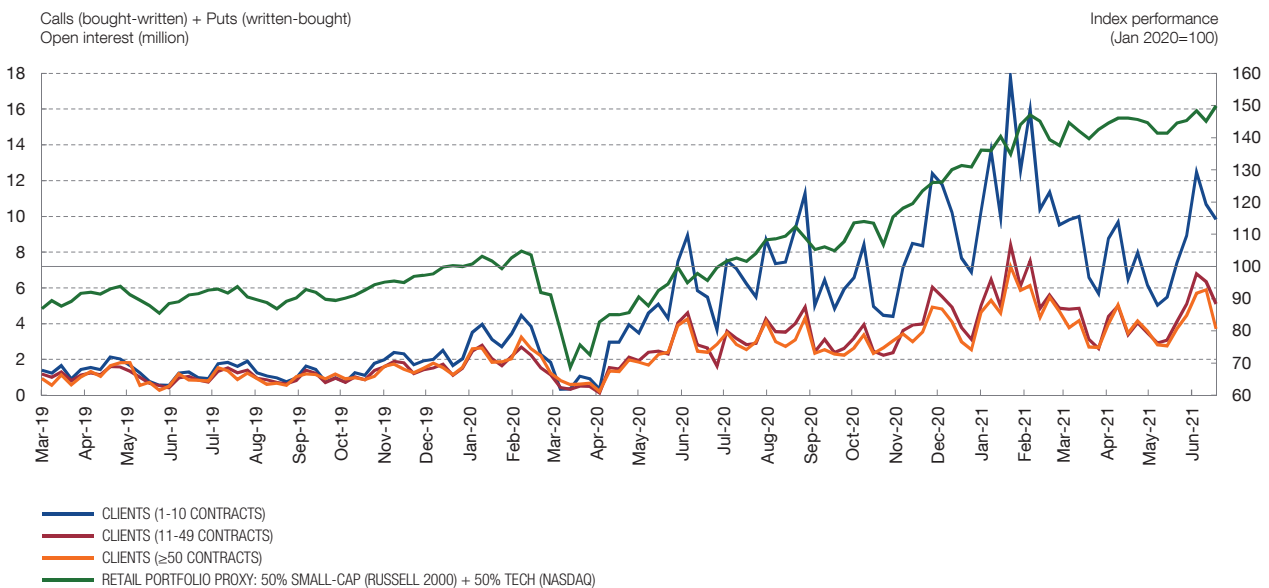
6 Conclusions

Financial derivatives can be used as hedging instruments for managing the risk of portfolio positions, but also to multiply exposure to the underlying assets. Some of the volatility events of 2021 have been related to the use of derivatives to take positions in small-cap stocks. In these cases, because the stocks are illiquid, the derivatives have contributed to trading feedback loops, exacerbating sudden movements in the underlying prices.

Technological, social and market structure changes will continue to open up market access to small investors, in particular through the use of exchange-traded options to express a sentiment on a firm's prospects. The balance between bullish and bearish stock option positions¹⁹ suggests that retail investor²⁰ momentum has subsided since the January 2021 highs, but it remains ten times higher than it was two years ago (see Chart 9).

Also, sophisticated investors' use of derivatives and leverage in highly concentrated positions could be a source of stress for their bank counterparties under a scenario of declining prices of these positions or heightened volatility. In the case of Archegos, although the losses for some of the banks involved have been significant, contagion effects have been limited. In any event, a cautionary note should be sounded on the system's risk-taking levels and aggregated leverage. In the United States, the year-on-year change in margin account

Chart 9
US STOCK OPTIONS MARKET SENTIMENT INDICATOR BY CLIENT SIZE



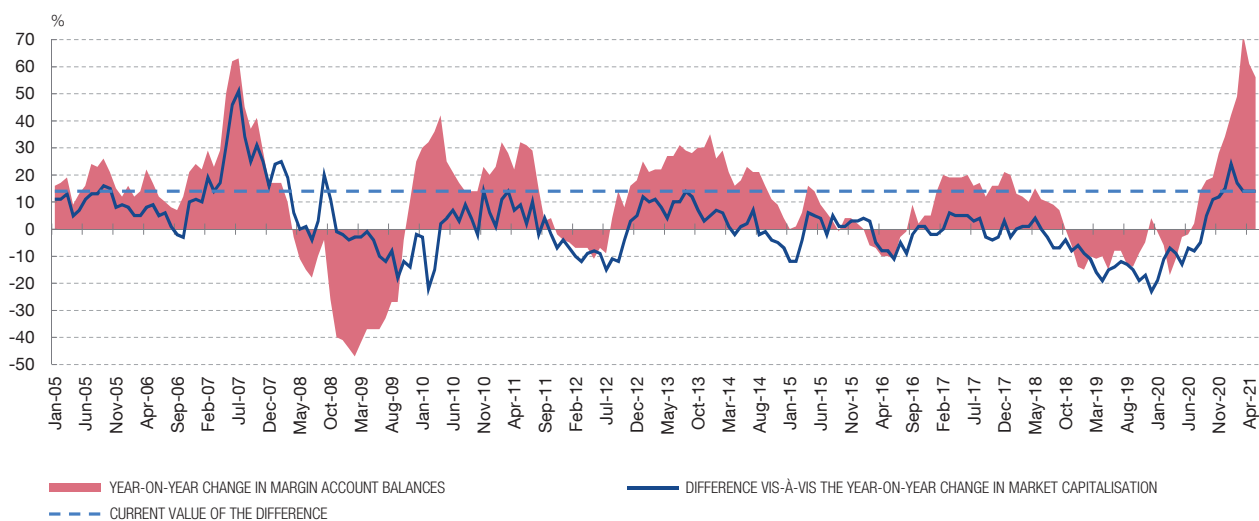
SOURCES: Options Clearing Corporation, Bloomberg and own calculations.

¹⁹ Defined as the open interest for: (bought calls + written puts) - (bought puts + written calls).

²⁰ Customers with positions of fewer or equal than 10 contracts.

Chart 10

GROWTH OF MARGIN DEBT IN THE UNITED STATES



SOURCES: Financial Industry Regulatory Authority, Bloomberg and own calculations.

balances reached 70% in April 2021 (see Chart 10), surpassing the peaks recorded prior to the onset of the global financial crisis. In relative terms, this growth is more than 15% higher than the year-on-year change in the S&P 500 in 2021. In addition, available measures of some hedge funds' leverage show an increase from the historical average (see Chart 6.2).

These episodes and their causes raise questions about the efficiency of some markets' current structures when illiquid assets are traded and transactions are not sufficiently transparent.

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